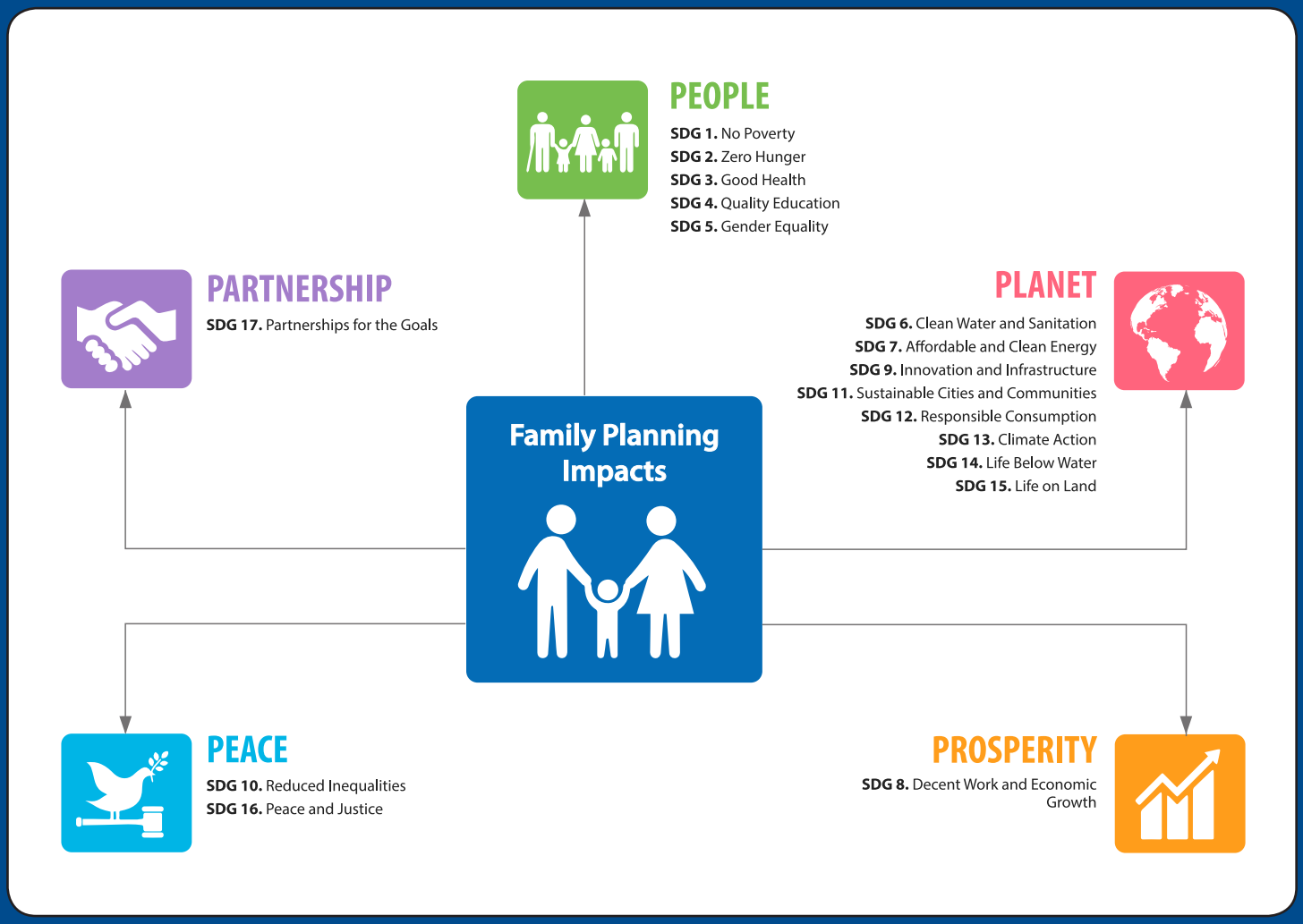
GHSP

Dedicated to what works in global health programs

GLOBAL HEALTH: SCIENCE AND PRACTICE

2016 | Volume 4 | Number 2

www.ghspjournal.org



USAID FROM THE AMERICAN PEOPLE

School of Public Health & Health Services
THE GEORGE WASHINGTON UNIVERSITY

JOHNS HOPKINS Center for Communication Programs™

K4Health™ Knowledge for Health

Global Health: Science and Practice

EDITORS

Editor-in-Chief

James D. Shelton, MD, MPH, Science Advisor, US Agency for International Development (USAID), Bureau for Global Health

Deputy Editor-in-Chief

Stephen Hodgins, MD, DrPH, Senior Technical Advisor, Save the Children, Newborn Health

Associate Editors

Victor K. Barbiero, PhD, MHS, Adjunct Professor, George Washington University, School of Public Health and Health Sciences, Department of Global Health

Matthew Barnhart, MD, MPH, Senior Advisor for Microbicides, USAID, Bureau for Global Health

Cara J. Chrisman, PhD, Biomedical Research Advisor, USAID, Bureau for Global Health

mHealth: Margaret d'Adamo, MLS, MS, Knowledge Management/Information Technology Advisor, USAID, Bureau for Global Health

Malaria: Michael Macdonald, ScD, Consultant, World Health Organization, Vector Control Unit, Global Malaria Programme

Nutrition: Bruce Cogill, PhD, MS, Programme Leader, Bioversity International, Nutrition and Marketing of Diversity

Managing Editors

Natalie Culbertson, Johns Hopkins Center for Communication Programs

Ruwaida Salem, MPH, Johns Hopkins Center for Communication Programs

EDITORIAL BOARD

Al Bartlett, Save the Children, USA
Zulfiqar Bhutta, Aga Khan University, Pakistan
Kathryn Church, London School of Hygiene and Tropical Medicine, United Kingdom
France Donnay, Bill & Melinda Gates Foundation, USA
Scott Dowell, Centers for Disease Control and Prevention, USA
Marelize Görgens, World Bank, USA
Stephen Hodgins, Save the Children, USA
Lennie Kamwendo, White Ribbon Alliance for Safe Motherhood, Malawi
Jemilah Mahmood, Malaysian Medical Relief Society, Malaysia
Vinand Nantulya, Uganda AIDS Commission, Uganda
Emmanuel (Dipo) Otolorin, Jhpiego, Nigeria
James Phillips, Columbia University, USA
Yogesh Rajkotia, Institute for Collaborative Development, USA
Suneeta Singh, Amaltas, India
David Sleet, CDC, USA
John Stanback, FHI 360, USA
Lesley Stone, USAID, USA
Douglas Storey, Johns Hopkins Bloomberg School of Public Health Center for Communication Programs, USA

Global Health: Science and Practice (ISSN: 2169-575X) is a no-fee, open-access, peer-reviewed journal published online at www.ghspjournal.org. It is published quarterly by the Johns Hopkins Center for Communication Programs, 111 Market Place, Suite 310, Baltimore, MD 21202 with funding from USAID.

Global Health: Science and Practice is distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of this license, visit: http://creativecommons.org/licenses/by/3.0/.

For further information, please contact the editors at editorialoffice@ghspjournal.org.

Table of Contents

June 2016 | Volume 4 | Number 2

EDITORIALS

Leading With LARCs in Nigeria: The Stars Are Aligned to Expand Effective Family Planning Services Decisively

Despite years of family planning effort in Nigeria, the modern contraceptive prevalence (mCPR) has reached only 10%. Yet a few recent seminal, well-executed programs have been outstandingly successful providing long-acting reversible contraceptives (LARCs)—both in the public and private sector, and in the North and South. Remarkably, the LARCs they provided were equivalent to 2% mCPR in 2015 alone.

Accordingly, we advocate markedly increased support for: (1) private-sector approaches such as social franchising, particularly in the South, (2) mobile outreach, and (3) support to public clinical facilities, including expanding access through community health extension workers (CHEWs), particularly in the North. Success will require system support, quality, and concerted engagement from a variety of partners including the Government of Nigeria.

Without significant progress in Nigeria, the global FP2020 goal appears unattainable. Fortunately, leading with LARCs along with wide choice of other methods provides a clear avenue for success.

James D Shelton, Clea Finkle

Glob Health Sci Pract. 2016;4(2):179–185
http://dx.doi.org/10.9745/GHSP-D-16-00135

A Convenient Truth: Cost of Medications Need Not Be a Barrier to Hepatitis B Treatment

Drugs that are inexpensive to manufacture and simple to administer greatly expand the potential to help tens of millions of people who need treatment for chronic hepatitis B virus (HBV) infection. Key program implementation challenges include identifying who would benefit from antiviral medication and ensuring long-term and consistent treatment to people who feel well. The best opportunities are where health systems are advanced enough to effectively address these challenges and in settings where HIV service platforms can be leveraged. Research, innovation, and collaboration are critical to implement services most efficiently and to realize economies of scale to drive down costs of health care services, drugs, and diagnostics.

Matthew Barnhart

Glob Health Sci Pract. 2016;4(2):186–190
http://dx.doi.org/10.9745/GHSP-D-16-00128

COMMENTARIES

Investing in Family Planning: Key to Achieving the Sustainable Development Goals

Voluntary family planning brings transformational benefits to women, families, communities, and countries. Investing in family planning is a development "best buy" that can accelerate achievement across the 5 Sustainable Development Goal themes of People, Planet, Prosperity, Peace, and Partnership.

Ellen Starbird, Maureen Norton, Rachel Marcusa

Glob Health Sci Pract. 2016;4(2):191–210
http://dx.doi.org/10.9745/GHSP-D-15-00374

mHealth for Tuberculosis Treatment Adherence: A Framework to Guide Ethical Planning, Implementation, and Evaluation

Promising mHealth approaches for TB treatment adherence include:
- **Video observation**
- **Patient- or device-facilitated indirect monitoring**
- **Direct monitoring through embedded sensors or metabolite testing**

To mitigate ethical concerns, our framework considers accuracy of monitoring technologies, stigmatization and intrusiveness of the technologies, use of incentives, and the balance of individual and public good.

Michael J DiStefano, Harald Schmidt

Glob Health Sci Pract. 2016;4(2):211–221
http://dx.doi.org/10.9745/GHSP-D-16-00018

ORIGINAL ARTICLES

Feasibility and Effectiveness of mHealth for Mobilizing Households for Indoor Residual Spraying to Prevent Malaria: A Case Study in Mali

Sending voice and/or text messages to mobilize households for spraying was more costly per structure and less effective at preparing structures than traditional door-to-door mobilization approaches supplemented with radio and town hall announcements. Challenges included:
- **Lack of familiarity with mobile phones and with public health mobile messaging**
- **Lack of face-to-face communication with mobilizers, making it easier to ignore mobilization messages and preventing trust-building**
- **Low literacy levels**
- **Gender differentials in access to mobile phones**

Keith Mangam, Elana Fiekowsky, Moussa Bagayoko, Laura Norris, Allison Belemvire, Rebecca Longhany, Christen Fornadel, Kristen George

Glob Health Sci Pract. 2016;4(2):222–237
http://dx.doi.org/10.9745/GHSP-D-15-00381

Factors Associated With Community Health Worker Performance Differ by Task in a Multi-Tasked Setting in Rural Zimbabwe

Programs should consider specific tasks and how they relate to health worker factors, community support, and the work context. In a setting where community health workers were responsible for multiple tasks, those who referred more pregnant women were female, unmarried, under 40 years old, and from larger households, and they felt they had adequate work resources and positive feedback from supervisors and the community. In contrast, workers with high scores on delivering household behavior change lessons were from smaller households and received more supportive supervision.

Rukundo A Kambarami, Mduduzi N NMbuya, David Pelletier, Dadirai Fundira, Naume V Tavengwa, Rebecca J Stoltzfus

Glob Health Sci Pract. 2016;4(2):238–250
http://dx.doi.org/10.9745/GHSP-D-16-00003

School Distribution as Keep-Up Strategy to Maintain Universal Coverage of Long-Lasting Insecticidal Nets: Implementation and Results of a Program in Southern Tanzania

A school-based net distribution program, piloted in the Southern Zone of Tanzania to sustain ⩾80% universal net coverage previously attained through mass campaigns, successfully issued nets to nearly all eligible students and teachers. Keys to success included:

- **Effective collaboration between the Ministry of Health, local government, and implementing partners**
- **Social mobilization to sensitize the community about the importance of net use**
- **Development of a mobile application to facilitate data collection and analysis**

Shabbir Lalji, Jeremiah M Ngondi, Narjis G Thawer, Autman Tembo, Renata Mandike, Ally Mohamed, Frank Chacky, Charles D Mwalimu, George Greer, Naomi Kaspar, Karen Kramer, Bertha Mlay, Kheri Issa, Jane Lweikiza, Anold Mutafungwa, Mary Nzowa, Ritha A Willilo, Waziri Nyoni, David Dadi, Mahdi M Ramsan, Richard Reithinger, Stephen M Magesa

Glob Health Sci Pract. 2016;4(2):251–263
http://dx.doi.org/10.9745/GHSP-D-16-00040

Improved Childhood Diarrhea Treatment Practices in Ghana: A Pre-Post Evaluation of a Comprehensive Private-Sector Program

From 2011 to 2015, a diarrhea management program in Ghana targeting pharmaceutical suppliers, private-sector providers, and caregivers successfully increased caregiver use of oral rehydration salts (ORS) with zinc to treat diarrhea in children under 5, from 0.8% to 29.2%, and reduced antibiotic use (which is generally inappropriate for treatment of non-bloody diarrhea) from 66.2% to 38.2%.

Marianne El-Khoury, Kathryn Banke, Phoebe Sloane

Glob Health Sci Pract. 2016;4(2):264–275
http://dx.doi.org/10.9745/GHSP-D-16-00021

Success Providing Postpartum Intrauterine Devices in Private-Sector Health Care Facilities in Nigeria: Factors Associated With Uptake

41% of women delivering in the social franchise private facilities chose the postpartum IUD. Factors associated with acceptance included lower education, higher parity, and being single. Scale-up of postpartum IUD services in both public and private facilities has the potential to significantly increase use of long-acting reversible contraception in Nigeria.

George IE Eluwa, Ronke Atamewalen, Kingsley Odogwu, Babatunde Ahonsi

Glob Health Sci Pract. 2016;4(2):276–283
http://dx.doi.org/10.9745/GHSP-D-16-00072

Partnerships for Policy Development : A Case Study From Uganda's Costed Implementation Plan for Family Planning

The development and launch of the costed implementation plan (CIP) in Uganda was successful in many ways. However, it would have benefitted from more focus on long-term partnership development critical for executing the CIP and by including district health officers—key players in executing the plan—more substantially in the process. Using a partnership approach sets the stage for ensuring that the right people are contributing to both development and execution.

Alyson B Lipsky, James N Gribble, Linda Cahaelen, Suneeta Sharma

Glob Health Sci Pract. 2016;4(2):284–299
http://dx.doi.org/10.9745/GHSP-D-15-00300

FIELD ACTION REPORTS

Family Planning Counseling in Your Pocket: A Mobile Job Aid for Community Health Workers in Tanzania

Using mobile job aids can help CHWs deliver integrated counseling on family planning and HIV/STI screening by following a step-by-step service delivery algorithm. Lessons learned during the pilot led to the development of additional features during scale-up to exploit the other major advantages that mHealth offers including:

- **Better supervision of health workers and accountability for their performance**
- **Improved communication between supervisors and workers**
- **Access to real-time data and reports to support quality improvement**

Smisha Agarwal, Christine Lasway, Kelly L'Engle, Rick Homan, Erica Layer, Steve Ollis, Rebecca Braun, Lucy Silas, Anna Mwakibete, Mustafa Kudrati

Glob Health Sci Pract. 2016;4(2):300–310
http://dx.doi.org/10.9745/GHSP-D-15-00393

Enhancing the Supervision of Community Health Workers With WhatsApp Mobile Messaging: Qualitative Findings From 2 Low-Resource Settings in Kenya

CHWs used WhatsApp with their supervisors to document their work, spurring healthy competition and team building between CHWs in the 2 pilot sites. While there was considerable variation in the number of times each participant posted messages—from 1 message to 270 messages—in total they posted nearly 2,000 messages over 6 months. 88% of messages corresponded to at least 1 of 3 defined supervisory objectives of (1) creating a social environment, (2) sharing communication and information, or (3) promoting quality of services.

Jade Vu Henry, Niall Winters, Alice Lakati, Martin Oliver, Anne Geniets, Simon M Mbae, Hannah Wanjiru

Glob Health Sci Pract. 2016;4(2):311–325
http://dx.doi.org/10.9745/GHSP-D-15-00386

SHORT REPORTS

Declining HIV Prevalence in Parallel With Safer Sex Behaviors in Burkina Faso: Evidence From Surveillance and Population-Based Surveys

HIV prevalence among pregnant women ages 15–49 declined from 7.1% to 2.0% in urban areas between 1998 and 2014, and from 2.0% to 0.5% in rural areas between 2003 and 2014; similar declines were reported in the Demographic and Health Surveys. During the same time period, individuals reported safer sex behaviors, including delayed sexual debut and reduced number of sex partners among youth, as well as increased condom use at last sex with nonmarital partners among men and women ages 15–49.

Fati Kirakoya-Samadoulougou, Nicolas Nagot, Sekou Samadoulougou, Mamadou Sokey, Abdoulaye Guiré, Issiaka Sombié, Nicolas Meda

Glob Health Sci Pract. 2016;4(2):326–335
http://dx.doi.org/10.9745/GHSP-D-16-00013

INNOVATIONS

Handwashing With a Water-Efficient Tap and Low-Cost Foaming Soap: The Povu Poa "Cool Foam" System in Kenya

The new handwashing system, designed with end user input, features an economical foaming soap dispenser and a hygienic, water-efficient tap for use in household and institutional settings that lack reliable access to piped water. Cost of the soap and water needed for use is less than US$0.10 per 100 handwash uses, compared with US$0.20–$0.44 for conventional handwashing stations used in Kenya.

Jaynie Whinnery, Gauthami Penakalapati, Rachel Steinacher, Noel Wilson, Clair Null, Amy J Pickering

Glob Health Sci Pract. 2016;4(2):336–341
http://dx.doi.org/10.9745/GHSP-D-16-00022

TAKING EXCEPTION

Fertility Awareness Methods Are Not Modern Contraceptives: Defining Contraception to Reflect Our Priorities

A recent article in GHSP calls for classifying fertility awareness methods as "modern contraceptives" despite their inferiority. We believe in a rights-based approach, which considers the real-world conditions that many women face, including constrained sexual agency and low baseline reproductive health literacy. We must demonstrate true commitment to increasing access to the most effective and reliable contraceptive methods.

Kirsten Austad, Anita Chary, Alejandra Colom, Rodrigo Barillas, Danessa Luna, Cecilia Menjívar, Brent Metz, Amy Petrocy, Anne Ruch, Peter Rohloff

Glob Health Sci Pract. 2016;4(2):342–345
http://dx.doi.org/10.9745/GHSP-D-16-00044

Response to Austad: Offering a Range of Methods, Including Fertility Awareness Methods, Facilitates Method Choice

When selecting a contraceptive method, women and men consider various attributes in addition to effectiveness, such as side effects, return to fertility, level of medical intervention, and interference with sexual activity. Offering a range of methods, including fertility awareness methods that meet the standard to be considered modern, helps to address these considerations, facilitating method choice.

Shawn Malarcher, Madeleine Short Fabic, Jeff Spieler, Ellen H Starbird, Clifton Kenon, Sandra Jordan

Glob Health Sci Pract. 2016;4(2):346–349
http://dx.doi.org/10.9745/GHSP-D-16-00115

LETTERS TO THE EDITOR

Perinatal Mortality Due to Pre-eclampsia in Africa: A Comprehensive and Integrated Approach Is Needed

Moshood Omotayo, Katherine Dickin, Rebecca Stolzfus

Glob Health Sci Pract. 2016;4(2):350–351
http://dx.doi.org/10.9745/GHSP-D-16-00054

Editor's Response to Omotayo: Research Needed on Better Prevention of Pre-Eclampsia

Glob Health Sci Pract. 2016;4(2):352–353
http://dx.doi.org/10.9745/GHSP-D-16-00136

Optimism for the UN Proclamation of the Decade of Action on Nutrition: An African Perspective

Richmond Aryeetey

Glob Health Sci Pract. 2016;4(2):354–355
http://dx.doi.org/10.9745/GHSP-D-16-00117

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

EDITORIAL

Leading With LARCs in Nigeria: The Stars Are Aligned to Expand Effective Family Planning Services Decisively

James D Shelton,[a] Clea Finkle[b]

Despite years of family planning effort in Nigeria, the modern contraceptive prevalence (mCPR) has reached only 10%. Yet a few recent seminal, well-executed programs have been outstandingly successful providing long-acting reversible contraceptives (LARCs)—both in the public and private sector, and in the North and South. Remarkably, the LARCs they provided were equivalent to 2% mCPR in 2015 alone.

Accordingly, we advocate markedly increased support for: (1) private-sector approaches such as social franchising, particularly in the South, (2) mobile outreach, and (3) support to public clinical facilities, including expanding access through community health extension workers (CHEWs), particularly in the North. Success will require system support, quality, and concerted engagement from a variety of partners including the Government of Nigeria.

Without significant progress in Nigeria, the global FP2020 goal appears unattainable. Fortunately, leading with LARCs along with wide choice of other methods provides a clear avenue for success.

THE VIRTUES OF LARCS—NIGERIA IS NO EXCEPTION

Provision of long-acting reversible contraceptives (LARCs)—IUDs and implants—has been highly effective, perhaps even revolutionary in the United States, in preventing unintended pregnancy, particularly with adolescents.[1] No single method, or even 2 methods, can satisfy the diverse needs of all clients, and clients must have good choice and access to a wide variety of methods. Yet those same attributes that have made LARCs so popular in the United States—very high effectiveness, long duration of action, independence of the sex act, generally manageable side effects, potential for use without partner knowledge, and in the case of implants no need for a pelvic exam—appear to have wide appeal in Nigeria. Still, success with LARCs requires more than simple availability of the products. LARCs require service delivery approaches with a higher degree of wherewithal and quality than for shorter-acting methods. But as described below, such LARC-enabling approaches are beginning to thrive in Nigeria.

[a] *Global Health: Science and Practice*, Editor-in-Chief, Washington, DC, USA.
[b] Bill & Melinda Gates Foundation, Seattle, WA, USA.
Correspondence to James D Shelton (jdshelton@jhu.edu).

COMPELLING NEED

Nigeria looms large in need for family planning. Its current 186 million population is projected to grow to almost 400 million by 2050, a mere 34 years from now.[2] Its maternal mortality ratio of 576 per 100,000 live births[3] is among the highest in the world—and far off the Millennium Development Goal (MDG) target of 300. Nigeria also performs poorly on most other health and development indicators, including infant mortality (69 per 1,000 live births),[3] poverty (62%),[4] and female literacy (50%).[5] Moreover, there are marked health disparities between the richest and poorest.[3]

DAUNTING CHALLENGES IN FAMILY PLANNING

Thus far, Nigeria has been rather resistant to family planning efforts. Between 2008 and 2013, the modern contraceptive prevalence rate (mCPR) remained at a mere 10%.[2] And that use was dominated by short-acting methods. Reported ideal family size is 6.5 children. The health system itself is highly challenged,[6] and the decentralized federal structure that delegates major functions to its 36 states and the Federal Capital of Abuja as well as to over 770 local government areas (LGAs) makes broad support and management unwieldy. Most people seek health

LARCs appear to have wide appeal in Nigeria.

services from a patchwork of private health care providers. Unfounded rumors about contraceptive methods are believed to be widespread. And women's knowledge about contraception is limited, especially about LARCs. In the 2013 Demographic and Health Survey, only 25% of married women had even heard of implants and 32% of IUDs.[3] Whereas modern contraceptive use in the more rural, less prosperous, and less literate North East and North West states is below 4%, levels are significantly higher in the southern zones, especially in the South West where contraceptive rates in 7 states range from 21% to 32%.

YET REMARKABLY POSITIVE DEVELOPMENTS

Despite this difficult backdrop, a diverse set of recent developments provide compelling evidence that family planning efforts are beginning to make significant headway in the country.

- Between 2008 and 2013, 6 states showed gains of 5 to 12 percentage points in modern contraceptive use.[3]
- The Nigerian Urban Reproductive Health Initiative (NURHI) in 4 urban areas increased contraceptive prevalence an average of 11% in 5 years by combining substantial demand- and supply-side efforts, including highly accessible mobile "outreach" services. Over 40% of those gains came from increased use of LARCs (mostly implants). Misconceptions about contraceptives declined markedly and intent to use contraception increased significantly.[7,8]

IUDs can be a popular choice among postpartum women

- As described in an article in this issue of GHSP,[9] an immediate postpartum, small-scale initiative with private providers in several states found that 41% of eligible women who delivered in those facilities received immediate insertion of an IUD—evidence that IUDs can be a popular choice among postpartum women.
- Following the 2012 London Summit on Family Planning, the Government of Nigeria articulated more prominent support for family planning including a detailed and cogent national family planning blueprint with ultra-ambitious objectives,[10] although actual financial resources provided so far have been limited. Many states have followed suit, with state-level costed implementation plans (CIPs). Some positive policy reforms have also occurred, notably allowing a basic-level cadre of service health worker—the community health extension worker (CHEW)—to provide implants and IUDs. Additional reforms have included making contraceptives free in public-sector clinics and reforming the nurse/midwife training curriculum to make it proficiency-based and supported by rigorous supervision.

Outstanding Successes With LARCs Specifically

A range of programmatic approaches in both the private and public sector emphasizing access and quality have achieved strikingly high provision of LARCs in Nigeria. Most are relatively recent:

- The Marie Stopes Nigeria "BlueStar" social franchising program, launched in 2012, supports more than 300 private-sector providers, especially in the South, of whom about 70% are midwives. They provided a notably large number of women—more than 65,000—with contraception, especially implants, in 2015 (Table).
- The Society for Family Health's Healthy Family Network social franchising program, also with more than 300 providers, has likewise been successful, although in its case more with the IUD (Table).
- A more recent entry to Nigeria, DKT International also gives support to private providers, particularly in the South. Its model consists mainly of marketing contraceptive products to providers and distributors, without the networking and other components of social franchising. LARC sales in 2015—at more than 100,000—are also striking (Table).
- Marie Stopes Nigeria deploys "mobile outreach" teams in the North. Such mobile outreach typically occurs in collaboration with the public sector and in public-sector sites. Remarkably, with only 8 outreach teams, they provided some 63,000 clients with LARCs in 2015, primarily implants (Table).
- Marie Stopes Nigeria also began the Family Health Plus initiative in 2014. It works with public-sector providers at the state level, now expanded to 20 states, emphasizing training, supportive supervision, and supply chain. Again, provision of LARCs to more than

TABLE. Provision of Long-Acting Reversible Contraceptive Methods by Selected Program Initiatives, Nigeria, 2015

Program	Implants	IUDs	Total LARCs
BlueStar (Marie Stopes Nigeria)	51,643	13,811	**65,454**
Healthy Family Network (SFH)	20,273	53,900	**74,173**
DKT International sales	15,967	87,600	**103,567**
Mobile outreach (Marie Stopes Nigeria)	53,786	9,200	**62,986**
Family Health Plus (Marie Stopes Nigeria)	222,705	29,686	**252,391**
Total	**364,374**	**194,197**	**558,571**

Abbreviations: IUDs, intrauterine devices; SFH, Society for Family Health; LARCs, long-acting reversible contraceptives.
Source of data: For Marie Stopes Nigeria, personal communication with Anna Mackay, Deputy Director of SIFPO Project, Marie Stopes International; for SFH, personal communication with Peter Entonu, Associate Director of Social Franchise Unit, SFH; for DKT, sales report from December 2015.[11]

250,000 clients in 2015 is highly impressive (Table).

What Is Particularly Notable About These Findings From the 5 Initiatives?

- **Sizable enough to "move" the needle.** More than 550,000 women received LARCs from just these 5 initiatives, representing over 2% of married women of reproductive age and 1.5% of all women of reproductive age in Nigeria nationally—a truly impressive proportion (Table). Of course these numbers don't translate directly into contraceptive prevalence. For example, some women would have switched from other methods, and sales do not precisely reflect method provision. Still, the results from just these 5 projects in just 1 year should be enough to register population-level impact. And because LARCs engender high rates of satisfaction and continuation, the sustained cumulative effect over a number of years would be substantial. Some corroboration of such an impact come from the Performance Monitoring & Accountability 2020 (PMA2020) surveys in Kaduna state in the North—a state where Family Health Plus, Healthy Family Network, Marie Stopes Nigeria mobile outreach, and NURHI (as well as others) are all active. Between 2014 and 2015, the *share* of overall modern contraceptive use for implants in Kaduna increased from 16% to 28%.[12]
- **Substantial untapped "latent" demand.** While these initiatives appropriately include modest demand-side components, they mainly consist of making contraceptive services highly accessible. Thus, a significant amount of demand for modern contraception among a sizable proportion of women already exists that can be satisfied with good services and a modicum of targeted demand "activation" support.
- **LARCs are highly acceptable for women desiring contraception.** This is particularly the case for implants, but also for IUDs.
- **Promoting equity: LARC programming serves very low-income as well as higher-income clients.** For example, client exit interview data indicate that 75%, 53%, and 49% of Marie Stopes Nigeria's mobile outreach, Family Health Plus, and social franchising clients, respectively, were from *households* living on less than US$2.50 per day (personal communication with Anna Mackay, Deputy Director of SIFPO Project, Marie Stopes International).

LARCs serve both low- and high-income clients.

- **Success in both the South and North.** While it is generally held that the more conservative North is highly resistant to family planning, these projects—notably, mobile outreach and the Family Health Plus public-sector support project—demonstrate that success can be achieved in the North as well.
- **Success in both the private and public sectors**. Private-sector approaches including

A woman in Nigeria has had a contraceptive implant inserted by providers from Marie Stopes Nigeria.

social franchising align well with the South, which has a large concentration of small private-sector providers and is more economically advanced. But the Family Health Plus experience shows that despite the public sector's reputation as a weak service delivery platform, working closely with state governments on public-sector service delivery can be successful.

In addition to the programming described above, a number of other worthwhile initiatives are ongoing in Nigeria, including traditional social marketing and clinic-based public-sector and NGO services. We are merely highlighting some of the more prominent programs that have been highly successful with LARCs.

Our proposed strategy: Support a diversity of service delivery approaches and wide method choice, including LARCs; emphasize the private sector in the South and the public sector in the North.

WHAT NEXT: OUR PRIORITIES FOR EXPANDED FAMILY PLANNING PROGRAMMING

Our proposed overall family planning strategy for Nigeria:

Support a diversity of service delivery approaches and wide method choice, but emphasize the private sector in the South and the public sector in the North. And prioritize service modes that include LARCs effectively.

Family planning is most successful when clients have a wide variety of methods to choose from, and clients can choose from a variety of service delivery sites. Accordingly, it makes strategic sense to pursue diverse programming efforts in both the public and private sector across the country, emphasizing those models that have a good track record. Recognizing that about 60% of contraceptive use nationally comes from the private sector, private/commercial-sector approaches such as social franchising are particularly well-suited for the South where of the very wide distribution of private-sector providers and the entrepreneurial climate. However, in the North, where that private-sector infrastructure is currently thin, priority should be with the public and NGO sectors. It also seems reasonable to be opportunistic by working most with states that are willing to commit more of their own resources. Since LARCs, especially implants, are so clearly popular and satisfy the needs of many clients well, it is wise to invest in service delivery modes that can provide LARCs effectively, along with a broad range of methods including injectables. Building on the successful models described above, we present some details of this strategy.

Social franchising. Current efforts in social franchising have been highly successful as described above, and indeed in a wide variety of other countries, and they should be expanded markedly, particularly in the South.

Mobile outreach. Although so far small in scale, mobile outreach has been shown to be highly effective already, particularly in the most difficult part of the country—the North and for hard-to-reach rural populations. But this proven approach should also be deployed in other areas such as urban slums and peri-urban areas generally. Notably, it was part of the highly effective urban NUHRI project in the North and South.

Expanded provision of LARCs and injectables by CHEWs, particularly in the public sector. Having CHEWs provide LARCs has been shown to be effective in research studies[13] and now presents a major opportunity for mainstream service delivery expansion, given the recently liberalized policy to permit it. A first order of activity is to scale-up training and supportive supervision for CHEWs to provide LARCs, thus nurturing "dedicated providers" who, in turn, become mentors to new providers. CHEWs have many other duties, however, and some will be more motivated to provide LARCs than others. Thus, finding a way to provide good

support to the most productive CHEWs is essential. Provision of injectables by CHEWs should be a complementary priority, especially in the North where CHEWs are often the main or only clinical providers.

Social marketing, especially focusing on injectables. The successful model DKT is following deserves considerable expansion. An additional opportunity is extending provision of injectables through the many qualified proprietary patent medicine vendors (PPMVs) in both the North and the South. Heretofore, PPMVs have not been permitted to provide injectables. However, a recent PPMV census found that over half in Northern states and about 30% in Southern states were staffed by trained professionals including nurses, pharmacists, and CHEWs.[14] Since CHEWs are now permitted to provide injectables (and implants) in the public sector, it seems entirely reasonable that PPMVs trained as CHEWs or nurses should also be permitted to give injectables. Sayana Press, the version of DMPA delivered subcutaneously via the prefilled Uniject device, is also being introduced in Nigeria, which offers a variety of advantages and additional potential for expanded injectable use.

Postpartum contraception, especially IUDs and implants. The results with immediate postpartum IUDs provided by private-sector providers described above are very promising. Nationally, 36% of women deliver in facilities, with significantly higher rates of facility delivery in the South compared with the North.[3] Especially for high-volume facilities where providers are more likely to retain skills, immediate postpartum insertion of IUDs or later provision of IUDs, implants, or other methods before discharge can be an important component of programming.[15] Moreover, providing contraception later in the postpartum period, for example, along with immunization services, can be highly effective for reaching women during this time of very high unmet need.[16] And mobile outreach in conjunction with child immunization services can successfully reach women in the postpartum period.

Key System Support Priorities

In addition to the priority program approaches described above, serious attention is needed to the following system support activities.

Demand support. The programmatic approaches we propose benefit markedly from a healthy component of demand activation, including community engagement to promote awareness and to address specific issues such as misconceptions about contraception. In addition, broader demand support such as through mass media is a compelling priority, addressing key issues such as social norms and the health benefits of birth spacing.

Supply chain. Family planning cannot succeed without functional supply chains. The current variably functioning public-sector supply chain depends not only on the federal government but on states and LGA support as well. It will require considerable additional attention. One progressive innovation is the "informed push" model to help ensure good distribution, which has been successfully piloted in Nigeria.[17,18] Private-sector distribution, such as for social franchising, can use a more commercial-sector type of supply chain approach capitalizing on the economic incentive, since participants along the chain are paying for the commodity. LARCs have the distinct advantage over shorter-acting methods that they do not require frequent resupply. On the other hand, they do requirea modest but important amount of equipment and disposable supplies such as gloves and disinfectants, which require additional supply attention.

Family planning cannot succeed without functional supply chains.

Human resources. The "2014 Nigeria Family Planning Blueprint" lays out the major challenges: lack of staff, lack of training, high turnover, and uneven geographic distribution in the public sector,[10] all of which need to be addressed systematically. Progressive task shifting will help. A major advantage of private-sector providers is that many are underemployed. Thus, making good use of private-sector CHEWs and qualified PPMVs to give injectables should be a high priority.

Policy and advocacy. Advocacy is needed at both the federal level and the state level toward meaningful funding for family planning. Again, key policy reforms, such as permitting trained pharmacists and PPMVs to provide injectables would make a considerable difference.

Monitoring and evaluation. Nigeria is fortunate that PMA2020 will be expanding its annual surveys from 2 states to 7, beginning this year (personal communication with Scott Radloff, Director, PMA2020). Priority should be given to support policy makers and program managers to

improve data use to enable course correction and decisions about resource allocation in those states.

Emerging primary health care platforms. The Government of Nigeria has recently resolved to strengthen primary health care overall,[6] and donors such as the U.S. Agency for International Development (USAID), the Department for International Development (DFID), and the Bill & Melinda Gates Foundation are providing significant support for such platforms in selected states. This emphasis should be a good opportunity to advance family planning services, but only if sufficient resources are forthcoming and key preventive services such as family planning are given high priority. A key opportunity would be inclusion of a robust set of family planning services under the planned national health insurance scheme.[19]

LEADING WITH LARCS – THE TIME IS NOW

The evidence is clear that family planning efforts not only can be successful—but *are* being successful—in Nigeria, especially through provision of LARCs. Nigeria is a large and complex country and ultimate success will require substantial resources, long-term attention, and a variety of approaches. Yet as we have seen, providing LARCs when done well with the proper service delivery wherewithal can be remarkably effective. Investments in these modes will go a substantial distance to meet client needs, stem unintended pregnancies, reduce maternal mortality, and support Nigeria's national family planning goals as well as the FP2020 global goal. Success will require substantial commitment, engagement, and partnership across the board, including the Government of Nigeria. The time is right for a substantial investment in Nigeria. Do not let this compelling opportunity pass by.

Acknowledgments: We appreciate the invaluable help from Jennifer Anyanti, Alan Bornbusch, Effiom Effiom, Peter Entonu, Onoriode Ezire, Marguerite Farrell, Moriam Jagun, Stephen Hodgins, Patricia MacDonald, Anna Mackay, Emmanuel Otolorin, Christopher Purdy, and Scott Radloff.

Competing Interests: None declared.

REFERENCES

1. McNicholas C, Peipert JF. Long-acting reversible contraception for adolescents. Curr Opin Obstet Gynecol. 2012;24(5):293-298. CrossRef. Medline
2. United Nations (UN), Department of Economic and Social Affairs, Population Division. World population prospects, the 2015 revision. New York: UN; 2015. Available from: http://esa.un.org/unpd/wpp/Download/Probabilistic/Population/
3. National Population Commission (NPC) [Nigeria]; ICF International. Nigeria demographic and health survey 2013. Abuja (Nigeria): NPC; 2014. Co-published by ICF International. Available from: https://dhsprogram.com/pubs/pdf/FR293/FR293.pdf
4. World Bank Open Data [Internet]. Washington (DC): The World Bank Group; c2016. Poverty headcount ratio at national poverty lines (% of population); [cited 2016 Apr 3]. Available from: http://data.worldbank.org/indicator/SI.POV.NAHC/countries/NG?display=graph
5. World Bank Open Data [Internet]. Washington (DC): The World Bank Group; c2016. Adult literacy rate, population 15+ years, both sexes (%); [cited 2016 Apr 3]. Available from: http://data.worldbank.org/indicator/SE.ADT.LITR.ZS/countries/TJ?display=graph
6. Green A. Experts skeptical about Nigeria's free health-care plans. Lancet. 2016;387(10023):1044. CrossRef. Medline
7. Measurement, Learning & Evaluation (MLE) Project; National Population Council (NPC); Data, Research and Mapping Consult, Ltd. Measurement, learning & evaluation of the Urban Reproductive Health Initiative: Nigeria 2014 endline survey. Chapel Hill (NC): MLE Project; 2015. Available from: https://www.urbanreproductivehealth.org/sites/mle/files/mle_twp2-2015_nigeria.pdf
8. Krenn S, Cobb L, Babalola S, Odeku M, Kusemiju B. Using behavior change communication to lead a comprehensive family planning program: the Nigerian Urban Reproductive Health Initiative. Glob Health Sci Pract. 2014;2(4):427-443. CrossRef. Medline
9. Eluwa GIE, Atamewalen R, Odogwu K, Ahonsi B. Success providing postpartum intrauterine devices in private-sector health care facilities in Nigeria: factors associated with uptake. Glob Health Sci Pract. 2016;4(2):276-283. CrossRef
10. Ministry of Health (MOH) [Nigeria]. Nigeria family planning blueprint (scale-up plan). Abuja (Nigeria): MOH; 2014. Available from: http://www.healthpolicyproject.com/ns/docs/CIP_Nigeria.pdf
11. DKT International. Monthly sales report-Dec 2015. Washington (DC): DKT International; 2015. Available from: http://www.dktinternational.org/wp-content/uploads/2013/06/December-2015-Sales-Report.pdf
12. Performance Monitoring & Accountability 2020 (PMA2020). PMA2015/Kaduna-R2. Baltimore (MD): PMA2020; 2015. Available from: http://pma2020.org/sites/default/files/NGR2-KADUNA-FPBrief-v10-2015-12.08.pdf
13. Charyeva Z, Oguntunde O, Orobaton N, Otolorin E, Inuwa F, Alalade O, et al. Task shifting provision of contraceptive implants to community health extension workers: results of operations research in Northern Nigeria. Glob Health Sci Pract. 2015;3(3):382-394. CrossRef. Medline
14. Liu J, Prach LM, Treleaven E, Hansen M, Anyanti J, Jagha T, et al. The role of drug vendors in improving basic health-care services in Nigeria. Bull World Health Organ. 2016;94(4):267-275. CrossRef. Medline
15. Gaffield ME, Egan S, Temmerman M. It's about time: WHO and partners release programming strategies for postpartum family planning. Glob Health Sci Pract. 2014;2(1):4-9. CrossRef. Medline
16. Dulli LS, Eichleay M, Rademacher K, Sortijas S, Nsengiyumva T. Meeting postpartum women's family planning needs through integrated family planning and immunization services: results

of a cluster-randomized controlled trial in Rwanda. Glob Health Sci Pract. 2016;4(1):73-86. CrossRef. Medline

17. Daff BM, Seck C, Belkhayat H, Sutton P. Informed push distribution of contraceptives in Senegal reduces stockouts and improves quality of family planning services. Glob Health Sci Pract. 2014;2(2):245-252. CrossRef. Medline
18. Watson N, McCord J. Evaluating last-mile distribution systems in Nigeria. Arlington (VA): USAID | DELIVER PROJECT, Task Order 4; 2015. Available from: http://deliver.jsi.com/dlvr_content/resources/allpubs/countryreports/NG_EvalLastMile.pdf
19. Lawyers Alert [Internet]. Makurdi (Nigeria): Lawyers Alert. The Nigeria National Health Act 2014: snap review; 2015 Jan 26 [cited 2016 May 3]. Available from: https://lawyersalert.wordpress.com/2015/01/26/the-nigeria-national-health-act-2014-snap-review/

First Published Online: 2016 May 19

Cite this article as: Shelton JD, Finkle C. Leading with LARCs in Nigeria: the stars are aligned to expand effective family planning services decisively. Glob Health Sci Pract. 2016;4(2):179–185. http://dx.doi.org/10.9745/GHSP-D-16-00135

© Shelton and Finkle. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00135.

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

EDITORIAL

A Convenient Truth: Cost of Medications Need Not Be a Barrier to Hepatitis B Treatment

Matthew Barnhart[a]

Drugs that are inexpensive to manufacture and simple to administer greatly expand the potential to help tens of millions of people who need treatment for chronic hepatitis B virus (HBV) infection. Key program implementation challenges include identifying who would benefit from antiviral medication and ensuring long-term and consistent treatment to people who feel well. The best opportunities are where health systems are advanced enough to effectively address these challenges and in settings where HIV service platforms can be leveraged. Research, innovation, and collaboration are critical to implement services most efficiently and to realize economies of scale to drive down costs of health care services, drugs, and diagnostics.

Viral hepatitis, principally due to chronic hepatitis B virus (HBV) and chronic hepatitis C virus (HCV), claimed 1.4 million lives worldwide in 2013,[1] a rising toll that is now actually greater than that of mortality from HIV. Of the annual deaths caused by viral hepatitis, almost half (686,000) are attributable to HBV.[1]

Although HBV vaccination rates for the childhood routine hepatitis B vaccine series were 82% globally in 2014,[2] coverage rates for the hepatitis B birth dose—to optimally prevent mother-to-child (perinatal) transmission—lag behind. Furthermore, global disability-adjusted life years lost due to HBV-associated liver cancer have continued to rise by 4.8% since 2005.[3] This is because the vast majority of complications from HBV occur among individuals older than 40 who were infected in the perinatal period or as young children. Indeed, an estimated 240 million individuals are already chronically infected,[4] of whom 20% to 30% will eventually develop cirrhosis and/or liver cancer in the absence of treatment.[5]

Although chronic hepatitis B (CHB) infection is usually not curable, thankfully certain antiviral drugs are highly effective at suppressing viral replication and preventing the progress of liver damage without the development of resistance. A momentum is now building to expand access to these medications, in keeping with a new commitment within the Sustainable Development Goals to "combat hepatitis."[6] In 2015, the World Health Organization (WHO) issued its first-ever recommendations for prevention, care, and treatment for persons with CHB,[5] and at the 2016 World Health Assembly a global health sector strategy on viral hepatitis was unanimously adopted[7] that includes targets to treat 5 million people with CHB by 2020 and 80% of people in need by 2030.[8] While not all 240 million persons living with CHB need treatment, the number who would benefit from medication is enormous—84 million people by one estimate.[9]

Considering that CHB treatment is lifelong in many cases, it might at first glance seem unaffordable to seek to expand treatment access to so many. But here is the convenient truth: CHB medications are simple to administer and potentially very inexpensive.

LOW-COST HBV MEDICATIONS CAN CREATE NEW OPPORTUNITIES

Unlike treatment for HIV or tuberculosis, in the substantial majority of CHB cases a single antiviral agent with a high barrier to resistance can effectively suppress HBV. WHO recommendations provide 2 options for preferred first-line agents, tenofovir disoproxil fumarate (TDF) or entecavir (ETV),[5] and rates of virologic resistance are vanishingly low with either when used in treatment-naïve patients: 0% with long-term TDF[10] and 1.2% at 5 years with ETV.[11] ETV and TDF both have a good safety and tolerability profile, although WHO recommends kidney function monitoring tests for people receiving either agent.[5] Long-term TDF use has been associated with loss of bone mineral density, and ETV must be avoided in pregnant women due to evidence of harm in animal studies.

[a] *Global Health, Science and Practice*, Associate Editor, Washington, DC, USA.
Correspondence to Matthew Barnhart (mbarnhart@ghspjournal.org).

TDF is already a backbone of HIV treatment at the same dosage approved for HBV treatment (300 mg/day) and had a ceiling price in 2015 of US$48 per patient year as a generic for HIV[12]; that price would be quite affordable for CHB treatment in middle-income countries, although less than ideal for low-income countries. On the other hand, ETV requires a very low dose of 0.5 mg/day (600-fold less than TDF), with an estimated cost of producing the active pharmaceutical ingredient (API) at scale of only US$2–$4 per year per a recent comprehensive analysis by Hill et al.,[13] which is one-sixth to one-twelfth the per-pill cost of API compared with TDF. Using quite conservative estimates, this analysis arrives at a price estimate of US$36 per year for generic ETV. However, since the API cost per patient year for ETV should be about US$20 less than TDF, it would also be reasonable to estimate that at high volumes the price of generic ETV could differ from the price of TDF by around US$20. Thus, if WHO's 2030 goal of reaching 80% of people in need of CHB with treatment—over 50 million people—were met, the potential cost savings in using generic ETV rather than TDF might be close to US$1 billion per year (although pregnant women and people living with HIV who were co-infected with HBV would still need to use TDF). ETV's low dose may also lower in-country logistic costs for transport and storage at sites.

PATENT EXPIRATIONS WILL HELP

While it is potentially very inexpensive to manufacture generic ETV, current prices of the drug are unfortunately very high, with a lowest global price of US$427 for a generic version not approved by a stringent regulatory authority such as the U.S. Food and Drug Administration, and US$6,127 for a generic version sold in the United States.[13] This is because use of entecavir is currently very low, due in part to the very high prices of branded ETV and TDF, which have to some degree limited the uptake of these drugs in middle- and high-income countries (2015 originator prices in the United States were US$15,111 for ETV and US$10,718 for TDF).[13] However, patents on ETV have recently expired in much of the world, including in the United States, and TDF's main patents will have expired by 2018 in most countries. This will create a dramatically different situation, as it should enable patients throughout the world to receive the most effective treatments while also making it economically feasible to explore the provision of treatment earlier in infection using a simplified public health approach.

PRIORITIZING RECIPIENTS

WHO's guidance appropriately recommends that treatment be prioritized first for patients who have cirrhosis. To prevent HBV-associated liver cancer and cirrhosis, however, it will be crucial to treat people *before* they develop cirrhosis,[14] since liver inflammation occurring over many years predisposes to cancer development and end-stage liver disease. To identify patients without cirrhosis who are at high long-term risk of liver cancer, WHO recommends primarily using quantitative HBV DNA (viral load, or VL) testing,[5] the key biomarker shown to correlate most closely with future risk.[15] However, as HBV DNA VL testing may not be available in the near term in many low-resource settings due to cost and implementation constraints, WHO recommendations also allow for treatment of individuals over age 30 who have persistent elevations of liver enzymes (a conditional recommendation with a low quality of evidence).[5] More research is needed to characterize easy-to-assess CHB prognostic factors for the development of HBV-related cirrhosis and liver cancer, including the relative benefits of treatment in preventing liver cancer in different disease stages, epidemiologic settings, and populations. This includes in sub-Saharan Africa, a region of the world where there is a dearth of robust prospective data despite having high prevalence overall and extremely high prevalence in many countries—for example 22% in South Sudan and 14% in Zimbabwe.[4]

KEY CHALLENGES: TESTING, TREATMENT ELIGIBILITY, AND RETENTION

Despite the low costs and clear benefits of antivirals, drugs will not be a magic bullet in and of themselves. To begin with, the proportion of people who have been tested for HBV is very low in most countries; WHO estimates that globally less than 5% of people living with chronic HBV and/or HCV are aware of their status.[8] On a more positive note, even a one-time HBV test for adults could enable the identification of most people who would benefit from treatment, because the vast majority of HBV-associated liver cancer and cirrhosis occurs among people who were infected perinatally or as children. Rapid,

The toll of viral hepatitis is now greater than that of mortality from HIV.

WHO-issued targets aim to reach 80% of people with chronic hepatitis B in need of treatment by 2030.

In most cases of chronic hepatitis B infection, a single antiviral agent with a high barrier to resistance can effectively suppress the virus.

The proportion of people tested for HBV is very low in most countries, but rapid point-of-care tests could help.

point-of-care tests have been developed for HBV[16] and could boost efficiencies. However, the majority of rapid tests have not yet been prequalified by WHO, and multiple tests lack international validation of sensitivity and specificity in the populations in which they might be used.

Beyond testing, other substantial implementation challenges include linkage to longitudinal care services and differentiating between patients qualifying for treatment now versus those who only need regular monitoring. In addition to providing drugs for long-term daily intake, programs will also need to convince people who feel healthy to adhere to long-term medication. While this is a challenge common to many chronic diseases, it is very salient for HBV, since only a minority of people living with chronic infection will die from its consequences, which often occur several decades after diagnosis. Engaging and retaining men into long-term treatment is also critical for CHB treatment programs, particularly because men have a more than threefold higher risk for HBV-associated liver cancer than women (27% vs. 8% lifetime risk, respectively, among those infected in the perinatal period).[17] Retention of patients on antivirals is important not only to reduce risk of liver cancer and cirrhosis but also to avoid hepatic "flares"—serious and sometimes life-threatening increases in liver inflammation that can occur for several reasons among people living with HBV, including due to an immune response to virus when it resurges after medications are stopped.[18]

To enable optimal access to low-cost HBV drugs and laboratory tests, countries will benefit from working together to achieve economies of scale.

LEVERAGING HIV PLATFORMS

Scaling up any new service entails significant organizational effort and cost. In light of these various hurdles, the best opportunities to expand CHB treatment rapidly may occur where health systems are relatively advanced, for example, in middle-income countries in Asia that have a high HBV burden. However, significant programmatic synergies with HIV platforms also exist, which could help enable service delivery even in low-income countries with less robust health systems, including many in sub-Saharan Africa that have extensive HIV treatment programs. Supply chain, laboratory testing, and longitudinal care systems for HIV treatment have great commonality with HBV treatment. Even for more complex elements of HBV care such as viral load testing, promising opportunities exist to leverage existing HIV infrastructure, as easy-to-transport dried-blood spots that are used for HIV DNA-PCR testing can also be used to quantify HBV DNA[19] and test Hepatitis B e antigen (HBeAg),[20] 2 strong markers of risk for developing liver cancer. HBV treatment programs can also draw on lessons from community outreach, peer support, and service delivery models that HIV programs have developed, including approaches to increase male engagement and to support adherence and retention.

Significant programmatic synergies with HIV platforms exist, which could help enable hepatitis B treatment programs in countries with less advanced health systems.

COLLABORATION, INNOVATION, AND RESEARCH

Most countries with high burdens of HBV have growing economies that can mobilize their own domestic resources to support the increased costs of expanding CHB treatment, which ultimately may save costs by reducing long-term medical expenses for liver cancer and cirrhosis. But to enable optimal access to generic ETV and the variety of HBV-related laboratory tests that will be needed, countries will benefit from actively working together to achieve greater economies of scale, using approaches such as coordinated ordering and prequalification of products to address regulatory bottlenecks. New technologies will also be important to drive down costs and improve outcomes. One such example is tenofovir alafenamide (TAF), a second-generation prodrug of tenofovir recently reported to be non-inferior to TDF in phase III trials of HBV treatment.[21] TAF causes less bone and renal toxicity than TDF and should be less expensive, as it is effective at a low dose of 25 mg/day, although as a patent-protected drug it may be very expensive for many countries. It is also quite possible that the dose of TDF needed to treat HBV effectively may be markedly less than for HIV, as in *in vivo* animal studies TDF produces about 50% of the levels of the active metabolites in liver cells compared with TAF on a per mg basis.[22] This suggests that dose-reduction studies of TDF for CHB treatment may be an alternate avenue to explore to reduce cost and toxicity. Low-dose agents such as TAF, and especially ETV, might also be amenable to long-acting implants,[23] which, along with technology platforms such as mHealth, may improve long-term adherence. And research toward a cure for CHB remains important.[24] Along with therapeutic advances, innovations in laboratory testing are needed, such as point-of-care liver function tests[25] and easier-to-use viral DNA assays. Lastly, and perhaps most importantly, the global health

community should learn by doing together, collaborating on a technical level to develop optimal delivery models for specific contexts and conducting joint research to provide better information about which patients would benefit from CHB treatment. Given the universally low CHB treatment access that currently exists in low-, middle-, and high-income countries, many people throughout the world would be helped from such technical collaborative efforts done in a true spirit of global health partnership.

Competing Interests: None declared.

REFERENCES

1. GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;385(9963):117–171. CrossRef. Medline
2. Subaiya S, Dumolard L, Lydon P, Gacic-Dobo M, Eggers R, Conklin L. Global routine vaccination coverage, 2014. MMWR Morb Mortal Wkly Rep. 2015;64(44):1252–1255. CrossRef. Medline
3. GBD 2013 DALYs and HALE Collaborators; Murray CJ, Barber RM, Foreman KJ, Abbasoglu Ozgoren A, Abd-Allah F, Abera SF, et al. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet. 2015;386(10009): 2145–2191. CrossRef. Medline
4. Schweitzer A, Horn J, Mikolajczyk RT, Krause G, Ott JJ. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. Lancet. 2015;386(10003):1546–1555. CrossRef. Medline
5. World Health Organization (WHO). Guidelines for the prevention, care and treatment of persons with chronic hepatitis B infection. Geneva: WHO; 2015. Available from: http://www.who.int/hiv/pub/hepatitis/hepatitis-b-guidelines/en/
6. Sustainable Development Knowledge Platform [Internet]. New York: United Nations Department of Economic and Social Affairs; c2016. Goal 3: ensure healthy lives and promote well-being for all at all ages; [cited 2016 May 1]. Available from: https://sustainabledevelopment.un.org/sdg3
7. World Hepatitis Alliance [Internet]. London (UK). World Hepatitis Alliance; 2016. Governments on track to eliminate viral hepatitis by 2030; 2016 May 28 [cited 2016 May 31]. Available from: http://www.worldhepatitisalliance.org/en/news/may-2016/governments-track-eliminate-viral-hepatitis-2030
8. World Health Organization (WHO). Draft global health sector strategy on viral hepatitis, 2016-2021: the first of its kind draft. Geneva: WHO; 2015. Available from: http://who.int/hepatitis/strategy2016-2021/Draft_global_health_sector_strategy_viral_hepatitis_13nov.pdf
9. Hatzakis A. Moving the global agenda forward: what needs to happen at national and international levels? Presented at: WHO Global Partners' Meeting on Hepatitis; 2014 Mar 27-28; Geneva.
10. Kitrinos KM, Corsa A, Liu Y, Flaherty J, Snow-Lampart A, Marcellin P, et al. No detectable resistance to tenofovir disoproxil fumarate after 6 years of therapy in patients with chronic hepatitis B. Hepatology. 2014;59(2):434–442. CrossRef. Medline
11. Tenney DJ, Rose RE, Baldick CJ, Pokornowski KA, Eggers BJ, Fang J, et al. Long-term monitoring shows hepatitis B virus resistance to entecavir in nucleoside-naïve patients is rare through 5 years of therapy. Hepatology. 2009;49(5): 1503–1514. CrossRef. Medline
12. Clinton Health Access Initiative (CHAI). 2015 antiretroviral (ARV) CHAI reference price list. Boston: CHAI; 2015. Available from: http://www.clintonhealthaccess.org/content/uploads/2016/01/2015-CHAI-ARV-Reference-Price-List.pdf
13. Hill A, Gotham D, Cooke G, Bhagani S, Andrieuz-Meyer I, Cohn J, et al. Analysis of minimum target prices for production of entecavir to treat hepatitis B in high- and low-income countries. J Virus Erad. 2015;1:103–110. Available from: http://viruseradication.com/journal-details/Analysis_of_minimum_target_prices_for_production_of_entecavir_to_treat_hepatitis_B_in_high-_and_low-income_countries/
14. Zoulim F, Mason W. Reasons to consider earlier treatment of chronic HBV infections. Gut. 2012;61(3):333–336. CrossRef. Medline
15. Chen CJ, Yang HI, Su J, Jen CL, You SL, Lu SN, et al; REVEAL-HBV Study Group. Risk of hepatocellular carcinoma across a biological gradient of serum hepatitis B virus DNA level. JAMA. 2006;295(1):65–73. CrossRef. Medline
16. Franzeck FC, Ngwale R, Msongole B, Hamisi M, Abdul O, Henning L. Viral hepatitis and rapid diagnostic test based screening for HBsAg in HIV-infected patients in rural Tanzania. PLoS One. 2013;8(3):e58468. CrossRef. Medline
17. Huang YT, Jen CL, Yang HI, Lee MH, Su J, Lu SN, et al. Lifetime risk and sex difference of hepatocellular carcinoma among patients with chronic hepatitis B and C. J Clin Oncol. 2011; 29(27):3643–3650. CrossRef. Medline
18. Chang ML, Liaw YF. Hepatitis B flares in chronic hepatitis B: pathogenesis, natural course, and management. J Hepatol. 2014;61(6):1407–1417. CrossRef. Medline
19. Lira R, Maldonado-Rodriguez A, Rojas-Montes O, Ruiz-Tachiquin M, Torres-Ibarra R, Cano-Dominguez C, et al. Use of dried blood samples for monitoring hepatitis B virus infection. Virol J. 2009;6:153. CrossRef. Medline
20. Mohamed S, Raimondo A, Pénaranda G, Camus C, Ouzan D, Ravet S, et al. Dried blood spot sampling for hepatitis B virus serology and molecular testing. PLoS One. 2013;8(4):e61077. CrossRef. Medline
21. Gilead Sciences [Internet]. Foster City (CA): Gilead; c2009-2016. Gilead B announces top-line results from two phase 3 studies evaluating tenofovir alafenamide (taf) for patients with chronic hepatitis infection; 2016 Jan 5 [cited 2016 Feb 21] . Available from: http://www.gilead.com/news/press-releases/2016/1/gilead-announces-topline-results-from-two-phase-3-studies-evaluating-tenofovir-alafenamide-taf-for-patients-with-chronic-hepatitis-b-infection
22. Murakami E, Wang T, Park Y, Hao J, Lepist EI, Babusis D, et al. Implications of efficient hepatic delivery by tenofovir alafenamide (GS-7340) for hepatitis B virus therapy. Antimicrob Agents Chemother. 2015;59(6):3563–3569. CrossRef. Medline
23. Gunawardana M, Remedios-Chan M, Miller CS, Fanter R, Yang F, Marzinke MA, et al. Pharmacokinetics of long-acting tenofovir alafenamide (GS-7340) subdermal implant for HIV prophylaxis. Antimicrob Agents Chemother. 2015;59(7): 3913–3919. CrossRef. Medline

24. Liang TJ, Block TM, McMahon BJ, Ghany MG, Urban S, et al. Present and future therapies of hepatitis B: from discovery to cure. Hepatology. 2015;62(6):1893–908. CrossRef. Medline

25. Pollock NR, Rolland JP, Kumar S, Beattie PD, Jain S, Noubary F, et al. A paper-based multiplexed transaminase test for low-cost, point-of-care liver function testing. Sci Transl Med. 2012; 4(152):152ra129. CrossRef. Medline

First Published Online: 2016 Jun 16

Cite this article as: Barnhart M. A convenient truth: cost of medications need not be a barrier to hepatitis B treatment. Glob Health Sci Pract. 2016;4(2):186–190. http://dx.doi.org/10.9745/GHSP-D-16-00128

© Barnhart. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00128.

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

COMMENTARY

Investing in Family Planning: Key to Achieving the Sustainable Development Goals

Ellen Starbird,[a] Maureen Norton,[a] Rachel Marcus[a]

Voluntary family planning brings transformational benefits to women, families, communities, and countries. Investing in family planning is a development ''best buy'' that can accelerate achievement across the 5 Sustainable Development Goal themes of People, Planet, Prosperity, Peace, and Partnership.

INTRODUCTION

Family planning encompasses the services, policies, information, attitudes, practices, and commodities, including contraceptives, that give women, men, couples, and adolescents the ability to avoid unintended pregnancy and choose whether and/or when to have a child. In this commentary, we outline family planning's links to the Sustainable Development Goals (SDGs) and highlight the transformational benefits that voluntary family planning brings to women, families, communities, and countries. We present family planning as a cross-sectoral intervention that can hasten progress across the 5 SDG themes of People, Planet, Prosperity, Peace, and Partnership (Figure). We particularly stress family planning's:

- Link to human rights, gender equality, and empowerment
- Impact on maternal, newborn, child, and adolescent health
- Role in shaping economic development and environmental and political futures

Accelerating progress in these areas is critical for SDG achievement.

We set forth evidence on ways that family planning can influence SDG achievement. At times, the evidence is strong; at other times, less so. Our hope is that the evidence gaps will motivate researchers to address unanswered questions. Most importantly, we hope that the evidence presented here leads to action at the international and country level—to fully support organized, voluntary family planning in the public and private commercial sectors, as well as through civil society.

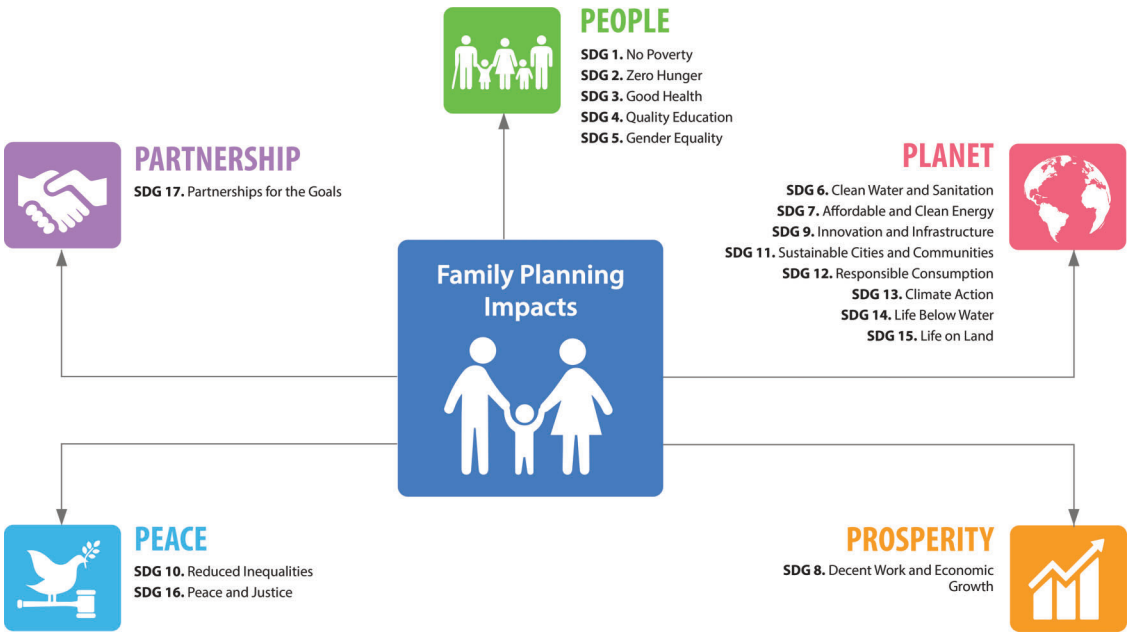
This paper outlines the multiple reasons why investing in family planning is a good decision at every level. It is aligned with recent studies that find that investing in family planning is a development "best buy."[1] Accordingly, we hope that the information presented here will help governments and planners—including Ministries of Finance, district health teams, and civil society organizations—to consider family planning as a fundamental element of any long-term, socioeconomic development strategy, and key to SDG achievement.

In 2000, representatives from 189 United Nations Member States endorsed 8 Millennium Development Goals (MDGs) to be achieved by 2015, and affirmed their collective commitment to poverty reduction and improved quality of life. However, during the next decade, progress toward MDG 4 (reduce child mortality), 5 (improve maternal health), and 6 (combat HIV/AIDs, malaria, and other diseases) was relatively slow. In fact, MDG 5.B, universal access to reproductive health, including access to voluntary family planning (not added until 2007), witnessed the least progress over the entire 15-year MDG time frame. By 2010, experts concluded that "the poorest, least educated women in sub-Saharan Africa have lost ground, with adolescents lagging farthest behind."[2]

The international community, however, has made important strides in recent years. The 2010 "Global Strategy for Women's and Children's Health" has mobilized new resource commitments, and Family Planning 2020 (FP2020), the UN Commission on Life-Saving Commodities, the MDG Health Alliance, and other groups have revitalized family planning globally. Civil society organizations are highly engaged at local

[a] U.S. Agency for International Development, Washington, DC, USA. Correspondence to Rachel Marcus (rmarcus@usaid.gov).

FIGURE. The 5 Sustainable Development Goal Themes of People, Planet, Prosperity, Peace, and Partnership



Investing in family planning is a development "best buy."

levels to ensure the positive momentum continues. Despite this renewed momentum, family planning investments and service access fall short of need in virtually all low-resource settings.

Below, we present the SDGs using the organizing principles set forth in the preamble of the Sustainable Development Goals—People, Planet, Prosperity, Peace, and Partnership. (Thus, the SDGs are not always presented in numerical order in this article.) We then synthesize the most recent analyses that document family planning's importance for the achievement of the SDGs.

Despite renewed momentum, family planning investments and service access fall short of need in virtually all low-resource settings.

PEOPLE

Family planning affects people in myriad ways. Most fundamentally, it advances human rights.

Voluntary family planning helps women and men secure their rights to decide freely, and for themselves, whether, when, and how many children they want to have—a basic human right.[3] Family planning supports the rights of the girl child to remain unmarried and childless, until she is physically, psychologically, and economically ready, and desires to bear children. It supports the rights of adolescent boys and girls to information on how rapid, repeat pregnancies will affect their future. It strengthens the rights of women with HIV to decide on future childbearing, free of coercion. Family planning supports the rights of all people to accurate, unbiased information on contraceptive methods that can help them achieve their reproductive preferences. Yet, in many countries, despite possessing these inherent rights, women and girls often bear more children than they want, or at times when they are not planned.

In 2012, the year for which the most recent data are available, approximately 85 million pregnancies, representing 40% of all pregnancies globally, were unintended.[125] This number was

projected to rise to 92 million by 2015.[4] In 2014, 225 million women in the developing world had an unmet need for a modern contraceptive method.[5] Women with unmet need are defined as those who want to stop or delay childbearing but are not using modern contraceptive methods.

SDGs 3.7 and 5.6 support "universal access to sexual and reproductive health-care services, including for family planning" and "universal access to sexual and reproductive health and reproductive rights," respectively.[6]

Beyond human rights, family planning affects people in other ways, as outlined below.

Goal 1. No Poverty: End Poverty in All Its Forms Everywhere

Family Planning Helps Reduce Poverty

Over the last 3 decades, extreme poverty has declined significantly. In 1981, 50% of the developing world's population lived on less than US$1.25 per day. In 2010, this indicator had dropped to 21%.[7] While population's links to poverty have been debated over the years, a consensus is emerging that rapid population growth can increase the sheer number of poor people.[8]

- The latest data show that the share of Africans who were poor fell from 56% in 1990 to 43% in 2012. Yet, due to population growth, many more people are poor—about 330 million in 2012, up from about 280 million in 1990.[9]
- Equally important, African population growth is not slowing as quickly as anticipated. In 2015, the UN estimated that Africa had the highest annual population growth rate among major geographic areas (2.55%) and projected that it would remain high in 27 African countries.[10]
- Between 2015 and 2050, an estimated 1.3 billion people will be added in Africa. The populations of Angola, Burundi, Democratic Republic of the Congo, Malawi, Mali, Niger, Somalia, Uganda, United Republic of Tanzania, and Zambia may increase at least fivefold by 2100.[10]

The 2015 UN report of population estimates and projections concludes, "… population growth in the poorest countries will make it harder for those governments to eradicate poverty and inequality … [and] improve the provision of basic services."[10] The challenges for poverty reduction strategies and family planning are clear.

At the household level, some studies caution against "the widely held view that large families are poorer" and fail to find links between household size and poverty.[11] Other studies take a different approach to examining family planning's contribution to poverty reduction. They focus instead on family planning's role in creating human capital. A 2010 study found that the family planning program in Colombia reduced women's completed lifetime fertility by approximately one-half of a child and explained a relatively low 6% to 7% of the fertility decline between 1964 and 1993.[12] "Despite its modest role in reducing lifetime fertility," the study concluded, "the ability of family planning to fight poverty cannot be easily dismissed." The study found that women with access to family planning as teenagers gained 0.05 more years of schooling, were 7% more likely to work in the formal sector, and were 2% less likely to cohabit with male partners. In addition, young Colombian women with access to modern contraception "experienced substantial socio-economic gains" because contraception allowed them to postpone their first births and determine their life course. The study concluded that these estimates may place family planning "among the most effective (and cost-effective) interventions to foster human development."[12]

This work links to other SDGs related to economic development and poverty reduction, including Goal 8 (decent work and economic growth) and Goal 10 (reduced inequalities).

In 2012, approximately 85 million pregnancies were unintended.

SDG 3.7 supports universal access to sexual and reproductive health care services, including family planning. SDG 5.6 supports universal access to sexual and reproductive rights.

Goal 2. Zero Hunger: End Hunger, Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture

Family Planning Contributes to Improved Nutrition Outcomes

As noted in a recent brief on the impacts of family planning on nutrition, "undernutrition, which includes stunting, underweight, wasting, and vitamin deficiencies, contributes to nearly half of all childhood deaths. This means that about 3.1 million children under age 5 die each year from malnutrition-related causes."[13]

The breastfeeding method of family planning—the Lactational Amenorrhea Method (LAM), considered a modern method of family planning[14]—yields all of the nutritional benefits of exclusive breastfeeding, and thus can directly

influence newborn and infant nutritional status. However, correct use of this method globally is low at 26% of reported LAM users.[15] Scaling up correct LAM use globally could bring tremendous nutritional benefits to newborns and infants and prevent unwanted pregnancy among postpartum women for 6 months, before transitioning to another modern method.

Family planning helps women time and space their pregnancies to ensure healthy nutritional outcomes.

Family planning also helps women time and space their pregnancies to ensure healthy nutritional outcomes:

- Spacing pregnancies at least 24 months apart (the equivalent of 3 years between births) is linked to reduction of a key measure of malnutrition—stunting—among children under 5. Children born after a 2-year interval or less, compared with a 4-year interval, are 27% more likely to be stunted and 23% more likely to be underweight.[16]
- Timing pregnancy to occur after age 18 improves adolescents' growth and development[17,18] and reduces the risk of poor outcomes for their children—stunting, low birth weight, and preterm birth.[19]
- Spacing pregnancies helps women replenish essential nutrients. Studies have found that "strong evidence" exists for women's folate depletion at 3 to 12 months postpartum,[21] a deficiency linked to the risk of low birth weight in the next pregnancy.[22,23]
- Spacing pregnancies also gives mothers more time, energy, and resources to breastfeed their infants. And when pregnancies are planned, research shows that mothers can breastfeed for longer periods of time and breastfeeding practices improve, leading to improved nutrition.[13,24,25,26]

© 2011 Bonnie Gillespie, Courtesy of Photoshare

A provider counsels a young woman on birth spacing at a primary health care center in Kagoro, Nigeria.

Goal 3. Good Health and Well-Being: Ensure Healthy Lives and Promote Well-Being at All Ages

Family Planning Saves Lives

Every day, approximately 830 women die from causes related to pregnancy and childbirth. Nearly all—99%— of these maternal deaths occur in low-income countries. More than half of the deaths occur in sub-Saharan Africa, while one-third occur in South Asia. In addition, in 2015 5.9 million children died who were under 5 years of age.[27]

Analyses indicate that, between 2012 and 2020, family planning could help avert approximately 7 million under-5 deaths and prevent 450,000 maternal deaths in 22 priority countries of the U.S. Agency for International Development (USAID).[28] A modeling study of 172 countries estimated that, in 2008 alone, family planning averted 272,040 maternal deaths—a 44% reduction compared with the maternal deaths that would have occurred without contraceptive use.[29] It also estimated that satisfying unmet need for contraception could prevent another 104,000 maternal deaths per year (an additional 30% reduction).

Demographic high-risk pregnancies—pregnancies that occur too early or late in the mother's age, are too closely spaced, or are considered too many (high parity)—are associated with higher risk of mortality or morbidity. Family planning improves the health of women and children by reducing the *proportion* of pregnancies that are considered to be high risk. Family planning also reduces the number of women exposed to pregnancy-related health risks, thus lowering the *number* of unintended pregnancies and births.

The global community generally agrees that family planning prevents maternal deaths by:

- Reducing the number of times a woman is exposed to the risks of pregnancy[30,31]
- Helping women avoid unintended and closely spaced pregnancies—a study in Bangladesh found that very short pregnancy intervals are

linked with 7 times increased risk of induced abortion[32]

- Helping women avoid more than 4 births, or births after 35 years of age[30]

The healthiest times for a pregnancy are between the ages of 18 and 34 and at least 24 months after a birth (which ensures about 3 years between births), while avoiding more than 4 births.

On newborn and child health, a wealth of studies conducted in both rich and poor countries, using diverse data sets, have found that spacing pregnancies at least 24 months after a live birth (or about 3 years between births) is associated with lower newborn, infant, and child mortality.[23,33,34,35] Other studies, focusing on contraceptives, despite mixed results have concluded that family planning helps women space their births and "is protective against short intervals."[36] Current analyses indicate that spacing births reduces the risk of death in infancy by up to 10%, and for children under age 5 by 21%.[16,31,35]

Questions remain on family planning's effects on children after they are born. A recent study among infants in Kenya found that a preceding birth interval of less than 18 months was associated with a twofold increase in mortality risk (compared with a birth interval of 36 months), while succeeding intervals of less than 20 months were associated with a 245% increase in early childhood mortality, compared with last births.[20] In another study, children in Afghanistan with a preceding birth interval less than 18 months or greater than 60 months had significantly higher risks of dying due to diarrhea, sepsis, and low birth weight than children with a preceding birth interval of 24–35 months.[37] Finally, a systematic review found evidence for folate depletion, vertical transmission of infection, and transmission of infectious disease between siblings as mechanisms that may explain the adverse perinatal, infant, and child health outcomes associated with short intervals.[22]

Questions also remain on the role of family planning *programs* in child survival. A recent analysis of trends in 57 countries (1985–2013) in the modern contraceptive prevalence rate (mCPR) and high-risk births found that the countries with the fastest mCPR progress experienced the greatest declines in high-risk births, including those due to short birth intervals, high parity, and older-age births. The analysis found no significant change in births to women younger than 18 years of age, and it did not examine first births. It also found that 63% of the increase in the mCPR was due to family planning program efforts, 21% due to economic development, and 17% due to women's education.[38]

The healthiest times for a pregnancy are between the ages of 18 and 34 and at least 24 months after a birth while avoiding more than 4 births.

Family planning helps women bear children at the healthiest times of their lives—when they are psychologically, physically, emotionally, and economically ready for a pregnancy and thus most likely to survive, stay healthy, and have healthy children. Through strengthened, integrated service delivery and improved counseling for women and girls, especially on the risks of short birth intervals,[39,40,41] high parity, and advanced maternal-age pregnancies,[42] family planning should be playing a larger role in child and maternal survival and in adolescent health and well-being.

Family Planning Prevents HIV/AIDS Transmission

Family planning has a critical role to play in curbing the HIV/AIDS epidemic.

In an era when approximately 34 million adults and children are living with HIV/AIDS, and women of childbearing age account for nearly half of the infected population, family planning has a critical role to play in curbing the HIV/AIDS epidemic.

Correct and consistent use of male or female condoms prevents transmission of the HIV virus. It also prevents unintended pregnancy in women with HIV, and thus potential transmission of the virus to the newborn, as well as maternal deaths (including those related to HIV). A modeling study found that, in the 14 countries with the largest numbers of pregnant women with HIV (at the time of the study), programs to prevent perinatal HIV transmission would prevent over 240,000 infant HIV infections if all women in need used the most efficacious antiretroviral regimen available; the estimated cost would be over US$131 million, or US$543 per infant infection averted per year. In comparison, the annual cost of providing family planning to all women with HIV who wished to prevent unintended pregnancies was estimated at about US$26 million in the 14 countries (US$33 million globally). If all unmet needs for family planning were satisfied for pregnant women with HIV, 423,000 births could be prevented at a cost of US$61 per birth averted in the 14 countries.[43]

While approximately 1 in 4 women in sub-Saharan Africa has an unmet need for family

planning, studies have shown that women living with HIV have higher unmet need for family planning and reproductive health services than the general population, in part due to lack of investment in integrated family planning and HIV services.[44] For example, a 2012 study found that programs that have "succeeded in promoting condom use and providing HIV prevention and treatment services … have largely missed the opportunity to address the contraceptive needs of the key populations they serve."[44] Another recent study found that if the needs of women with HIV for modern contraceptive methods and antiretroviral medication were both fully met, HIV transmission from mothers to newborns would be nearly eliminated—reduced by 93% annually,[5] greatly contributing to the "AIDS-Free Generation" goal of the U.S. President's Emergency Plan for AIDS Relief (PEPFAR). Pursuing opportunities to advance family planning integration with HIV services would significantly expand family planning access across Africa and address unmet need.

Goal 4. Quality Education: Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All

Family Planning Supports Women's and Girls' Education

Family planning can help women and girls, especially those who have become mothers, stay in school, become literate, learn a trade, start a business, or otherwise achieve their educational and employment goals. Early and unintended pregnancy can be both a cause and a consequence of dropping out of school.[45]

Early and unintended pregnancy can be both a cause and a consequence of dropping out of school.

Since 2000, adolescent pregnancy has declined only modestly in most countries,[46] and adolescents continue to face many barriers in obtaining contraceptive services and commodities.[47] In 2015, in 56 USAID-assisted countries, approximately 22 million adolescents ages 15–19 had begun childbearing and, of these, 4.3 million have had a second or third child.[48] Adolescent pregnancy affects the adolescents themselves, their families, communities, and broader society.[18] With such high numbers of adolescent pregnancies globally, the world "squanders the well-being, talents, and contributions" of the 20,000 young girls under the age of 18 who give birth each day."[49]

Research shows how family planning supports girls' and women's education:

- An analysis in Iran explored married women's contraceptive use and education and found that those using a modern contraceptive method before the first birth were 84% more likely to advance their education by 1 to 2 years than those not using any method before the first birth.[50]
- An analysis of 200,000 married women from 242 districts in 26 African countries concluded that the number of births to women with children under age 6 and short intervals between the last 2 children "have substantial negative effects" on women's employment outside agriculture."[51]
- A series of case studies concluded that "overall well-being of women and girls improves as fertility declines, especially as it relates to their maternal health, educational attainment, and workforce participation," and fertility decline has had a more positive impact on girls' education than it has had on boys' education.[52]
- A study in Bangladesh found wide-ranging and multiple, positive impacts of family planning on the education and empowerment of women and girls. Women in the family planning-maternal and child health intervention area had not only fewer children with longer intervals between births but also higher individual and household incomes than that of the women and households in the comparison group. The daughters of the program households were better educated than the daughters of families who were not in the program.[53]
- The lifetime opportunity costs of adolescent pregnancy—a measure of the annual income adolescent mothers forgo over their lifetime—range from 1% of annual gross domestic product (GDP) in a large country, such as China, to 30% of annual GDP in a smaller economy such as Uganda. If adolescent girls in Brazil and India were able to wait until their early twenties to have children, the increased economic productivity would equal more than US$3.5 billion and US$7.7 billion, respectively.[54]

Goal 5. Gender Equality: Achieve Gender Equality and Empower All Women and Girls

Family Planning Advances Gender Equality and Empowerment

Gender equality and empowerment call for equal access to resources, services, and opportunities.

Gender equality refers to equal enjoyment of human rights, goods, opportunities, and services among women and men, while empowerment refers to expanding people's capacity to make and act on decisions.[55] They require addressing the barriers women face in making decisions about their own daily lives.[46] Women's access to their chosen family planning method and their ability to negotiate use of the method, therefore, strongly supports gender equality and empowerment.

Many women, however, are unable to make and act on decisions affecting their reproductive lives. A 2014 report found that less than half of currently married women use modern contraception in 37 of 46 countries, and around one-quarter or more of currently married women have an unmet need for family planning in 21 of the 46 countries.[46] High levels of unmet need may indicate that women are not empowered to use contraception because they lack access to health care or are unable to negotiate family planning with their partner. Increasing women's ability to choose the number, timing, and spacing of their children, or their ability to decide if they want to bear children at all, is fundamental for women's control over the circumstances of their lives and for the full achievement of SDG 5.

While family planning programs are not the only contributors to increasing equality, empowerment, and education, the evidence is clear that family planning makes a critical contribution toward achieving these global goals. These broader societal impacts have been achieved, in part, through well-designed and implemented service delivery programs that reach underserved communities—programs that should now be scaled up across Africa and Asia.[56,57,58,59,60]

PLANET

In 2016, scientists issued an urgent environmental call—"we have a global emergency"[61]—and predicted that climate change will be quicker and more catastrophic than anticipated.[62] They stated that even 2 degrees Celsius[63] of global warming would be too much and recommended that "fossil fuel CO_2 emissions should be reduced as rapidly as practical." While not all agree with the scientists' dire assessment, their pragmatic recommendations are ones that all concerned with planetary health should heed. Family planning has a critical role to play in the growing social movement of support for the transformation from "public to planetary health."[64]

Clear and compelling evidence points to serious consequences of rapid population growth on environmental outcomes. Population dynamics, including human population size, growth, density, and migration, are important drivers of environmental and natural resource degradation, including land, forests, biodiversity, and water.[65] The relationships are complex, mediated by poverty, technology, and management practices, among other factors.[66] However, as recognized in the 2013 Second International Population, Health, and Environment Conference, "poor reproductive health outcomes and population growth exist hand-in-hand with poverty and unsustainable natural resource use," especially in remote and rural communities.[67] Although up-to-date empirical data on the specific role of family planning is scarce, a recent review of the existing evidence found that integrating family planning into non-health sector projects, such as natural resource management, has led to improvements in environmental indicators, increased use of contraceptives, and, in instances where long-term measurement was possible, declines in parity or crude birth rates.[67]

Women's access to their chosen family planning method and their ability to negotiate use of the method strongly supports gender equality and empowerment.

Goal 6. Clean Water and Sanitation: Ensure Availability and Sustainable Management of Water and Sanitation for All

Family Planning Mitigates Population Growth's Effects on Access to Water and Sanitation

In 2014, the World Economic Forum identified water crises as the global systemic risk of third highest concern.[68] Population growth affects water scarcity in important ways. It contributes to increased demand and competition for water for domestic, industrial, and municipal uses, including irrigation, and limits the amount of water available per person. Estimates suggest that by 2035, 3.6 billion people will be living in areas of water stress or scarcity, up from approximately 2 billion today.[69]

Population growth also negatively affects access to sanitation. The United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) estimate that, in 2015, some 2.4 billion people—over one-third of the world's population—lacked access to improved sanitation.[70] Between 1990 and 2011, Eastern and Southern Africa and West and Central Africa experienced massive population growth, and the number of people practicing open defecation in both regions rose to over

Family planning has a critical role to play in the planetary health movement.

100 million.[70] In sub-Saharan Africa overall, the number of people defecating in the open is still increasing, largely due to population growth, declared UNICEF and WHO.[70]

To what extent can family planning influence availability of water and sanitation? While the evidence is not extensive:

- Analyses have highlighted water availability under projected scenarios of high and low fertility. For example, estimates suggest that in Jordan, with low fertility (total fertility rate of 2.1 rather than the current rate of 3.8) 26% less water (644 cubic meters versus 733 cubic meters) would be required for the country as a whole in 2040.[71]
- Analyses have also found that family planning programs in Egypt and Jordan have generated modest sectoral savings in water and sanitation (but significant sectoral savings in health and education).[71,72]

Goal 7. Affordable and Clean Energy: Ensure Access to Affordable, Reliable, Sustainable, and Modern Energy for All

Integrated Population, Health, and Environment Projects Can Expand Access to Clean and Renewable Energy

Access to clean and renewable energy is a global issue. Clean energy is defined as heat and electricity produced from renewable sources (wind, sun, rain, waves, tides), generating little or no pollution or emissions. In contrast, approximately 2.8 billion people cook with firewood and other fuels that are linked with health issues and widespread deforestation.[73] In 2012, at least 4.3 million premature deaths, mostly to women and children, were attributed to household air pollution and the effects of reliance on polluting cook stoves.[74]

Over the years, population growth has eroded renewable energy gains. A 2013 World Bank report found that although 1.7 billion people gained access to electricity in the last 10 years, "this is only slightly ahead of population growth of 1.6 billion over the same period."[73] Therefore, "the pace of expansion will have to double" to meet the 2030 targets for modern electricity access.

Integrated population, health, and environment projects have successfully introduced both family planning and clean energy into communities.

Integrated population, health, and environment (PHE) projects have successfully introduced both family planning and clean energy into communities. A family planning project in Uganda collaborated with a clean energy provider to provide solar lights to family planning peer educators. Prior to the project, the peer discussions were necessarily held during daylight hours and thus engaged women only. The solar lights, powered by the sun, were cleaner, more sustainable, and less expensive than kerosene, and they enabled the peer educators to visit homes at night—when the men would be home from work—to talk to couples about family planning.[75]

Goal 9. Industry, Innovation, and Infrastructure: Build Resilient Infrastructure, Promote Inclusive and Sustainable Industrialization, and Foster Innovation

Family Planning Contributes to Building Resilient Infrastructures

Resilience refers to the ability of households, communities, systems, and countries to respond to and recover from shocks and stresses in ways that reduce chronic vulnerability and facilitate inclusive growth.[76]

The dramatic case of the Sahel demonstrates the important role that family planning can play in helping to create resilient countries and communities. Since 1960, the Sahel, "one of the most chronically vulnerable regions of the world"[76] encompassing 10 countries and 100 million inhabitants, has experienced severe drought, food insecurity, low rainfall, environmental degradation, and civil conflict, leading to declining agricultural production. All countries in the Sahel have experienced the "gendered nature of natural disasters."[77] Four of the 10 countries with the highest total fertility rates in the world are in the Sahel (Niger 7.6, Chad 6.5, Burkina Faso 6.0, and Mali 5.9).[76] Contraceptive use by married women is extremely low—for example, less than 2% of married women in Chad use contraception.

Continuing this trajectory of high fertility and low contraceptive use will severely undermine these countries' abilities to respond to social sector needs. In Niger, population growth is 4% annually and will double in just 20 years. "This growth will require a massive investment in schools, health clinics, and job creation for youth," with additional investment also needed in agriculture and livestock systems to ensure food security. Increased investment in family planning in the region could make a critical step toward resilience.[78]

An analysis in Egypt helps us understand how family planning and lower population growth

helped build a more resilient infrastructure for health and economic development. The Egyptian family planning program contributed to a decline in the total fertility rate, from 5.6 in 1976 to 3.1 in 2005. During this time, use of contraception increased from 19% to 59%, made available through the expansion of public-sector and NGO clinics.[72] Under conditions of constant fertility in Egypt, by 2040 there would be 3.6 million births per year. On the other hand, if the fertility rate were lowered, by 2040 there would be about 2 million births per year (about 2.4 per woman). Under this scenario, there would also be[79]:

- 1.3 million fewer people entering the labor force
- 6.4 million fewer primary students in 2040
- 80 billion Egyptian Pounds saved in health care costs
- 20% more land per person in 2040
- 13% less water required
- 17% more electricity available per person

Analysis revealed that, between 1980 and 2005, the family planning program contributed to 45,838 million Egyptian Pounds in savings in expenditures on education, child health, and food subsidies, while costing 2,402 million Egyptian Pounds. The resulting lower health care and education costs, and more land, water, electricity, and jobs available per person, has yielded multiple development benefits for Egypt and an improved quality of life for Egyptians.[72]

Goal 11. Sustainable Cities and Communities: Make Cities and Human Settlements Inclusive, Safe, Resilient, and Sustainable

Family Planning Contributes to Building Safe, Resilient, and Sustainable Cities

Studies have found that it is "not only rapid population growth, but rapid urbanization that is causing problems for the poorest countries."[80] Estimates indicate that the world is confronting the largest wave of urbanization in human history.[81] By 2030, about 5 billion people will live in cities,[81] putting huge pressure on infrastructures, such as health, water, sanitation, and education.

- The urban population in 2014 accounted for 54% of the total global population, up from 34% in 1960, and continues to grow.[82]

© 2007 Tara O'Connell, Courtesy of Photoshare

Houses in Cambodia stand on the Siem Reap River, which is clogged with litter and refuse.

- Africa is experiencing the most rapid urbanization in the world, with annual urban growth rates in recent years of 3.36% per year.[83] As the UN Economic Commission for Africa stated in a recent report, "Urbanization, together with Africa's approaching demographic transition, may well become the most decisive determinants of Africa's economic and social development since independence."[83]
- The estimated number of slum dwellers is increasing, from over 650 million in 1990 to about 863 million in 2012.[81] In Africa between 1990 and 2010, the proportion of urban residents living in slums declined from 70% to 62%, "yet the actual number of slum dwellers has almost doubled from 103 million to 200 million."[84]

Family planning and lower population growth can help build a more resilient infrastructure for health and economic development.

Urban growth in Africa is happening so quickly that it is overwhelming governments' abilities to provide education, health services, housing, drinking water, transportation, electricity, and waste disposal.[84] The latest Demographic and Health Survey data show that although urban women in Africa continue to have fewer children than their rural counterparts,[85] the urban total fertility rate is still above 3 in most countries.[85] While many assume that urban dwellers have greater access to family planning messages and services than rural populations, in many instances this is not the case.[86]

Findings from a longitudinal family planning study in the urban areas of India (Uttar Pradesh),

Kenya, Nigeria, and Senegal shed light on effective, evidence-based strategies to address the unmet need for family planning of urban women and slum dwellers. The study found that exposure to demand-generation activities was significantly and positively associated with modern method use in all of the countries' studied, showing that "targeted, multi-level demand generation activities can make an important contribution to increasing modern method use in urban areas of Africa."[87]

Goal 12. Responsible Consumption and Production: Ensure Sustainable Consumption and Production Patterns

Family Planning Can Help Reduce Population Effects on Food and Chemical Waste

Population dynamics have an important connection to both the challenges of and solutions to the problem of climate change.

According to the United Nations Environment Programme, "The well-being of humanity, the environment, and the functioning of the economy, ultimately depend upon the responsible management of the planet's finite natural resources. These challenges are mounting as the world population is forecast to reach over 9 billion by 2050."[88] Sustainable consumption and production is about managing finite resources and energy efficiency. Key SDG 12 targets involve managing resources efficiently by reducing waste—for example, by 2030, halving per capita food waste, reducing waste generation, and achieving sound management of chemical waste.

Countries of the Organisation for Economic Co-operation and Development (OECD) produce almost half of the world's waste, while Africa and South Asia produce the least. But the issue of waste management is relevant for Asia and Africa and for family planning because, as a World Bank report observed, "… waste is inextricably linked to urbanization."[89] It noted, "Today, more than 50% of the world's population lives in cities, and the rate of urbanization is increasing quickly." As urbanization increases, income and consumption also increase, leading to a corresponding increase in waste. The report found[89]:

- Improving waste management in low-income countries is an urgent priority.
- Poor waste management has an enormous impact on health and well-being—contributing to flooding, pollution, respiratory ailments, diarrhea, and dengue fever.
- Today there are about 3 billion urban residents generating about 1.2 kg of waste per person per day; by 2025, this will increase to 4.3 billion urban residents generating about 1.4 kg of waste per person per day.
- In lower-income cities, solid waste management is usually the single largest budgetary item.

Given the urgency of these issues, studies are needed on the role family planning could play as it relates to urbanization and reduction of food and chemical waste, and the sectoral financial savings that might be generated as a result.

Goal 13. Climate Action: Take Urgent Action to Combat Climate Change and Its Impact

Family Planning Helps Address the Challenges of Climate Change

Population dynamics have an important connection to both the challenges of and solutions to the problem of climate change. Rapid population growth exacerbates vulnerability to the negative consequences of climate change and exposes growing numbers of people to climate risk. The Intergovernmental Panel on Climate Change (IPCC) considers population (along with economic growth and technical change) "one of the root causes of greenhouse gas emissions."[90] Meeting family planning needs will stem population growth, easing challenges associated with adapting to climate change impacts and reducing the growth of greenhouse gas emissions.

- A 2015 study on family planning as a cost-effective strategy to address food insecurity and climate change concluded that slowing population growth can "slow global climate change, by providing 16% to 29% of the needed emissions reductions" by 2050 and reduce the need to increase food production.[91,92] By the end of the century, the effect of slower population growth could reduce total emissions from fossil fuel use by 37% to 41%.
- Another study found that improving access to family planning is a relatively inexpensive intervention for reducing carbon emissions compared with other strategies such as solar, wind, and nuclear power; biofuels; or carbon capture and storage.[93]
- The IPCC argues that "providing access to reproductive health services (including modern family planning)" is an opportunity "to achieve co-benefits … to improve child and maternal health through birth spacing and

reduce population growth, energy use, and consequent CAP [climate-altering pollutants] emissions over time."[94]

- An analysis examining the relationship between food security, population growth, and climate change in Ethiopia showed the potential of family planning to address the food security gap resulting from decreased crop productivity due to climate change. Assuming the current pace of climate change continues, the study found that, by the year 2050, slower population growth would "compensate completely for the effects of climate change on food insecurity."[95]

An analysis found that between 2004 and 2009, in government reports articulating priorities for climate change adaptation, 37 of 40 governments recognized that population growth was important for climate change, yet only 6 proposed activities to address it.[96] The analysis called for broad-based adaptation of an integrated approach and gave the example of an integrated watershed management project in Ethiopia in Wichi province that aimed to improve crop production, minimize biodiversity loss, and increase access to family planning and HIV/AIDS awareness. It concluded that governments' repeated emphasis on the relevance of demographic trends in their climate change adaptation plans "provide a strong collective case for the 'mainstreaming' of an integrated approach … exemplified by the Ethiopian case study." Such a call is still highly relevant today.

Goal 14. Life Below Water: Conserve and Sustainably Use the Oceans, Seas, and Marine Resources for Sustainable Development

Family Planning Helps to Protect Declining Marine Resources

Under intense population pressure, global fisheries are disappearing and ocean resources are becoming extinct.

- A 2009 study of global commercial fisheries found that "80% of fish stocks have either been fully exploited, overexploited, or have collapsed."[97] While reducing the catch by 20% to 50% is needed for sustainable fishing, demand for fish is expected to increase by 35 million tons due to increased consumption and population.
- Of the 21 marine species known to have become extinct in the past 300 years, 16 disappeared since 1972.[98] Population growth affects the oceans in many ways including coral reef damage; accidental killing of millions of tons of birds, fish, and sea turtles; runoff laced with massive chemical fertilizer applications creating ocean "dead zones;" and a vast amount of discarded waste of 6.8 billion consumers, which finds its way to the oceans.
- Population growth will likely impact the success of programs meant to help species rebound and protect the ocean ecosystem. More research is needed on how family planning can support the protection of oceans and marine resources.

Goal 15. Life on Land: Protect, Restore, and Promote Sustainable Use of Terrestrial Ecosystems, Sustainably Manage Forests, Combat Desertification, and Halt and Reverse Land Degradation and Halt Biodiversity Loss

Family Planning Helps Mitigate the Effects of Deforestation and Unhealthy Interaction Among Humans, Domestic Animals, and Wildlife

The world loses approximately 14.5 million hectares of forest each year.[99] As populations grow rapidly, the demand for food and forest products also grows, and forest areas are turned into fields for agriculture and commercial forestry.

As populations grow rapidly, the demand for food and forest products also grows.

A comprehensive study of 46 countries in Africa, Asia, and Latin America found that "agriculture is the main driver of deforestation, causing 73% of all deforestation."[100] Deforestation threatens the well-being and livelihoods of millions of people who heavily depend on forest resources.[101,102] Deforestation also contributes to biodiversity loss: it is estimated that the Southeast Asia region, which has the highest relative rates of deforestation, will lose three-quarters of its original forests and up to 42% of its biodiversity by 2100.[103] Rapid population growth is a driver of biodiversity loss.

Preventing desertification and land degradation is also part of these goals. Desertification occurs with intensive farming, as well as changing climate conditions. Population density contributes to soil depletion and erosion. Providing men and women with family planning to achieve their desires for smaller family sizes will contribute to reduced rates of deforestation, desertification, and land degradation.

Population dynamics can also contribute to unhealthy interactions among humans, domestic

animals, and wildlife. Human population density has been found to be a "significant independent predictor" of emerging infectious diseases.[104] Population expansion is linked to other underlying drivers of disease emergence, including environmental changes. For example, increasing interaction among humans, domestic animals, and wildlife, following land use change, is considered to be a significant contributor to disease emergence.[105]

PROSPERITY

Goal 8. Decent Work and Economic Growth: Promote Sustained, Inclusive, and Sustainable Economic Growth, Full and Productive Employment, and Decent Work for All

Family Planning Contributes to Economic Growth

One important way that family planning contributes to economic growth is by facilitating changes in a country's age structure. Rapid fertility decline, which is linked to increased family planning use, lowers the ratio of dependents to income earners. This results in a higher proportion of wage earners and leads to national savings. With supportive socioeconomic policies and attention to equity, countries can then experience a "demographic dividend" of rapid economic growth. Estimates indicate that the demographic dividend effect of family planning is most pronounced in countries with current high fertility, where rates of return on economic productivity and potential lifetime earnings from improved availability and uptake of contraception could exceed 8% of GDP by 2035."[1]

In the case of the East Asian Tigers (Hong Kong, Singapore, South Korea, and Taiwan), the demographic dividend lasted up to 25 years and has been estimated to account for between 25% to 40% of East Asia's "economic miracle."[106] Across Africa, estimates suggest that a demographic dividend could raise average incomes by 56% compared with a scenario in which the share of the working age population remains constant.[107] The demographic dividend is a window of opportunity for countries to take advantage of a robustly expanding workforce. The payoffs will be high if social and economic policies support the education and employment of young people, especially girls.

The poor-rich gap in contraceptive use is diminishing, but gaps remain in many sub-Saharan African countries.

South Korea and Thailand, demographic dividend success stories, represent strong examples of countries' aligning population policy and family planning services with human capital development policies to accelerate economic growth.[108,109,110]

PEACE

As a multi-sectoral intervention, family planning also contributes to reaching vulnerable populations, mitigating conflict, and achieving state stability and peace.

Goal 10. Reduced Inequalities: Reduce Inequality Within and Among Countries

Family Planning Promotes Inclusive Societies by Addressing the Needs of Disadvantaged Populations

SDG 10 states, "There is growing consensus that economic growth is not sufficient to reduce poverty if it is not inclusive. … To reduce inequality, policies should be universal in principle paying attention to the needs of disadvantaged and marginalized populations."[111]

Unmet need for contraception is often highest among the most disadvantaged and vulnerable—adolescents, the poor, those living in rural areas and urban slums, people living with HIV, and internally displaced persons. These groups have the fewest resources and are the least able to deal with the demands of an unexpected pregnancy. Postpartum women have especially high unmet need: 61% of women within 1 year of their last birth have an unmet need for modern contraceptive methods.[112] Effective family planning programs reach these underserved populations and will need to accelerate efforts in this area if the universal access goals of SDGs 3.7 (universal access to sexual and reproductive health-care services), 5.6 (universal access to sexual and reproductive health and reproductive rights), and 10 (reduce inequality) are to be achieved. A 2015 study showed that, overall, the poor-rich gap in contraceptive use is diminishing, and even more so when family planning programs are strong. Gaps remain in many sub-Saharan African countries.[113]

At the individual and household level, experts note that identifying the effect of demographic factors on economic welfare has "proved elusive," and finding the links between household poverty and childbearing has "proved contentious."[8] As discussed under the SDGs for poverty, education, and equality, some studies show that more women are likely to enter the labor force with fewer children[114]; families who received family planning and maternal-child health services were

more likely to have higher incomes and greater savings and assets[53,115]; and fewer children per family leads to increased household savings and increased investments in each child.[116] A study from Pakistan found that the direct effect of more children of all age/sex combinations on savings is negative and substantial,[117] and a study from Nigeria found that household size was linked with the probability of being poor.[118]

These few studies suggest that new research is needed on fertility's effects on household income and savings.

Goal 16. Peace, Justice, and Strong Institutions: Promote Peaceful and Inclusive Societies for Sustainable Development, Provide Access to Justice for All, and Build Effective, Accountable, and Inclusive Institutions at All Levels

Family Planning Contributes to Peace and Stability

Studies have shown that a large "youth bulge" (defined as a high proportion of youth 15 to 29 years old relative to the older adult population) is associated with a high risk of civil conflict.[119] That is, states with youthful age structures—especially within a politically organized minority[120]—are more likely to experience armed, intrastate conflict and other types of violence.

The political impact of fertility decline is significant. As a country and its population age, studies show that the probability of attaining and maintaining a liberal democracy is increased.[121]

Currently, more than 40 countries are "young," with total fertility rates above 4 children per woman. However, in another 70 countries the demographic transition is more advanced, and the chances for liberalization—and stability—are greater.[122]

In many of the "young" countries, large numbers of alienated youth cannot find jobs and are easy recruits for radical groups that can provide a regular salary. While family planning is not the sole solution, it is important to understand that the high proportion of jobless youth relates to the overall population structure and the sluggish economies that cannot support even menial jobs for everyone. Other experts also see the "youth bulge" as a possible precursor to violence. They urge such countries to consider increasing support for girls' education, family planning, and youth employment, contending that "the pill is mightier than the sword."[123]

© 2010 Chetan Soni, Courtesy of Photoshare

With the help of an NGO in Alirajpur district, India, a father started a basket-weaving business, allowing him to send his girl child to school.

PARTNERSHIP

Goal 17. Partnerships for the Goals: Strengthen the Means of Implementation and Revitalize the Global Partnership for Sustainable Development

Family Planning Partnerships Can Support the Achievement of the SDGs

A revitalized family planning agenda continues to be needed.[8] Family planning services still fall short of need in all developing regions, though analyses show that for every dollar invested in family planning, between US$1.47 and US$4.00 is saved in maternal and newborn health care.[5,124] Investing in family planning, in addition to maternal and newborn services, can save US$1.5 billion while achieving the same health outcomes.[5] According to the new Global Investment Framework for Women's and Children's Health, scaling up access to and use of modern contraceptive methods would directly avert 53% (78 million) of the 147 million child deaths prevented under the high-investment scenario but would require only 4% of intervention-specific costs between 2015 and 2035.[1]

For every US$1 invested in family planning, up to US$4 is saved in maternal and newborn health care.

A wide range of global partnerships have made important strides in recent years in promoting and strengthening family planning. These partnerships—including FP2020, the UN Commission on Life-Saving Commodities, the Ouagadougou Partnership, and the MDG Health Alliance—provide a foundation and a

BOX. The Central Role of Family Planning in Achieving the Sustainable Development Goals Across the 5 Themes of People, Planet, Prosperity, Peace, and Partnership

PEOPLE

- Family planning advances human rights.
- Family planning helps reduce poverty.
- Family planning contributes to improved nutrition outcomes.
- Family planning saves lives.
- Family planning prevents HIV/AIDS transmission.
- Family planning supports women's and girls' education.
- Family planning advances gender equality and empowerment.

PLANET

- Family planning mitigates population growth's effects on access to water and sanitation.
- Integrated population, health, and environment projects can expand access to clean and renewable energy.
- Family planning contributes to building resilient infrastructures.
- Family planning contributes to building safe, resilient, sustainable cities.
- Family planning helps reduce population effects on food and chemical waste.
- Family planning helps address the challenges of climate change.
- Family planning helps to protect declining marine resources.
- Family planning helps mitigate the effects of deforestation and unhealthy interaction among humans, domestic animals, and wildlife.

PROSPERITY

- Family planning contributes to economic growth.

PEACE

- Family planning promotes inclusive societies by addressing the needs of disadvantaged populations.
- Family planning contributes to peace and stability.

PARTNERSHIP

- Family planning partnerships can support the achievement of the SDGs.

model for the collaborative, multi-sectoral efforts that are needed to support sustainable development. Moreover, these partnerships will be critical in supporting country-level partnerships that include the public and private commercial sectors, foundations, civil society organizations, and non-health sector groups (e.g., in education, environment, income generation) to accelerate country-level change in the years ahead, and to ultimately achieve the Sustainable Development Goals.

CONCLUSION: INVEST IN FAMILY PLANNING TO ACHIEVE THE SDGS

In the time frame of the SDGs, the world has the opportunity to achieve a grand convergence between the developed and developing world, ending preventable child and maternal deaths and achieving relative parity in meeting the family planning needs of women, men, couples, and adolescents who want to space or limit childbearing.

Family planning can accelerate progress across the 5 SDG themes of People, Planet, Prosperity, Peace, and Partnership and is critical to achieving the goals and the post-2015 development agenda (see Box for a summary). Empowering women to choose the number, timing, and spacing of their pregnancies is not only a matter of health and human rights but also touches on many multi-sectoral determinants vital to sustainable development, including women's education and status in society. Without universal access to family planning and reproductive health, the impact and effectiveness of other interventions will be less, will cost more, and will take longer to achieve. Global strategies and partnerships—and health decision makers at all levels—must leverage the abundance of available research, evidence, and the range of justifications presented here to prioritize family planning as a foundational component of health, rights, and long-term development strategies.

Acknowledgments: The opinions expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Agency for International Development.

Competing Interests: None declared.

REFERENCES

1. Stenberg K, Axelson H, Sheehan P, Anderson I, Gülmezoglu AM, Temmerman M, et al. Study Group for the Global Investment Framework for Women's Children's Health. Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework. Lancet. 2014;383 (9925):1333-1354. CrossRef. Medline
2. United Nations Population Fund (UNFPA). How universal is access to reproductive health? A review of the evidence. New York: UNFPA; 2010. Available from: https://www.unfpa.org/sites/default/files/pub-pdf/universal_rh.pdf
3. Hardee K, Newman K, Bakamjian L, Kumar J, Harris S, Rodriguez M, et al. Voluntary family planning programs that respect, protect and fulfill human rights: a conceptual framework. Washington (DC): Futures Group. Available from: https://www.engenderhealth.org/files/pubs/family-planning/Voluntary_Family_Planning_Programs_A_Conceptual_Framework
4. Tsui AO, McDonald-Mosley R, Burke AE. Family planning and the burden of unintended pregnancies. Epidemiol Rev. 2010; 32(1):152-174. CrossRef. Medline
5. Singh S, Darroch J, Ashford L. Adding it up: the costs and benefits of investing in sexual and reproductive health 2014. New York: Guttmacher Institute; 2014. Available from: https://www.guttmacher.org/pubs/AddingItUp2014.html
6. Sustainable Development Knowledge Platform [Internet]. (2015). New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development. Sustainable development goals; [cited 2016 May 14] . Available from: https://sustainabledevelopment.un.org/post2015/transformingourworld
7. Olinto P, Uematsu H. The state of the poor: where are the poor and where are they the poorest ? Washington (DC): World Bank, Poverty Reduction and Equity Unit; 2010. Available from: http://www.worldbank.org/content/dam/Worldbank/document/State_of_the_poor_paper_April17.pdf
8. Cleland J, Bernstein S, Ezeh A, Faundes A, Glasier A, Innis J. Family planning: the unfinished agenda. Lancet. 2006;368 (9549):1810-1827. CrossRef. Medline
9. Beegle K, Christiaensen L, Dabalen A, Gaddis I. Poverty in a rising Africa. Washington (DC): World Bank; 2016. CrossRef
10. United Nations (UN), Department of Economics and Social Affairs, Population Division. World population prospects: the 2015 revision, key findings and advance tables. New York: UN; 2015. Available from: http://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf
11. Lanjouw P, Ravallion M. Poverty and household size. Econ J. 1995;105(433):1415-1434. CrossRef
12. Miller G. Contraception as development? New evidence from family planning in Colombia. Econ J. 2010;120(545):709-736. CrossRef
13. Naik R, Smith R. Impacts of family planning on nutrition. Washington (DC): Futures Group, Health Policy Project; 2015. Available from: http://www.healthpolicyproject.com/pubs/690_FPandnutritionFinal.pdf
14. Malarcher S, Spieler J, Fabic M, Jordan S, Starbird E, Kenon C. Fertility awareness methods: distinctive modern contraceptives. Glob Health Sci Pract. 2016;4(1):13-15. CrossRef. Medline
15. Fabic MS, Choi Y. Assessing the quality of data regarding use of the Lactational Amenorrhea Method. Stud Fam Plann. 2013; 44(2):205-221. CrossRef. Medline
16. Rutstein S, Winter R. The effects of fertility behavior on child survival and child nutritional status: evidence from the demographic and health surveys, 2006 to 2012. DHS Analytical Studies 37. Calverton (MD): ICF International; 2014. Available from: http://dhsprogram.com/publications/publication-as37-analytical-studies.cfm

Without universal access to family planning and reproductive health, the impact and effectiveness of other interventions will be less, will cost more, and will take longer to achieve.

17. Rah JH, Christian P, Shamim AA, Arju UT, Labrique AB, Rashid M. Pregnancy and lactation hinder growth and nutritional status of adolescent girls in rural Bangladesh. J Nutr. 2008;138(8): 1505-1511. Medline
18. Ganchimeg T, Ota E, Morisaki N, Laopaiboon M, Lumbiganon P, Zhang J, et al. Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study. BJOG. 2014;121 (Suppl 1):40-48. CrossRef. Medline
19. Fall CHD, Sachdev HS, Osmond C, Restrepo-Mendez MC, Victora C, Martorell R, et al. Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). Lancet Glob Health. 2015;3(7):e366-e377. CrossRef. Medline
20. Fotso JC, Cleland J, Mberu B, Mutua M, Elungata P. Birth spacing and child mortality: an analysis of prospective data from the Nairobi urban health and demographic surveillance system. J Biosoc Sci. 2013;45(06):779-798. (note: in-text citation not in sequential order). CrossRef. Medline
21. Smits LJM, Essed GGM. Short interpregnancy intervals and unfavourable pregnancy outcome: role of folate depletion. Lancet. 2001;358(9298):2074-2077. CrossRef. Medline
22. Conde-Agudelo A, Rosas-Bermudez A, Castaño F, Norton MH. Effects of birth spacing on maternal, perinatal, infant, and child health: a systematic review of causal mechanisms. Stud Fam Plann. 2012;43(2):93-114. CrossRef. Medline
23. Conde-Agudelo A, Rosas-Bermúdez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. JAMA. 2006;295(15):1809-1823. CrossRef. Medline
24. Chinebuah B, Pérez-Escamilla R. Unplanned pregnancies are associated with less likelihood of prolonged breast-feeding among primiparous women in Ghana. J Nutr. 2001;131(4): 1247-1249. Medline
25. Hromi-Fiedler AJ, Pérez-Escamilla R. Unintended pregnancies are associated with less likelihood of prolonged breast-feeding: an analysis of 18 demographic and health surveys. Public Health Nutr. 2006;9(3):306-312. Medline
26. Yalçin SS, Yalçin S, Kurtuluş-Yiğit E. Determinants of continued breastfeeding beyond 12 months in Turkey: secondary data analysis of the demographic and health survey. Turk J Pediatr. 2014;56(6):581-591. Medline
27. World Health Organization (WHO) [Internet]. Geneva: WHO; c2016. Children: reducing mortality: fact sheet; updated 2016 Jan [cited 2016 May 15]. Available from: http://www.who.int/mediacentre/factsheets/fs178/en/
28. U.S. Agency for International Development (USAID). Acting on the call: ending preventable child and maternal deaths Report June 2014. Washington (DC): USAID; 2014. Available from: https://www.usaid.gov/sites/default/files/documents/1864/USAID_ActingOnTheCall_2014.pdf
29. Ahmed S, Li Q, Liu L, Tsui AO. Maternal deaths averted by contraceptive use: an analysis of 172 countries. Lancet. 2012;380(9837):111-125. CrossRef. Medline
30. Stover J, Ross J. How increased contraceptive use has reduced maternal mortality Matern Child Health J. 2010;14(5):687-695. CrossRef. Medline
31. Cleland J, Conde-Agudelo A, Peterson H, Ross J, Tsui A. Contraception and health. Lancet. 2012;380(9837):149-156. CrossRef. Medline
32. DaVanzo J, Hale L, Razzaque A, Rahman M. Effects of interpregnancy interval and outcome of the preceding pregnancy on pregnancy outcomes in Matlab, Bangladesh. BJOG. 2007;114(9):1079-1087. CrossRef. Medline
33. Zhu BP, Rolfs RT, Nangle BE, Horan JM. Effect of the interval between pregnancies on perinatal outcomes N Engl J Med. 1999;340(8):589-594. CrossRef. Medline
34. Kozuki N, Lee AC, Silveira MF, Victora CG, Adair L, Humphrey J, et al. The associations of birth intervals with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-analysis. BMC Public Health. 2013;13 (Suppl 3):S3. CrossRef. Medline
35. Rutstein SO. Further evidence of the effects of preceding birth intervals on neonatal, infant, and under-five-years mortality and nutritional status in developing countries: evidence from the demographic health surveys. DHS Working Paper No. 41. Calverton (MD): Macro International; 2008. Available from: https://dhsprogram.com/pubs/pdf/WP41/WP41.pdf
36. Yeakey MP, Muntifering CJ, Ramachandran DV, Myint Y, Creanga AA, Tsui AO. How contraceptive use affects birth intervals: results of a literature review. Stud Fam Plann. 2009;40 (3):205-214. CrossRef. Medline
37. Rasooly MH, Saeed KMI, Noormal B, Aman I, Arnold F, Govindasamy P, et al. The effect of birth intervals on causes of under-five mortality in Afghanistan. DHS Working Papers No. 96. Calverton (MD): ICF International; 2013. Available from: https://dhsprogram.com/pubs/pdf/WP96/WP96.pdf
38. Brown W, Ahmed S, Roche N, Sonneveldt E, Darmstadt GL. Impact of family planning programs in reducing high-risk births due to younger and older maternal age, short birth intervals, and high parity. Semin Perinatol. 2015;39(5):338-344. CrossRef. Medline
39. Ahmed S, Ahmed S, McKaig C, Begum N, Mungia J, Norton M, et al. The effect of integrating family planning with a maternal and newborn health program on postpartum contraceptive use and optimal birth spacing in rural Bangladesh. Stud Fam Plann. 2015;46(3):297-312. CrossRef. Medline
40. Ahmed S, Norton M, Williams E, Ahmed S, Shah R, Begum N, et al. Operations research to add postpartum family planning to maternal and neonatal health to improve birth spacing in Sylhet District, Bangladesh. Glob Health Sci Pract. 2013;1(2):262-276. CrossRef. Medline
41. Cooper CM, Ahmed S, Winch PJ, Pfitzer A, McKaig C, Baqui AH. Findings from use of a narrative story and leaflet to influence shifts along the behavior change continuum toward postpartum contraceptive uptake in Sylhet District, Bangladesh. Patient Educ Couns. 2014; 97(3):376-382. CrossRef. Medline
42. Health Communication Capacity Collaborative (HC3). Engaging families for healthy pregnancies: a focused desk review of knowledge, attitudes and behaviors related to pregnancies in three high-risk situations: advanced maternal age; high parity; and rapid repeat pregnancy after abortion or miscarriage. Baltimore: Johns Hopkins Bloomberg School of Public Health, Center for Communications Programs; 2014. Available from: http://www.healthcommcapacity.org/wp-content/uploads/2014/03/HTSP-AMA-HP-Assessment-Final-Report-approved-21Mar14.pdf
43. Halperin DT, Stover J, Reynolds HW. Benefits and costs of expanding access to family planning programs to women living with HIV. AIDS. 2009;23 (Suppl 1):S123-S130. CrossRef. Medline
44. Petruny T, Minichiello SN, McDowell M, Wilcher R. Meeting the contraceptive needs of key populations affected by HIV in Asia: an unfinished agenda. AIDS Res Treat. 2012;2012:792649. CrossRef. Medline
45. United Nations Educational, Scientific and Cultural Organization (UNESCO). Developing an education sector

response to early and unintended pregnancy. Paris (France): UNESCO; 2014. Available from: http://unesdoc.unesco.org/images/0023/002305/230510E.pdf

46. Head SK, Zweimueller S, Marchena C, Hoel E. Women's lives and challenges: equality and empowerment since 2000. 2014 Prepared by ICF International for USAID.
47. Bankole A, Malarcher S. Removing barriers to adolescents' access to contraceptive information and services. Stud Fam Plann. 2010;41(2):117-124. CrossRef. Medline
48. Knowledge Management Services Project. Analysis of first, second, and third pregnancies among adolescents in USAID-assisted countries. Washington (DC): John Snow; 2015.
49. Loaiza E, Liang M. Adolescent pregnancy: a review of the evidence. New York: UNFPA; 2013. Available from: https://www.unfpa.org/sites/default/files/pub-pdf/ADOLESCENT%20PREGNANCY_UNFPA.pdf
50. Erfani A. The impact of family planning on women's educational advancement in Tehran, Iran. Washington (DC): International Center for Research on Women; 2012. Available from: http://www.icrw.org/files/publications/Erfani%20MS%20edit%20Feb%202013.pdf
51. Longwe A, Smits J, de Jong E. Number and spacing of children and women's employment in Africa. NiCE Working Paper 13-103. Nijmegen (The Netherlands): Radboud University Nijmegen, Institute for Management Research, Nijmegen Center for Economics (NiCE); 2013. Available from: http://www.ru.nl/publish/pages/516298/nice-13103.pdf
52. Stoebenau K, Pande R, Malhotra A. How have fertility declines benefitted women's lives in low- and middle-income countries? A review of the evidence. Washington (DC): International Center for Research on Women; 2014. Available from: http://www.icrw.org/sites/default/files/publications/ICRW_Fertility_Brief_040814.pdf
53. Gribble J, Voss M. Family planning and economic well-being: new evidence from Bangladesh. Washington (DC): Population Reference Bureau: 2009. Available from: http://www.prb.org/pdf09/fp-econ-bangladesh.pdf
54. United Nations Population Fund (UNFPA) [Internet]. New York: UNFPA. Population and poverty; 2014 [cited 2015 Dec 1] . Available from: http://www.unfpa.org/resources/population-and-poverty
55. Interagency Gender Working Group (IGWG). Gender-related terms and definitions. Washington (DC): IGWG; [date unknown]. Available from: http://www.igwg.org/training/DevelopingSharedVocabulary/DefiningGenderRelatedTerms.aspx
56. Family Planning High Impact Practices [Internet]. Washington (DC): U.S. Agency for International Development; c; 2016. Available from: https://www.fphighimpactpractices.org/
57. U.S. Agency for International Development (USAID)/Africa Bureau; USAID/Population and Reproductive Health; Ethiopia Federal Ministry of Health; Malawi Ministry of Health; Rwanda Ministry of Health. Three successful Sub-Saharan African family planning programs: lessons for meeting the MDGs. Washington (DC): USAID; 2012. Available from: http://pdf.usaid.gov/pdf_docs/PA00HQSV.pdf
58. Duvall S, Thurston S, Weinberger M, Nuccio O, Fuchs-Montgomery N. Scaling up delivery of contraceptive implants in sub-Saharan Africa: operational experiences of Marie Stopes International. Glob Health Sci Pract. 2014;2(1):72-92. CrossRef. Medline
59. Munroe E, Hayes B, Taft J. Private-sector social franchising to accelerate family planning access, choice and quality: results from Marie Stopes International. Glob Health Sci Pract. 2015; 3(2):195-208. CrossRef. Medline
60. Extending Service Delivery (ESD) Project. Healthy images of manhood: a male engagement approach for workplaces and community programs integrating gender, family planning and HIV/AIDS: a case study. Washington (DC): ESD Project; 2010. Available from: http://www.pathfinder.org/publications-tools/pdfs/Healthy-Images-of-Manhood-A-Male-Engagement-Approach-for-Workplaces-and-Community-Programs-Integrating-Gender-Family-Planning-and-HIV-AIDS.pdf?x=88&y=15
61. Hansen J, Sato M, Hearty P, Ruedy R, Kelley M, Masson-Delmotte V, et al. Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming could be dangerous. Atmos Chem Phys. 2016;16(6):3761-3812. CrossRef
62. Mooney C. We had all better hope these scientists are wrong about the planet's future. Washington Post. 2016 Mar 22 . Available from: https://www.washingtonpost.com/news/energy-environment/wp/2016/03/22/we-had-all-better-hope-these-scientists-are-wrong-about-the-planets-future/
63. Davenport C, Gillis J, Chan S, Eddy M. Inside the Paris climate deal. New York Times. 2015 Dec 12 . Available from: http://www.nytimes.com/interactive/2015/12/12/world/paris-climate-change-deal-explainer.html
64. Horton R, Beaglehole R, Bonita R, Raeburn J, McKee M, Wall S. From public to planetary health: a manifesto. Lancet. 2014;383 (9920):847. CrossRef. Medline
65. Population Action International (PAI). Why population matters. Washington (DC): PAI; 2010. Available from: http://pai.org/wp-content/uploads/2011/10/Why-Population-Matters.pdf
66. Bremner J, López-Carr D, Suter L, Davis J. Population, poverty, environment, and climate dynamics in the developing world. Interdisciplinary Environ Rev. 2010;11(2/3):112-126. Available from: http://geog.ucsb.edu/~carr/wordpress/wp-content/uploads/2012/04/Bremneretal_IntEnvRev_201012.pdf
67. Yavinsky RW, Lamere C, Patterson KP, Bremner J. The impact of population, health, and environment projects: a synthesis of the evidence. Working Paper. Washington (DC): Population Council, The Evidence Project; 2015. Available from: http://evidenceproject.popcouncil.org/wp-content/uploads/2015/06/PHE-Synthesis-Report1.pdf
68. World Economic Forum. Global risks 2014, 9th ed. Geneva: World Economic Forum; 2014. Available from: http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2014.pdf
69. Mogelgaard K. Why population matters to water resources. Washington (DC): Population Action International; 2012. Available from: http://pai.org/wp-content/uploads/2012/04/PAI-1293-WATER-4PG.pdf
70. United Nations Children's Fund (UNICEF) [Internet]. New York: UNICEF. Water, sanitation and hygiene; [cited 2016 May 14] . Available from: http://www.unicef.org/wash/
71. Higher Population Council; Health Policy Project. Jordan RAPID: population growth and its impact on energy. Amman (Jordan): Higher Population Council; 2013. Available from: http://www.healthpolicyproject.com/index.cfm?id=publications&get=pubID&pubId=255
72. Moreland S. Egypt's population program: assessing 25 years of family planning. Washington (DC): POLICY Project; 2006. Available from: http://www.policyproject.com/pubs/countryreports/Egypt%2025%20yr%20retro%20Final.pdf
73. Goering L. Population growth erodes sustainable energy gains: UN report. Thomson Reuters Foundation News [Internet]. 2013 May 31 [cited 2016 May 14] . Available from: http://news.trust.org//item/20130531145822-jlky7

74. World Health Organization (WHO). Burden of disease from household air pollution for 2012. Geneva: WHO; 2014. Available from: http://www.who.int/phe/health_topics/outdoorair/databases/HAP_BoD_results_March2014.pdf?ua=1
75. Shillingi L. Innovation by solar lamp powers family planning services, poverty reduction, and clean energy use. 2012 Sep 1 [cited 2016 Apr 1]. In: Pathfinder International Blog [Internet]. Watertown (MA): Pathfinder International. Available from: http://www.pathfinder.org/blog/innovation-by-solar-lamp-powers-family-planning-poverty-reduction.html
76. Bremner J. Building resilience through family planning: a transformative approach for women, families, and communities. Washington (DC): Population Reference Bureau; 2015. Available from: http://www.prb.org/pdf15/sahel-resilience-brief.pdf
77. Neumayer E, Plümper T. The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981-2002. Ann Assoc Am Geogr. 2007;97(3):551-566. CrossRef
78. U.S. Agency for International Development (USAID). Sahel JPC strategic plan: reducing risk, building resilience and facilitating inclusive economic growth. Washington (DC): USAID; 2012. Available from: https://www.usaid.gov/sites/default/files/documents/1860/Sahel%20JPC%20Strategy%20Presentation.pdf
79. Abel E. Egypt: population and development [PowerPoint presentation]. Washington (DC): The Futures Group; [date unknown].
80. Stephenson J, Newman K, Mayhew S. Population dynamics and climate change: what are the links? J Public Health (Bangkok). 2010;32(2):150-156. CrossRef. Medline
81. United Nations Population Fund (UNFPA) [Internet]. New York: UNFPA. Urbanization; [cited 2016 Feb 1] . Available from: www.unfpa.org/urbanization
82. World Health Organization (WHO) [Internet]. Geneva: WHO; c2016. Global Health Observatory (GHO) data: urban population growth; [cited 2016 Feb 1]. Available from: http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/
83. United Nations (UN) Economic Commission for Africa. Contribution to the 2014 United Nations Economic and Social Council (ECOSOC) integration segment. Addis Ababa (Ethiopia): UN Economic Commission for Africa; 2014. Available from: http://www.un.org/en/ecosoc/integration/pdf/economiccommissionforafrica.pdf
84. Mutunga C, Zulu E, De Souza RM. Population dynamics, climate change, and sustainable development in Africa. Washington (DC): Population Action International; 2012. Co-published by the African Institute for Development Policy . Available from: http://pai.org/wp-content/uploads/2012/09/Sustainable-Development-in-Africa.pdf
85. Population Reference Bureau (PRB). The urban-rural divide in health and development: data sheet. Washington (DC): PRB; 2015. Available from: www.prb.org/pdf15/urban-rural-datasheet.pdf
86. Ezeh AC, Kodzi I, Emina J. Reaching the urban poor with family planning services. Stud Fam Plann. 2010;41(2):109-116. CrossRef. Medline
87. Speizer IS, Corroon M, Calhoun L, Lance P, Montana L, Nanda P, et al. Demand generation activities and modern contraceptive use in urban areas of four countries: a longitudinal evaluation. Glob Health Sci Pract. 2014;2(4):410-426. CrossRef. Medline
88. United Nations Environment Programme (UNEP). Sustainable consumption and production for poverty eradication. Nairobi (Kenya): UNEP; 2012. Available from: http://www.unep.org/10yfp/Portals/50150/downloads/publications/poverty/SCP_for_Poverty_full.pdf
89. Hoornweg D, Bhada-Tata P. What a waste: a global review of solid waste management. Washington (DC): World Bank; 2012. Available from: http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
90. Jiang L, Hardee K. How do recent population trends matter to climate change? Popul Res Policy Rev. 2011;130(2):287-312. CrossRef
91. O'Neill BC, Dalton M, Fuchs R, Jiang L, Pachauri S, Zigova K. Global demographic trends and future carbon emissions. Proc Natl Acad Sci USA. 201;107(41):17521-17526. CrossRef. Medline
92. Speidel JJ, Raifman S, Thompson KMJ. By slowing population growth, family planning can help address food security and climate change. San Francisco (CA): University of California, San Francisco, Bixby Center for Global Reproductive Health; 2015. Available from: https://bixbycenter.ucsf.edu/sites/bixbycenter.ucsf.edu/files/PFC_Feb_3_2015.pdf
93. Wheeler D, Hammer D. The economics of population policy for carbon emissions reduction in developing countries. Washington (DC): Center for Global Development; 2010. Available from: http://www.cgdev.org/publication/economics-population-policy-carbon-emissions-reduction-developing-countries-working
94. Smith KR, Woodward A, Campbell-Lendrum D, Chadee DD, Honda Y, Liu Q, et al. Human health: impacts, adaptation, and co-benefits. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, et al., editors . Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the fifth assessment report of the Intergovernmental Panel on Climate Change. Cambridge (UK): Cambridge University Press; 2014. p. 709-754. Available from: https://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap11_FINAL.pdf
95. Moreland S, Smith E. Climate change, food security, and population in Sub-Saharan Africa: modeling the linkages. Int J Climate Change. 2013;4(2):29-47.
96. Bryant L, Carver L, Butler CD, Anage A. Climate change and family planning: least developed countries define the agenda. Bull World Health Organ. 2009;87(11):852-857. CrossRef. Medline
97. Mora C, Myers RA, Coll M, Libralato S, Pitcher TJ, Sumaila RU, et al. Management effectiveness of the world's marine fisheries. PLoS Biol. 2009;7(6):e1000131. CrossRef. Medline
98. Eilperin J. Wave of marine species extinctions feared. Washington Post. 2005 Aug 24 . Available from: http://www.washingtonpost.com/wp-dyn/content/article/2005/08/22/AR2005082200036.html
99. World Bank [Internet]. Washington (DC): World Bank; c2016. Sustaining forests and livelihoods in a changing world; 2013 Jan 29 [cited 2016 Apr 1] . Available from: http://www.worldbank.org/en/news/feature/2013/01/29/sustaining-forests-livelihoods-changing-world
100. Hosonuma N, Herold M, De Sy V, De Fries RS, Brockhaus M, Verchot L, et al. An assessment of deforestation and forest degradation drivers in developing countries. Environ Res Lett. 2012;7(4):044009. CrossRef

101. Mutunga C. Why population matters to forests. Washington (DC): Population Action International; 2011. Available from: http://pai.org/wp-content/uploads/2012/02/PAI-1293-FORESTS_compressed.pdf

102. Pan W, Carr D, Barbierri A, Bilsborrow R, Suchindran C. Forest clearing in the Ecuadorian Amazon: a study of patterns over space and time. Popul Res Policy Rev. 2011;26(5-6):635-659. CrossRef. Medline

103. Sodhi NS, Koh LP, Brook BW, Ng PKL. Southeast Asian biodiversity: an impending disaster. Trends Ecol Evol. 2004;19(12):654-660. CrossRef. Medline

104. Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P. Global trends in emerging infectious diseases. Nature. 2008;451(7181):990-993. CrossRef. Medline

105. Murray KA, Daszak P. Human ecology in pathogenic landscapes: two hypotheses on how land use change drives viral emergence. Curr Opin Virol. 2013;3(1):79-83. CrossRef. Medline

106. Bloom DE, Canning D, Sevilla J. The demographic dividend: a new perspective on the economic consequences of population change. Santa Monica (CA): RAND; 2003. Available from: https://www.rand.org/content/dam/rand/pubs/monograph_reports/2007/MR1274.pdf

107. Drummond P, Thakoor V, Yu S. Africa rising: harnessing the demographic dividend. Washington (DC): International Monetary Fund; 2014. Available from: https://www.imf.org/external/pubs/ft/wp/2014/wp14143.pdf

108. Gribble JN. South Korea's demographic dividend. Washington (DC): Population Reference Bureau; 2012. Available from: http://www.prb.org/Publications/Articles/2012/south-korea-population.aspx

109. Population Connection [Internet]. Washington (DC): Population Connection; c2016. Demographic dividend: the economic boost that follows a switch to low fertility; [cited 2016 Apr 1]. Available from: http://www.populationconnection.org/article/demographic-dividend/

110. United Nations Population Fund (UNFPA) [Internet]. New York: UNFPA. Demographic dividend; [cited 2016 Apr 1] . Available from: http://www.unfpa.org/demographic-dividend

111. United Nations (UN) Sustainable Development Goals. New York: UN; c2016. Goal 10: reduce inequality within and among countries; [cited 2016 Apr 1] . Available from: http://www.un.org/sustainabledevelopment/inequality/

112. Moore Z, Pfitzer A, Gubin R, Charurat E, Elliott L, Croft T. Missed opportunities for family planning: an analysis of pregnancy risk and contraceptive method use among postpartum women in 21 low- and middle-income countries. Contraception. 2015;92(1):31-39. CrossRef. Medline

113. Ross J. Improved reproductive health equity between the poor and the rich: an analysis of trends in 46 low- and middle-income countries. Glob Health Sci Pract. 2015;3(3):419-445. CrossRef. Medline

114. Bloom DE, Canning D, Fink G, Finlay JE. Fertility, female labor force participation, and the demographic dividend. Boston (MA): Harvard School of Public Health; 2007. Available from: http://www.hsph.harvard.edu/program-on-the-global-demography-of-aging/WorkingPapers/2007/pgda_wp25_2007.pdf

115. Joshi S, Schultz TP. Family planning as an investment in development: evaluation of a program's consequences in Matlab, Bangladesh. New Haven (CT): Yale University, Economic Growth Center; 2007. Available from: http://www.econ.yale.edu/~pschultz/SchultzJoshiEGCWorkingPaper951.pdf

116. Canning D, Schultz TP. The economic consequences of reproductive health and family planning. Lancet. 2012;380(9837):165-171. CrossRef. Medline

117. Cochrane S, Kozel V, Alderman H. Household consequences of high fertility in Pakistan: effect of household size on income and savings. World Bank Discussion Papers No. 111. Washington (DC): World Bank; Available from: http://www-wds.worldbank.org/servlet/WDSContentServer/IW3P/IB/1990/12/01/000009265_3980217141235/Rendered/PDF/multi0page.pdf

118. Anyanwu JC. Rural poverty in Nigeria: profile, determinants and exit paths. Afr Dev Rev. 2005;17(3):435-460. CrossRef

119. Cincotta R, Doces J. The age-structural maturity thesis: the impact of the youth bulge on the advent and stability of liberal democracy. In : Goldstone J,Kaufmann E,Toft MD, editors. Political demography: how population changes are reshaping international security and national politics. Oxford (UK): Oxford University Press; 2012. p. 98-116.

120. Cincotta R. Minority youth bulges and the future of intrastate conflict. 2011 Oct 13 [cited 2016 Apr 1]. In: New Security Beat: the blog of the Environmental Change and Security Program [Internet]. Washington (DC): Woodrow Wilson International Center for Scholars. Available from: https://www.newsecuritybeat.org/2011/10/minority-youth-bulges-and-the-future-of-intrastate-conflict/

121. Cincotta RP. Demography as early warning: gauging future political transitions in the age-structural time domain. J Intelligence Analysis. 2015;22(2): 129-148.

122. Cincotta RP. How democracies grow up: countries with too many young people may not have a fighting chance at freedom. Foreign Policy. 2009 Oct 9 . Available from: http://foreignpolicy.com/2009/10/09/how-democracies-grow-up/

123. Potts M, Mahmood A, Graves AA. The pill is mightier than the sword. Int J Health Policy Manag. 2015;4(8):507-510. CrossRef. Medline

124. Frost JJ, Finer LB, Tapales A. The impact of publicly funded family planning clinic services on unintended pregnancies and government cost savings. J Health Care Poor Underserved. 2008;19(3):778-796. CrossRef. Medline

125. Sedgh G, Singh S, Hussain R. Intended and unintended pregnancies worldwide in 2012 and recent trends. Stud Fam Plann. 2014;45(3):301-314. (note: in-text citation not in sequential order) CrossRef. Medline

Peer Reviewed

Received: 2015 Nov 18; **Accepted:** 2016 May 2; **First Published Online:** 2016 Jun 9

Cite this article: Starbird E, Norton M, Marcus R. Investing in family planning: key to achieving the sustainable development goals. Glob Health Sci Pract. 2016;4(2):191–210. http://dx.doi.org/10.9745/GHSP-D-15-00374

© Starbird et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-15-00374

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

COMMENTARY

mHealth for Tuberculosis Treatment Adherence: A Framework to Guide Ethical Planning, Implementation, and Evaluation

Michael J DiStefano,[a] Harald Schmidt[b]

Promising mHealth approaches for TB treatment adherence include:

- **Video observation**
- **Patient- or device-facilitated indirect monitoring**
- **Direct monitoring through embedded sensors or metabolite testing**

To mitigate ethical concerns, our framework considers accuracy of monitoring technologies, stigmatization and intrusiveness of the technologies, use of incentives, and the balance of individual and public good.

INTRODUCTION

Adherence to tuberculosis (TB) treatment is important for promoting individual and public health. Poor adherence results in more individual suffering and death as well as more costly treatment as treatment regimens lengthen and drug resistance develops. As resource allocation pressures intensify under the Sustainable Development Goals and the global push for universal health coverage,[1] exploring novel ways of improving adherence is timely and important.

Mobile health (mHealth) holds considerable promise to improve quality and efficiency in health care.[2] Yet its potential for TB adherence remains largely unexplored,[3,4] and there is a lack of people-centered mHealth approaches responsive to the complexity of real life.[5] Also lacking are ethical evaluations of mHealth interventions,[6,7] particularly those considering the nuances of disease- and goal-specific interventions. Perceived and real acceptability cannot be taken for granted. The planning, implementation, and evaluation of mHealth interventions for TB treatment adherence must be guided by values as much as by technical innovation.

In this article, we describe salient mHealth approaches to monitor and enhance TB treatment adherence, establish a framework for consideration of the central ethical issues, particularly when mHealth is paired with incentives, and outline a model to help guide the ethical planning, implementation, and evaluation of future mHealth interventions for adherence. In doing so, we highlight areas of ethical concern as well as opportunities for ethical improvement over direct observation of therapy (DOT), the global standard for monitoring TB treatment adherence.

TUBERCULOSIS AND THE IMPORTANCE OF ADHERENCE

In 2014, 9.6 million people became ill with TB and 1.5 million died, ranking TB alongside HIV as a leading cause of death worldwide.[8] More than 95% of TB deaths occur in low- and middle-income countries (LMICs).[9]

According to the World Health Organization (WHO), the optimal TB treatment plan consists of an initial treatment phase requiring daily ingestion of 4 first-line anti-TB drugs for 2 months, followed by a 4-month continuation phase during which 2 daily drugs are necessary. Regimens of ingesting drugs thrice weekly in both the initial and continuation phase are also possible.[10] TB susceptible to first-line drugs is called drug-susceptible TB (DS-TB). Two forms of drug-resistant TB (DR-TB) are widely recognized: multidrug-resistant TB and extensively drug-resistant TB. Treating

[a] University of Pennsylvania, Department of Medical Ethics and Health Policy, Philadelphia, PA, USA.
[b] University of Pennsylvania, Department of Medical Ethics and Health Policy, Center for Health Incentives and Behavioral Economics, Philadelphia, PA, USA.
Correspondence to Michael J DiStefano (mjad88@gmail.com).

mHealth interventions for TB treatment adherence must be guided by ethical values as much as by technical innovation.

Proper TB treatment rests in part on proper patient adherence, so monitoring and enhancing adherence is critical.

New TB treatment adherence monitoring techniques should be compared with DOT in terms of ethical acceptability.

Barriers to TB treatment adherence can be many, relating to structural, patient, social, and health care service factors.

even the less resistant forms of DR-TB can take up to 2 years and may also require daily medication.

Proper treatment of all forms of TB is critical to reducing individual morbidity and mortality and to interrupting transmission among family and community members. Proper treatment also limits the development and spread of DR-TB. Treatment for DR-TB is more expensive, less effective, and has more serious side effects.[11] The impact of poor treatment on morbidity, mortality, and disease transmission is exacerbated by poverty, weak health systems, and low levels of health literacy found in many LMICs. Because proper treatment rests in part on proper adherence, monitoring and enhancing adherence is important to safeguarding both individual and public health.

Ensuring adherence is therefore a key component of WHO's post-2015 global TB strategy—the "End TB Strategy." Pillar 1 of this strategy calls for "supportive treatment supervision … [to help] patients to take their medication regularly and to complete treatment, thus facilitating their cure and preventing the development of drug resistance."[12] The strategy indicates supervision should be "carried out in a context-specific and patient-sensitive manner" and acknowledges the many barriers to adherence, including "educational, emotional, and material needs," "stigmatization and discrimination," and health-system factors[12] Given these diverse barriers, supportive treatment supervision will be necessarily complex, spanning interventions to train treatment partners, provide greater social protection, disseminate and exchange necessary information and experiences across potentially long distances, and using incentives.

Where supportive treatment supervision includes monitoring of adherence, DOT (i.e., when a health worker directly witnesses the swallowing of anti-TB drugs in a clinical, community, work, or personal setting) has long been recommended by WHO and is the global standard of care. New adherence monitoring techniques should therefore be compared with DOT in terms of ethical acceptability.

Barriers to Adherence

While DOT has seen great success in specific contexts,[13] its limitations can be understood against the barriers of non-adherence recognized in WHO's End TB Strategy. Munro et al. elaborated on these barriers by identifying and describing 4 categories of adherence barriers related to structural, patient, social, and health care service factors.[14] The influence and interplay of these 4 factors vary. Addressing non-adherence to TB treatment therefore requires awareness of context and targeting all relevant factors.

Structural Factors

Structural factors are obstacles, such as poverty and gender, over which patients have very little control and which can complicate adherence even when patients are strongly motivated. Poverty, especially when linked to the factors discussed below, can impact adherence. For example, where treatment costs are not covered, poor patients or those supporting others, may feel they must choose between work and health. In LMICs, the mean total cost of TB (i.e., direct medical and non-medical costs and lost income due to sickness) is 39% of annual reported household income, and 148% at its highest.[15] Gender-related factors may also impact adherence. TB-related stigma can lead to greater concealment and denial of disease among women than men, and gender roles within traditional or poor families that translate to women having less leisure time and status may result in greater difficulties for women to pursue treatment.[16]

Patient Factors

Variations in patient motivation and willingness can also impact adherence and may be affected by forgetfulness, a lack of understanding regarding the importance of TB treatment, general interpretations of illness such as the belief that one is sick only if symptomatic, alcohol or drug use, or a perceived loss of agency and aversion to elements of control and surveillance associated with DOT. Furthermore, side effects of TB drugs, which include fever, fatigue, weakness, nausea, vomiting, hepatitis, or death,[17] can affect patient motivation due to unpleasantness or substantial interference with a patient's ability to work. This is especially true as the side effects grow more diverse and severe during DR-TB treatment to include psychiatric disorders, hearing loss, and epileptic seizures.[18]

Social Context

Strong social support within a patient's family, community, or health care context can help counteract structural and personal barriers to

adherence by influencing motivation or knowledge and beliefs about TB. However, lack of support or knowledge about TB and its treatment in a patient's family, community, or health care context, as well as real or perceived stigmatization of the sick, can hinder adherence.

Health Care Service Factors

Inadequate drug stocks, long waiting times, inconvenient service hours, and difficulties accessing health facilities reveal the opportunity costs associated with attending health facilities, such as neglecting household responsibilities (e.g., caring for one's children) and losing work and income. All these factors can therefore thwart adherence to TB treatment. For example, a study in Ethiopia found that the average patient traveled approximately 70 hours to a DOT health facility. Following the initial treatment phase, patients traveled only once per month to a DOT health facility to collect drugs. Distance rendered regular observation of drug ingestion impractical (either on a daily or alternating daily basis) and may have contributed to treatment success rates that fell below WHO targets.[19]

THE PROMISE OF MHEALTH FOR TB TREATMENT ADHERENCE

While a multitude of barriers to TB treatment adherence needs to be considered, mHealth interventions can potentially address several central adherence challenges. First, the number of mobile cellular subscriptions per 100 people in LMICs is 87 and growing[20]: mHealth can potentially obviate DOT-related travel and improve adherence in remote areas. Second, mHealth may improve health system efficiency in regions where resources and trained medical professionals are very scarce. For instance, in South Africa, an intervention that relies on mobile phones and SMS (short message service) has enabled nurses to track 50 to 60 TB patients instead of only 10, thus making time to focus on otherwise neglected aspects of their work.[21]

Additionally, mHealth can address important patient factors in non-adherence by facilitating novel and sophisticated ways of providing financial and non-financial incentives. For example, a study of warfarin adherence used pill compartments that wirelessly entered patients into a daily lottery when opened according to the prescribed treatment plan,[22] therefore eliminating the need for human observation and recordkeeping. Mobile platforms can also help overcome some logistical challenges of incentive delivery. Examples from Kenya,[23] Malawi,[24] and Zambia[24] demonstrate the feasibility of efficient electronic transfer schemes that eliminate the need for travel to a bank or remote patient areas, potentially expanding the reach of incentive programs, lowering the costs of incentive delivery, and rendering the process more sustainable.

Finally, empirical research supports mHealth's promise for improving adherence. A recent study, the first to conduct a large and rigorous trial in this area, found that electronic reminders from medication monitors improved TB treatment adherence.[25] Various smaller, proof-of-concept studies have established the potential benefit of using other forms of mHealth for TB adherence.[4]

AN ETHICAL FRAMEWORK

We conducted a comprehensive search of PubMed and Google Scholar on March 15, 2016, for mHealth interventions focused on TB adherence using the following 2 search strings:

- "adherence AND (eHealth OR mHealth OR 'electronic health' OR 'mobile health' OR e-health OR m-health)"
- "adherence[Title/Abstract]) AND "systematic review"[Title/Abstract]) AND (eHealth OR mHealth OR 'electronic health' OR 'mobile health' OR e-health OR m-health)"

Adapting and adding to previously identified types of mHealth for TB adherence,[26] we constructed the following 5 intervention categories (Table 1):

1. **Video observation of therapy (VOT):** patients use smartphones to record videos of themselves taking each medication dose, allowing health care workers to view the videos either synchronously or asynchronously; facial recognition and motion-detecting software can even replace the need for human observation
2. **Indirect monitoring technology, patient-facilitated (IP):** after ingesting their medication, patients place a free call or send an SMS to a central server
3. **Indirect monitoring technology, device-facilitated (ID):** after the patient removes the cap of the medication bottle, a message is wirelessly transmitted to a central server

mHealth can facilitate novel ways of providing financial and non-financial incentives to encourage TB treatment adherence.

TABLE 1. Types of mHealth Interventions for TB Treatment Adherence Compared With the Global Standard of Direct Observation of Therapy

Intervention Category	Examples	Description
Direct observation of therapy (DOT) – Global standard	WHO DOTS[27]	A DOT worker directly observes and records patient swallowing medication.
Video observation of therapy (VOT)	VDOT System[28] Automated DOT[29]	Patients use smartphones to record videos of themselves taking each dose of medication. Observation by a health official can be either synchronous ("video conferencing") or asynchronous ("store-and-forward").[28] Other systems, such as the Automated DOT software, replace human observation with facial recognition and motion-detecting software.
Indirect monitoring technology		
Patient-facilitated (IP)	SIMmed[21] 99dots[30]	Patients place a free call or send an SMS to a central server after ingesting medication.
Device-facilitated (ID)	SIMpill[21] MEMSCap[31] GlowCap[32] Wisepill[33]	Medication bottles containing a SIM card or other sensor wirelessly transmit message to a central server following medication cap removal by a patient.
Direct monitoring technology		
Embedded sensors (DE)	ID-cap[34] Proteus[35]	A wearable hub that attaches to the patient's wrist, arm, hip, or abdomen detects when the patient ingests medication or a pill capsule, equipped with an ingestible sensor, and wirelessly transmits the data to a central server.
Metabolite testing (DM)	Adhere.IO[36]	Patients receive low-cost, encrypted chromatography test strips for home use, which reveal codes when correct drug metabolites are detected in the patient's urine. The patient sends an SMS with the code to a central server.

Abbreviations: DOTS, directly observed treatment, short-course; SIM, subscriber identification module; SMS, short message service; TB, tuberculosis; WHO, World Health Organization.

4. **Direct monitoring technology, embedded sensors (DE):** when the patient ingests the medication, which is equipped with an ingestible sensor, a wearable hub attached to the patient's body wirelessly transmits the data to a central server
5. **Direct monitoring technology, metabolite testing (DM):** patients use low-cost, encrypted chromatography urine test strips, which detect drug metabolites in the patients' urine revealing a code; the patients then send an SMS with the code to a central sever

Any mHealth adherence intervention can comprise (1) a monitoring technology and (2) features that use monitoring data to enhance adherence.

In our analysis, we considered the possibility that any mHealth intervention for adherence can comprise, first, a monitoring technology and, second, features that use monitoring data to enhance adherence, such as personal reminders or incentives. We discuss the potential of the 5 categories of mHealth interventions to ethically monitor and enhance TB treatment adherence in line with WHO's "supportive treatment supervision" guidelines, and in comparison with DOT—the global standard of care for adherence monitoring. Building on prior work that analyzed the ethics of policies to promote individual responsibility for health,[37] we developed an analytical framework for this comparison that comprises 4 ethically relevant elements:

1. Accuracy of monitoring technologies
2. Stigmatization and intrusiveness of monitoring technologies
3. The use of incentives
4. The balance of individual and public good

In discussing strengths and weaknesses of each mHealth intervention category, we identify areas of ethical concern as well as opportunities for ethical improvement over DOT. Finally, we outline a model using the 4 ethical elements to

help guide the ethical planning, implementation, and evaluation of future mHealth interventions for TB adherence (Table 2). This recommended model will always require adaptation to suit specific contexts—for example, the relative prevalence of DS-TB versus DR-TB in resource-limited settings and the different challenges presented by varying levels of government oversight—but hopefully provides useful baseline orientation.

Accuracy of Monitoring Technologies

Health officials must have accurate knowledge of non-adherent patients in order to provide individual support and protect public health. Monitoring technologies that accurately capture adherence data in a cost-effective and minimally burdensome way are therefore of considerable relevance to public health and the health of individuals.

Each monitoring technology presents distinct technical challenges, but here we are concerned with the potential for accuracy assuming optimal technical functioning. DOT is highly accurate in monitoring adherence as it requires direct observation. However, patients could feign drug ingestion,[39] or DOT workers may generate false reports, thus overreporting adherence, or simply not provide treatment according to DOT guidelines.[40] VOT is subject to similar accuracy concerns,[41] although employing facial recognition software can avoid issues associated with human observers. IP/ID faces greater accuracy challenges than DOT or VOT. IP may require placing a free call to a central server after taking medication. ID may use medication bottles that automatically transmit messages to a server following cap removal. It is relatively easy for patients to falsely report adherence by placing calls or removing pill caps without ingesting medication. In terms of accuracy, DE and DM are potentially superior to DOT, VOT, and IP/ID by requiring actual ingestion of the drugs rather than health worker or patient reports.

Stigmatization and Intrusiveness of Monitoring Technologies

DOT is potentially stigmatizing by sometimes requiring health personnel to be present in patients' workplaces or communities, which may distinguish patients and result in unwanted public disclosure of disease status.[42] Because stigmatization can deter patients with TB from seeking treatment[14] and has other serious socioeconomic implications,[42] monitoring technologies that increase stigmatization are harmful to these individuals and counter-productive from a public health perspective. Monitoring technologies that focus unwanted attention on patients should therefore be avoided.

Monitoring technologies that focus unwanted attention on patients should be avoided.

DE that employs visibly worn wireless hubs risks stigmatizing patients. In most current forms, DE uses ingestible sensors embedded in either pills or standard pill capsules. A wearable hub that attaches to the wrist, arm, hip, or abdomen detects when capsules have been swallowed and transmits adherence data wirelessly to a central server. VOT and IP/ID are less stigmatizing by not requiring patients to publicly meet with health personnel or wear a potentially visible hub. Similarly, urinalysis-based DM would be less stigmatizing if employed in regions where people have privacy when relieving themselves.

Patients have reported that DOT feels like "doing time" and that it is "awkward" to be observed while taking treatment.[14] DOT can be perceived as dehumanizing[43] and may therefore contribute to self-stigma, characterized by low self-esteem and self-efficacy.[44] Alternatively, patients have reported that VOT allowed them to retain a sense of control over their care,[28] thus promoting autonomy, and that VOT was less intrusive than DOT given that videophone conferences last only a few minutes and can be scheduled with greater flexibility.[41] DE that employs wearable monitoring technologies may extend perceptions of intrusive surveillance, even if worn invisibly beneath clothing.[45] (Although there is debate in the electronic health field over the precise meanings of "intrusiveness" and "obtrusiveness,"[46] we use the former for simplicity's sake.) Additionally, wearable technologies could be equipped to enable location surveillance of patients by authorities in a way not possible with IP/ID, DM, and VOT, which are non-wearable, and may have detrimental effects on these grounds. Governments may use adherence data to identify problematic or expensive patients and initiate more active engagement in potentially unwelcome forms, such as compulsory detention.[47] To varying extents, these possibilities show that tensions between particular monitoring technologies and respecting individual autonomy are possible.

Direct monitoring technology through embedded sensors or metabolite testing, which require actual ingestion of drugs, are potentially more accurate than DOT and other technologies that depend on health worker or patient reports.

VOT, IP/ID, and DM respect individual autonomy better than DOT and DE by relying on less intrusive involvement in adherence monitoring.

Video observation, indirect monitoring, and direct monitoring through metabolite testing respect patient autonomy better than DOT.

TABLE 2. Framework for the Ethical Evaluation of DOT and mHealth Interventions for TB Treatment Adherence, by Deceasing Accuracy of Adherence Detection

Intervention		Criteria for Ethical Evaluation			
(1) Monitoring Technology	**(2) Feature(s) to Enhance Patient Adherence**	**(1) Accuracy**	**(2) Stigmatization and Intrusiveness**	**(3) The Use of Incentives**	**(4) Balance of Individual and Public Good**
Direct monitoring technology (metabolite testing) (DM)	Follow-up by health care workers when non-adherent SMS reminders to take medication throughout treatment Reward incentives (e.g., in-kind goods, or reductions in insurance contributions)[a] conditional on good adherence Penalty incentives (e.g., insurance surcharges) when non-adherent	**Most accurate:** medication ingestion and metabolization is necessary for adherence detection	**Least risk:** urinalysis can be used with greater privacy and does not enable surveillance; respect for patient agency and autonomy	General risk of coercion with penalty incentives **Incentive size:** incentives that are too small may fail to address all relevant adherence barriers; incentives that are too large may have greater risk of coercion **Incentive type:** guaranteed rewards may have greater risk of coercion than lotteries and may be more likely to "crowd-out" intrinsic patient motivation **Incentive frequency:** less frequent incentives may increase patients' susceptibility to present-biased preferences	General risk of violating patient freedom and privacy when using individual adherence data to develop a picture of population-level adherence or to assist in contact tracing
Direct monitoring technology (embedded sensors) (DE)		**Most accurate:** medication ingestion is necessary for adherence detection, but patients could induce vomiting	**Most risk:** if visible, wearable hub is potentially stigmatizing; even if invisible, may enable location surveillance and identification of "problem" patients; restricted patient agency and autonomy		
Video observation of therapy (VOT)		**Fairly accurate:** swallowing is observed, but patients can feign ingestion or, where a human observer is required, collude to create false report	**Least risk:** can be used with greater privacy and does not enable surveillance; respect for patient agency and autonomy		
Direct observation of therapy (DOT)			**Most risk:** association of patient with health care worker can be stigmatizing; restricted patient agency and autonomy		
Indirect monitoring technology (patient- and device-facilitated) (IP and ID)		**Least accurate:** swallowing not observed; patient can place false call or remove cap without taking medication	**Least risk:** can be used with greater privacy and does not enable surveillance; respect for patient agency and autonomy		
Recommended intervention	Follow-up by health care workers when non-adherent SMS reminders to take medication throughout treatment Reward incentives (e.g., in-kind goods, or reductions in insurance contributions) conditional on good adherence	Maximize accuracy by minimizing opportunity for patient deception and adherence overreporting	Minimize stigmatization and intrusiveness to preserve patient agency and promote autonomy	Use reward incentives, but minimize risk of coercion by using 2-way SMS or video conferencing between patients and providers Reward value should be carefully tailored to local social and economic context (smaller value to address patient factor barriers; larger value to address non-patient factor barriers) Daily/weekly lottery	Develop population-level picture of adherence to more efficiently use resources, learn about best practices and regions where improvement is needed, and ensure timely drug restocking Strive for anonymity, thus promoting public good while minimizing restriction of individual freedom and privacy

[a] For additional examples, see CDC, 2012.[38]

Such technologies are potentially agency-promoting, while the others may be experienced as more controlling technologies that limit autonomy.

The Use of Incentives

Incentives may be paired with mHealth monitoring technologies to enhance adherence. There is demonstrated interest in understanding whether incentives can effectively enhance TB treatment adherence within a non-mHealth context,[48] as well as whether incentives paired specifically with mHealth monitoring can effectively enhance adherence within non-TB disease contexts.[22] Therefore, it is possible in principle to envision the combination of incentives and mHealth monitoring to enhance TB treatment adherence, especially given that mHealth can facilitate and enable the administration of incentives in various ways.

It might seem odd to offer follow-up, reminders, or incentives assuming that—absent external barriers, particularly structural, social, or health care service factors—patients should have a clear self-interest in taking their medication. Yet even when external barriers are not an issue, adherence rates are not ideal. For example, one study identified a 22% rate of incorrect warfarin doses to prevent blood clotting even when cost and distance were not significant adherence barriers.[22] Behavioral economists have systematically studied the reasons for such behavior. Decision errors include powerful cognitive mechanisms such as present-biased preferences, in which short-term benefits are given disproportionate weight relative to long-term benefits.[49] In the case of TB adherence, this phenomenon may lead patients to prioritize immediate relief from medication side effects (by not taking the medication) over the future possibility of cure, even when cure is desired. Even absent side effects, the effort required to regularly take medication can overshadow long-term gains. The challenging life circumstances often found in LMICs only exacerbate these difficulties. Incentives that offer a tangible short-term benefit can counteract these dynamics and help patients overcome such biases.[50]

For these reasons, interventions to enhance TB treatment adherence, including both DOT and mHealth approaches, may employ incentives alongside adherence monitoring, although many, including DOT, often do not do so because administering incentives can have unintended effects or be logistically challenging.[51] Insofar as these challenges can be met, however, we discuss here the risk of coercion associated with using incentives as well as the size, type, and frequency of the incentive.

The Risk of Coercion

Incentives can be structured as either rewards (e.g., cash, reductions in insurance contributions, or in-kind goods) or penalties (e.g., insurance surcharges). On one account, only threats can coerce since threats indicate that an individual's failure to behave in a desired manner will result in that individual being made worse off.[52] Because penalties constitute threats, rewards appear ethically preferable. Still, a reward may also risk coercion insofar as the offer is one an individual could not reasonably refuse.[53] Rewards very large in value may lead individuals to engage in behaviors that are not in their best interests. For example, patients receiving incentives for adherence may be less inclined to report side effects or other treatment-related difficulties such as an inability to work if they believe doing so may result in reduced or revoked incentives.

Incentives structured as rewards generally are ethically preferable over those structured as penalties.

Policy makers should take seriously these treatment-related difficulties. Rather than remain unidirectional,[54] mHealth interventions should connect health workers with individuals requiring extra attention by employing 2-way SMS communication or video conferencing to allow patients to provide reasons for non-adherence and still receive the incentive. Such feedback and patient assurance may enable ethical use of incentives within both DS-TB and DR-TB populations, despite the more severe side effects of DR-TB treatment. In general, allowing interaction between patient and provider may facilitate development of caring relationships that support adherence, a potential benefit of DOT that may be lost with mHealth approaches.

Present-biased preferences may lead patients with TB to stop taking their medication because they prioritize immediate relief from medication side effects over the future possibility of cure.

Incentive Size

Reward incentives of small value may sufficiently spur adherence in high-income countries where patient factors such as present-biased preferences are the primary obstacles to adherence (as in the case of warfarin). However, social context and structural and health care service factors may be more significant in LMICs. For example, incentives of small value may be inadequate where patients experience significant income loss during treatment or must travel long distances for drug resupply. mHealth interventions for adherence

Because structural and health care service factors are significant in LMICs, incentives of large value should be considered to offset major costs of TB treatment.

should therefore consider using incentives of large value to enhance adherence by addressing major costs of treatment, which can include direct medical and non-medical costs and lost income. It is far from straightforward to determine non-coercive incentive values, which requires considerations of effectiveness and fairness alongside country-specific circumstances. Still, there are useful benchmarks, such as average basic household expenses or daily local labor rates.[55]

Individual adherence data can be used to better understand population-level adherence.

Incentive Type

Incentives can be provided with either more or less certainty, which has implications for effectively influencing motivation. Most incentives are fixed expectations whereby a reward of known value is provided whenever the qualifying activity is completed. However, incentives can be offered in less direct ways, for example, through lotteries. Here, patients who properly adhere (e.g., by ingesting all prescribed treatment doses within a specified period) receive a *chance* of winning a reward, not a guarantee. Lotteries are attractive because they can decouple behavior from the firm expectation of receiving immediate benefits for adherence, while still functioning as an effective "nudge."[56] Such incentives are less likely to coerce patients. Furthermore, lack of a certain reward may help avoid "crowding-out" intrinsic motivation,[56] which is concerning for several reasons[57] and has been observed empirically in some cases,[58] although not universally.[59,60]

"Lotteries" in which patients have a chance of winning a reward, not a guarantee, are less likely to be coercive.

Incentive Frequency

Incentive frequency may impact patients' susceptibility to present-biased preferences. For example, when considering the short-term benefit of no side effects, patients may de-prioritize the relatively long-term benefit of a small monthly or yearly reward just as they would the long-term benefit of cure. Daily incentives can counter this tendency.[50] Lotteries can be especially useful. For example, participants in a warfarin adherence study were given a daily 1-in-5 chance of winning US$10 and a 1-in-100 chance of winning US$100, with an expected value of US$3 per day. In addition to providing feedback to patients with successful adherence, participants were also told what they would have won had they adhered, exploiting the motivating power of anticipated regret—another powerful behavioral economics principle.[22] Providing incentives on a less frequent basis (e.g., weekly) can still have an impact, but higher frequency can increase the traction of the approach.

Balance of Individual and Public Good

Individual adherence data can be used to better understand population-level adherence. Knowing in advance which regions have lower adherence rates can enable more efficient resource allocation such as drug restocking—insofar as there are no prohibitive supply chain or logistical obstacles—therefore reducing the risk that patients non-adhere from lack of drugs. Officials could also study these regions to develop detailed knowledge of the factors working against adherence within specific contexts. Conversely, analyzing regions with high adherence rates could reveal best practices for application elsewhere. Striving to keep individual-level adherence data anonymous, or implementing robust firewalls where this is not feasible, can help ensure that each approach serves the public good while respecting individual privacy.

DE that employs wearable monitoring technologies equipped with location surveillance, while potentially stigmatizing and intrusive, could alternatively assist in contact tracing and interrupting disease transmission. Policy around the use of mHealth must consider and balance the potential for promoting both individual and public good.

THE ETHICAL BOTTOM LINE

In summary, mHealth interventions for TB treatment adherence have the potential to ethically improve on DOT in line with WHO's End TB Strategy. In Table 2, we summarize the strengths and weaknesses of each intervention category, highlight areas of ethical concern and opportunities for ethical improvement over DOT, and provide a set of recommendations for future interventions.

Based on this analysis, we suggest urinalysis-based DM as the mHealth intervention category with the greatest potential for ethical acceptability. Assuming optimal technical functioning, DM maximizes accuracy in monitoring by most effectively restricting opportunities for deception. This model also minimizes stigmatization and intrusiveness compared with DOT and other monitoring technologies, preserving patient agency and promoting autonomy.

Of course, mHealth for TB treatment adherence will be implemented in diverse health care contexts and adherence barriers will vary widely. Urinalysis-based DM may not always be the most

practical or cost-effective intervention. Where other intervention categories are more appropriate, our summary and recommendations also provide valuable ethical guidance. The ethical strengths and weaknesses of each mHealth intervention category must always be balanced with the specific barriers faced by patients, as well as the practical realities of implementing public health programs such as cost-effectiveness. Difficult choices regarding trade-offs are inevitable, but ethical acceptability should be a critical component of these debates.

CONCLUSION

Controlling TB is urgent. While proper treatment adherence is critical to TB control, barriers to adherence are significant and diverse. mHealth constitutes an emerging field with particular promise to address such barriers, thus improving individual and population health and health systems efficiency. The ethical framework established here is intended to help with developing ethical mHealth interventions for TB adherence by flagging key ethical issues that need to be considered in planning, implementing, and evaluating programs.

Acknowledgments: We are grateful to Jeff Campbell and Jessica Haberer for helpful discussion and comments on an earlier version of the manuscript as well as the comments offered by our anonymous reviewers.

Competing Interests: None declared.

REFERENCES

1. Schmidt H, Gostin LO, Emanuel EJ. Public health, universal health coverage, and Sustainable Development Goals: can they coexist? Lancet. 2015;386(9996):928-930. CrossRef. Medline
2. Lewis T, Synowiec C, Lagomarsino G, Schweitzer J. E-health in low- and middle-income countries: findings from the Center for Health Market Innovations. Bull World Health Organ. 2012; 90(5):332-340. CrossRef. Medline
3. World Health Organization (WHO). Digital health in the TB response: scaling up the TB response through information and communication technologies. Geneva: WHO; 2014. Available from: http://www.who.int/tb/publications/ehealth_TB.pdf
4. Denkinger CM, Grenier J, Stratis AK, Akkihal A, Pant-Pai N, Pai M. Mobile health to improve tuberculosis care and control: a call worth making. Int J Tuberc Lung Dis. 2013;17(6):719-727. CrossRef. Medline
5. van Gemert-Pinjen JEWC, Wynchank S, Covvey HD, Ossebaard HC. Improving the credibility of electronic health technologies. Bull World Health Organ. 2012;90(5):323-323A. CrossRef. Medline
6. World Health Organization (WHO); International Telecommunication Union. National eHealth strategy toolkit. Geneva: WHO; 2012. Co-published by International Telecommunication Union. Available from: https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-E_HEALTH.05-2012-PDF-E.pdf
7. Kay M, Santos J, Takane M. mHealth: new horizons for health through mobile technologies. Geneva: World Health Organization; 2011. Available from: http://www.who.int/goe/publications/goe_mhealth_web.pdf
8. World Health Organization (WHO). Global tuberculosis report 2015. Geneva: WHO; 2015. Available from: http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf
9. World Health Organization (WHO) [Internet]. Geneva: WHO; c2016. Tuberculosis: fact sheet no. 104; reviewed 2016 Mar [cited 2015 Dec 18]. Available from: http://www.who.int/mediacentre/factsheets/fs104/en/
10. World Health Organization (WHO). Treatment of tuberculosis: guidelines, 4th ed. Geneva: WHO; 2010. Available from: http://apps.who.int/iris/bitstream/10665/44165/1/9789241547833_eng.pdf
11. Centers for Disease Control and Prevention (CDC) [Internet]. Atlanta (GA): CDC. Drug-resistant TB; last updated 2016 Apr 13 [cited 2015 Dec 18]. Available from: http://www.cdc.gov/tb/topic/drtb/default.htm
12. World Health Organization (WHO). Global strategy and targets for tuberculosis prevention, care and control after 2015: report by the Secretariat. Geneva: WHO; 2013. Available from: http://apps.who.int/gb/ebwha/pdf_files/EB134/B134_12-en.pdf
13. Islam MA, May MA, Ahmed F, Cash RA. Making tuberculosis history: community-based solutions for millions. Dhaka (Bangladesh): University Press; 2011.
14. Munro SA, Lewin SA, Smith HJ, Engel ME, Fretheim A, Volmink J. Patient adherence to tuberculosis treatment: a systematic review of qualitative research. PLoS Med. 2007;4(7):e238. CrossRef. Medline
15. Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. Eur Respir J. 2014; 43(6):1763-1775. CrossRef. Medline
16. Johansson E, Long NH, Diwan VK, Winkvist A. Gender and tuberculosis control: perspectives on health seeking behaviour among men and women in Vietnam. Health Policy. 2000; 52(1):33-51. CrossRef. Medline
17. Centers for Disease Control and Prevention (CDC) [Internet]. Atlanta (GA): CDC. Latent tuberculosis infection: a guide for primary health care providers; last updated 2013 Apr 3 [cited 2015 Dec 18]. Available from: http://www.cdc.gov/tb/publications/ltbi/treatment.htm
18. Törün T, Güngör G, Ozmen I, Bölükbaşi Y, Maden E, Biçakçi B, et al. Side effects associated with the treatment of multidrug-resistant tuberculosis. Int J Tuberc Lung Dis. 2005; 9(12):1373-1377. Medline
19. Datiko DG, Lindtjørn B. Cost and cost-effectiveness of treating smear-positive tuberculosis by health extension workers in Ethiopia: an ancillary cost-effectiveness analysis of community randomized trial. PLoS One. 2010;5(2):e9158. CrossRef. Medline
20. World Bank Open Data [Internet]. Washington (DC): The World Bank; c2016. Mobile cellular subscriptions (per 100 people); [cited 2015 Jun 10]. Available from: http://data.worldbank.org/indicator/IT.CEL.SETS.P2
21. Barclay E. Text messages could hasten tuberculosis drug compliance. Lancet. 2009;373(9657):15-16. CrossRef. Medline
22. Volpp KG, Loewenstein G, Troxel AB, Doshi J, Price M, Laskin M, et al. A test of financial incentives to improve warfarin adherence. BMC Health Serv Res. 2008;8(1):272. CrossRef. Medline

23. Center for Health Market Innovations (CHMI) [Internet]. Washington (DC): CHMI; c2016. TIBU: Year launched: 2012; [cited 2015 Dec 18]. Available from: http://healthmarketinnovations.org/program/tibu
24. Boccia D, Hargreaves J, Lönnroth K, Jaramillo E, Weiss J, Uplekar M, et al. Cash transfer and microfinance interventions for tuberculosis control: review of the impact evidence and policy implications. Int J Tuberc Lung Dis. 2011;15 Suppl 2:S34-S49. CrossRef. Medline
25. Liu X, Lewis JJ, Zhang H, Lu W, Zhang S, Zheng G, et al. Effectiveness of electronic reminders to improve medication adherence in tuberculosis patients: a cluster-randomised trial. PLoS Med. 2015;12(9):e1001876. CrossRef. Medline
26. Garfein RS. mHealth for monitoring tuberculosis treatment adherence [webinar]. New Brunswick (NJ): Rutgers Global Tuberculosis Institute; 2014.
27. World Health Organization (WHO) [Internet]. Geneva: WHO; c2016. The 5 elements of DOTS: element 3: standardized treatment, with supervision and patient support; [cited 2015 Dec 19]. Available from: http://www.who.int/tb/dots/whatisdots/en/index2.html
28. Garfein RS, Collins K, Muñoz F, Moser K, Cerecer-Callu P, Raab F, et al. Feasibility of tuberculosis treatment monitoring by video directly observed therapy: a binational pilot study. Int J Tuberc Lung Dis. 2015;19(9):1057-1064. CrossRef. Medline
29. Hanina A. Automated DOT: facial recognition software to confirm medication adherence on mobile devices. New York: AiCure; 2014. Available from: http://www.tbcontrollers.org/docs/posters-2014-national-tb-conference/Hanina_Automated-DOT-Facial-Recognition-Software_June2014NTC.pdf
30. 99Dots [Internet]. Microsoft Research; [cited 2015 Dec 19]. Available from: http://99dots.org
31. WestRock [Internet]. Sion (Switzerland): WestRock Switzerland Ltd.; c2016. MEMSCap medication event monitoring system; [cited 2015 Dec 19]. Available from: http://www.mwvaardex.com/index.php/our-adherence-solutions-data-collection/memscap-tm
32. GlowCap [Internet]. Los Angeles (CA): Vitality, Inc.; c2013. Product; [cited 2015 Dec 19]. Available from: http://www.glowcaps.com/product/
33. WisePill [Internet]. WisePill Technologies; [cited 2015 Dec 19]. Available from: http://www.wisepill.com/
34. eTect [Internet]. Newberry (FL): eTect, Inc.; c2014. What we do; [cited 2015 Dec 19]. Available from: http://etectbio.com
35. Hafezi H, Robertson TL, Moon GD, Au-Yeung KY, Zdeblick MJ, Savage GM. An ingestible sensor for measuring medication adherence. IEEE Trans Biomed Eng. 2015;62(1):99-109. CrossRef. Medline
36. Gomez-Marquez J. Adhere.IO. In: Donner J, Mechael P, editors. mHealth in practice: mobile technology for health promotion in the developing world. New York: Bloomsbury Academic; 2013. p. 162-172.
37. Schmidt H. Bonuses as incentives and rewards for health responsibility: a good thing? J Med Philos. 2008;33(3):198-220. CrossRef. Medline
38. Centers for Disease Control and Prevention (CDC) [Internet]. Atlanta (GA): CDC. Self-study modules on tuberculosis. Module 9: patient adherence to tuberculosis treatment: using incentives and enablers to improve adherence; last updated 1999 Oct [cited 2016 Jun 2]. Available from: http://www.cdc.gov/tb/education/ssmodules/pdfs/9.pdf
39. Moulding T. A neglected research approach to prevent acquired drug resistance when treating new tuberculosis patients. Int J Tuberc Lung Dis. 2011;15(7):855-861. CrossRef. Medline
40. Greaves F, Ouyang H, Pefole M, MacCarthy S, Cash RA. Compliance with DOTS diagnosis and treatment recommendations by private practitioners in Kerala, India. Int J Tuberc Lung Dis. 2007;11(1):110-112. Medline
41. DeMaio J, Schwartz L, Cooley P, Tice A. The application of telemedicine technology to a directly observed therapy program for tuberculosis: a pilot project. Clin Infect Dis. 2001; 33(12):2082-2084. CrossRef. Medline
42. Courtwright A, Turner AN. Tuberculosis and stigmatization: pathways and interventions. Public Health Rep. 2010; 125 Suppl 4:34-42. Medline
43. Noyes J, Popay J. Directly observed therapy and tuberculosis: how can a systematic review of qualitative research contribute to improving services? A qualitative meta-synthesis. J Adv Nurs. 2007;57(3):227-243. CrossRef. Medline
44. Corrigan PW, Watson AC. Understanding the impact of stigma on people with mental illness. World Psychiatry. 2002;1(1): 16-20. Medline
45. Sharp RR. Ingestible drug adherence monitors: trending toward a surveillance society? Am J Bioeth. 2015;15(11):1-2. CrossRef. Medline
46. Hensel BK, Demiris G, Courtney KL. Defining obtrusiveness in home telehealth technologies: a conceptual framework. J Am Med Inform Assoc. 2006;13(4):428-431. CrossRef. Medline
47. Weiler-Ravell D, Leventhal A, Coker RJ, Chemtob D. Compulsory detention of recalcitrant tuberculosis patients in the context of a new tuberculosis control programme in Israel. Public Health. 2004;118(5):323-328. CrossRef. Medline
48. Bock NN, Sales RM, Rogers T, DeVoe B. A spoonful of sugar...: improving adherence to tuberculosis treatment using financial incentives. Int J Tuberc Lung Dis. 2001;5(1):96-98. Medline
49. O'Donoghue T, Rabin M. Doing it now or later. Am Econ Rev. 1999;89(1):103-124. CrossRef
50. Asch DA, Muller RW, Volpp KG. Automated hovering in health care—watching over the 5000 hours. N Engl J Med. 2012; 367(1):1-3. CrossRef. Medline
51. Lutge EE, Wiysonge CS, Knight SE, Sinclair D, Volmink J. Incentives and enablers to improve adherence in tuberculosis. Cochrane Database Syst Rev. 2015;(9):CD007952. CrossRef. Medline
52. Wertheimer A. Coercion. Princeton (NJ): Princeton University Press; 1988.
53. O'Neill O. Which are the offers *you* can't refuse? In: Frey RG, Morris CW, editors. Violence, terrorism, and justice. Cambridge: Cambridge University Press; 1991. p. 70-95.
54. van Heerden A, Tomlinson M, Swartz L. Point of care in your pocket: a research agenda for the field of m-health. Bull World Health Organ. 2012;90(5):393-394. CrossRef. Medline
55. International Committee of the Red Cross (ICRC); International Federation of Red Cross and Red Crescent Societies. Guidelines for cash transfer programming. Geneva: ICRC; 2007. Co-published by International Federation of Red Cross and Red Crescent Societies. Available from: http://www.ifrc.org/Global/Publications/disasters/guidelines/guidelines-cash-en.pdf
56. Schmidt H. Planning, implementing and evaluating the effectiveness and ethics of health incentives: key considerations. Eurohealth. 2014;20(2):10-14. Available from: http://www.euro.who.int/__data/assets/pdf_file/0017/252251/EuroHealth_v20n2.pdf

57. Gorin M, Schmidt H. 'I did it for the money': incentives, rationalizations and health. Public Health Ethics. 2015;8(1): 34-41. CrossRef

58. Frey BS, Jegen R. Motivation crowding theory. J Econ Surv. 2001;15(5):589-611. CrossRef

59. Promberger M, Marteau TM. When do financial incentives reduce intrinsic motivation? Comparing behaviors studied in psychological and economic literatures. Health Psychol. 2013; 32(9):950-957. CrossRef. Medline

60. Sen AP, Huffman D, Loewenstein G, Asch DA, Kullgren JT, Volpp KG. Do financial incentives reduce intrinsic motivation for weight loss? Evidence from two tests of crowding out. Presented at: 5th Biennial Conference of the American Society of Health Economics (ASHEcon 2014); 2014 Jun 23-25; Los Angeles, California. Paper available from: http://nebula.wsimg.com/48d17bb1ab7e18ec9dc988823fb69ea1?AccessKeyId=6D9673982F271B3E540E&disposition=0&alloworigin=1

Peer Reviewed

Received: 2016 Jan 27; **Accepted:** 2016 Apr 14

Cite this article as: DiStefano MJ, Schmidt H. mHealth for tuberculosis treatment adherence: a framework to guide ethical planning, implementation, and evaluation. Glob Health Sci Pract. 2016;4(2):211–221. http://dx.doi.org/10.9745/GHSP-D-16-00018

© DiStefano and Schmidt. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00018

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

Feasibility and Effectiveness of mHealth for Mobilizing Households for Indoor Residual Spraying to Prevent Malaria: A Case Study in Mali

Keith Mangam,[a] Elana Fiekowsky,[a] Moussa Bagayoko,[b] Laura Norris,[c] Allison Belemvire,[c] Rebecca Longhany,[c] Christen Fornadel,[c] Kristen George[c]

Sending voice and/or text messages to mobilize households for spraying was more costly per structure and less effective at preparing structures than traditional door-to-door mobilization approaches supplemented with radio and town hall announcements. Challenges included:

- **Lack of familiarity with mobile phones and with public health mobile messaging**
- **Lack of face-to-face communication with mobilizers, making it easier to ignore mobilization messages and preventing trust-building**
- **Low literacy levels**
- **Gender differentials in access to mobile phones**

ABSTRACT

Components of mHealth are increasingly being added to development interventions worldwide. A particular case of interest is in Mali where the U.S. President's Malaria Initiative (PMI) Africa Indoor Residual Spraying (AIRS) Project piloted a mobile mass-messaging service in Koulikoro District in August 2014 to determine whether voice and/or text messages received on cell phones could effectively replace door-to-door mobilization for an indoor residual spraying (IRS) campaign. To measure the pilot's effectiveness, we evaluated structure preparedness (all household and food items removed) in 3 pilot intervention villages compared with 3 villages prepared for spray through door-to-door mobilization that was modified by incorporating town hall meetings and radio spots. Structure preparedness was significantly lower in households mobilized through the mobile-messaging approach compared with the door-to-door approach (49% vs. 75%, respectively; $P=.03$). Spray coverage of targeted households also was significantly lower among the mobile-messaging villages than the door-to-door mobilization villages (86% vs. 96%, respectively; $P=.02$). The mobile-messaging approach, at US$8.62 per structure prepared, was both more costly and less effective than the door-to-door approach at US$1.08 per structure prepared. While literacy and familiarity with technology were major obstacles, it also became clear that by removing the face-to-face interactions between mobilizers and household residents, individuals were not as trusting or understanding of the mobilization messages. These residents felt it was easier to ignore a text or voice message than to ignore a mobilizer who could provide reassurances and preparation support. In addition, men often received the mobile messages, as they typically owned the mobile phones, while women—who were more likely to be at home at the time of spray—usually interacted with the door-to-door mobilizers. Future attempts at using mHealth approaches for similar IRS mobilization efforts in Mali should be done in a way that combines mHealth tools with more common human-based interventions, rather than as a stand-alone approach, and should be designed with a gender lens in mind. The choice of software used for mass messaging should also be considered to find a local option that is both less expensive and perhaps more attuned to the local context than a U.S.-based software solution.

[a] Abt Associates, U.S. President's Malaria Initiative (PMI), Africa Indoor Residual Spraying (AIRS) Project, Bethesda, MD, USA.
[b] Abt Associates, PMI AIRS Project, Bamako, Mali.
[c] U.S. Agency for International Development, PMI, Washington, DC, USA.
Correspondence to Keith Mangam (Keith_Mangam@abtassoc.com).

INTRODUCTION

The main strategy for lowering malaria prevalence is through vector control, which targets the mosquitoes that transmit malaria. The World Health

Organization states the 2 most effective vector-control measures are long-lasting insecticide-treated nets (LLINs) and indoor residual spraying (IRS).[1] This article focuses on IRS.

IRS is the application of insecticide to the inside of dwellings, on walls and other surfaces that serve as a resting place for mosquitoes that transmit malaria. The insecticide then kills mosquitoes as they come in contact with treated surfaces. In order for IRS to be most effective, the following conditions must apply:

1. Majority of vectors (i.e., mosquitoes that transmit malaria) must feed and rest indoors.
2. Vectors are susceptible to the insecticide in use.
3. Houses have surfaces that are eligible to be sprayed (i.e., porous, permanent surfaces).
4. A high proportion of the houses in target areas are sprayed (more than 80%).

IRS campaigns include a period of community mobilization intended to educate residents about the causes and risks of malaria, ways to protect against the disease, and the benefits of IRS to prepare beneficiaries for household spraying and ensure the IRS campaign achieves at least 80% coverage—the point at which the full potential of IRS is realized.[1] At 80% coverage, the 20% of households that have *not* received protective measures can benefit from the reduction in transmission achieved by the other 80% of households in the community. The initial periods of insecticide spraying are usually followed by a "mop-up" period to revisit areas where the overall number of structures sprayed was below the 80% target.

Traditionally, door-to-door mobilization methods are used to prepare structures for IRS and to ensure general understanding and acceptance of IRS campaigns. With the unprecedented growth in mobile phone users around the world, however, mHealth offers great potential for reaching a large proportion of populations with behavioral messages that address an array of public health challenges, including IRS mobilization.[2] The number of mobile-cellular subscriptions has increased from just over 2 billion in 2005 to 6.9 billion globally in 2014, with low-income developing countries accounting for 78% of these subscriptions.[3]

A systematic review of mHealth projects in Africa illustrates that these initiatives have generated a number of positive results including: (a) support to patients to make health care appointments, (b) reduced communication delays, (c) improved data collection, (d) efficient communication with patients, resulting in reduced need for transportation and increased uptake of diagnostic services, and (e) improved health care provider compliance with protocols. Researchers have attributed these successes to accessibility, acceptance, and affordability of the technology used, as well as the ability to obtain stakeholder buy-in and to effectively integrate the use of tools into the local context.[4] For example, evidence from studies in India and Peru indicate that both patients and health care workers considered text messages to be highly useful for appointment reminders and for communicating with health care providers and receiving health information.[5]

Indoor residual spraying involves applying insecticide to the inside of dwellings to kill the mosquitoes that transmit malaria.

There is limited research documenting whether cost savings are generated by mHealth initiatives. However, it is acknowledged that these efforts have the potential to reduce costs related to the management of patient records, production of vital statistics, and referral and billing processes, by shifting from time-intensive paper-based processes to more efficient processes that make use of shared technological platforms. Similarly, since mHealth initiatives are able to reduce the need for physical displacement of patients and/or providers, they can result in a subsequent decrease in the time needed to provide those services. The strategy of cost savings needs to be evaluated in multiple scenarios to determine in which settings an mHealth approach could indeed decrease program costs.

The purpose of this case study was to evaluate the use of mHealth tools for IRS mobilization in Mali. The U.S. President's Malaria Initiative (PMI) Africa Indoor Residual Spraying (AIRS) Project piloted a mobile mass-messaging service in 3 villages of Mali to determine whether voice and/or text messages received on cell phones could effectively replace door-to-door mobilization for an IRS campaign. To measure the pilot's effectiveness, the team evaluated structure preparedness in the pilot villages and compared them with villages mobilized through a traditional door-to-door mobilization that also incorporated town hall meetings and radio spots. The case study's goal was not only to evaluate the effectiveness of these mobile messages but also to determine if there was a reduction in mobilization costs.

Door-to-door mobilization methods are traditionally used to prepare households for indoor residual spraying, but mHealth may provide new approaches for reaching people.

TRADITIONAL DOOR-TO-DOOR MOBILIZATION APPROACH USED IN MALI

The PMI AIRS Project in Mali traditionally uses a door-to-door IRS mobilization method in which, 30 days before an IRS campaign is set to begin, mobilizers inform households about the benefits of IRS, the date spray operators will be coming to their village, and what they need to do to prepare their homes for IRS.

Households must prepare for IRS in advance by moving all furniture, belongings, and food from rooms in which residents sleep.

For a household to be considered prepared, all furniture and belongings must be removed, as well as anything on the walls, from the rooms in which residents sleep. Similarly, any food products in the rooms must be taken outside and placed in a safe place until IRS has been completed. Any furniture or belongings that are too heavy to move must be covered with a plastic sheet that will protect them from any contamination by insecticide.

The PMI AIRS Project engages and trains mobilizers who work with the health facilities to deliver these IRS messages. In addition to the initial conversations with households in advance of the IRS campaign, these same mobilizers accompany the IRS teams during implementation. The mobilizers are able to assist the IRS team if a household has not properly removed belongings and furniture from within the house, and they can also help to encourage reluctant households to accept IRS.

Once a house has been sprayed, the mobilizers remind the beneficiaries of the guidelines they need to follow to prolong the effectiveness of the IRS and to ensure their safety. For example, all windows and doors must remain shut for 2 hours after IRS is completed, and then the rooms must be aired out for 1 more hour before anyone can enter. Then, once the necessary time has passed, a resident must enter the room and sweep up all the dead insects before being bringing all furniture and belongings back into the room.

In 2013, more than 1,000 mobilizers in Mali were used for these purposes in 3 districts implementing IRS. Because it is difficult to supervise such a large cadre of seasonal workers, performance quality varies widely. Furthermore, this method of door-to-door mobilization is expensive, both financially and in terms of human resources.

METHODS

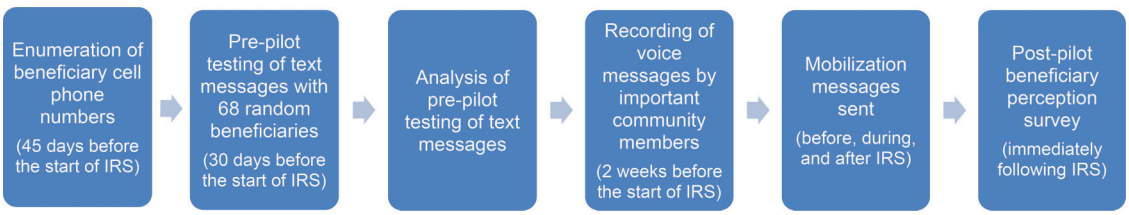
In an attempt to provide cost savings while maintaining structure preparedness, the PMI AIRS Project piloted a mobile-messaging mobilization approach in Mali's Koulikoro District where the project has been implementing IRS since 2012. The purpose of this pilot was to effectively prepare the maximum number of structures for IRS, while reducing overall costs compared with traditional mobilization methods. To evaluate the feasibility of eliminating door-to-door mobilization, this project used only cell phone messaging for IRS mobilization in the pilot district. The hypothesis was that by reducing the number of people required to implement mobilization, and simultaneously removing the need for extensive field supervision of mobilizers, the project could benefit from a large reduction in mobilization costs while not diminishing the overall preparedness of structures. To measure the pilot's effectiveness, the case study evaluated structure preparedness in the pilot intervention villages compared with preparedness in comparison villages mobilized through standard door-to-door mobilization methods. This activity was reviewed by the Institutional Review Board at Abt Associates and determined to be exempt from review.

Intervention and Comparison Areas

The mobile-messaging approach was piloted between May and September 2014 in 3 villages in the district of Koulikoro: Tienfala Village, Tienfala Gare, and Fougadougou. These villages were chosen because of their proximity to Bamako, with the assumption that a higher percentage of residents in these areas owned phones than residents living in areas farther from Bamako. Similarly, it was assumed that more of the residents were literate in the selected areas compared with those living in Bla or Baroueli, the other 2 IRS districts. Beneficiaries in all 3 intervention villages received text messages, and beneficiaries in Fougadougou and Tienfala Gare received voice messages in addition to text messages. Figure 1 demonstrates the flow of activities for this mobilization approach.

Three comparison villages were selected to receive the door-to-door mobilization in the district of Koulikoro: Fassa, Wolongotomo Socoura, and Wolongotomo Socoro. The door-to-door mobilization approach included: (1) door-to-door visits from mobilizers 10 days before the campaign, (2) radio spots on local radio stations explaining campaign information, (3) town hall meetings at the village level, and (4) a follow-up mobilizer to

FIGURE 1. Flow of Activities for Mobile-Messaging Mobilization Approach, Koulikoro District, Mali, May–September 2014



Abbreviation: IRS, indoor residual spraying.

FIGURE 2. Flow of Activities for Door-to-Door Mobilization Approach, Koulikoro District, Mali, May–September 2014

Abbreviation: IRS, indoor residual spraying.

assist with IRS teams during implementation to encourage refusal cases to accept IRS and to help residents prepare their structures (Figure 2). Because this pilot added radio spots to prime beneficiaries about the benefits of IRS before mobilization teams arrived, the teams conducted door-to-door visits only 10 days before IRS began as opposed to the traditional 45 days before IRS.

Enumeration of Cell Phone Numbers

The AIRS Mali monitoring and evaluation (M&E) team collected mobile phone numbers from 673 residents in 576 structures in the 3 pilot villages. The 576 structures do not represent the entirety of households in these communities. Some households were vacant during enumeration, and others did not have any phone linked to the household. Therefore, some households in the pilot villages were not included in the list of numbers that would later be used for sending text and voice messages.

After collecting phone numbers from the households in the 3 pilot villages, a data entry clerk uploaded the numbers into the TextIt platform, a commonly used technology platform for mass mobile messaging. The TextIt platform allows a single user to send short text messages to a large number of mobile phones via a computer. AIRS Mali used a team of data entry clerks to enter the collected mobile phone numbers into a database that allowed the M&E manager to run summary statistics on information about the individuals whose numbers had

been collected, including the number of residents who were capable of sending text messages and who were literate in either French or Bambara (the local language). This helped the team determine which language to use when sending messages to specific groups of beneficiaries.

Types of Mobile Messages

Mobile messages were sent to households before, during, and after the campaign to educate and instruct households about IRS.

Messages were sent before, during, and after the IRS campaign. The AIRS Mali team sent 4 types of text and voice messages to beneficiaries:

- "Mobilization" messages were sent 10 days before the campaign to remind beneficiaries of the benefits of IRS and to let residents know the timing of the spray campaign in their village.
- "Alert" messages were sent 3 days before the start of the campaign to warn beneficiaries of the dangers of malaria and how they can protect themselves from malaria, such as accepting IRS.
- "Instruction" messages were sent during the spray campaign in advance of the arrival of IRS teams to let residents know what to do to prepare themselves and their structures for spraying, as well as what to do immediately following IRS.
- "Advice" messages were sent a few days after spraying to inform beneficiaries about what steps should be taken in order to prolong the positive effects of IRS, i.e., avoiding painting interior walls or hanging posters on treated surfaces.

Pre-Pilot Testing of Text Messages

Once the mobile phone numbers were registered in TextIt, the AIRS Mali team pretested the technology and the type of messages to see if they would be effective as a means for mobilization. The M&E team randomly selected 68 phone numbers (about 10% of the total number of phone numbers collected) to receive test messages. Messages were sent in Bambara and French, according to the self-reported preferences during enumeration of beneficiary cell phone numbers.

Two days after the messages were sent, the M&E team returned to the field to evaluate the perception and comprehension of these messages by 20 of the 68 beneficiaries who had received the test messages. The team chose only 20 beneficiaries due to time and resource constraints as well as to avoid delaying the start of the IRS campaign. Ultimately, only 18 of the 20 chosen beneficiaries were available for these short interviews.

Only 3 of the 20 individuals selected for interviews (15%) received and understood the text messages (Table 1). Conversely, 15 individuals (75%) were not able to use the information in the messages either because they were illiterate (n=3), they did not read the message after receiving it (n=11), or they deleted the message upon receipt without reading it (n=1). Furthermore, only individuals with Android-based cell phones were able to see the Bambara characters on their screens. Simpler phones that are much more common in Mali cannot display the special characters contained in the Bambara alphabet.

TABLE 1. Text Message Pretest Results for the Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Village	Message Received and Understood	Message Received and Not Read	Beneficiary Unavailable at Time of Survey	Beneficiary Illiterate	Message Received and Deleted Before Reading	Total, No. (%)
Tienfala Gare	2	9	0	0	0	**11 (55)**
Tienfala Village	1	1	2	0	0	**4 (20)**
Fougadougou	0	1	0	3	1	**5 (25)**
Total, No. (%)	**3 (15)**	**11 (55)**	**2 (10)**	**3 (15)**	**1 (5)**	**20 (100)**

In this case, the Bambara letters are transliterated into the more common Latin alphabet, which is a common practice among simple phone users in Mali.

Addition of Voice Messages

Based on findings from the pre-pilot text message testing, the team modified the methodology by adding voice messaging in the pilot to increase the possibility that beneficiaries would understand the mobile messages and be prepared for the spray campaign. Two of the pilot villages, Tienfala Gare and Fougadougou, received text messages plus voice messages, while the third pilot village, Tienfala Village, received only text messages, allowing the team to evaluate whether there were different performance outcomes based on the types of messages sent.

The teams drafted scripts for the voice messages and then, in collaboration with the Health Center Technical Director (DTC) from Tienfala Gare, approached community representatives to record the messages (see Box for transcripts of sample voice messages). The team selected people who are well respected within the Tienfala Gare community, whose voices were recognizable, and who were well spoken: the village chief, an actress from Tienfala Gare, and the president of the community health associations (Association de Santé Communautaire, or ASACO). All voice messages were less than 1 minute long and recorded in French and Bambara in order to comply with beneficiary preferences. Due to time constraints, the team was unable to pretest the voice messages as they had done with the text messages.

After recording the messages, the team uploaded the voice recordings into the VOTO Mobile platform, a web-based platform that allows users to create and send voice messages. A benefit of having done the enumeration of beneficiary phone numbers was that the numbers were divided by geography and preferred language, as well as their preferred time to receive messages. Thus, the team was able to select the appropriate prerecorded message for each village and send them to the appropriate phone numbers. Upon answering the phone, the beneficiary would immediately hear the message about the IRS campaign. The team set the VOTO Mobile preferences to retry phone numbers up to 5 times. If, on the fifth attempt, a subscriber did not pick up their phone, the platform left the recording as a message. The team did not have the ability to check whether the voicemail had been listened to.

Data Collection During IRS Implementation

Typically, spray operators collect specific information on the households receiving IRS. This information includes number of structures, total population residing in the structures, and reasons for not receiving IRS. For this pilot, in addition to the traditionally collected information, data on structure preparedness were collected in both intervention and comparison areas via a question that was added to the data collection form used by spray operators: Was the structure prepared to receive spraying?

Voice messages were added to the mHealth approach to account for low literacy levels in the intervention areas.

The answer to this question indicates whether the beneficiaries had properly prepared before IRS by removing all household and food items from the structure and acts as means for estimating the effectiveness of mobilization in preparing structures. Structures that are not prepared in advance lead to delays ranging from 1 hour to an entire day, which can be very costly on a service delivery project such as IRS. Spray operators were trained to answer this question on their forms on their first approach to a structure.

Beneficiary Perception Survey

After the IRS campaign was completed, the AIRS Mali M&E team wanted to understand the beneficiaries' perception of text and voice messages as a means of IRS mobilization. In the pilot villages, the mHealth team went door to door, surveying 673 beneficiaries, as to how many messages residents received, if they understood the messages, and if the messages were helpful.

Data Analysis

Once the data from these different activities were collected, we conducted several kinds of analysis to evaluate how the pilot performed compared with the door-to-door approach. We used Microsoft Excel to look at beneficiary literacy levels, quantity of voice and text messages sent, and perception of mobile messages across pilot villages. Similarly, Excel was used to analyze spray coverage and structure preparedness, the main indicator for evaluating effectiveness, in addition to creating the cost tracking spreadsheets used to perform cost analysis. Finally, to test the statistical significance in terms of preparedness differences among pilot and control villages, STATA 12 was used to perform Poisson regressions.

BOX. Sample Voice Message Transcripts for the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, August 2014

French	Bambara (Local Language)	English
Sample Pre-Spray Messages		
Les habitants de Tienfala ceci est un message pour vous informer que la campagne PID 2014 va commencer le 11 Aout 2014. Vous serez informé sur le calendrier de la campagne sur votre téléphone, les mesures à prendre avant, pendant et après la campagne. Tous unis pour une meilleure campagne de PID.	Anw Balima Tienfala Kaw so fiye baaraw bi da mine uti Kalo kile 11 Tienfala mara la. Kuna foni be di aw ma a ka telephoni ka campagni boloda bara hougoumou kono na waleya mounou kan ka ta sani campagne ka se ani campagne konona la ani ni campagne temena. Aw ni tie aw ka timinandiya la.	Residents of Tienfala, this message is to inform you that the Spray campaign will start on August 11th, 2014. You will be informed about the timing of the campaign on your phone, the measures to be taken before, during and after the campaign. All together for a better spray campaign.
Préparer votre structure à temps, tous les objets et meubles doivent être sortis de la structure ou rassemblés au centre et couverts afin de permettre à l'opérateur d'accéder facilement aux murs de la pièce.	Sokonominenw bee be labo kenema: tobiliminenw, finiw, dumininfenw, minen minuw dulo ne do kogow la.Minen girinmanw minnu talika gelen, olu be fara nogokan so cemance la, ku datugu kane. Obatofiyeli kela be seka sokono na soro nogoyala.	Prepare your structure at time, all objects and furniture must be removed from the structure and gathered in the center and covered to allow the spray operator easy access in the structure to spray.
La PID est gratuite, tous les frais sont pris en charge par l'USAID (fonds du peuple américain).	So fiye ye fu ye a moussaka be taledo lamericainw ka deme diekouloufe no bi wele ko USAID.	The Indoor Residual Spraying is free, all the costs are supported by USAID (funds of the American people).
Sample Mid-Spray Message		
Mettre tous les animaux domestiques en cage/dans un enclos hors de la maison, tenez éloigne les enfants pendant la pulvérisation.	Du denw bee ani du banga misenniw, ni chiyew bee be to kene ma fiyeli waati. Fiyelikela mana tila aw be so da tugou kane.	Put all animals out of the house and keep children away while spraying.
Sample Post-Spray Messages		
Laver à l'eau et au savon les tissus qui ont servi à couvrir les objets pendant la pulvérisation.	Fini minuw kera ka minnen girimaw datugu, o bee be ko ka je ni safine ye.	Wash with soap and water fabrics that were used to cover objects during spraying.
Laisser les portes et les fenêtres fermées pendant au moins 2 heures après la PID.	Fiyeli bane ko fe, aw be daw ani finetiriw tugulen to, fo ka tase lere fila ma.	Keep doors and windows closed for at least 2 hours after the spray.
Eviter de peindre, de mettre de l'enduit et de laver les murs pour préserver l'efficacité de l'insecticide.	So fiyelen kofe, aw man ka ka sow konona mu walima ku pintiri walima ku ko, walasa fennenamafagalan fanga kana ban.	Avoid painting, plastering, or washing the walls to preserve the effectiveness of the insecticide.

Abbreviations: PID, pulvérisation intradomiciliaire (indoor residual spraying); USAID, U.S. Agency for International Development.

RESULTS

Literacy and Mobile-Messaging Preferences of Pilot Participants

Literacy in French and Bambara is relatively low in Fougadougou (33% and 24%, respectively), and only moderately better in Tienfala Gare (62% and 58%, respectively) (Figure 3). Levels of literacy in Tienfala Village fell in between the other 2 pilot villages, with 50% of respondents able to read in French and 44% able to read in Bambara.

The enumerators also questioned the beneficiaries about what time of day they preferred to

receive text messages. The majority (65%) of beneficiaries reported preferring to receive messages in the afternoon or at night while 13% preferred to receive messages in the morning. About one-fifth (22%) of beneficiaries did not have a preference.

Number of Messages Sent

The project sent 6,234 text messages to 673 beneficiaries in the 3 villages, or, on average, about 10 messages per beneficiary phone number. In the 2 villages that received voice messages in addition to the text messages, the project sent 4,474 voice messages to 477 beneficiaries, amounting to, on average, about 9 voice messages per beneficiary number (Table 2).

Structure Preparedness and Spray Coverage

Structure preparation was significantly lower in households mobilized via the mobile-messaging approach compared with households mobilized using the door-to-door approach (49% vs. 75%, respectively; $P = .03$) (Table 3). In the end, both pilot and comparison villages had high spray coverage (defined as the percentage of structures identified during enumeration that were sprayed). However, spray coverage in pilot villages was lower compared with coverage in the villages mobilized through traditional door-to-door mobilization (85% vs. 96%, respectively; $P = .02$) (Table 3). It is also worth noting that mop-up teams had to be sent back to the pilot villages receiving mobile messaging to increase the number of structures accepting to be sprayed from the initial 80% coverage to the final 86%.

The most common reason structures were not sprayed in the pilot mobile-messaging areas was due to refusal. Other reasons cited by beneficiaries for not having their structures sprayed included sickness, closed/locked structure, and funeral in the household.

Structure preparation and spray coverage were significantly lower in households mobilized via mobile messaging vs. door-to-door mobilizers.

Beneficiary Perceptions

In general, surveyed beneficiaries in the mobile-messaging areas were very curious about the mobile messages and wanted further information

FIGURE 3. Literacy and Text-Messaging Capabilities of Beneficiaries, Koulikoro District, Mali, May–September 2014 (N=673)

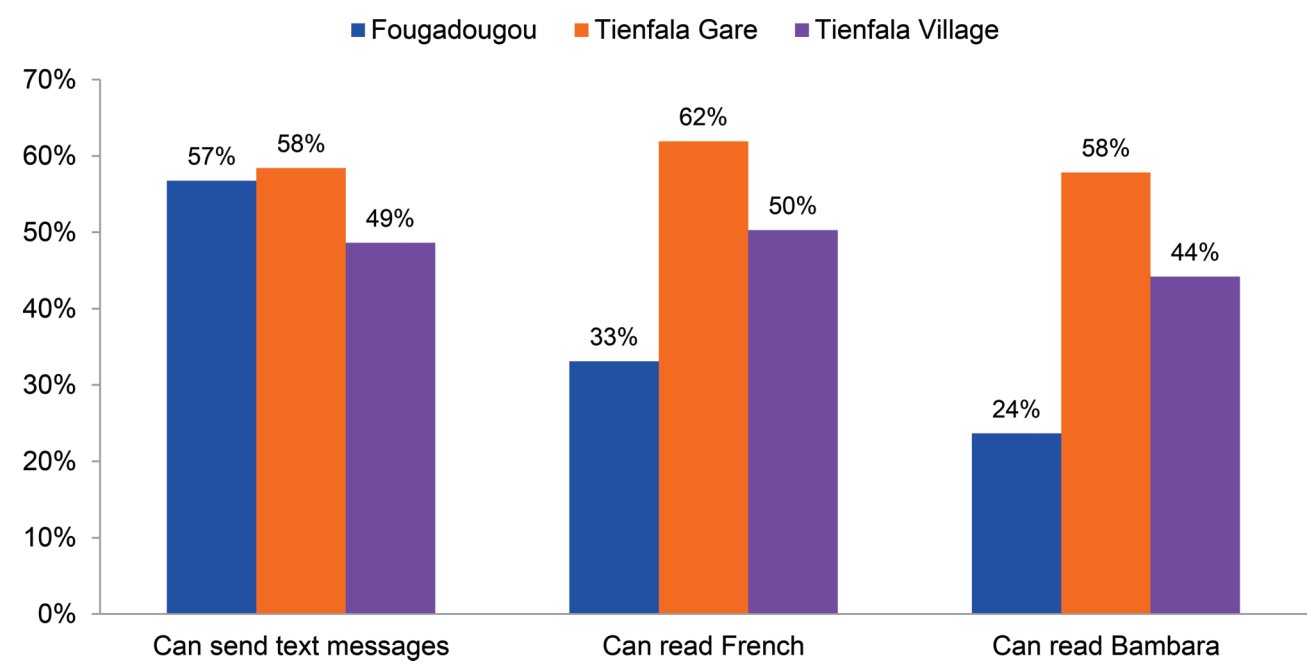


TABLE 2. Number of Messages Sent During the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Village	Types of Messages Sent	No. of Beneficiary Phone Numbers	No. of Text Messages Sent	No. of Text Messages Sent per Beneficiary Phone Number	No. of Voice Messages Sent	No. of Voice Messages Sent per Beneficiary Phone Number
Tienfala Village	Text only	181	1,760	10	0	0
Tienfala Gare	Voice + Text	344	3,290	10	3,290	10
Fougadougou	Voice + Text	148	1,184	8	1,184	8
Total		**673**	**6,234**	**9.3 (mean)**	**4,474**	**9.1 (mean)**

TABLE 3. Indoor Residual Spray Coverage and Household Preparedness in Pilot and Comparison Villages, Koulikoro District, Mali, May–September 2014

Village	No. of Structures Targeted	No. of Structures Sprayed	Spray Coverage	No. of Structures Prepared	Structure Preparation Coverage
Mobile-Messaging Mobilization					
Fougadougou	163	136	83%	66	40%
Tienfala Gare	262	212	81%	144	55%
Tienfala Village (text only)	151	140	93%	71	47%
Subtotal	**576**	**488**	**85%**	**281**	**49%**
Door-to-Door Mobilization					
Fassa	255	249	98%	199	78%
Wolongotoba Socoro	372	342	92%	230	62%
Wolongotoba Socoura	250	247	99%	232	93%
Subtotal	**877**	**838**	**96%**	**661**	**75%**

about the spray campaign. Interest was driven due to 2 main aspects of the mobile-messaging campaign. First, the number used to send the messages was based in the United States, and as such, beneficiaries wanted to verify the source of the number and were curious when seeing a text message from a foreign country code. Second, for people who had received voice messages, beneficiaries recognized the voices on the prerecorded message and wanted to ask those people further questions. In fact, many residents tried to speak to the voice recording or call back the number. Moreover, village residents who had received only text messages found out that other villages were

receiving voice messages and wanted to know why they had not received the voice messages. They requested they be sent voice messages in addition to text messages.

Other qualitative information gained through interviews with beneficiaries related to how mobile messaging impacted men and women differently. For example, women felt they were no longer a part of the mobilization process. With door-to-door mobilization, women usually interacted with mobilizers. With mobile messaging, however, the men of the household more often received the information directly because they typically own the phones. Conversely, men enjoyed receiving the mobile messages because it provided them with the information directly, even if they were in the field working.

Women in the mobile-messaging areas felt excluded from the mobilization process since men typically owned mobile phones.

Cost Analysis

An important driver for this pilot was to find ways to increase IRS mobilization efficiency while reducing implementation costs. This section analyzes the costs of the mobile-messaging and the door-to-door approach and then compares the costs to performance results in the different villages. Operational set-up costs, variable costs, and fixed costs for each approach were considered. Finally, per-structure costs are presented to evaluate the cost of these approaches if they were rolled out across all intervention areas in the AIRS Mali program as well as to allow a fair comparison of the 2 approaches, even though there were more structures in the comparison villages than the intervention villages.

Mobile-Messaging Mobilization Costs

To determine the cost per structure for the 2 different arms of the mobile-messaging approach—text only and voice plus text—we first considered the general set-up costs and the specific messaging costs separately. These were then combined to create the per-structure costs of each approach.

Set-up costs. The set-up costs associated with the mobile-messaging mobilization approach included the costs related to training enumerators, the enumeration of cell phone numbers and a data entry clerk, per diem costs for DTC supervision of data collection, Internet and phone card costs (fixed cost), and the costs of the mop-up, or the process of revisiting unsprayed structures (Table 4). The cost per structure for general set-up expenses was US$1.13, based on the 576 structures sprayed in all 3 villages. There were significant costs associated with mop-up for the mobile-messaging approach. It should be noted that in the 3 comparison villages the teams were able to spray all targeted structures during their first visit and so mop-up was not necessary.

Costs of text and voice messaging. Costs differed among the pilot villages according to the type of message a village received because text messages were less expensive than voice messages. As such, a per-structure cost was calculated for Tienfala Village to represent the model of text messages only. This was calculated by multiplying the number of text messages sent by the cost of a text message (an average of the costs to send a text message on the same carrier and the costs to send between different carriers; US$0.05 per text message) and dividing by the number of structures mobilized within that village. Thus the per-structure cost of sending text messages was US$0.58.

Next, a per-structure cost was calculated for the villages that received both voice and text messages by multiplying the number of text messages sent by the cost of a text message, adding that to the multiplication of the number of voice messages sent by the cost of a voice message, including the total cost of recording the voice messages for both villages, and dividing the sum of those components by the total number of structures mobilized in both Tienfala Gare and Fougadougou. This resulted in a per-structure cost for sending both voice and text messages of US$3.89.

Overall costs. Finally, we compared the difference in per-structure costs for the village that received only text messages as compared with villages that received voice and text messages, as shown in the last column of Table 5. For Tienfala Village that received only text messages, the overall costs totaled US$1.71 per structure, while for the villages receiving both kinds of messages, the per-structure cost was US$4.73. It is important to note that there were no costs to the beneficiaries associated with receiving the mobile messages.

The mobile-messaging approach included significant mop-up campaign costs while mop-up was not necessary in the door-to-door mobilization areas.

Door-to-Door Mobilization Costs

During this pilot, the traditional door-to-door mobilization approach using interpersonal communication between mobilizers and households included additional aspects comprising radio spots and town hall announcements. By doing so, the team was able to reduce the number of mobilizers to 1 per village (previous campaigns used up to

TABLE 4. Operational Costs for Mobile-Messaging Mobilization for the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Description	No. of People	No. of Days	Unit Cost (XOF)	Total Cost (XOF)	Total Cost (USD)
Training					
Enumeration training	5	1	10,000.00	50,000.00	100.00
Food during training	12	1	3,500.00	42,000.00	84.00
Enumeration					
Data collection in the field	4	3	1,500.00	18,000.00	36.00
DTC supervision (per diem)	1	5	10,000.00	50,000.00	100.00
Data entry clerk	1	10	8,000.00	80,000.00	160.00
Operational Costs for TextIt/VOTO Mobile[a]					
Software services	1	-	-	612.24	1.22
Mop-Up (revisiting unsprayed structures in all 3 villages)					
Spray operators	5	3	3,000.00	45,000.00	90.00
Team leader	1	3	3,500.00	10,500.00	21.00
Supervisor	1	3	5,000.00	15,000.00	30.00
DTC health official	1	3	5,000.00	15,000.00	30.00
GRAND TOTAL				**326,112.24**	**652.22**

Abbreviations: DTC, Health Center Technical Director; USD, U.S. Dollar; XOF, CFA Franc.
[a] These costs were estimated taking the overall costs associated with running the TextIt/VOTO Mobile applications and dividing it across all 735 villages in the project intervention areas that would be included in a full project roll out. This number was then multiplied by 3 to estimate the costs for the 3 treatment villages.

TABLE 5. Cost of Sending Text and Voice Messages per Structure for the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Village	No. of Structures Identified[a]	No. of Text Messages Sent	No. of Voice Messages Sent	Total Cost of Text and Voice Messages (USD)	Voice Recording Costs (USD)	Cost of Messages per Structure (USD)	Operational Cost per Structure (USD)	Total Cost[b] per Structure (USD)
Tienfala Village (text only)	151	1,760	0	88.00	0.00	0.58	1.13	1.71
Tienfala Gare and Fougadougou (text + voice)	425	4,474	4,474	1,207.98	320.00	3.60	1.13	4.73

[a] By spray operators during the first week.
[b] Comprises costs of sending text and voice messages and recording voice messages as well as operational costs.

TABLE 6. Costs of Door-to-Door Mobilization for the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Description	No. of People or Units	No. of Villages	No. of Days	Unit Cost (XOF)	Total Cost (XOF)	Total Cost (USD)
FIXED COSTS						
Per diem for DTC for IEC TOT	1	3	3	1,071.43[a]	9,643	19.29
DTC accommodation	1	3	3	1,428.57	12,857	25.71
District coordinator	1	3	3	159.36[b]	1,434	2.87
Per diem for NMCP/DNACPN staff	3	3	3	159.36[c]	4,303	8.61
Abt staff for IEC TOT	1	3	3	646.03[d]	5,814	11.63
Meals	1	3	3	1,145.00	10,302	20.60
Logistics IEC TOT - car rental	1	3	3	874.83	7,873	15.75
Logistics IEC TOT - fuel	1	3	3	336.47	3,028	6.06
Venue hire	1	3	3	201.88	1,817	3.63
Communication fees (subscription)	1	3		423.96	1,272	2.54
Office supplies	-	-	-	-	25,000	50.00
Radio spots	600[e]			13.46	8,075	16.15
Subtotal				**6,460.36**	**91,418**	**182.84**
VARIABLE COSTS						
Mobilizer training costs	1	3	3	15,000.00	135,000	270.00
Mobilizer daily salary	1	3	10	1,500.00	45,000	90.00
Per diem for DTC supervision	1	3	1	10,000.00	30,000	60.00
Town crier	1	3	15	1,000.00	45,000	90.00
Subtotal					**255,000**	**510.00**
GRAND TOTAL					**346,418**	**692.84**

Abbreviations: DNACPN, Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances (National Directorate for Sanitation and Pollution Control); DTC, Health Center Technical Director; IEC, information, education, and communication; NMCP, National Malaria Control Program; TOT, training of trainers; USD, U.S. Dollar; XOF, CFA Franc.

[a] For DTC-related expenses, their unit costs were calculated by dividing the normal cost for 1 DTC supervisor by 14 villages. DTC personnel supervise 14 villages on average.

[b] The expenses for district coordinators were divided across all 251 villages in Koulikoro District.

[c] The NMCP/DNACPN staff covered the entirety of Koulikoro District; thus, their cost was divided by Koulikoro's 251 villages.

[d] Total cost for the Abt staff, meals, car rental, fuel, venue hire, and radio spots were divided across all 735 in the project intervention areas in order to arrive at the unit costs listed.

[e] This number is based on 30 different radio spots that were broadcast over 20 different radio stations.

TABLE 7. Cost per Structure Prepared for the Pilot Indoor Residual Spraying Campaign, Koulikoro District, Mali, May–September 2014

Village	No. of Structures Targeted	Mobilization Costs (USD)	No. of Structures Prepared	% Structures Prepared	Cost per Structure Prepared (USD)
Door-to-Door Mobilization Villages					
Fassa	255	201.45	199	78.04%	1.01
Wolongotoba Socoro	372	293.88	230	61.83%	1.28
Wolongotoba Socoura	250	197.50	232	92.80%	0.85
Mobile-Messaging Mobilization Villages					
Fougadougou	163	771.00	66	40.49%	11.68
Tienfala Gare	262	1,239.26	144	54.96%	8.61
Tienfala Village (text only)	151	258.21	71	47.02%	3.64

3 mobilizers per village) and delayed the beginning of mobilization to just 10 days before the start of the IRS campaign. This approach has been adapted in many other PMI AIRS countries due to its continued effectiveness at reducing costs. The door-to-door mobilization approach included costs for training, per diems for various staff attending trainings, supervisory staff, and for fieldwork, radio spots, and lodging and transportation costs for associated personnel (Table 6).

The overall cost of this door-to-door approach was US$692.84, which covered 877 structures in 3 villages, resulting in a per-structure cost of US$0.79.

Mobile-Messaging vs. Door-to-Door Mobilization Costs

The cost analysis revealed that the per-structure cost of the door-to-door mobilization approach was less expensive than either of the mobile-messaging approaches. Mobile messaging using only text messages was 3.4 times as expensive per structure prepared as the door-to-door approach, and mobile messaging using both voice and text messaging was more than 7 times more expensive per structure prepared than the door-to-door approach.

Mobile messaging was 3–7 times more expensive than traditional door-to-door mobilization.

It is also important to look at the relative performance of each approach to determine which method was more effective. Table 7 shows the calculations of U.S. dollars spent per structure prepared for each village: the number of structures identified by spray operators in the village multiplied by the cost of mobilization per structure for the method used in that village. This cost was then divided by the actual number of houses that were prepared when the spray operators arrived.

Mobile-messaging mobilization was both more costly and less effective at preparing structures to be sprayed. In areas that used mobile-messaging mobilization, AIRS Mali spent US$8.17 (a weighted average of the costs across all 3 villages) per structure prepared, while in the modified door-to-door mobilized areas, the project spent US$1.08 (a weighted average of the costs across all 3 villages) per structure prepared.

DISCUSSION

The villages that received mobile-messaging mobilization had higher refusal rates for spraying their houses with insecticide and were not as prepared as the comparison group of villages that received the modified door-to-door mobilization with radio spots and town hall announcements. Despite using best practices for the mobile-messaging

mobilization activities, such as thorough enumeration to gather phone numbers and testing the text messages before the start of the spray campaign, the pilot intervention was not as effective as door-to-door mobilization. One reason could be that text and voice messages are a new technology for most beneficiaries, and so while many residents in the pilot villages owned phones, they did not use them regularly. Furthermore, this was the first time many of the subscribers had received a public health mobilization message through their mobile device. Future mHealth communication campaigns may experience better results once beneficiaries are more familiar with this mobile-messaging mobilization concept. However, mobile messaging might not be able to completely replace interpersonal communication between mobilizers and households. When beneficiaries were hesitant to have their structures sprayed (e.g., not wanting to miss a day of farming or not wanting to take out all their furniture), it was much easier to ignore the mobile message. On the other hand, when a mobilizer goes door-to-door on the day of spray, it is harder for beneficiaries to ignore the mobilizer because there is an opportunity to have their questions answered and build trust, creating more tangible motivation to accept having their structures sprayed. In person, the mobilizer can work directly with the beneficiary or village leader to gain acceptance. Finally, it should also be considered that the literacy rate is quite low in Mali; in the districts where IRS is implemented in the country, the literacy rate is 33.6%.[6]

Lessons Learned

1. Mobile-messaging mobilization in Mali had limited effectiveness because much of the population is illiterate and thus could not read the IRS mobilization text messages. Some illiterate residents, however, would ask other individuals to read the messages to them allowing some illiterate beneficiaries to still get the message about the timing of IRS. This illiteracy was also not overcome through the addition of voice messages in 2 of the 3 pilot villages. Implementation of the mobile-messaging mobilization approach in countries with higher literacy rates could potentially increase comprehension and utility of these messages. A potential list of countries with higher literacy rates for the population between 15 and 65 years old and where the AIRS PMI Project works includes: Ghana (76.6%), Madagascar (64.7%), Rwanda (70.5%), Zambia (63.4%), and Zimbabwe (86.5%).[7]
2. It is much easier for beneficiaries to ignore a text message—and even a voice message—than a face-to-face interaction in regards to preparing their household for spraying. With a text or voice message, beneficiaries may have the good intentions to comply, but could easily forget once they put their phone down. However, if there is someone there in person asking household members to comply, it will be harder to forget or ignore this request.
3. Although the enumeration was very important for this pilot because it let the AIRS Mali team test the technology before implementation, it has proven to be a very costly exercise and would likely have to be done each year, as cell phone numbers change frequently.
4. After analyzing aspects of the door-to-door approach, it became clear that the additions of radio announcements and community town hall meetings helped to ensure that mobilization messages reached a large portion of the community. Moreover, the community meetings helped communicate important messages, such as the change in insecticide and the description of the pilot project, and they reinforced the benefits of IRS. If radio announcements and town hall meetings had been added to the mobile-messaging approach, the team could potentially have seen better structure preparedness because it would have added an important human aspect to an approach that otherwise lacks traditional social interaction.
5. The use of the TextIt platform was not the most economical choice as it is a system based in the United States. Future interventions attempting to implement similar mobile-messaging approaches should investigate possible options of partnering with locally based telecom providers, to reduce the overall costs associated with sending mass messages. Similarly, use of an open-source mass text messaging service could reduce the associated costs of running such software.
6. This pilot demonstrated that different methods of mobilization can affect men and women differently. With door-to-door mobilization, women usually interact with mobilizers since they are typically at home at the time when

It is much easier for people to ignore mobile phone campaign messages than mobilizers at their door.

Radio announcements and town hall meetings were an important addition to the traditional door-to-door IRS mobilization approach.

mobilizers visit. With mobile messaging, however, the men of the household more often received the information directly because they typically own the phones. This is a significant difference in approach because women are usually at home during the day to allow the IRS team to enter the household. By relying only on mobile messaging, the team no longer engaged women and this could be seen as an unanticipated effect of choosing an mHealth approach.

Implications for Future mHealth Projects

While the results of this pilot do not suggest relying solely on text or voice messages for IRS mobilization in the same implementation design as was done in Mali, it does provide a stepping stone toward potentially more effective implementation of mHealth approaches. The use of mHealth has been found to be most effective in producing health outcomes when incorporated as part of a multifaceted behavior change strategy, as opposed to a stand-alone intervention. For instance, mobile-messaging mobilization could be used in combination with a mobilizer traveling with an IRS team on the day of spraying. This pilot did not choose to test a hybrid blend of mobile messaging and standard mobilization approaches since the team's goal was to evaluate a unique mobile-message approach, but a hybrid approach could be tested in future campaigns. The 2 methods of communication (mobile and interpersonal) complement each other, but the population in these villages is not yet comfortable enough with mobile technology to rely solely on mobile-based messaging.

There are advantages to using mobile-based mobilization, such as the ability to alert a village remotely the morning of arrival of IRS teams. One drawback is the higher cost of the mobile-messaging approach compared with the traditional approach, in part a result of the additional burden of a separate phone enumeration process that would theoretically have to be repeated each year. A possible way of reducing this cost moving forward is to incorporate phone number collection into the spray operators' regular data collection processes. Thus, after the first year of IRS implementation, the team would have phone numbers for each structure that could then be used in upcoming IRS campaigns.

CONCLUSION

This case study provides a useful example where an mHealth approach was *not* appropriate given contextual constraints and highlights the importance of performing a contextual analysis before choosing to move forward with using mHealth for public health interventions. As noted earlier, the low literacy and strong dependency on human interaction and social ties in Mali do not create an atmosphere conducive to such a technological innovation. By eliminating the human interaction aspect of mobilization through the mobile-messaging approach, the overall success of IRS mobilization suffered due to lower rates of acceptance and structure preparedness. If key components such as high literacy and familiarity with newer technology are available, combining mHealth with a broader public health intervention could produce fruitful results.

Acknowledgments: This pilot project was conducted by the United States Agency for International Development's Africa Indoor Residual Spraying Project with financial support of the President's Malaria Initiative. The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID.

Competing Interests: None declared.

REFERENCES

1. World Health Organization (WHO) [Internet]. Geneva: WHO; c2016. Malaria fact sheet; [updated 2016 Apr; cited 2015 Dec 7] . Available from: http://www.who.int/mediacentre/factsheets/fs094/en/
2. Chib A, Wilkin H, Ling LX, Hoefman B, Van Biejma H. You have an important message! Evaluating the effectiveness of a text message HIV/AIDS campaign in Northwest Uganda. J Health Commun. 2012;17 Suppl 1:146-157. CrossRef. Medline
3. International Telecommunication Union (ITU). The world in 2014: ICT facts and figures. Geneva: ITU; 2014. Available from: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf
4. Aranda-Jan CB, Mohutsiwa-Dibe N, Loukanova S. Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa. BMC Public Health. 2014;14:188. CrossRef. Medline
5. Chib A, van Velthoven MH, Car J. mHealth adoption in low-resource environments: a review of the use of mobile healthcare in developing countries. J Health Commun. 2015;20(1):4-34. CrossRef. Medline
6. United Nations Educational, Scientific, and Cultural Organization (UNESCO) [Internet]. Paris: UNESCO. Mali [country profile]; [cited 2015 Dec 7]. Available from: http://en.unesco.org/countries/mali
7. United Nations Educational, Scientific, and Cultural Organization (UNESCO) [Internet]. Paris: UNESCO; c2014. Regional and country profiles; [cited 2015 Dec 7]. Available from: http://www.uis.unesco.org/DataCentre/Pages/regions.aspx

Peer Reviewed

Received: 2015 Nov 25; **Accepted:** 2016 Apr 5

Cite this article as: Mangam K, Fiekowsky E, Bagayoko M, Norris L, Belemvire A, Longhany R, et al. Feasibility and effectiveness of mHealth for mobilizing households for indoor residual spraying to prevent malaria: a case study in Mali. Glob Health Sci Pract. 2016;4(2):222–237. http://dx.doi.org/10.9745/GHSP-D-15-00381

© Mangam et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-15-00381.

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

Factors Associated With Community Health Worker Performance Differ by Task in a Multi-Tasked Setting in Rural Zimbabwe

Rukundo A Kambarami,[a] Mduduzi NN Mbuya,[a,b] David Pelletier,[a] Dadirai Fundira,[a] Naume V Tavengwa,[b] Rebecca J Stoltzfus[a]

Programs should consider specific tasks and how they relate to health worker factors, community support, and the work context. In a setting where community health workers were responsible for multiple tasks, those who referred more pregnant women were female, unmarried, under 40 years old, and from larger households, and they felt they had adequate work resources and positive feedback from supervisors and the community. In contrast, workers with high scores on delivering household behavior change lessons were from smaller households and received more supportive supervision.

ABSTRACT

Background: Zimbabwe, like most low-income countries, faces health worker shortages. Community health workers (CHWs) bridge this gap by delivering essential health services and nutrition interventions to communities. However, as workloads increase, CHWs' ability to provide quality services may be compromised. We studied influences upon CHWs' performance related to pregnancy surveillance and nutrition and hygiene education in rural Zimbabwe.

Methods: In the context of a cluster-randomized trial conducted in 2 rural districts between November 2012 and March 2015, 342 government-employed CHWs identified and referred pregnant women for early antenatal care and delivered household-level behavior change lessons about infant feeding and hygiene to more than 5,000 women. In 2013, we conducted a survey among 322 of the CHWs to assess the association between demographic and work characteristics and task performance. Exploratory factor analyses of the Likert-type survey questions produced 8 distinct and reliable constructs of job satisfaction and motivation, supervision, peer support, and feedback (Cronbach α range, 0.68 to 0.92). Pregnancy surveillance performance was assessed from pregnancy referrals, and nutrition and hygiene education performance was assessed by taking the average summative score (range, 5 to 30) of lesson delivery observations completed by a nurse supervisor using a 6-item Likert-type checklist. Poisson and multiple linear regressions were used to test associations between CHW demographic and work characteristics and performance.

Results: CHWs who referred more pregnant women were female, unmarried, under 40 years old, from larger households, and of longer tenure. They also perceived work resources to be adequate and received positive feedback from supervisors and the community, but they were less satisfied with remuneration. CHWs with high scores on behavior change lesson delivery were from smaller households, and they received more supportive supervision but less operational supervision. Measures of job satisfaction and motivation were not associated with either task.

Conclusion: Among CHWs responsible for multiple tasks in rural Zimbabwe, factors associated with performance of one task were not the same as those associated with performance of another task. Our methods and findings illustrate ways to examine heterogeneity in CHW performance and to identify organizational factors associated with quality of program delivery.

[a] Cornell University, Division of Nutritional Sciences, Program in International Nutrition, Ithaca, NY, USA.
[b] Zvitambo Institute for Maternal and Child Health Research, Harare, Zimbabwe.
Correspondence to Rukundo A Kambarami (rak283@cornell.edu).

INTRODUCTION

Community health workers (CHWs) are an effective part of the workforce for delivering essential maternal and child health and nutrition services.[1,2]

Many sub-Saharan African countries such as Zimbabwe face critical health worker shortages, driving the continued expansion of the role of CHWs in these health systems.[3,4] CHWs' scope of practice varies substantially among and within countries; as CHW workload and task complexity increase, concern exists about the quality of services provided by CHWs.[5,6]

In Zimbabwe, CHWs have been the front line of the national health system since the 1980s.[7] They provide basic health care treatment and health promotion education on a broad range of topics and report monthly to the head nurse at their nearest primary health care facility. CHWs are selected by their community and are expected to cover a population of about 100 households in their geographical catchment area, working approximately 4 hours per week.[7]

The functionality of the CHW system in Zimbabwe has declined in recent years due to severe economic shocks experienced in the early 2000s.[8] The social services sector faced funding cuts that contributed to the collapse of health infrastructure including the closure of some government hospitals, drug shortages, brain drain, and the overall deterioration of public health services.[8] A 2009 report estimated that approximately half of all rural households in Zimbabwe did not have contact with or knowledge of a CHW in their area; furthermore the CHWs lacked basic medicines.[9] As part of a strategy to strengthen the national health system, the government has been revitalizing the CHW program by increasing recruitment and training of CHWs.[7,8]

For this health system to work, CHWs need not only to be in place but also to perform at high quality. CHW performance is a complex construct.[10] Some frameworks describing CHW performance apply a general social ecological perspective, describing the influence of intrapersonal, family, community, and organizational characteristics on CHW performance.[11–13] This perspective provides a broad context for situating the individual in the larger environment but provides limited understanding for how the factors interact between levels.[14]

From the field of organizational behavior, goal-setting theory and self-determination theory provide frameworks for understanding the role of CHWs' extrinsic environments and their intrinsic needs and expectancies at an individual and organizational level.[15–17] Goal-setting theory posits that workers identify, commit, and strive to achieve goals and are motivated by clear, challenging goals and appropriate feedback on those goals.[15] Self-determination theory posits that intrinsic motivation to perform is increased in environments that foster workers' intrinsic needs (autonomy, competence, and relatedness).[17]

Together, these theories link motivation, self-efficacy, knowledge, skills, and goal-setting capacity with performance, and they explain the maintenance of behaviors through a positive feedback, motivation, and effort loop.[15,17] However, others also describe the moderating relationship of the nature of the task, especially task complexity, on goal setting and performance.[18] Thus, different levels of effort are required to perform different tasks. The exertion of these efforts requires the mobilization of different internal (e.g., intrinsic motivation) and external (e.g., work tools) resources. In an enabling context, these efforts are translated into performance.

The nature of tasks, requiring mobilization of different internal and external resources, may affect task performance.

As CHWs' workloads expand, describing pathways to performance is helpful in understanding the correlates of variation in CHW performance across different tasks and in developing strategies to mitigate poor performance. Therefore, we explored the internal and external resources mobilized by CHWs performing different tasks in the Sanitation Hygiene and Infant Nutrition Efficacy (SHINE) study, a randomized evaluation of several intervention packages delivered by CHWs in rural Zimbabwe. Specifically, the purpose of this article is to investigate (1) CHW demographic and work characteristic factors associated with the performance of 2 different tasks performed by CHWs in the SHINE study, and (2) whether these factors varied by the specific task.

METHODS

Study Context

SHINE was a community-based 2x2 factorial cluster-randomized trial conducted in rural Zimbabwe between November 2012 to March 2015.[19] The trial aimed to determine the independent and combined effects of a water, sanitation, and hygiene (WASH) intervention and improved infant and young child feeding (IYCF) intervention on linear growth and anemia in children born to enrolled pregnant women. Government-recruited CHWs were the backbone of SHINE's intervention delivery.[20]

Organizational behavior theories provide frameworks for understanding the role of health workers' extrinsic environments and intrinsic needs at the individual and organizational level.

As part of SHINE, CHWs conducted early pregnancy identification surveillance every 5 weeks

in their catchment areas. For every woman of childbearing age in a CHW's catchment area, the CHW recorded last menstrual period data on a 5-weekly basis and offered pregnancy tests to women who missed a menstrual period and who assented to the test.[19] CHWs were also responsible for delivering all behavior change lessons and material inputs as needed (e.g., soap) from the time women were enrolled into SHINE (during early pregnancy) until the new child was 18 months of age. Monthly lesson delivery was aligned with specific gestational age or infant age, to increase relevance for the women and facilitate uptake and modification of key maternal behaviors. CHWs delivered intervention arm-specific messages and standard-of-care messages (that cover Ministry of Health and Child Care [MoHCC] content) to all participants.[19]

All SHINE CHWs received a standard 5-month MoHCC training program. The program consisted of 8 weeks each of in-classroom and field-based training and concluded with a 4-week classroom session following the field internship.[7] Training covered topics in maternal and neonatal care, HIV/AIDS, tuberculosis, child health and nutrition, non-communicable diseases, WASH, communication, and adult education methods.[7] Short refresher trainings were mandatory and conducted twice annually if funding was available.[7] SHINE CHWs were trained for an additional 20–35 days on content specific to the SHINE trial[20] and on work scheduling and planning to help CHWs integrate SHINE activities into their normal work routines. Experienced MoHCC trainers conducted all trainings, and SHINE staff provided support for the additional SHINE-specific training. All CHWs received a standard monthly MoHCC allowance of US$14, distributed every quarter, along with a SHINE food basket valued at US$42 in token of the additional time CHWs spent on SHINE activities.[19]

We focused on health workers' performance related to pregnancy referral rates and behavior change lesson delivery.

Thirty-two SHINE nurse supervisors provided constructive feedback and supervision support for the 342 CHWs. Half of the supervisors were men, half were married, and they ranged in age from 23–48 years. Supervisors met once a month with CHWs for group meetings (approximately 11 CHWs per supervisor) to discuss concerns, troubleshoot, and review expectations. Individual review meetings with CHWs were held in the field approximately once a month, and supervisors evaluated performance of specific tasks and provided additional support.

Survey Participants and Instrument

A survey was conducted in 2013 among all 342 CHWs living in Chirumanzu and Shurugwi districts participating in the SHINE trial. Two CHWs declined and 18 did not attend the meetings where the survey was administered.

The questionnaire was adapted from a survey used in a previous study[21] and was modified, translated, and pretested by the study team to fit the Zimbabwean context. The questionnaire included questions about sociodemographic characteristics, motivation, supervisory support, peer support, community and organizational feedback mechanisms, and standard health curriculum knowledge covered in MoHCC training. Questions varied in format, but most used a 5-point Likert response scale ranging from strongly agree to strongly disagree.[22]

The questionnaire was administered to CHWs by 5 trained Zimbabwean enumerators (fluent in English and the local language Shona), and data were captured electronically using netbook computers.[19,20] Data were collected over 20 days in April 2013 while CHWs attended SHINE trainings. On average, 16 questionnaires were administered to CHWs each day, with each interview lasting 45–60 minutes.

Ethical Approval

Written informed consent was obtained from CHWs in their preferred language before administering the questionnaire. Ethical approval for the study was provided by the Medical Research Council of Zimbabwe and the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Performance Outcomes

We selected pregnancy referral rate and behavior change lesson delivery as important and contrasting performance outcomes and because of their relevance to other maternal and child health interventions. The major differences between the 2 outcomes were the novelty and prestige of the task (higher for pregnancy referrals), CHW and community cultural acceptability for the task (higher for lesson delivery), and time burden for the task (higher for lesson delivery) (Supplementary Table 1).

Assessment of Pregnancy Referrals

Pregnancy referral data were obtained from the SHINE database. CHWs regularly visited all

women of reproductive age in their area and identified new pregnancies through a 2-stage process of asking about the last menstrual period and confirming pregnancies with a dipstick urinary hCG test (Pregnancy Midstream Tests, Kurkel Enterprises, LLC). Pregnant women were referred to clinics for antenatal care, including HIV testing and care. Pregnancy referral information was also sent to a SHINE supervisor who arranged for a second, confirmatory urine test administered by a research nurse. Confirmed (i.e., SHINE-validated) CHW pregnancy referrals were entered daily into the SHINE database. Total referrals in 2013 were summed for each CHW, and data on the median number of women 15–49 years per CHW catchment area were extracted from CHW registers. Referrals per women of reproductive age were calculated as an annual rate. Pregnancy referral data were available for 319 CHWs.

Assessment of Behavior Change Lesson Delivery

Nurse supervisors assessed the quality of behavior change lesson delivery during a supervisory visit planned to occur during one of the first times that a specific lesson was being delivered. The supervisor observed the CHW delivering a lesson and completed a checklist of 6 statements about adherence to quality lesson delivery:

1. Reviewed last session with mother
2. Asked mother questions about her recall, knowledge, and current practices
3. Delivered lesson in a relaxed manner
4. Allowed mother to ask questions
5. Responded to mother's questions correctly and appropriately
6. Reviewed current lesson information at the end of the session

The supervisors rated each checklist statement on a 5-point Likert scale,[22] and a summative score (range, 5–30 points) was later calculated by the researchers (Cronbach $\alpha = 0.83$). Supervisors provided feedback to the CHW after each observation. In the SHINE Trial, which aimed to evaluate the effects of 2 different CHW content packages in a 2x2 factorial design (4 intervention arms), the CHWs delivered 15 different behavior change lessons.[19] However, the instrument assessed issues of quality that were relevant to every lesson, regardless of content. For each CHW, the average lesson score was calculated from all lessons observed (median, 6 lessons; interquartile range, 3–10) between January 2013 and August 2014. Lesson delivery score data were available for 289 CHWs; all were included in this analysis.

TABLE 1. Background Characteristics of Community Health Workers, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013 (N = 322)

Characteristic	Value
Age, mean ± SD, years	45.0 ± 8.8
<40, No. (%)	87 (27.0)
40–50, No. (%)	153 (47.5)
>50, No. (%)	82 (25.5)
Gender, No. (%)	
Female	237 (73.6)
Marital status, No. (%)	
Currently married	247 (76.7)
Other	75 (23.3)
Household size, mean ± SD	4.82 ± 2.50
Educational level, No. (%)	
Primary (7 years)	54 (16.8)
Some secondary (8–10 years)	101 (31.4)
"O" Level[a] or higher (11+ years)	167 (51.9)
Tenure as CHW, median (IQR), years	3.2 (2.2, 11.1)
First experience with health education job, No (%)	243 (75.5)

Abbreviations: IQR, interquartile range; SD, standard deviation; CHW, community health worker.
[a] Ordinary, or "O", Level certificate examination is a terminal examination taken after 4 years of secondary education.

Statistical Analyses

Descriptive statistics were performed on CHW demographic data. Exploratory factor analysis was used to reduce data from the questionnaire. From each section, factors were retained after principal axis factor extraction, scree tests, and promax rotation.[23] Items with factor-loadings above 0.30 were included in factors and any items that cross-loaded were included in the factor where they had the higher factor-loading and conceptual relevance. Reliability analyses

were performed on factors, and items that decreased reliability were omitted from the final factors. For each factor, the total score was calculated as the sum of scores for the items in the factor. Factors were standardized as *z* scores to account for the different number of items in each factor. Across factor variables, the proportion of CHWs missing data was 15% (n=49). Missing data from factors were imputed using multiple imputation by chained equations with 10 iterations and all model covariates with non-missing data specified.[24]

Multiple linear regression was used to investigate associations between CHW lesson delivery score and demographic and factor variables. Models were adjusted to account for the different number of lesson observations per CHW. Poisson regression was used to assess associations with the number (count) of pregnant woman referred over the 1-year period. To account for the different number of women of childbearing age in each CHW's catchment area, a natural log of median number of women of childbearing age was included in the model as an offset. Linearity of continuous independent variables was examined for each outcome by scatter plot smoothing.[25] For pregnancy referral rate, the job satisfaction and motivation factor was modeled as a categorical variable. All other variables were modeled as linear variables for both regression models.

All demographic variables and standardized factors were entered into a backwards-stepwise regression analysis. Level of significance was at the $P=.05$ level. Models were adjusted for SHINE trial randomization variables and demographic variables of interest from CHW performance literature.[12] To assess differences among the variables associated with performance between the 2 tasks, we fit a multilevel linear model.

Multilevel modeling was used to account for the non-independence of performance scores for the same CHWs nested within nurse supervisors. CHW and nurse supervisor were identified as random effects, and CHW demographic and work characteristics were modeled as fixed effects. To compare predictors between the different tasks, first we transformed the pregnancy referrals data using a square root transformation because it followed a Poisson distribution. Then we standardized as *z* scores the lesson delivery score and the transformed pregnancy referrals data. We created a dummy variable for the task and tested the interaction term between the dummy variable and each demographic and work characteristic variable. This interaction model was adjusted for SHINE trial randomization variables, the number of lesson observations per CHW, and the median number of women of childbearing age in a CHW's catchment area. All data were analyzed using STATA 12.0.

RESULTS

CHW Demographic and Work Context Factors

Nearly three-quarters (73.6%) of the 322 CHWs were women, most were married (76.7%) and of middle age (mean, 45.0 years ± 8.8 years), and 83.3% had some secondary school experience or higher (Table 1). The median duration of job tenure was 3.2 years, and for 75.5% of CHWs, this was their first experience with a health education job.

Eight factors emerged from factor analyses of work characteristic questions (Table 2):

- Job satisfaction and motivation
- Satisfaction with remuneration
- Perceived peer support
- Perceived supportive supervision
- Perceived operational supervision
- Perceived adequacy of resources for work
- Perceived negative feedback (from supervisors, community, and peers)
- Perceived positive feedback (from supervisors, community, and peers)

Reliability analyses showed adequate internal consistency for all scales (Cronbach $\alpha \geq 0.70$) except for perceived positive performance feedback ($\alpha=0.68$) (Table 3). Mean scores on 5 of the 8 factors were high, at or above 75%. Negative feedback and satisfaction with remuneration mean factor scores were moderate, at 70% (mean score of 17.6 out of a maximum score of 25) and 66% (mean score of 9.9 out of maximum of 15), respectively. Adequacy of resources for work had the lowest mean score at 63%. CHWs' knowledge scores were moderate (mean of 17.6 out of 24 questions), and less than 1% of CHWs scored below 12 out of 24 questions (Table 3).

Pregnancy Referral Rate

Several CHW characteristics were significantly associated with more pregnancy referrals in the

TABLE 2. Description of 8 Work Characteristic Factors Emerging From Factor Analysis of CHW Survey Responses, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013

Factor	Number of Survey Items	Description of Factor
Perceived job satisfaction and intrinsic motivation	12	Feels personally motivated and happy with work and making a positive impact; feels appreciated by community, health workers, and organization for work
Satisfaction with remuneration	3	Satisfied with remuneration for the work
Perceived peer support	5	Receives advice and support from other CHWs
Perceived supportive supervision	12	Feels valued, motivated, guided, and heard, and feels supervisor is accessible
Perceived operational supervision	10	Feels informed and consulted about work activities; received communication to improve work; feels needs are represented
Perceived adequacy of resources for work	5	Frequency of shortage of transportation and work tools
Perceived negative performance feedback	5	Community, other CHWs, and supervisor attitude indicate poor performance
Perceived positive performance feedback	6	Supervisor and community inform CHW of good performance, positive changes in community; increased job confidence

Abbreviation: CHW, community health worker.

TABLE 3. Reliability of Scales Assessing CHW Work Characteristic Survey Questions, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013

Work Characteristic (Range of Scale) (No. of Respondents)	Cronbach alpha	Range in Data	Mean ± SD
Health curriculum knowledge (1–24) (N = 322)	–[a]	11–22	17.6 ± 2.0
Job satisfaction and motivation (12–60) (N = 311)	0.85	39–60	53.0 ± 4.7
Satisfaction with remuneration (3–15) (N = 318)	0.92	3–15	9.9 ± 3.4
Perceived peer support (5–25) (N = 316)	0.75	5–25	18.7 ± 4.4
Perceived supportive supervision (12–60) (N = 314)	0.90	31–60	51.7 ± 5.7
Perceived operational supervision (10–50) (N = 310)	0.77	22–50	42.6 ± 5.7
Perceived negative feedback (5–25) (N = 307)	0.72	7–25	17.6 ± 3.6
Perceived positive feedback (6–30) (N = 315)	0.68	16–30	25.3 ± 2.5
Perceived adequacy of resources for work (5–25) (N = 312)	0.70	5–25	15.7 ± 4.3

Abbreviations: CHW, community health worker; SD, standard deviation.
[a] Knowledge items were based on training materials and do not reflect a singular "knowledge" construct; therefore, we do not report a Cronbach alpha.

Supportive supervision was significantly associated with higher behavior change lesson scores, while operational supervision was significantly associated with lower scores.

imputed model (Table 4): female gender (incidence rate ratio [IRR] for referring an additional woman = 1.13; $P<.05$), larger household size (IRR = 1.01; $P<.05$; range, 0–16 people), and longer job tenure (IRR = 1.01; $P<.01$; range, 1–30 years). Middle-aged (IRR = 0.89; $P<.05$) and older CHWs (IRR = 0.81; $P<.01$), as well as those who were married (IRR = 0.88; $P<.05$), made fewer referrals.

From CHW perceptions of their work characteristics, positive feedback (IRR = 1.06; $P<.05$) and adequacy of work resources (IRR = 1.06; $P<.05$) were the only factors significantly associated with more referrals. Interestingly, CHWs who were more satisfied with remuneration made fewer referrals (IRR = 0.92; $P<.001$).

Behavior Change Lesson Delivery Score

Multiple regression analysis showed 2 variables were significantly associated with lesson delivery score (Table 5): supportive supervision was associated with higher scores (B, 0.41; $P<.05$), but operational supervision was associated with lower scores (B, -0.43; $P<.05$).

Interaction Model

The type of task significantly modified the relationship between work performance and some CHW demographic and work characteristic variables (Supplementary Table 2). Significant interactions were observed for CHW gender, household size, job tenure, work resources, and operational supervision. Higher task performance on pregnancy referrals (more referrals) was associated with female gender ($P<.05$), larger household size ($P<.05$), more job tenure ($P<.01$), more operational supervision ($P<.05$), and the availability of resources for work ($P<.10$) (Figure). However, the same variables were associated with *lower* task performance on lesson

TABLE 4. Poisson Regression Models to Predict Factors Associated With the Pregnancy Referral Rate (in 1 Year) of CHWs, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013

	Pregnancy Referral Rate			
	Complete-Case Model (N = 299)		Imputed Model (N = 319)	
CHW Variables	IRR (95% CI)	*P* Value	IRR (95% CI)	*P* Value
Age, years (reference: <40)				
40–49	0.89 (0.80, 0.99)	.04*	0.89 (0.80, 0.98)	.02*
≥50	0.81 (0.70, 0.93)	.002**	0.81 (0.71, 0.93)	.002**
Gender (reference: male)	1.14 (1.02, 1.26)	.02*	1.13 (1.02, 1.25)	.02*
Marital status (reference: not married)	0.89 (0.80, 0.98)	.02*	0.88 (0.80, 0.97)	.01*
Household size	1.02 (1.00, 1.03)	.07	1.01 (1.00, 1.03)	.047*
Tenure, years	1.01 (1.00, 1.02)	.003**	1.01 (1.00, 1.02)	.003**
Satisfaction with remuneration	0.92 (0.87, 0.96)	<.001***	0.92 (0.88, 0.96)	<.001***
Perceived adequacy of resources for work	1.06 (1.02, 1.11)	.008**	1.06 (1.02, 1.11)	.006**
Perceived positive feedback	1.06 (1.01, 1.11)	.01*	1.06 (1.01, 1.10)	.01*

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; CHW, community health worker.
Models adjusted for CHWs' education, knowledge, study arm, cluster ID, ward number, and median number of women of childbearing age per CHW catchment area.
Significant at *$P<.05$; **$P<.01$; ***$P<.001$.

TABLE 5. Multiple Linear Regression Models to Predict Factors Associated With Behavior Change Lesson Delivery Scores[a] of CHWs, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013

	Lesson Delivery Score			
	Complete-Case Model (N = 274)		Imputed Model (N = 289)[a]	
CHW Variables	Beta (SE)	*P* Value	Beta (SE)	*P* Value
Household size	-0.14 (0.08)	.05	-0.12 (0.07)	.08
Tenure, years	-0.05 (0.03)	.13	-0.05 (0.04)	.11
Perceived supportive supervision	0.43 (0.21)	.04*	0.41 (0.20)	.04*
Perceived operational supervision	-0.45 (0.21)	.03*	-0.43 (0.20)	.04*

Abbreviations: CHW, community health worker; SE, standard error.
[a] Based on supervisor's summative score to six 5-point Likert response statements: reviewed last session with mother; asked mother questions about her recall, knowledge, and current practices; delivered lesson in a relaxed manner; allowed mother to ask questions; responded to mother's questions correctly and appropriately; and reviewed current lesson information at the end of the session.
Models adjusted for age, gender, marital status, education, knowledge, study arm, cluster ID, ward number, and number of observations per CHW.
Significant at $*P<.05$; $**P<.01$; $***P<.001$.

scores (lower scores) (Figure). The magnitudes of effect were weak for household size (z score < 0.10), tenure (z score < 0.10), and adequate work resources (z score < 0.14), and moderate for perceived operational supervision (z score < 0.15) and gender (z score < 0.32).

DISCUSSION

In this context of well-trained and supported CHWs in rural Zimbabwe, different individual and organizational factors were associated with the performance of different tasks. Performance related to pregnancy referrals was associated with several CHW demographic characteristics (age, gender, marital status, and household size) and several work characteristics (financial incentives, feedback, resources, and job tenure) while performance on behavior change lesson delivery was associated with only 1 demographic characteristic (household size) along with supervision factors. The factors that proved significant for these Zimbabwean CHWs have also been highlighted by other authors,[5,12] but there have been no studies considering how factors differ by the type of task. Our findings suggest the need for programs to tailor approaches to improve CHW performance by carefully considering the different factors associated with various tasks that CHWs perform. Moreover, for researchers it reinforces the need to explore how various factors lead to improved performance for different tasks.

The same variables that were associated with higher task performance on pregnancy referrals were associated with lower task performance on behavior change lesson scores.

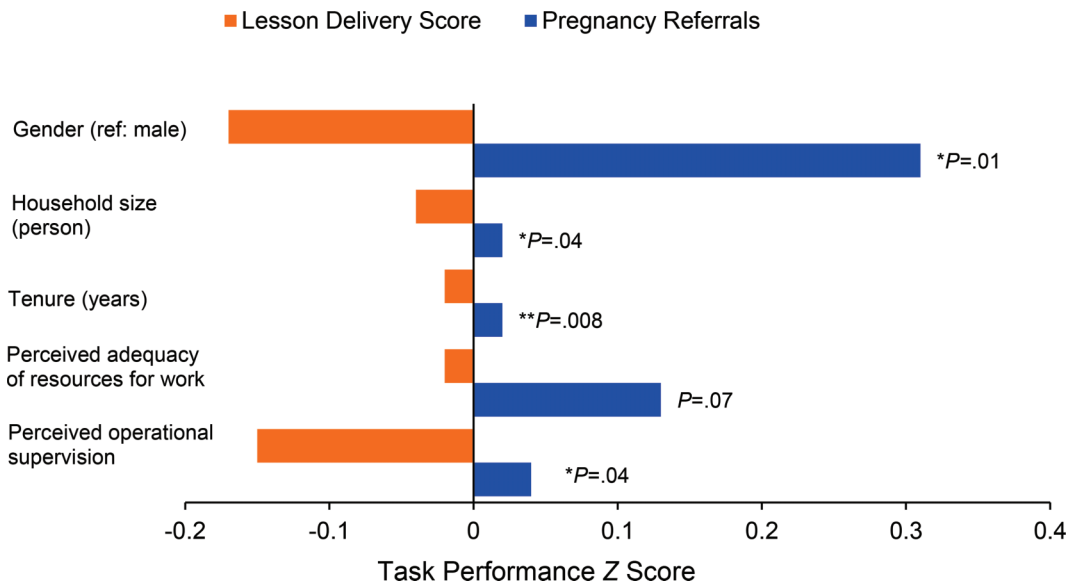
Factors Associated With Pregnancy Referrals

Female CHWs made more pregnancy referrals than male CHWs. In many cultures, early pregnancy detection is a culturally sensitive topic,[26] and it may be easier for women to disclose their pregnancy to female CHWs. Other studies have shown gender to positively influence performance on maternal and child health activities,[27–29] consistent with our findings. The fact that the gender and task interaction was significant further illustrates that for different types of tasks, women perform the task differently than men.

Female community health workers made more pregnancy referrals than male workers.

For age and marital status, there is no consensus in the literature regarding associations with health worker performance, and it seems plausible that the influence of these factors varies by task and social context.[12] In this Zimbabwean context, younger (<40 years old) and unmarried

FIGURE. Significant Interaction Terms of Task and Demographic and Work Characteristics From the Interaction Model, Shurugwi and Chirumanzu Districts, Zimbabwe, 2013



Significant at *$P<.05$; **$P<.01$; ***$P<.001$.

CHWs performed more pregnancy referrals. CHWs' younger age may increase their accessibility to women of childbearing age and their physical capacity to canvass villages. Unmarried CHWs may have less time demands and be able to conduct more pregnancy referrals. Variability in task time burden and task complexity can influence which characteristics are associated with better performance.

CHWs with larger households (adjusted for age) made more pregnancy referrals. Larger households could be a proxy for family support,[30,31] and a few studies suggest CHWs with fewer household duties and family support may be more productive.[30,31] There was also a significant interaction between pregnancy referrals and job tenure (adjusted for age). Limited and mixed evidence suggests more job experience may improve client satisfaction and CHW use of tools.[32,33] The novelty and social prestige associated with the pregnancy identification task may increase community and family support and the sharing of household duties,[30,31,34] giving CHWs time to work and motivating CHWs to perform.

Despite numerous studies reporting that financial incentives are associated with motivation and improved performance,[12,35–37] CHWs who were more satisfied with their remuneration made fewer pregnancy referrals. SHINE CHW allowances were higher than the ordinary government allowance and were also independent of the workload and performance. Thus, low performers, satisfied with their allowances, may have found no added incentive to performing the new task. A similar finding among CHWs delivering behavior change education in rural Haiti led those authors to posit that the CHWs perceived little benefit to increasing performance in face of the difficult terrain, an observation they termed "disgruntled stars and happy slackers."[38] Similarly rugged working conditions exist in rural Zimbabwe that could explain our results. However, it is important to note that this observation applied to the new task and it could also be a function of workload. This has implications for increasing CHW workload, particularly in difficult-to-reach, resource-limited settings. CHWs work under challenging conditions and livelihood

constraints in many parts of the world. In fact, SHINE and the MoHCC initiated a performance-based incentive scheme after this study was completed, and these data are currently being evaluated.

Adequate work resources were associated with more pregnancy referrals, a finding consistent with several studies.[12] Pregnancy identification required CHWs to have pregnancy test kits to make referrals. The nature of the task influenced how CHWs perform on tasks, as the significant interaction of work resources and task type confirmed. When tools are essential to the performance of a task, the lack of those tools certainly constrains performance.

Positive feedback from supervisors and the community was associated with improved performance for pregnancy referrals. Our finding is consistent with prior studies linking supervision and recognition with improved motivation and performance.[31,39–41] The pregnancy identification task allowed CHWs and women to find out women's pregnancy status immediately, and CHWs likely received immediate feedback from the women. Additionally, the supervisor's skill providing constructive positive feedback may have motivated CHWs to perform this new activity. Supervision is important for all tasks; but for different tasks, specific aspects of supervision are vital to improved performance, reinforcing the importance of different supervision approaches.

Factors Associated With Behavior Change Lesson Delivery

Fewer demographic and work characteristic items predicted lesson delivery scores than pregnancy referral completions. CHWs from larger households (adjusted for age) had lower scores—a finding exactly opposite from those for pregnancies referrals. Lesson delivery is a routine activity, takes approximately an hour to complete, and lacks the social prestige of newer, faster-to-complete tasks, which may reduce family support and household duty redistribution, resulting in lower lesson scores for CHWs with large families. In addition, CHW fatigue is also likely to decrease motivation to perform, particularly in the absence of family and community support.[34]

We assessed perceptions of two types of supervision, supportive and operational, and they were oppositely associated with lesson delivery. Supportive supervision, characterized by treating CHWs as peers and supporting their work needs, was positively associated with lesson delivery. Operational supervision, characterized by frequent interactions and consultations for work, was inversely associated with lesson delivery. Because of the routine nature of lesson delivery, CHWs may have perceived operational support as disruptive and a hindrance to performance, as indicated by the interaction of operational supervision and task type. It is also possible that supervisors intervened with weaker CHWs by providing more operational support than supportive supervision (reverse causality in our analysis). How CHWs perceive different supervision approaches is just as important as the supervision package itself. Further research is required to unpack supervision and understand what types of supervision approaches are appropriate for different tasks to promote improved CHW performance.[12,42]

Interestingly, the item we termed "job satisfaction and motivation" was not associated with either pregnancy referrals or behavior change lesson delivery. This factor contained items representing recognition, satisfaction, and intrinsic motivation. Although these items loaded as one factor and had an adequate Cronbach's alpha, it may have been too broad. A better scale separating out these constructs might provide more clarity for the relationships between the tasks and constructs.

Theoretical and Practical Implications

Our work suggests that pathways to health worker performance for different tasks may vary, which has implications for contexts where CHW responsibilities are expanding. Importantly our findings show there is no single strategy that can be used to improve performance. There is need for broader conceptual thinking about CHW performance, the specific tasks they perform, and the environments in which they perform these tasks. Theories of motivation and performance are drawn from settings where there are clear roles and organizational structures and where workers are paid for their services. However, in low-income settings where CHWs are often unpaid, have less clearly defined roles, and have dual responsibility to their community and the health system, these theories may require adaption to fit the context. Further research examining CHW motivation and performance that acknowledge specific activities or groups of activities can begin

There is no single strategy that can be used to improve task performance.

to take cognizance of the complexity of CHW performance and help to develop relevant theoretical frameworks that can guide the design and strengthening of programs.

Where CHWs have multiple concurrent responsibilities, selecting or recruiting CHWs based on the type and number of tasks within their purview is a substantial challenge. For practical, logistical, and political reasons, it might be more feasible to use such information for targeting supportive supervision and mentoring for performance improvement.

From a CHW training perspective, practices that include targeting CHWs based on gender or tenure and offering additional or special trainings for some groups of CHWs based on specific tasks may facilitate improved task performance. For CHW supervision, training CHW supervisors on supervision approaches that are less didactic and more interactive—where CHWs feel they are heard and guided—can foster improved performance. In addition, monitoring supervisor feedback and interactions with CHWs will also help ensure supervision is constructive. For those CHWs that require extra supervision, it is even more important to tailor the supervision approach to meet supervisory goals without negatively affecting CHW performance.

CHW programs in Zimbabwe and elsewhere can consider supporting CHWs based on meta-characteristics that include the structural and social aspects of the work environment. A meta-characteristic profiling/targeting of CHWs would be one that considers the requirements for the job tasks, for example, time to conduct the activities, community value for the health activities, cultural norms about the health activities, the size of population to be covered, and family support for the CHW's work. Using this information, the program can navigate appropriate CHW strengthening to promote improved task performance. National CHW surveys can help programs answer the question of what services CHWs actually provide. With this knowledge, programs can then examine various drivers for task-specific performance.

Improving performance of health workers responsible for multiple tasks requires building a facilitative environment.

Overall, improving CHW performance in multi-task environments requires building a facilitative environment. This means using community-wide interventions that integrate CHW demographic factors, the community, and the work context. This package of interventions can address CHW training, supervision, remuneration, household-level dynamics, and community sensitivities for different tasks to create a conducive environment for CHWs to perform tasks.

Limitations

Our findings should be interpreted taking into account certain limitations of the study. First, the cross-sectional design does not allow for causal inference nor permit inference about the direction of associations and for how different factors change over time. A longitudinal cohort study would be the ideal design to examine directionality and how the relationships change over time.

Second, the behavior change lesson delivery checklist was a subjective measure of performance and more vulnerable to random error and rater bias than pregnancy referral performance—an objective measure.[43,44] We attempted to minimize any rater bias that could either inflate or deflate estimates by training the nurse supervisors on a standardized procedure to complete the lesson delivery checklist.[20] While objective measures are often more reliable, they reflect the results of behaviors, whereas subjective measures reflect the actual behaviors,[45] which was key for assessing the *quality* of lesson delivery. Using lesson scores from multiple observers unfamiliar with the CHW could help increase precision and reduce potential bias; however, this was not possible in our study.

Third, to minimize potential social desirability bias from the CHW interviews, the data collectors were trained in interviewer neutrality and followed a standard operating procedure for administering the interview.[20] Finally, these results take place within an efficacy study with adequate resources and supported by national and local government entities in the 2 districts. The CHWs received an extensive amount of support, with an emphasis on a relatively small number of tasks, which limits the external validity of our results in other countries and contexts, such as government programs, that have fewer resources. Nevertheless, our results highlight that the factors shaping performance vary for different types of task.

CONCLUSION

CHW services are important in ensuring the delivery of primary health care services in many low-income settings. We studied factors associated with CHW performance on contrasting jobs tasks and found that the factors associated with performance differed by task. This suggests that

in multi-task environments, what works to improve performance for some tasks may not work for other tasks. As such, CHW programs should consider creating facilitative work environments that include developing familial and community support for CHW tasks and addressing CHW needs, including appropriate remuneration. Also, focusing on understanding drivers of CHW performance in multi-task settings can help to prevent overburdening CHW workloads and to maintain quality CHW performance as countries seek a transition toward universal health coverage.[46]

What works to improve performance for some tasks may not work for other tasks.

Acknowledgments: The authors thank the SHINE trial team for support and Jeff Sobal for comments. This work is supported by funding from the Bill & Melinda Gates Foundation and the United Kingdom Department for International Development.

Competing Interests: None declared.

REFERENCES

1. Lewin S, Munabi-Babigumira S, Glenton C, Daniels K, Bosch-Capblanch X, van Wyk BE, et al. Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. Cochrane Database Syst Rev. 2010;(3):CD004015. CrossRef. Medline
2. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet. 2013;382(9890):452-477. CrossRef. Medline
3. Global Health Workforce Alliance; World Health Organization (WHO). Global experience of community health workers for delivery of health related Millennium Development Goals: a systematic review, country case studies, and recommendation for integration into national health systems. Geneva: WHO; 2010. Available from: http://www.who.int/workforcealliance/knowledge/publications/CHW_FullReport_2010.pdf
4. Global Health Workforce Alliance; World Health Organization (WHO). A universal truth: no health without a workforce. Geneva: WHO; 2014. Available from: http://www.who.int/workforcealliance/knowledge/resources/GHWA-a_universal_truth_report.pdf
5. Jaskiewicz W, Tulenko K. Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. Hum Resour Health. 2012;10:38. CrossRef. Medline
6. Frymus D, Kok M, de Koning K, Quain E. Knowledge gaps and a need based global research agenda by 2015. Geneva: Global Health Workforce Alliance; 2013. Available from: http://www.who.int/workforcealliance/knowledge/resources/CHWsResearch_Agenda_by2015.pdf
7. Zimbabwe Ministry of Health and Child Care (MoHCC). The village health worker strategic direction. Harare (Zimbabwe): MoHCC; 2010. Available from: https://www.humanitarianresponse.info/system/files/documents/files/Village%20Health%20Worker%20Strartegic%20Direction.pdf
8. Zimbabwe Ministry of Health and Child Care (MoHCC). The national health strategy for Zimbabwe 2009-2013. Harare (Zimbabwe): MoHCC; 2013. Available from: http://www.who.int/workforcealliance/countries/zwe_healthStrategy.pdf
9. Zimbabwe Health Workforce Observatory. Human resources for health--country profile: Zimbabwe. [place unknown]: The Observatory; 2009. Available from: http://s3.amazonaws.com/zanran_storage/www.hrh-observatory.afro.who.int/ContentPages/2453220542.pdf
10. Dieleman M, Harnmeijer JW. Improving health worker performance: in search of promising practices. Geneva: World Health Organization; 2006. Available from: http://cdrwww.who.int/entity/hrh/resources/improving_hw_performance.pdf
11. Naimoli JF, Frymus DE, Wuliji T, Franco LM, Newsome MH. A community health worker "logic model": towards a theory of enhanced performance in low- and middle-income countries. Hum Resour Health. 2014;12:56. CrossRef. Medline
12. Kok MC, Dieleman M, Taegtmeyer M, Broerse JE, Kane SS, Ormel H, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. Health Policy Plan. 2015;30(9):1207-1227. CrossRef. Medline
13. Bronfenbrenner U. The ecology of human development: experiments by nature and design. Cambridge (MA): Harvard University Press; 1979.
14. Sallis JF, Owen N, Fisher EB. Ecological models of health behavior. In : Glanz K,Rimer BK,Viswanath K, editors. Health behavior and health education: theory, research, and practice. 4th ed. San Francisco (CA): John Wiley & Sons; 2008.
15. Locke EA, Latham GP. Goal setting theory: an introduction. In: A theory of goal setting & test performance. Upper Saddle River (NJ): Prentice Hall; 1990. p.1–26.
16. Maslow AH, Frager R. Motivation and personality. New York: Harper and Row; 1987.
17. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol. 2000;55(1):68-78. CrossRef. Medline
18. Maynard DC, Hakel MD. Effects of objective and subjective task complexity on performance. Hum Perform. 1997;10(4):303-330. CrossRef
19. Sanitation Hygiene Infant Nutrition Efficacy (SHINE) Trial Team; Humphrey JH, Jones AD, Manges A, Mangwadu G, Maluccio JA, Mbuya MN, et al. The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) trial: rationale, design, and methods. Clin Infect Dis. 2015;61(Suppl 7):S685-S702. CrossRef. Medline
20. Mbuya MNN, Jones AD, Ntozini R, Humphrey JH, Moulton LH, Stoltzfus RJ, et al. Theory-driven process evaluation of the SHINE trial using a program impact pathway approach. Clin Infect Dis. 2015;61 Suppl 7:S752–S758. CrossRef. Medline
21. Menon P, Mbuya M, Habicht J-P, Pelto G, Loechl CU, Ruel MT. Assessing supervisory and motivational factors in the context of a program evaluation in rural Haiti. J Nutr. 2008;138(3):634–637. Medline
22. Likert R. A technique for the measurement of attitudes. Arch Psychol. 1932;22(140):5-55. Available from: http://www.voteview.com/pdf/Likert_1932.pdf
23. Costello AB, Osborne JW. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Pract Assess, Res Eval. 2005;10(7):1-9.
24. Allison PD. Missing data. Thousand Oaks (CA): Sage; 2002.
25. Cleveland WS, Devlin SJ. Locally weighted regression: an approach to regression analysis by local fitting. J Am Stat Assoc. 1988;83(403):596-610. CrossRef
26. Finlayson K, Downe S. Why do women not use antenatal services in low- and middle-income countries? A meta-synthesis of qualitative studies. PLoS Med. 2013;10(1):e1001373. CrossRef. Medline

27. Bagonza J, Kibira SPS, Rutebemberwa E. Performance of community health workers managing malaria, pneumonia and diarrhoea under the community case management programme in central Uganda: a cross sectional study. Malar J. 2014; 13(1):367. CrossRef. Medline
28. Jenson A, Gracewello C, Mkocha H, Roter D, Munoz B, West S. Gender and performance of community treatment assistants in Tanzania. Int J Qual Health Care. 2014;26(5):524-529. CrossRef. Medline
29. Kok MC, Kane SS, Tulloch O, Ormel H, Theobald S, Dieleman M, et al. How does context influence performance of community health workers in low- and middle-income countries? Evidence from the literature. Health Res Policy Syst. 2015;13(1):13. CrossRef. Medline
30. Alam K, Tasneem S, Oliveras E. Performance of female volunteer community health workers in Dhaka urban slums. Soc Sci Med. 2012;75(3):511-515. CrossRef. Medline
31. Alam K, Tasneem S, Oliveras E. Retention of female volunteer community health workers in Dhaka urban slums: a case-control study. Health Policy Plan. 2012;27(6):477-486. CrossRef. Medline
32. Crispin N, Wamae A, Ndirangu M, Wamalwa D, Wangalwa G, Watako P, et al. Effects of selected socio-demographic characteristics of community health workers on performance of home visits during pregnancy: a cross-sectional study in Busia District, Kenya. Glob J Health Sci. 2012;4(5):78-90. CrossRef. Medline
33. Alamo S, Wabwire-Mangen F, Kenneth E, Sunday P, Laga M, Colebunders RL. Task-shifting to community health workers: evaluation of the performance of a peer-led model in an antiretroviral program in Uganda. AIDS Patient Care STDS. 2012;26(2):101-107. CrossRef. Medline
34. Rahman SM, Ali NA, Jennings L, Seraji MH, Mannan I, Shah R, et al. Factors affecting recruitment and retention of community health workers in a newborn care intervention in Bangladesh. Hum Resour Health. 2010;8:12. CrossRef. Medline
35. Puett C, Coates J, Alderman H, Sadruddin S, Sadler K. Does greater workload lead to reduced quality of preventive and curative care among community health workers in Bangladesh? Food Nutr Bull. 2012;33(4):273-287. CrossRef. Medline
36. Willis-Shattuck M, Bidwell P, Thomas S, Wyness L, Blaauw D, Ditlopo P. Motivation and retention of health workers in developing countries: a systematic review. BMC Health Serv Res. 2008;8:247. CrossRef. Medline
37. Glenton C, Colvin CJ, Carlsen B, Swartz A, Lewin S, Noyes J, et al. Barriers and facilitators to the implementation of lay health worker programmes to improve access to maternal and child health: qualitative evidence synthesis. Cochrane Database Syst Rev. 2013;(10):CD010414. CrossRef. Medline
38. Mbuya MN. Exploring the role of community health workers and their perceived work context on the delivery of behavior change communication in rural Haiti [thesis]. Ithaca (NY): Cornell University; 2008.
39. Bhattacharyya K, Winch P, LeBan K, Tien M. Community health worker incentives and disincentives: how they affect motivation, retention, and sustainability. Arlington (VA): BASICS II; 2001. Available from: http://pdf.usaid.gov/pdf_docs/PNACQ722.pdf
40. Dieleman M, Cuong P, Anh L, Martineau T. Identifying factors for job motivation of rural health workers in North Viet Nam. Hum Resour Health. 2003;1(1):10. CrossRef. Medline
41. Yeboah-Antwi K, Snetro-Plewman G, Waltensperger KZ, Hamer DH, Kambikambi C, MacLeod W, et al. Measuring teamwork and taskwork of community-based "teams" delivering life-saving health interventions in rural Zambia: a qualitative study. BMC Med Res Methodol. 2013;13(1):84. CrossRef. Medline
42. Hill Z, Dumbaugh M, Benton L, Källander K, Strachan D, ten Asbrek A, et al. Supervising community health workers in low-income countries--a review of impact and implementation issues. Glob Health Action. 2014;7:24085. CrossRef. Medline
43. Feldman JM. Beyond attribution theory: Cognitive processes in performance appraisal. J Appl Psychol. 1981;66(2):127-148. CrossRef
44. Bommer WH, Johnson JL, Rich GA, Podsakoff PM, MacKenzie SB. On the interchangeability of objective and subjective measures of employee performance: a meta-analysis. Person Psychol. 1995;48(3):587-605. CrossRef
45. Sturman M. Searching for the inverted U-shaped relationship between time and performance: meta-analyses of the experience/performance, tenure/performance, and age/performance relationships. J Manage. 2003;29(5):609-640. CrossRef
46. World Health Organization (WHO). The world health report 2013: research for universal health coverage. Geneva: WHO; 2013. Available from: http://apps.who.int/iris/bitstream/10665/85761/2/9789240690837_eng.pdf

Peer Reviewed

Received: 2016 Jan 4; **Accepted:** 2016 Apr 12

Cite this article as: Kambarami RA, Mbuya MNN, Pelletier D, Fundira D, Tavengwa NV, Stoltzfus RJ. Factors associated with community health worker performance differ by task in a multi-tasked setting in rural Zimbabwe. Glob Health Sci Pract. 2016;4(2):238–250. http://dx.doi.org/10.9745/GHSP-D-16-00003

© Kambarami et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00003

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

School Distribution as Keep-Up Strategy to Maintain Universal Coverage of Long-Lasting Insecticidal Nets: Implementation and Results of a Program in Southern Tanzania

Shabbir Lalji,[a*] Jeremiah M Ngondi,[a*] Narjis G Thawer,[a] Autman Tembo,[a] Renata Mandike,[b] Ally Mohamed,[b] Frank Chacky,[b] Charles D Mwalimu,[b] George Greer,[c] Naomi Kaspar,[c] Karen Kramer,[d] Bertha Mlay,[e] Kheri Issa,[e] Jane Lweikiza,[e] Anold Mutafungwa,[a] Mary Nzowa,[a] Ritha A Willilo,[a] Waziri Nyoni,[f] David Dadi,[f] Mahdi M Ramsan,[a] Richard Reithinger,[g] Stephen M Magesa[a]

A school-based net distribution program, piloted in the Southern Zone of Tanzania to sustain ≥80% universal net coverage previously attained through mass campaigns, successfully issued nets to nearly all eligible students and teachers. Keys to success included:

- **Effective collaboration between the Ministry of Health, local government, and implementing partners**
- **Social mobilization to sensitize the community about the importance of net use**
- **Development of a mobile application to facilitate data collection and analysis**

ABSTRACT

Tanzania successfully scaled up coverage of long-lasting insecticidal nets (LLINs) through mass campaigns. To sustain these gains, a school-based approach was piloted in the country's Southern Zone starting in 2013, called the School Net Program 1 (SNP1). We report on the design, implementation, monitoring, and outputs of the second round (SNP2) undertaken in 2014. SNP2 was conducted in all schools in Lindi, Mtwara, and Ruvuma regions, targeting students in primary (Standards 1, 3, 5, and 7) and secondary (Forms 2 and 4) schools and all teachers. In Lindi region, 2 additional classes (Standards 2 and 4) were targeted. LLIN distribution data were managed using an Android software application called SchoolNet. SNP2 included 2,337 schools, 473,700 students, and 25,269 teachers. A total of 5,070 people were trained in LLIN distribution (487 trainers and 4,583 distributors), and 4,392 (434 ward and 3,958 village) community change agents undertook sensitization and mobilization. A total of 507,775 LLINs were distributed to schools, with 464,510 (97.9% of those registered) students and 24,206 (95.8% of those registered) school teachers receiving LLINs. LLIN ownership and use is expected to have increased, potentially further reducing the burden of malaria in the Southern Zone of Tanzania.

[a] RTI International, Dar es Salaam, Tanzania.
[b] Ministry of Health and Social Welfare, National Malaria Control Programme, Dar es Salaam, Tanzania.
[c] U.S. President's Malaria Initiative/U.S. Agency for International Development, Dar es Salaam, Tanzania.
[d] Swiss Tropical and Public Health Institute, Dar es Salaam, Tanzania.
[e] Tanzania Red Cross Society, Dar es Salaam, Tanzania.
[f] Johns Hopkins Center for Communication Programs, Dar es Salaam, Tanzania.
[g] RTI International, Washington, DC, USA.
* Co-first authors.
Correspondence to Jeremiah M Ngondi (jngondi@rti.org).

BACKGROUND

Mass distribution of insecticide-treated nets, specifically long-lasting insecticidal nets (LLINs), is an effective vector control intervention to prevent malaria[1,2] and has been associated with large reductions in malaria morbidity and mortality.[2] The use of LLINs in sub-Saharan Africa has increased in the past decade to reach 80% universal coverage (defined as 1 LLIN per 2 people in a household).[3–5] Since 2000, the Tanzania National Malaria Control Programme (NMCP) has led the National Insecticide Treated Nets

Not all eligible people in Tanzania received LLINs through the voucher program, either because they did not attend health facilities or did not redeem vouchers.

(NATNETS) Programme to scale up LLIN distribution and use in Tanzania. NATNETS introduced the Tanzania National Voucher Scheme (TNVS) to provide pregnant women and infants with LLINs at highly discounted prices.[6,7] The TNVS was successful in distributing LLINs to pregnant women and infants; however, not all eligible people were accessing health facilities to benefit from the program and not all people attending health facilities redeemed their vouchers.[8–10]

To ensure that the entire population (including those not covered by the TNVS) would have access to LLINs, 2 LLIN mass campaigns were implemented: (1) the children under 5 years of age catch-up campaign (U5CC) in 2009 and (2) the universal coverage campaign in 2011.[11] Between 2009 and 2011, these campaigns distributed approximately 27 million LLINs, in addition to more than 3 million nets delivered through the TNVS.[11–13] The TNVS, U5CC, and universal coverage campaign were successful in dramatically increasing LLIN ownership in Tanzania. Household net ownership increased from 38% in 2007 to more than 85% in 2011, and use of LLINs increased from 25% in 2007 to 63% in 2011.[14]

The Ministry developed a keep-up strategy in schools to complement the voucher scheme.

To maintain at least 80% universal coverage of LLINs, the Ministry of Health and Social Welfare developed a keep-up strategy in schools to complement the TNVS. Keep-up strategies focus on long-term, continuous distribution through channels such as schools, health facilities, community initiatives, and the private sector; catch-up strategies are periodic mass distribution campaigns. NATNETS assessed all possible keep-up options and determined that a combined approach including the TNVS and school-based distribution, involving both push and pull systems, was the most cost-effective and efficient keep-up strategy for Tanzania.[12,15–17] Because school enrollment in Tanzania is high and teachers can easily facilitate and manage the delivery of LLINs, school-based distribution of LLINs can be an effective strategy to reach many households.[18]

In 2013, the NMCP and partners piloted the first round of the School Net Program (SNP1) to distribute LLINs in the Southern Zone of Tanzania (Lindi, Mtwara, and Ruvuma regions). Each student in Standards 1, 3, 5, and 7 of primary schools, and Forms 2 and 4 of secondary schools, received an LLIN to take home. A total of 421,285 students (83% of those eligible) received LLINs.[19] The assumption behind this strategy was that as the children moved through the school system, they would bring home a new LLIN every 2 years, which would be redistributed within the household or community. The pilot program demonstrated that it was feasible to rapidly and equitably distribute large quantities of LLINs through schools to the community. Household ownership of at least 1 LLIN increased by almost 17% compared with an area not covered under SNP1.[20] Use of LLINs among older children and adolescents also increased.

We describe here the design, implementation, monitoring, and outputs of the second round of the School Net Program (SNP2), conducted in 2014.

METHODS

Study Setting

Figure 1 shows a map of Tanzania with the locations of schools in the Southern Zone (Lindi, Mtwara, and Ruvuma regions) and 19 districts where SNP2 was implemented. In 2012, the total populations by region were 864,652 in Lindi; 1,270,854 in Mtwara; and 1,376,891 in Ruvuma.[21] In 2011, the prevalence of malaria among children under 5 years of age ranged from 12% in Ruvuma and 17% in Mtwara to 26% in Lindi.[14] In 2010, the gross enrollment ratio, which refers to the total number of students of any age enrolled in school expressed as a percentage of the official school-age population, was 94.8%, 102.5%, and 106.6% for primary schools and 11.1%, 31.2%, and 33.6% for secondary schools in Lindi, Mtwara, and Ruvuma, respectively.[22] The national average gross enrollment ratio was estimated at 99.0% and 31.8% for primary and secondary schools, respectively.

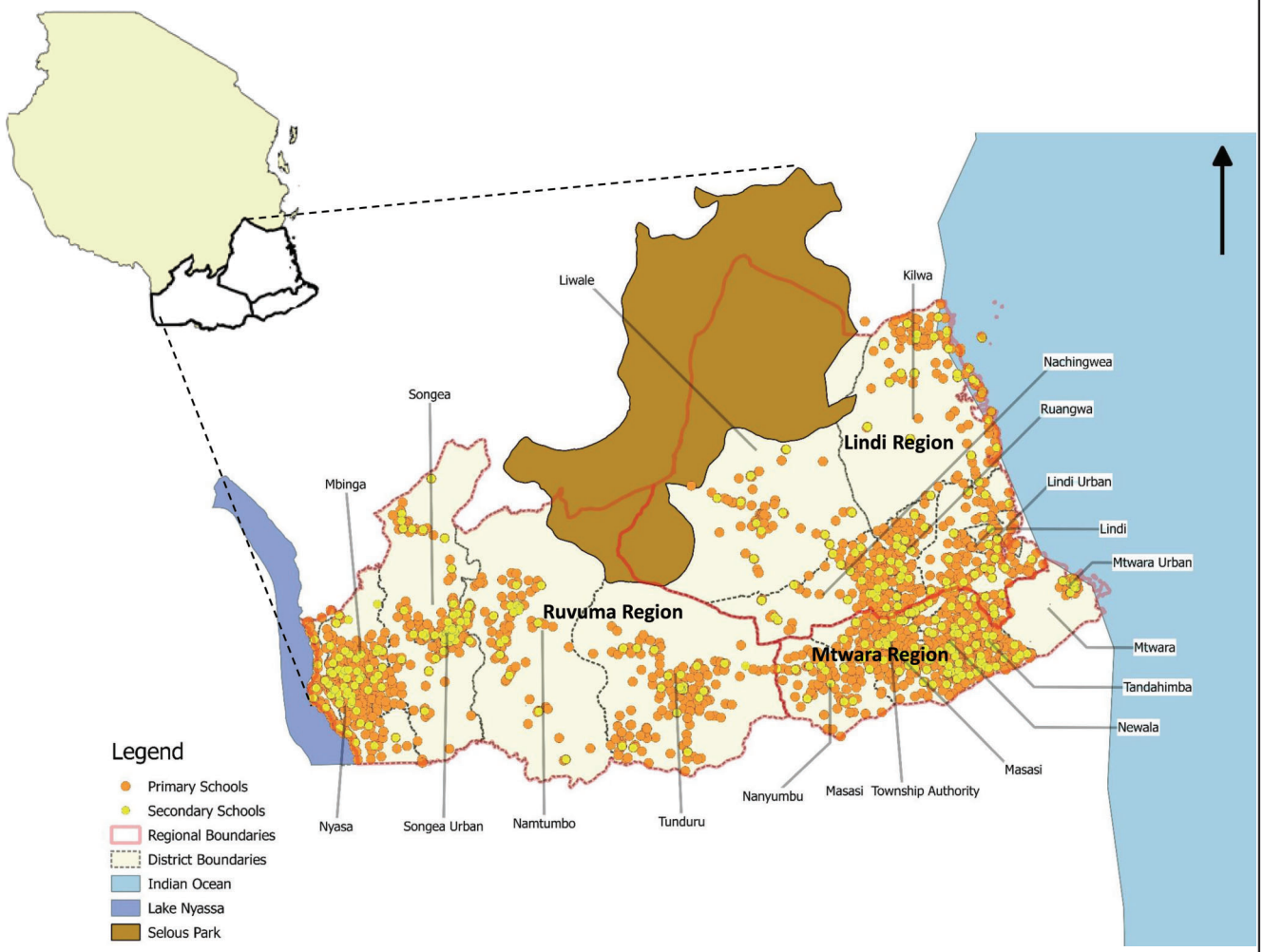
Study Design

SNP2 aimed to increase access to LLINs and maintain at least 80% coverage in the 3 regions by distributing LLINs free of charge to primary and secondary school students and teachers. Teachers were included as beneficiaries in SNP2 because there was an excess supply of LLINs from SNP1. In Lindi, an additional 2 grades (Standards 2 and 4) were targeted for LLIN distribution to reduce the expected remaining stock. As in SNP1, each student from Standards 1, 3, 5, and 7 and Forms 2 and 4 in Mtwara and Ruvuma received 1 LLIN.

Partnership, Coordination, and Planning

An SNP task force, chaired by the NMCP, was created to oversee the implementation of SNP2

FIGURE 1. Locations of Schools Implementing the Second Round of the School Net Program (SNP2) in the Southern Zone of Tanzania, 2014



(Box). The task force played a key role in the planning, coordination, and implementation of SNP2. It ensured that LLIN distribution aligned with the NMCP's LLIN strategy and that partners were involved in key implementation decisions. It also took into account the recommendations, experiences, and lessons learned from SNP1. Advocacy meetings were held before LLIN distribution at national, regional, and district levels. Subcommittees were formed to plan specific activities, including LLIN quantification and logistics, training, social mobilization, and monitoring and evaluation (M&E).

LLIN Quantification

Before the SNP1 pilot, we used the NetCALC Planning Tool (www.vector-works.org/resources/netcalc-planning-tool) to estimate the quantity of nets required to maintain at least 80% universal coverage in the Southern Zone of Tanzania.[12] For SNP2, the number of students attending each school was estimated using SNP1 registration records. We also obtained data from the district education department on the number of students and teachers in each school. Data were compared and verified to determine if there were any discrepancies. Data for eligible classes and teachers

BOX. Members of the School Net Program 2 (SNP2) Task Force

Members of the SNP2 task force included representatives from the:

- National Malaria Control Programme
- Ministry of Health and Social Welfare School Health Program
- Ministry of Education and Vocational Training
- Prime Minister's Office Regional Authority and Local Government
- Swiss Tropical and Public Health Institute's NETCELL project
- U.S. President's Malaria Initiative
- World Health Organization
- Johns Hopkins Center for Communication Programs
- U.S. Peace Corps
- Mennonite Economic Development Associates
- RTI International
- Tanzania Red Cross Society
- Population Services International
- John Snow, Inc.

in each school were used to estimate the number of LLINs to deliver to each school. A contingency amount of 3% of the overall number of estimated LLINs for each school was also included.

Training of Trainers and Implementers

The SNP task force training subcommittee was responsible for reviewing and revising all required training manuals. The strategy for training in SNP2 was a cascade approach, beginning with training of trainers (TOT) at the district level, who then trained implementers (teachers) at the ward level. This was a shift away from a more centralized model used in SNP1, which required a substantial period of time, as one team of trainers moved from one district and region to another to conduct trainings. The training period for SNP2 was also reduced from a 2-day session to a half-day session at both the district and ward levels. The TOT targeted district malaria focal persons, district school health coordinators for health and education, and the ward education coordinators. The training of implementers was at the ward level, whereby head teachers and school health teachers from all schools within a ward attended the training. The ward education coordinators were the principal trainers who were supervised by national, regional, and district-based staff. Training focused on the use of LLINs, continuous distribution of LLINs through schools, monitoring, and reporting. Participants learned a systematic approach to managing the LLIN distribution process, including handling data collection forms, enumerating students, recording LLIN issuance data, summarizing data, and submitting data.

A tablet-based application called SchoolNet enabled real-time data collection from schools on LLIN issuance.

Social Mobilization

The IEC/BCC subcommittee of the SNP task force planned advocacy and sensitization meetings; reviewed information, education, and communication (IEC) and behavior change communication (BCC) materials; and trained community change agents and volunteers. The task force distributed IEC materials, and aired radio spots and programs on local radio stations in Ruvuma, Lindi, and Mtwara regions to sensitize the community on the importance of LLIN ownership and use. IEC materials and radio spots focused on the community aspect of LLIN distribution. Spots provided details on the importance of using LLINs, emphasizing that students who received LLINs served as conduits for delivering them to the community.

Development of Tools and Manuals

The M&E subcommittee of the SNP task force was set up to revise data collection tools and training manuals. The M&E team developed registration and issuance booklets as well as summary booklets to capture data at the school level during LLIN issuance. They used the summary booklets, filled in by the school principal, to compare the number of LLINs issued against the number of students in the registration and issuance booklets, filled in by class teachers.

Implementation of the SchoolNet Application

We developed a database application called SchoolNet to facilitate the collection and management of data from SNP2 schools. The SchoolNet app runs on Android tablets. We trained data clerks to use the SchoolNet app and developed an operative manual for guidance. Data clerks were responsible for entering data from the respective schools onto the tablets. Data were transmitted in real time through the local mobile phone network to a central database where the M&E team cleaned and analyzed the data in a timely manner for programmatic decision making. This approach to data management reduced the time-lag between LLIN issuance and data reporting, which

enabled prompt analysis while maintaining high standards of data quality.

Delivery of LLINs

The logistics subcommittee of the SNP task force was responsible for reviewing the transport and logistics protocols, streamlining distribution procedures, and developing a program and timeline to distribute LLINs from Dar es Salaam to all SNP2 schools. The bulk transportation and distribution of LLINs to schools was led by the Tanzania Red Cross Society (TRCS), a humanitarian organization with expertise in logistics and supply chain management. Moving the LLINs from Dar es Salaam to schools involved geographical reconnaissance, transportation planning, rebundling, storage, and transport to the schools through the districts. TRCS transported LLINs from the central-level medical store department warehouse to the district level, rebundled them according to the quantification data, and stored them in warehouses until distribution to respective SNP2 schools.

Geographical Reconnaissance

Logistics teams were dispatched to all districts to collect data regarding storage facilities, availability of council and private transports, and maps to design distribution routes. The geographic reconnaissance data were critical to developing a comprehensive logistics and transportation schedule, as it took into account geographical opportunities and challenges, such as poor road infrastructure in hard-to-reach areas.

Rebundling and Transport of LLINs

Rebundling LLINs involved grouping them into bales according to the needs of each school in the district, based on quantification data gathered during the SNP2 planning phase. TRCS packed LLINs in smaller volumes and labeled each with the quantity of LLINs and the respective school name. Labeled bundles were loaded onto smaller vehicles for ease of access on rural roads to ensure that they reached the targeted schools. To properly account for the LLIN inventory, SNP2 used delivery notes, warehouse journals, and bin cards to document and track net movement at every point of delivery. We conducted an independent procedural audit to track the LLINs from the central warehouse in Dar es Salaam, to a sample of 3 districts warehouses and to a sample of 27 schools. The audit reported that the logistics chain was effective in delivering LLINs and that there were no losses.

LLIN Issuance to Schools and Definition of LLIN Coverage

LLIN delivery and issuance to all primary and secondary schools took place over a 3-day period on regular school days. Class teachers organized preregistered students by their respective classes. Each student and teacher receiving an LLIN were required to sign against his or her name in the registration and issuance booklets as proof of having received an LLIN. Supervision and documentation focused on the integrity of school data; adherence to procedures for distribution; and feedback on successes, challenges, and areas for improvement related to the LLIN distribution and issuing. We defined LLIN coverage as the proportion of eligible students and teachers who received LLINs.

Data Collection, Management, and Analysis

With technical assistance and supervision from the M&E team, data clerks entered data from hard copy training reports, inventory booklets, attendance registers, and school registers in central databases via the SchoolNet app. All information was subjected to periodic data quality checks through regular supervision and review of documents. The head teacher or school principal filled in summary booklets for each school, which the M&E team used to compare the number of LLINs issued against the number of students registered in each class. The issuance forms also captured the number of LLINs that schools received from the district warehouses, thus enabling the schools to keep track of remaining stocks.

Issuance forms captured the number of LLINs that schools received, enabling them to track remaining stock.

Data from each school were submitted to ward education coordinators for verification and subsequently sent to the district education officers. The M&E team then verified and cleaned the data. The M&E team visited all district offices to supervise the data collection process and to verify the quality, tools, and methodology used. To verify the data entered onto the tablets by the data clerks, the M&E team cross-checked them with hard copies of the issuance forms and summary booklets. All hard copy records were reviewed for accuracy and consistency, and filed in a central repository. Naming conventions were assigned for easy storage and retrieval of the

records on hand. Relevant data were extracted from the SchoolNet app database and exported to a Microsoft Excel spreadsheet for analysis.

The M&E team used Stata 12.0 to conduct data analysis. The team used descriptive statistics to investigate frequency distributions and proportions, and box plots to investigate the distributions of number of students eligible for SNP by class and region.

Ethical Consideration

SNP2 was undertaken as part of public health programming, and therefore ethical clearance was not required a priori. The National Health Research Ethics Subcommittee granted written permission to publish these data.

Overall, 98% of eligible students and 96% of eligible teachers received LLINs in the 3 regions.

RESULTS

Training of Trainers and Implementers

Table 1 shows the number of people trained as trainers and implementers (teachers) in the targeted 19 districts in 3 regions, by gender. Overall, 487 trainers (78.1% male) and 4,583 teachers as implementers (66.8% male) were trained.

Social Mobilization

Comprehensive social mobilization activities complemented LLIN distribution, including IEC and BCC materials, radio spots, and sensitization sessions.

Table 2 shows the number of IEC and BCC materials distributed during SNP2 by region. In addition, 2,600 radio spots and 23 *PataPata* children's radio programs were broadcast through local radio stations, including Jogoo FM, Pride FM, Newala FM, and the Tanzania Broadcasting Corporation. A total of 4,392 community change agents (434 at the ward level and 3,958 at the village level) delivered 1,500 sensitization and mobilization sessions, reaching 42,626 people.

Participation in the Program

All 2,337 schools participated in SNP2-targeted districts, the majority of which were primary schools (Table 3). The number of schools varied within each district, ranging from 41 in Lindi Municipal Council to 269 in Mbinga District Council. A total of 473,700 students were registered in SNP2 schools and were eligible to participate in the distribution. Primary school students in Standards 1, 3, 5, and 7 comprised 89.3% of the total number of eligible students. Figure 2 shows the distribution of registered students by region for each grade eligible to receive an LLIN through SNP2. The number of registered students declined in each subsequent grade, with a median of 59 (interquartile range [IQR], 40–83) students in Standard 1 compared with a median of 34 (IQR, 23–51) students in Standard 7. In secondary schools, the median (IQR) students in Form 2 and Form 4 were 60 (40–97) and 25 (14–49), respectively (Figure 2). A total of 25,269 teachers were registered in all schools (Table 3).

LLINs Issued to Schools and LLIN Coverage

Schools received a total of 507,775 LLINs, of which 91.5% and 4.8% were issued to students and teachers, respectively (Table 4). After distribution, 3.7% of LLINs remained, ranging from 1.7% in Ruvuma to 5.4% in Lindi.

Figure 3 shows the distribution of LLIN coverage by grade and region, and Table 4 and Figure 4 shows coverage by district. Overall, 97.9% of students and 95.8% of teachers received LLINs in the 3 regions. Mtwara Region had the lowest LLIN coverage for both teachers and students, at 96.6% and 94.5%, respectively. Across all districts, the percentage of teachers and students that received LLINs was consistently above 90% (Figure 3 and Figure 4).

DISCUSSION

The school-based net distribution program, SNP2, successfully issued LLINs to 98% of eligible students and 96% of eligible teachers in the 3 targeted regions of Tanzania. Our findings are consistent with a similar pilot study in Ghana where LLINs were distributed to students in grades 2 and 6 of primary schools, teachers, and district office team members, and achieved nearly 100% LLIN coverage among eligible participants.[23] Independent evaluations of SNP1 and SNP2 in Tanzania found that this school-based approach resulted in increased household ownership and improved usage of LLINs compared with control districts with no school-based delivery mechanism.[24,25] Following SNP2 implementation, household ownership of LLINs was 84% in Mtwara, 84% in Lindi, and 75% in Ruvuma, and universal coverage of LLINs (households with 1 net for every 2 people) was estimated at 70% in Mtwara, 65% in Lindi, and 56% in Ruvuma. In comparison, universal coverage of LLINs in non-SNP2 control districts in Lake Zone was lower: 33% in Chato District and 46% in Sengerema District.[25] Despite 2 rounds of SNP, coverage of LLINs across the 3 SNP target regions was still below the universal coverage target of 80%.

TABLE 1. Number of Trainers and Implementers Trained for SNP2, by District and Gender, 2014

		Trainers		Implementers (Teachers)	
Region	**District**	**Total**	**% Male**	**Total**	**% Male**
Lindi	Kilwa District Council	27	96.3%	250	82.8%
	Lindi District Council	25	80.0%	223	65.9%
	Lindi Municipal Council	11	54.5%	82	56.1%
	Liwale District Council	23	82.6%	139	74.8%
	Nachingwea District Council	34	70.6%	258	65.5%
	Ruangwa District Council	23	69.6%	192	65.1%
Subtotal		143	77.6%	1,144	69.8%
Mtwara	Masasi District Council	26	76.9%	293	65.5%
	Masasi Town Council	14	64.3%	90	47.8%
	Mtwara District Council	31	80.6%	298	73.8%
	Mtwara Municipal Council	18	83.3%	104	58.7%
	Nanyumbu District Council	17	76.5%	200	73.5%
	Newala District Council	31	74.2%	291	69.1%
	Tandahimba District Council	34	88.2%	289	72.0%
Subtotal		171	78.9%	1,565	68.5%
Ruvuma	Mbinga District Council	44	75.0%	552	59.8%
	Namtumbo District Council	23	95.7%	283	63.6%
	Nyasa District Council	21	90.5%	226	78.8%
	Songea District Council	21	76.2%	245	60.4%
	Songea Municipal Council	23	78.3%	230	49.6%
	Tunduru District Council	41	82.9%	338	71.0%
Subtotal		173	82.1%	1,874	63.5%
Grand Total		**487**	**79.7%**	**4,583**	**66.8%**

Abbreviation: SNP2, School Net Program – Round 2.

This is largely attributed to the fact that SNP started in 2013, 2 years after the 2011 mass LLIN distribution campaign. Based on NetCALC models, LLIN coverage would have declined by 50% to 60% between 2011 and 2013.[12,26] To maintain universal coverage, we recommend that continuous distribution through SNP should be implemented within 9 to 12 months of any mass LLIN distribution campaign.[26]

Compared with SNP1, SNP2 achieved higher LLIN coverage of students (98% versus 83%), distributed 16% more nets, and had fewer LLINs remaining after distribution (4% versus 17%) due to a change in the program design to include

We recommend implementing continuous LLIN distribution through schools within 9 to 12 months of any mass distribution campaign.

TABLE 2. Number of IEC Materials Distributed by SNP2, by District, 2014

Type of IEC Material	Mtwara	Lindi	Ruvuma	Total
Community posters (*Tushirikiane Kutokomeza Malaria*)	4,878	3,738	3,000	11,616
School posters (*Mwanafunzi Shiriki*)	3,975	3,025	3,700	10,700
Multiplication tables	64,125	45,600	70,775	180,500
Patapata posters	3,225	2,400	3,725	9,350
Comic brochures	166,667	166,667	166,666	500,000
Patapata notebooks	5,285	10,220	9,905	25,410
Patapata notebooks for radio station	5	5	5	15
Teacher cue cards	1,935	1,440	2,235	5,610
Community change agents cue cards (*Dondoo za Majadiliano*)	302	282	284	868

Abbreviations: IEC, information, education, and communication; SNP2, School Net Program – Round 2.

teachers in all regions and additional grades in Lindi region. SNP2 was built on effective collaboration and teamwork between the Ministry of Health and Social Welfare, local government, and implementing partners. Specific roles and responsibilities were assigned to working groups to implement elements of the SNP framework—a crucial ingredient for the success of SNP2 activities, as demonstrated in previous campaigns conducted in Tanzania.[8,11] Some adjustments were made to the pilot SNP1 approach, which also contributed to SNP2's success. These included (1) providing training to the trainers and implementers; (2) implementing comprehensive social mobilization activities[12,25]; (3) introducing the SchoolNet app, enabling real-time data entry into a central database, more effective data management, feedback on data quality, and easier and more timely data analysis and dissemination; and (4) timing the LLIN distribution in August (i.e., during the dry season) to ensure easier access to all schools for LLIN delivery.

Future school-based LLIN distribution should consider targeting primary school students only.

Slight differences between school enrollment data provided by districts (used for quantification) and student registration at schools (recorded in real time during issuing) may have resulted in a deficit or oversupply of LLINs in a small proportion of schools. Such deficits were resolved through redistribution of excess LLINs from neighboring schools. We therefore recommend that head teachers should provide school enrollment data for net quantification. Also, based on feedback from participants, the half-day training for trainers and implementers was not adequate to cover all necessary SNP2 details; trainings should be extended to 1 day in future rounds of the SNP. We also recommend that the training of key implementers (teachers) should be coordinated by the Ministry of Education and Vocational Training, who should be more engaged in SNP. Finally, models have shown that 35% of households are potentially not reached by either the TNVS or SNP.[24] Registration data suggest that as students progress to higher grades, dropout rates increase, meaning that in households where all children drop out of school, they will not be eligible to receive LLINs. Thus, while it is expected that some households not eligible for LLINs via the TNVS or SNP could benefit from LLIN redistribution within households, further strategies are needed to ensure universal access to LLINs by the general population. The results of this program show that substantial proportions (89.3%) of students eligible for SNP were from primary schools; therefore, future school-based LLIN distribution should consider targeting primary school students only.

CONCLUSION

SNP2 was successful in reaching 98% of eligible students and 96% of eligible teachers in 3 regions

TABLE 3. Schools, Eligible Students, and Teachers Participating in SNP2, by District, 2014

		No. of Schools			No. of Students[a]									
Region	District	Primary	Secondary	Total	Std. 1	Std. 2	Std. 3	Std. 4	Std. 5	Std. 7	Form 2	Form 4	Total	No. of Teachers
Lindi	Kilwa District Council	108	28	136	7,483	6,283	5,925	5,631	4,604	4,255	1,448	547	36,176	1,226
	Lindi District Council	114	27	141	7,364	5,972	4,965	5,420	3,987	3,428	1,428	574	33,138	1,218
	Lindi Municipal Council	32	9	41	2,421	1,937	1,853	1,766	1,567	1,358	843	400	12,145	619
	Liwale District Council	54	16	70	4,225	3,220	2,982	3,204	2,582	2,035	1,233	309	19,790	654
	Nachingwea District Council	103	26	129	6,302	5,890	4,769	4,299	3,860	3,192	1,755	428	30,495	1,222
	Ruangwa District Council	82	15	97	4,301	3,829	3,144	3,526	2,468	2,119	873	313	20,573	886
Subtotal		493	121	614	32,096	27,131	23,638	23,846	19,068	16,387	7,580	2,571	152,317	5,825
Mtwara	Masasi District Council	126	23	149	8,645		6,838		6,024	5,439	1,863	1,156	29,965	1,588
	Masasi Town Council	37	8	45	3,130		2,214		1,776	2,003	888	410	10,421	714
	Mtwara District Council	127	24	151	8,253		7,201		5,879	5,108	1,304	457	28,202	1,360
	Mtwara Municipal Council	33	21	54	3,232		2,641		2,394	2,096	2,079	915	13,357	1,112
	Nanyumbu District Council	87	11	98	6,804		4,532		3,577	2,631	1,053	152	18,749	885
	Newala District Council	118	28	146	6,175		4,963		5,207	4,087	1,740	534	22,706	1,419
	Tandahimba District Council	115	28	143	7,852		6,964		5,998	5,007	1,630	506	27,957	1,485
Subtotal		643	143	786	44,091		35,353		30,855	26,371	10,557	4,130	151,357	8,563
Ruvuma	Mbinga District Council	227	52	279	11,583		8,815		9,078	7,833	3,634	1,745	42,688	2,601
	Namtumbo District Council	108	29	137	7,505		5,980		5,131	4,526	2,060	1,077	26,279	1,561
	Nyasa District Council	97	18	115	5,721		4,594		4,235	3,197	1,116	534	19,397	964
	Songea District Council	95	27	122	6,086		5,168		4,393	3,715	1,776	820	21,958	1,647
	Songea Municipal Council	78	37	115	7,547		5,740		5,234	4,557	3,664	1,985	28,727	2,365
	Tunduru District Council	146	23	169	10,887		5,889		5,902	4,944	2,370	985	30,977	1,743
Subtotal		751	186	937	49,329		36,186		33,973	28,772	14,620	7,146	170,026	10,881
Grand Total		**1,887**	**450**	**2,337**	**125,516**	**27,131**	**95,177**	**23,846**	**83,896**	**71,530**	**32,757**	**13,847**	**473,700**	**25,269**

Abbreviation: SNP2, School Net Program – Round 2.
[a] Standard 2 and Standard 4 students were eligible for SNP2 in Lindi region only.

in Tanzania. Effective partnerships, coordination, and teamwork facilitated the successful implementation of SNP2. LLIN ownership and use in the community is expected to increase and therefore reduce the burden of malaria in the 3 regions. This program can serve as a model for other countries who wish to implement a school-based approach as a keep-up strategy to maintain

FIGURE 2. Distribution of Registered Students Eligible to Receive a Long-Lasting Insecticidal Net, by Class and Region

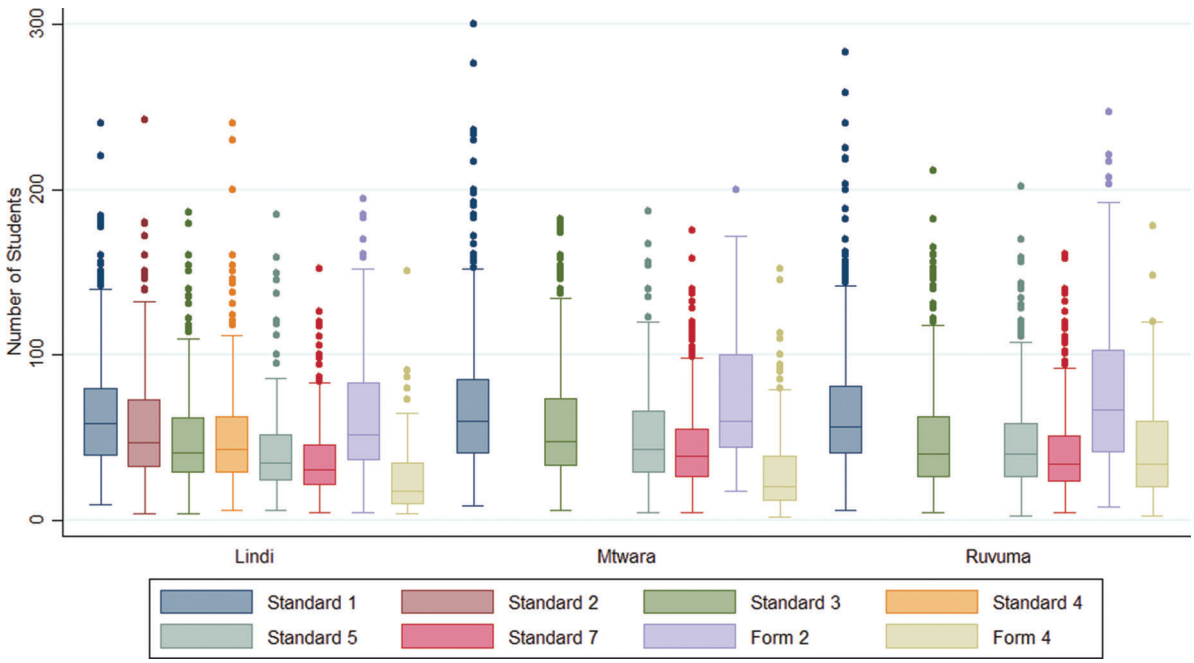


FIGURE 3. Percentage of Eligible Students and Teachers Receiving a Long-Lasting Insecticidal Net, by Class and Region

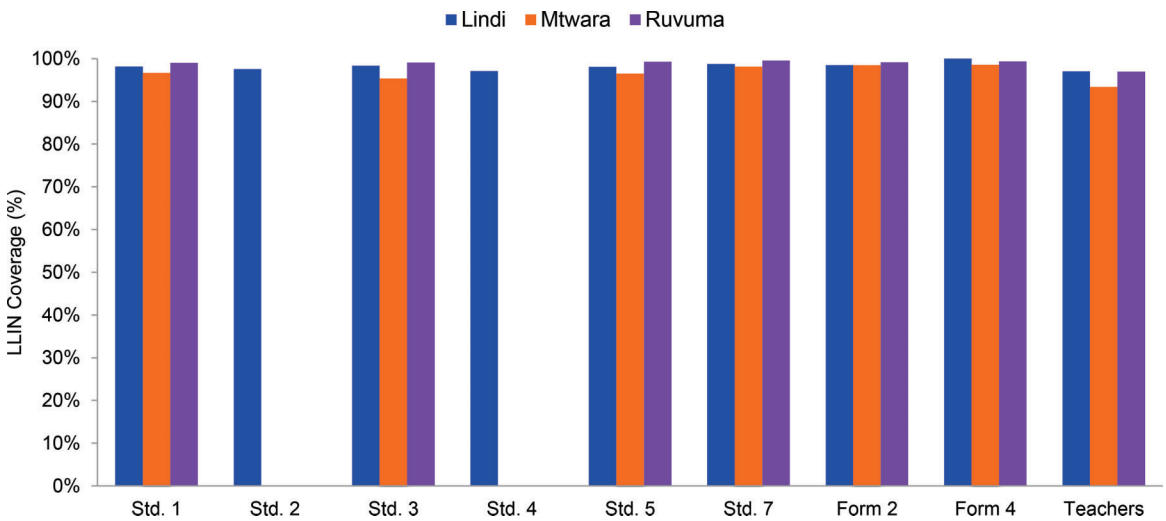
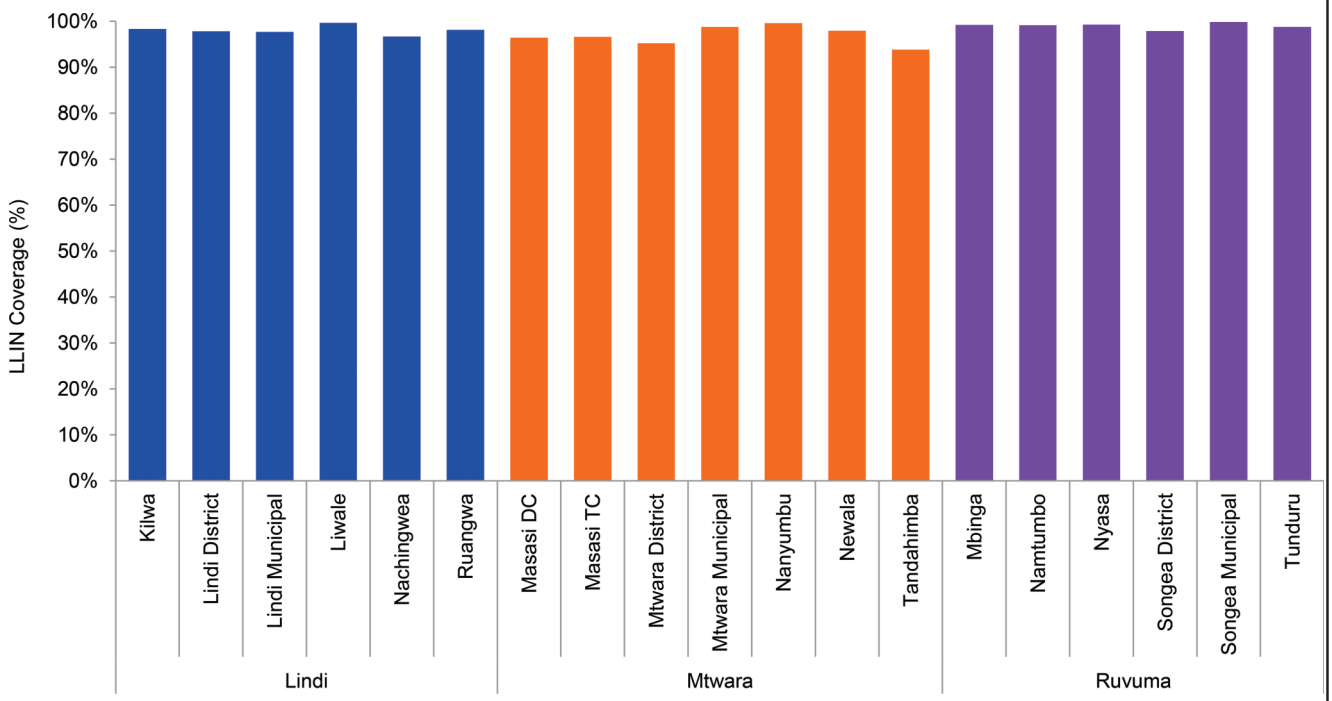


TABLE 4. LLINs Issued to Teachers and Students by SNP2, by District, 2014

		No. of LLINs:					Percentage of:		
Region	District	Received by School	Issued to Students	Issued to Teachers	Total Issued	Remaining After Issuing	Registered Students Issued LLINs	Registered Teachers Issued LLINs	LLINs Remaining
Lindi	Kilwa District Council	35,575	35,702	1,206	36,781	1,903	98.3%	98.4%	4.6%
	Lindi District Council	32,425	32,451	1,195	33,620	4,195	97.9%	98.1%	11.0%
	Lindi Municipal Council	11,853	11,901	619	12,472	200	97.7%	100.0%	1.2%
	Liwale District Council	19,730	19,807	653	20,383	461	99.7%	99.8%	1.8%
	Nachingwea District Council	29,555	29,660	1,112	30,667	421	96.7%	91.0%	1.0%
	Ruangwa District Council	20,194	20,194	868	21,062	1,993	98.2%	98.0%	8.6%
Subtotal		149,332	149,715	5,653	154,985	9,173	98.0%	97.0%	5.4%
Mtwara	Masasi District Council	28,932	28,932	1,501	30,433	2,740	96.5%	94.5%	8.3%
	Masasi District Council	10,095	10,095	664	10,759	175	96.6%	93.0%	1.6%
	Mtwara District Council	26,896	26,896	1,266	28,162	719	95.3%	93.1%	2.5%
	Mtwara Municipal Council	13,244	13,244	1,050	14,294	100	98.8%	94.4%	0.7%
	Nanyumbu District Council	18,681	18,681	878	19,559	1,384	99.6%	99.2%	6.6%
	Newala District Council	22,314	22,314	1,322	23,636	1,185	98.0%	93.2%	4.8%
	Tandahimba District Council	26,310	26,310	1,317	27,627	508	93.8%	88.7%	1.8%
Subtotal		146,472	146,472	7,998	154,470	6,811	96.6%	93.4%	4.2%
Ruvuma	Mbinga District Council	42,380	42,380	2,550	44,930	670	99.2%	98.0%	1.5%
	Namtumbo District Council	26,133	26,133	1,483	27,616	393	99.2%	95.0%	1.4%
	Nyasa District Council	19,281	19,281	943	20,224	98	99.3%	97.8%	0.5%
	Songea District Council	21,525	21,525	1,584	23,109	607	97.9%	96.2%	2.6%
	Songea Municipal Council	28,689	28,689	2,365	31,054	1,074	99.9%	100.0%	3.3%
	Tunduru District Council	30,698	30,698	1,630	32,328	233	98.8%	93.5%	0.7%
Subtotal		168,706	168,706	10,555	179,261	3,075	99.1%	97.0%	1.7%
Grand Total		**507,775**	**464,510**	**24,206**	**488,716**	**19,059**	**97.9%**	**95.8%**	**3.7%**

Abbreviations: LLIN, long-lasting insecticidal net; SNP2, School Net Program – Round 2.

FIGURE 4. Percentage of Eligible Students and Teachers Receiving a Long-Lasting Insecticidal Net, by District and Region



universal coverage of LLINs for malaria prevention and control.

Acknowledgments: We would like to acknowledge members from the Ministry of Health and Social Welfare, Ministry of Education and Vocational Training, and the Prime Minister's Office, Regional Authority and Local Government for their involvement and continuous support during SNP2. We would also like to acknowledge the contribution of schools' district and ward education officers, school teachers, and Tanzania Red Cross Society (TRCS) volunteers in SNP2. We thank the Johns Hopkins Center for Communication Programs and Population Services International (PSI) for leading social mobilization activities. We are grateful to John Snow, Inc. and the medical store department for LLIN logistics as well as PSI and TRCS for their support during advocacy activities. This work was supported by the President's Malaria Initiative via the United States Agency for International Development (USAID) and an interagency agreement with the U.S. Centers for Disease Control and Prevention (CDC). The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of USAID, CDC, or other employing organizations or sources of funding.

Competing Interests: None declared.

REFERENCES

1. Curtis CF, Maxwell CA, Magesa SM, Rwegoshora RT, Wilkes TJ. Insecticide-treated bed-nets for malaria mosquito control. J Am Mosq Control Assoc. 2006;22(3):501–506. CrossRef. Medline
2. Lengeler C. Insecticide-treated bed nets and curtains for preventing malaria. Cochrane Database Syst Rev. 2004;(2): CD000363. CrossRef. Medline
3. Roll Back Malaria/World Health Organization. The Abuja declaration and the plan of action. Geneva: Roll Back Malaria Partnership Secretariat, World Health Organization; 2000. Available from: http://apps.who.int/iris/bitstream/10665/67816/1/WHO_CDS_RBM_2003.46.pdf
4. World Health Organization. Insecticide-treated mosquito nets: a WHO position statement. Geneva: World Health Organization Global Malaria Programme; 2007. Available from: http://files.givewell.org/files/DWDA%202009/Interventions/Nets/itnspospaperfinal.pdf
5. National Malaria Control Programme [Tanzania]. Medium term strategic plan 2008–2013. Dar es Salaam (Tanzania): National Malaria Control Programme; 2008.
6. Mushi AK, Schellenberg JRMA, Mponda H, Lengeler C. Targeted subsidy for malaria control with treated nets using a discount voucher system in Tanzania. Health Policy Plan. 2003; 18(2):163–171. CrossRef. Medline
7. Magesa SM, Lengeler C, de Savigny D, Miller JE, Njau RJA, Kramer K, et al. Creating an "enabling environment" for taking insecticide treated nets to national scale: the Tanzanian experience. Malar J. 2005;4:34. CrossRef. Medline
8. Njau RJA, de Savigny D, Gilson L, Mwageni E, Mosha FW. Implementation of an insecticide-treated net subsidy scheme

under a public-private partnership for malaria control in Tanzania--challenges in implementation. Malar J. 2009; 8:201. CrossRef. Medline

9. Marchant T, Schellenberg D, Nathan R, Armstrong-Schellenberg J, Mponda H, Jones C, et al. Assessment of a national voucher scheme to deliver insecticide-treated mosquito nets to pregnant women. CMAJ. 2010;182(2):152–156. CrossRef. Medline
10. Mulligan JA, Yukich J, Hanson K. Costs and effects of the Tanzanian national voucher scheme for insecticide-treated nets. Malar J. 2008;7:32. CrossRef. Medline
11. Renggli S, Mandike R, Kramer K, Patrick F, Brown NJ, McElroy PD, et al. Design, implementation and evaluation of a national campaign to deliver 18 million free long-lasting insecticidal nets to uncovered sleeping spaces in Tanzania. Malar J. 2013;12:85. CrossRef. Medline
12. Koenker HM, Yukich JO, Mkindi A, Mandike R, Brown N, Kilian A, et al. Analysing and recommending options for maintaining universal coverage with long-lasting insecticidal nets: the case of Tanzania in 2011. Malar J. 2013;12:150. CrossRef. Medline
13. Bonner K, Mwita A, McElroy PD, Omari S, Mzava A, Lengeler C, et al. Design, implementation and evaluation of a national campaign to distribute nine million free LLINs to children under five years of age in Tanzania. Malar J. 2011;10:73. CrossRef. Medline
14. Tanzania Commission for AIDS (TACAIDS); Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS); Office of the Chief Government Statistician (OCGS); ICF International. Tanzania HIV/AIDS and malaria indicator survey 2011-12. Dar es Salaam (Tanzania): TACAIDS; 2013. Co-published by ZAC, NBS, OCGS, and ICF International. Available from: https://dhsprogram.com/pubs/pdf/AIS11/AIS11.pdf
15. Grabowsky M, Nobiya T, Selanikio J. Sustained high coverage of insecticide-treated bednets through combined Catch-up and Keep-up strategies. Trop Med Int Health. 2007;12(7):815–822. CrossRef. Medline
16. Roll Back Malaria, Vector Control Working Group. Continuous long-lasting insecticidal net distributions: a guide to concepts and planning. Geneva: Roll Back Malaria Partnership Secretariat, World Health Organization; 2011. Available from: http://www.rollbackmalaria.org/files/files/partnership/wg/wg_itn/docs/ws3/3-Guide_to_continuous_distribution_strategy.pdf
17. Sexton AR. Best practices for an insecticide-treated bed net distribution programme in sub-Saharan eastern Africa. Malar J. 2011;10:157. CrossRef. Medline
18. Johns Hopkins Center for Communication Programs (CCP), NetWorks project. Continuous LLIN distribution: piloting school net distribution in mainland Tanzania. Lessons in Brief, No. 9. Baltimore (MD): CCP; [2014]. Available from: https://www.k4health.org/sites/default/files/tanzania_llin_9_new.pdf
19. RTI International, Tanzania Vector Control Scale-up Project. School net program performance report: March 28-December 30, 2014. Research Triangle Park (NC): RTI International; 2014.
20. RTI International. LLIN school distribution keep-up campaign, Tanzania: monitoring and evaluation plan. Research Triangle Park (NC): RTI International; 2014.
21. National Bureau of Statistics (NBS) [Tanzania]; Office of Chief Government Statistician (OCGS). 2012 population and housing census: population distribution by administrative areas. Dar es Salaam (Tanzania): NBS; 2013. Co-published by OGCS. Available from: http://ihi.eprints.org/1344
22. National Bureau of Statistics (NBS) [Tanzania]; ICF Macro. Tanzania demographic and health survey 2010. Dar es Salaam (Tanzania): NBS; 2011. Co-published by ICF Macro. Available from: http://dhsprogram.com/pubs/pdf/FR243/FR243%5B24June2011%5D.pdf
23. Zegers de Beyl C, Asamoah OE, Ato Selby R. Report of the process evaluation of the continuous LLIN distribution system in Ghana. Baltimore (MD): Johns Hopkins Center for Communication Programs; 2013. Available from: https://www.k4health.org/sites/default/files/report_-_process_evaluation_of_eastern_region_llin_continuous_distribution_pilot_0.pdf
24. Nathan R, Kalage R, Lutambi A. Evaluation of School Net Pilot Project in the Southern zone: final report. Dar es Salaam (Tanzania): Ifakara Health Institute; 2013.
25. Lutambi A, Nathan R, Chacky F, Mandike R, Kramer K, Masanja H, et al. School-based LLIN distribution in Tanzania: results of repeated cross-sectional surveys. Presented at the 64th ASTMH meeting; 2015 Oct 28; Philadelphia, Pennsylvania. Abstract available from: http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=dd7fcf42-c32f-48f1-82bf-2b4738ac711b&cKey=e285f334-0672-4b94-92f9-34d015bec7d9&mKey=ab652fdf-0111-45c7-a5e5-0ba9d4af5e12
26. National Insecticide Treated Nets (NATNETS)-Tanzania [Internet]. Dar es Salaam (Tanzania): National Malaria Control Programme, NATNETS; c2012-2015. School Net Programme; [cited 2016 Apr 1]. Available from: http://www.natnets.org/index.php/programme-components/school-net-programme.html.

Peer Reviewed

Received: 2016 Feb 9; **Accepted:** 2016 Apr 20

Cite this article as: Lalji S, Ngondi JM, Thawer NG, Tembo A, Mandike R, Mohamed A, et al. School distribution as keep-up strategy to maintain universal coverage of long-lasting insecticidal nets: implementation and results of a program in southern Tanzania. Glob Health Sci Pract. 2016;4(2):251–263. http://dx.doi.org/10.9745/GHSP-D-16-00040

© Lalji et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00040

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

Improved Childhood Diarrhea Treatment Practices in Ghana: A Pre-Post Evaluation of a Comprehensive Private-Sector Program

Marianne El-Khoury,[a] Kathryn Banke,[a] Phoebe Sloane[a]

From 2011 to 2015, a diarrhea management program in Ghana targeting pharmaceutical suppliers, private-sector providers, and caregivers successfully increased caregiver use of oral rehydration salts (ORS) with zinc to treat diarrhea in children under 5, from 0.8% to 29.2%, and reduced antibiotic use (which is generally inappropriate for treatment of non-bloody diarrhea) from 66.2% to 38.2%.

ABSTRACT

Diarrhea is the fourth leading cause of child mortality in Ghana. In 2010, Ghana endorsed guidelines from the World Health Organization and the United Nations Children's Fund for use of zinc with low-osmolarity oral rehydration salts (ORS) for the treatment of acute childhood diarrhea. From late 2011 through 2014, the Strengthening Health Outcomes through the Private Sector (SHOPS) project implemented a comprehensive program in 3 regions of Ghana to increase the availability and use of ORS and zinc and to decrease incorrect use of antibiotics and antidiarrheals. The program included (1) partnering with local pharmaceutical firms to introduce and market locally produced zinc products, (2) collaborating with the Ghanaian Pharmacy Council to provide training and supportive supervision of private-sector providers on diarrhea management, and (3) conducting mass media campaigns to raise caregiver awareness. We evaluated the effect of this program using a baseline survey of 754 caregivers of children under 5 with diarrhea at the start of the intervention in 2012 and a follow-up survey of 751 caregivers in 2014. Regression analysis showed that use of ORS with zinc increased from 0.8% in 2012 to 29.2% in 2014 ($P<.001$), and antibiotic use declined from 66.2% to 38.2% ($P<.001$) during the same period. The magnitude and statistical significance of these results remained the same after including potential confounding factors as covariates. Inappropriate antibiotic use, however, remained high at follow-up. We conclude that similar programs applied in other settings have the potential to rapidly scale up use of ORS and zinc. Additional efforts are required to reduce persistent incorrect antibiotic use.

INTRODUCTION

Diarrhea is the third leading cause of death globally among children under the age of 5.[1] Most of these deaths are related to dehydration and can easily be prevented with low-cost treatments such as oral rehydration salts (ORS).

In 2004, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) issued a joint statement endorsing the use of zinc together with a low-osmolarity formulation of ORS for the treatment of acute diarrhea (with no presence of blood in the stool or fever) among children.[2] Numerous clinical trials demonstrated that, when given for 10 to 14 days during the course of an acute diarrhea episode, zinc reduces the duration and severity of the episode and prevents recurrence of diarrhea in the following 2 to 3 months.[3–6] The benefits of zinc are substantial: it has been estimated that diarrhea mortality could be reduced by 23% with increased use of zinc to treat diarrhea.[7] However, ORS and zinc remain underused, and antibiotics and/or antidiarrheals are often incorrectly administered instead.[8–10]

Since 2005, donor-funded country programs have promoted the provision and use of ORS and zinc, while aiming to reduce incorrect treatment for children with diarrhea. For example, the United States Agency for International Development (USAID) has supported ORS and zinc projects in Benin, Ghana, India, Madagascar, Nepal, and Pakistan, among others. The Clinton Health Access Initiative (CHAI) has supported programs in India, Kenya, Nigeria, and Uganda. The Bill

[a] Abt Associates, Inc., Bethesda, MD, USA.
Correspondence to Phoebe Sloane (phoebe_sloane@abtassoc.com).

& Melinda Gates Foundation has supported a national zinc promotion program in Bangladesh and, along with UNICEF, the Children's Investment Fund Foundation, and the Micronutrient Initiative, has also supported several pilot projects in India. Programmatic activities have generally included both public- and private-sector approaches focused on introducing high-quality and affordable zinc products to local markets in a sustainable way, using mass media campaigns and interpersonal communication to raise consumer knowledge of correct diarrhea treatment, and improving provider knowledge and skills through training and educational visits.

Despite the wealth of on-the-ground experience over the last decade, only a few studies have evaluated the effectiveness of such ORS and zinc interventions in improving correct management of acute childhood diarrhea. A recent evaluation in Bihar, India, found that children with diarrhea were almost 3 times as likely to be treated with ORS and zinc 2 years after an intervention designed to train public-sector providers and increase ORS and zinc availability.[11] Another evaluation in India found that zinc use among children increased from 3% to 22% in Gujarat and from 3% to 7% in Uttar Pradesh, after training and supportive supervision interventions targeting public and private providers.[12] In Bangladesh, over a 2-year period of implementing a national program to scale up zinc treatment, zinc use among children increased from less than 5% at baseline to 25%–30% in urban non-slum areas, 15%–20% in urban slums, and 9%–13% in rural areas.[13] Six months after the launch of an ORS and zinc promotion campaign in Nepal, use of ORS with zinc rose from virtually zero to 12%.[14] In Benin, zinc use in project districts rose from 32% to 54%, and ORS use rose from 40% to 58%, following a combination of interventions over 2 years. These interventions included providing zinc to public- and private-sector facilities, pharmacies, and outlets; training public- and private-sector providers; and conducting a mass media campaign.[15]

This study evaluates the effect of a comprehensive USAID-funded program that introduced zinc and promoted its use with ORS in Ghana beginning in late 2011. The Strengthening Health Outcomes through the Private Sector (SHOPS) program in Ghana was implemented in close collaboration with the Ghanaian Ministry of Health and other regulatory agencies such as the Pharmacy Council and the Food and Drugs Authority. Programmatic lessons learned from this evaluation may inform the implementation of childhood diarrhea treatment programs in other settings.

PROGRAM DESCRIPTION

Ghana Context

Diarrheal diseases are the fourth leading cause of child mortality in Ghana, accounting for an estimated 9% of all mortality among children under 5 years of age.[16] In the 2014 Ghana Demographic and Health Survey (DHS), prevalence of diarrhea among children under 5 in the 2 weeks preceding the survey was 12%.[17] Our analysis of the 2014 DHS data showed that 43% of caregivers who seek diarrhea treatment for their child do so in the private sector, while 53% seek care in the public sector and the remaining 4% go to other sources such as traditional practitioners. The same analysis showed that private pharmacies and over-the-counter medicine sellers (OTCMS)—the primary drug-dispensing outlets at the community level—are by far the most commonly used private sources for diarrhea treatment accessed by caregivers of children under 5 years. Together, they account for over half of visits to private-sector providers for childhood diarrhea.

Zinc reduces the duration and severity of diarrhea episodes and has the potential to reduce diarrhea mortality by 23%.

Diarrheal diseases are the fourth leading cause of child mortality in Ghana.

In 2010, Ghana's government adopted the WHO/UNICEF guidelines that recommend treating acute diarrhea in children under 5 with a new, lower-osmolarity ORS plus 20 mg of zinc supplements (10 mg for children younger than 6 months). By 2011, the Ghana Health Service (the service delivery arm of the Ghana Ministry of Health) had created the policies and protocols needed to adopt the recommendations outlined in the joint WHO/UNICEF statement on diarrhea management and, with UNICEF funding, was prepared to train public-sector staff and procure dispersible zinc tablets for public-sector facilities. In addition, the Ghana Food and Drugs Authority had approved local production of dispersible zinc tablets (which prior to September 2011 were unavailable in public-sector facilities or in the private sector) and low-osmolarity ORS. These actions were critical in creating an enabling environment for the successful launch of a private-sector zinc program in Ghana.[18]

Ghana adopted the WHO/UNICEF diarrhea treatment guidelines in 2010.

The SHOPS Project in Ghana

Between September 2011 and September 2015, the USAID-funded SHOPS project collaborated with the Ghanaian Ministry of Health and other local partners to develop and implement a

comprehensive program for introducing zinc and the new diarrhea treatment guidelines to the private sector as a complement to public-sector efforts. The SHOPS project included (1) working with local pharmaceutical manufacturers to ensure supply and availability of quality, affordable zinc, (2) training private health care providers and providing supportive supervision to improve their childhood diarrhea management practices, and (3) developing and airing a targeted national mass media campaign to generate demand for zinc and promote its use alongside ORS to treat childhood diarrhea. Most of the SHOPS activities were national in scope; however, at the request of USAID, SHOPS focused provider training and supportive supervision in USAID's 3 priority regions (Greater Accra, Western, and Central), which account for approximately one-third of the country's population.[19] SHOPS focused its provider efforts primarily on OTCMS, as they are the most commonly used private-sector source for diarrhea treatment.

The SHOPS project partnered with a local pharmaceutical manufacturer in Ghana to create demand for its zinc product.

Building a Viable Zinc Market and Ensuring Supply and Availability

SHOPS partnered with local pharmaceutical manufacturer M&G Pharmaceuticals Ltd. (M&G) to encourage its entry into the commercial market and to help create demand for its zinc product, Zintab. SHOPS worked with M&G to develop a marketing plan and an innovative strategy to distribute zinc products nationally through commercial channels, particularly into rural areas. SHOPS worked primarily with commercial wholesalers. In addition, it facilitated a distribution partnership between M&G and local NGOs in hard-to-reach rural areas. The NGOs, who were in the business of distributing health commodities, procured ORS and zinc from M&G and resold them to local OTCMS. In January 2012, M&G entered the private commercial market, beginning distribution in certain areas of the country. By the end of 2013, M&G was also supplying its zinc products to public-sector health facilities. In 2014, zinc was available in the public and private sectors in USAID's 3 priority regions, and by the end of the SHOPS project in 2015, zinc was available nationwide.

© Odartei Lamptey, Abt Associates

An over-the-counter medicine seller in Ghana sells oral rehydration salts (ORS) and Zintab, a zinc product manufactured locally by M&G Pharmaceuticals.

Provider Training and Supportive Supervision

Zinc programs worldwide have faced challenges in changing provider behaviors with regard to diarrhea management. In USAID's 3 priority regions of Ghana, the SHOPS project collaborated with the Ghana Health Service, the Ghana Pharmacy Council, professional associations, and other stakeholders to implement an innovative partnership approach to improve providers' diarrhea management practices. Between 2012 and 2014, this approach included:

- Developing standard training curricula for nonclinical personnel working at the community level (such as OTCMS, pharmacy technicians, and community health workers) as well as for clinical providers.
- Training frontline private-sector providers (OTCMS and pharmacists) in the priority regions during March and April 2012. M&G made Zintab available for sale to providers at the end of each training session, and trainees were given information on where to purchase additional supplies of zinc. SHOPS also partnered with the Pharmacy Council to offer refresher trainings to OTCMS.
- Extending the diarrhea management training to other private providers including midwives, physician assistants, pharmacy technicians, and dispensing technicians.
- Implementing a supportive supervision program aimed at Pharmacy Council inspection

teams. These teams, who visit OTCMS at least twice per year, were provided with training and a mobile phone-based supportive supervision tool so they could answer questions and provide on-the-job training to OTCMS in diarrhea management.

- Implementing a mobile phone text message campaign that provided systematic reminders, via interactive quiz questions, to OTCMS during diarrhea season to reinforce key messages from the trainings.

Mass Media Campaign and Other Demand-Generation Activities

SHOPS partnered with the USAID-funded Ghana Behavior Change Support (BCS) project to conduct a national mass media campaign, featuring television and radio advertisements designed to increase awareness among both caregivers and service providers of the new diarrhea treatment protocols for children under 5. SHOPS and BCS developed the content of the campaign materials, and a local advertising agency designed and pretested them. Launched in July 2012, the mass media campaign ran annually during the diarrhea season, from April to October. The campaign provided information on the effectiveness of ORS and zinc for treating diarrhea and how to correctly administer both products. Job aids, treatment guideline wall charts, and client brochures created through this partnership were distributed widely for use in pharmacies and all OTCMS shops, and by M&G's sales teams.

Other Zinc Promotion Programs in Ghana

To the best of our knowledge, the SHOPS interventions were the *only* comprehensive and ongoing ORS and zinc promotion activities taking place in the 3 target regions during the study period, and the only activities working with the private sector. Procurement processes for the purchase of zinc for public-sector use were initiated during 2011–2012, and zinc was thereafter made available at public-sector facilities nationally. In addition, during 2012, with UNICEF and USAID funding, the Ghana Health Service revised training curricula on childhood diarrhea management and then conducted a one-time training on diarrhea management with ORS and zinc targeting public-sector pediatricians, general practitioners, midwives, and community health nurses from all 10 regions.

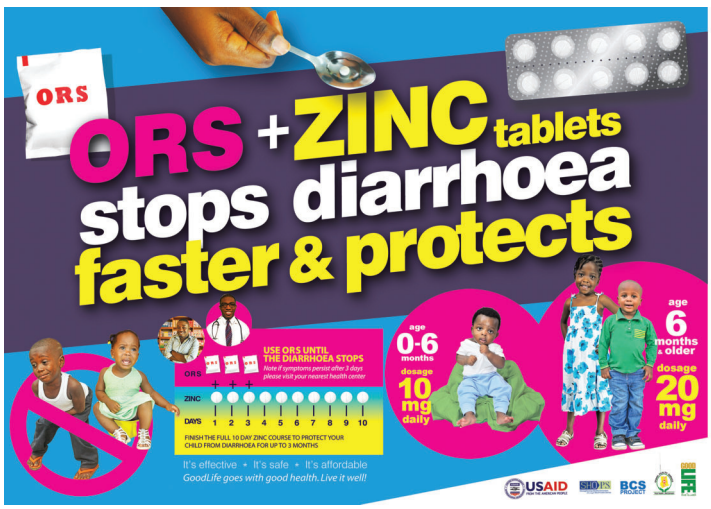
METHODS

Study Design and Procedures

We used a pre-post study design to examine changes in diarrhea treatment practices among caregivers over time. We administered 2 cross-sectional household surveys of caregivers: a baseline survey at the beginning of SHOPS interventions (May–June 2012), and a follow-up survey just over 2 years later (August–September 2014).

We administered both surveys in the 3 USAID target regions (Greater Accra, Western, and Central) during Ghana's rainy seasons (April–July and September–November), when diarrhea prevalence is highest. Eligible survey respondents were caregivers of children ages 6–59 months who reported that their child had had an episode of diarrhea (defined as having 3 or more loose or watery stools over the course of 1 day) in the previous 2 weeks. We excluded children under the age of 6 months because the prevalence of acute diarrhea is lower in this age group than in the 6–59-month age group.

We contracted with a data collection firm based in Accra to train data collectors, pilot test the instruments, and conduct the fieldwork. All



© Abt Associates

A poster advertising oral rehydration salts (ORS) and zinc, part of the SHOPS mass media campaign in Ghana, was distributed widely to pharmacies and over-the-counter medicine sellers to improve caregivers' and providers' awareness of the new diarrhea treatment protocols for children under 5.

interviews were done face-to-face in local languages (Twi, Fante, and Ga) and/or English.

Sampling

Sample Size and Power Calculations

We developed sample size estimates for the household surveys based on practical considerations, including budget and time constraints. Accordingly, we determined a sample size of 750 caregivers for each survey across all 3 study regions. We calculated the minimum detectable effect to ensure that the sample was large enough to show changes in key indicators between baseline and follow-up. With a sample of 750 caregivers in each survey, the minimum detectable effect with 80% power was estimated to be a 2.2 percentage point increase in zinc use.

Sampling Design

We used a multi-stage sampling approach to select the sample of caregivers for each survey. In Ghana, regions are divided into districts, which are in turn divided into enumeration areas (EAs). At each stage (region, district, EA, household), we first selected the number of sampling units and then allocated the target sample of 750 caregivers among these units according to the following procedure:

Stage 1: Regional strata. We divided the 3 study regions into 4 sampling strata: Accra metropolitan, Accra nonmetropolitan, Central, and Western. For each survey, we allocated the target sample of 750 caregivers to each stratum in proportion to its population, using population census data.[19]

Stage 2: Districts. We selected a sample of 15 districts from the 44 total districts in the 4 strata—using the same districts in the baseline and follow-up surveys. We included the Accra Metropolitan district as the only district in its stratum. The remaining 14 districts were selected using stratified probability proportional to size (PPS) sampling, where size was the population of the district. For each district, we allocated the target sample of caregivers in proportion to the population of that district.

Stage 3: Enumeration areas. We divided each of the 15 selected districts into urban and rural EAs (where applicable), selecting a total of 4 EAs in each district (2 urban and 2 rural) using equal probability sampling. (If a district had only urban or rural EAs, we selected 4 urban or 4 rural EAs.) This yielded a total of 60 EAs across all 15 districts. We divided the target sample of caregivers allocated to each district equally among the 4 EAs selected for that district. We supplemented the list of 60 EAs with a randomly selected list of additional urban and rural EAs, to be assigned to districts where the allocated sample size of eligible caregivers could not be met in implementing the survey. In the end, 70 EAs were selected for the baseline survey and 84 EAs were selected for the follow-up survey.

Stage 4: Households. Using detailed EA maps and a landmark (school, church, mosque, etc.) as a starting point, data collection teams went door-to-door to screen every household and identify those with at least 1 caregiver of a child aged 6–59 months who experienced diarrhea in the prior 2 weeks. As soon as an eligible caregiver was identified, the interviewers administered the survey. Screening and surveying in each EA stopped once the target sample of surveyed eligible caregivers was met; supplemental EAs were used if the target could not be met in a given EA.

Stage 5: Caregivers. If an eligible household contained more than 1 caregiver of a child aged 6–59 months who experienced diarrhea in the prior 2 weeks, the interviewers randomly selected 1 of the caregivers for the survey using a Kish grid.[20] Similarly, if the selected caregiver had more than 1 child aged 6–59 months with diarrhea in the prior 2 weeks, the interviewers used a Kish grid to randomly select only 1 child for the survey.

Final samples. Our final sample sizes were 754 caregivers in the baseline survey and 751 in the follow-up survey. Refusal rates were less than 0.5% in each survey. The household sampling was done independently for each survey; however, it is possible that some of the same households participated in both the baseline and follow-up surveys given that we visited the same areas.

Survey Instruments

We developed 3 study instruments: (1) a household listing and screening form; (2) a baseline survey instrument; and (3) a follow-up survey instrument. Data collectors used the household listing and screening form to screen households in each EA and to determine their eligibility for the study. To ensure comparability of baseline and follow-up data, the baseline and follow-up survey instruments were nearly identical, with a few additional questions included in the follow-up

survey. To minimize misclassification of treatments and misreporting, the interviewers used visual aids containing photos of popular drugs and treatments currently on the market in Ghana. Whenever possible, the interviewer asked the caregiver to show the treatment packaging to confirm which treatments were used.

Variables

Our main outcome variables of interest were the proportion of caregivers reporting use of ORS, zinc, ORS with zinc, antibiotics, and antidiarrheals at each point in time.

At both baseline and follow-up, we also collected demographic and socioeconomic data (caregiver's sex, age, education level, and marital status, and child's age), diarrhea characteristics (duration in days, presence of fever, presence of blood), sources of treatment, and data on household assets. We constructed a wealth index by adapting a methodology applied in El-Khoury et al.[21] and Pitchforth et al.[22] (See supplementary material for more information.) For each household in the sample, we recorded the asset variables collected in the surveys, then assigned a population-level wealth quintile to each caregiver in the sample. In the follow-up survey, we asked respondents about their recall of diarrhea and zinc messages in the past month.

Analytic Methods

We first conducted chi-square and *t* tests to determine whether our baseline and follow-up samples were balanced in terms of certain observable demographic and socioeconomic characteristics.

We then conducted bivariate and multivariate regression analyses using Stata software to estimate changes in caregiver treatment behaviors between baseline and follow-up.[23] We ran ordinary least squares (OLS) regressions on the pooled sample of caregivers from the baseline and follow-up surveys (N = 1,505), using the following model:

$$y_{it} = \beta_0 + \delta_0 T_t + \beta_1 X_{it} + \varepsilon_{it}$$

Where:

- y_{it} is the binary dependent variable (outcome) for caregiver *i* at time *t* (where *t* indicates either baseline or follow-up).
- T_t is a binary variable equal to 1 for the follow-up period and 0 for the baseline.
- X_{it} is a vector of covariates for caregiver *i* at time *t*.

Covariates included caregiver characteristics (sex, age, education, marital status), child age, diarrhea characteristics (duration in days, presence of fever, presence of blood), household characteristics (wealth index score, wealth quintile), and district of residence (in order to adjust for potential district effects).

Then:

- β_0 is the conditional average value of the outcome at baseline.
- $(\beta_0 + \delta_0)$ is the conditional average value of the outcome at follow-up.
- δ_0 is the estimate of interest, which measures the conditional difference in the value of the outcome between baseline and follow-up.

We ran the model on the 5 main outcome variables mentioned above. For each outcome variable, we ran the regression with and without the vector of covariates (X).

Antibiotics are generally considered inappropriate to use in cases of non-bloody diarrhea. We analyzed changes in antibiotic use over time among caregivers who did *not* report blood with their child's diarrhea episode and tested whether outcomes differed among this subgroup. We implemented this analysis by interacting T_t with a dummy variable indicating the presence of blood in our model and testing for significance of the interaction term on antibiotic use. In addition, we analyzed the group of caregivers who used ORS with zinc in combination with antibiotics at follow-up, according to whether the diarrhea episode was accompanied by blood in stool and/or fever.

Finally, we used a chi-square test to examine whether recall of zinc messages was associated with zinc use at follow-up.

All variables were weighted using sampling weights that conformed to our sampling strategy.

Ethical Approval

The study was reviewed by Abt Associates' Institutional Review Board and was granted exemption. The study was also reviewed and approved by the Ghana Health Service Ethical Review Committee. SHOPS obtained oral informed consent from respondents, and those who did not provide consent were not surveyed.

Use of ORS and zinc increased substantially and significantly between baseline and follow-up.

Use of antibiotics declined significantly between baseline and follow-up.

43% of caregivers who used ORS with zinc in combination with antibiotics said their child did not have blood in the stool or a fever, suggesting inappropriate antibiotic use.

RESULTS

Characteristics of Study Sample

The baseline and follow-up samples were balanced with respect to most observable characteristics (Table 1). In both samples, about 98% of caregivers were female, with an average age of just over 31 years. A higher percentage of caregivers in the follow-up sample were married than in the baseline sample (84% vs. 77%, respectively; $P=.07$). The majority of caregivers in both samples had completed at least primary school.

There was no difference in mean duration of the diarrhea episode between baseline and follow-up (4.5 and 4.3 days, respectively) or in the proportion of children who had fevers during the diarrhea episode (43.8% and 43.5%, respectively). However, approximately twice as many children in the baseline sample had blood in their stool compared with those in the follow-up sample (11.4% vs. 5.6%, respectively; $P=.095$). Since presence of blood in the stool typically warrants antibiotic treatment, caregivers in the baseline sample should have been more likely to use antibiotics over other treatments compared with caregivers in the follow-up sample.

While the constructed *wealth index* was the same, on average, across both samples (score of 0.58 out of 1 in the baseline sample and 0.59 in the follow-up sample), there was a statistically significant difference in the *distribution of wealth* between baseline and follow-up ($P=.008$). The follow-up sample was more likely to include caregivers from the second population wealth quintile and less likely to include caregivers from the first (poorest) wealth quintile. These differences in the wealth distribution may have affected treatment behavior across the 2 samples, especially if costs of treatments were prohibitive for those belonging to the poorest quintile.

We included all variables in Table 1, including presence of blood in the stool and wealth quintiles, as covariates in the multivariate regression analysis.

Changes in Diarrhea Management Practices Among Caregivers

Table 2 shows changes in caregiver diarrhea treatment practices between baseline and follow-up. Each row shows the results of a separate regression run on each outcome of interest, without covariates (Panel A) and with covariates (Panel B).

Results showed a large, positive, and statistically significant increase in use of recommended diarrhea treatments between baseline and follow-up, both with and without covariates. The bivariate regression results show that use of zinc rose from 1.3% at baseline to 31.3% at follow-up—an increase of 30.0 percentage points ($P<.001$) (Panel A, Row 1). Use of ORS rose from 37.7% to 59.9%—an increase of 22.2 percentage points ($P<.001$) (Panel A, Row 2). Importantly, use of the recommended combination treatment, ORS with zinc, rose 28.4 percentage points ($P<.001$), from 0.8% at baseline to 29.2% at follow-up (Panel A, Row 3). About 93% of caregivers who used zinc at follow-up used it in combination with ORS, as recommended. The size and statistical significance of these results remained largely the same after including covariates to adjust for possible confounding factors (Panel B). We found that the wealth index and wealth quintiles were not significant contributors to zinc and ORS use.

Results also showed significant declines in caregiver use of antibiotics and antidiarrheals. The bivariate regression results show that antibiotic use dropped by 28 percentage points ($P<.001$), from 66.2% at baseline to 38.2% at follow-up (Panel A, Row 4). When adding covariates, the reduction in antibiotic use was even higher, at 31.2 percentage points ($P<.001$) (Panel B, Row 4). Antidiarrheal use decreased by 5.1 percentage points ($P<.05$), from 10.2% at baseline to 5.1% at follow-up (Panel A, Row 5). When adding covariates, the decline was around half as great (2.8 percentage points) and was not statistically significant (Panel B, Row 5).

We found no evidence that trends in antibiotic use were different among the subgroup of caregivers who did not report blood with the diarrhea episode. The coefficient on the interaction term was not statistically significant ($P=.49$). The reduction in antibiotic use among caregivers who did not report blood in the stool was estimated at 31.9 percentage points ($P<.001$) (not shown).

In some cases, caregivers reported using antibiotics in addition to ORS and zinc. Overall, in the follow-up survey, 21.8% of caregivers who used ORS and zinc also used antibiotics. Table 3 analyzes the group of caregivers who used ORS with zinc *in combination with antibiotics* at follow-up (n=52), according to whether the diarrhea episode was accompanied by blood in stool and/or fever. Close to half of this group (43.2%) reported

TABLE 1. Characteristics of Study Samples in Ghana at Baseline (2012) and Follow-Up (2014)

Characteristics	Baseline (N = 754)	Follow-Up (N = 751)	*P* Value
Caregiver			
Female, %	97.9	97.8	.98[a]
Age, mean (SD), years	31.1 (9.1)	31.5 (9.1)	.64[a]
Married, %	77.0	84.0	.07*[a]
Education, % distribution			.16[b]
None	15.4	15.3	
Primary	26.2	20.7	
Completed primary or some middle	43.9	43.5	
Completed middle or some secondary	13.9	18.5	
Completed secondary or above	0.6	2.1	
Child			
Child age, mean (SD), months	29.3 (15.4)	28.0 (13.9)	.31[a]
Diarrhea duration, mean (SD), days	4.5 (3.0)	4.3 (3.3)	.64[a]
Diarrhea with fever, %	43.8	43.5	.95[a]
Diarrhea with blood, %	11.4	5.6	.095*[a]
Household			
Wealth index score,[c] mean (SD)	0.58 (0.2)	0.59 (0.1)	.70[a]
Wealth quintile, % distribution			.008***[b]
First (poorest)	23.4	14.3	
Second	19.9	32.6	
Third	42.1	46.2	
Fourth	14.1	10.3	
Fifth (wealthiest)	0.6	0.3	

Abbreviation: SD, standard deviation.
***$P < .01$, **$P < .05$, *$P < .10$.
[a] *P* value from *t* test.
[b] *P* value from chi-square test.
[c] Wealth index score ranges from 0 to 1.

that their child had neither a fever nor blood in the stool with the episode of diarrhea, suggesting that antibiotics should not have been used.

Sources of Diarrhea Treatment

At follow-up, about 64% of caregivers sought treatment from the private sector and 36% sought

TABLE 2. Changes in Caregiver Diarrhea Management Practices in Ghana Between Baseline (2012) and Follow-Up (2014) (N = 1,505)

	(A) Bivariate Regression Results				(B) Multivariate Regression Results[a]		
Treatment	**Baseline (β_0)**	**Follow-Up ($\beta_0 + \delta_0$)**	**Difference Over Time (δ_0)**	***P* Value**	**Follow-Up ($\beta_0 + \delta_0$)**	**Difference Over Time (δ_0)**	***P* Value**
(1) Zinc (with or without ORS)	0.013	0.313	0.300***	<.001	0.321	0.308***	<.001
(2) ORS (with or without zinc)	0.377	0.599	0.222***	<.001	0.611	0.234***	<.001
(3) ORS with zinc	0.008	0.292	0.284***	<.001	0.301	0.293***	<.001
(4) Antibiotics	0.662	0.382	-0.280***	<.001	0.350	-0.312***	<.001
(5) Antidiarrheals	0.102	0.051	-0.051**	.02	0.074	-0.028	.13

Abbreviation: ORS, oral rehydration salts.
***$P < .01$, **$P < .05$, *$P < .10$.
[a] Covariates included in multivariate regressions are caregiver characteristics (sex, age, education, marital status), child age, diarrhea characteristics (duration in days, presence of fever, presence of blood), household characteristics (wealth index score, wealth quintile), and district fixed effects.

TABLE 3. Characteristics of Diarrhea Episode Among Caregivers in Ghana Who Gave ORS With Zinc in Combination With Antibiotics at Follow-Up (2014) (N = 52)

Characteristics of Diarrhea Episode	**Value**
Diarrhea with no blood in stool or fever, %	43.2
Diarrhea with fever only, %	49.0
Diarrhea with blood in stool only, %	3.0
Diarrhea with blood in stool and fever, %	4.7
Diarrhea duration, mean (SD), days	4.3 (2.5)

Abbreviations: ORS, oral rehydration salts; SD, standard deviation.

treatment from the public sector. Specifically, 54% of caregivers who reported using ORS with zinc at follow-up sought treatment from the private sector (mainly private pharmacies or OTCMS), while 46% sought treatment from the public sector. About 61% of caregivers who used antibiotics at follow-up sought treatment from the private sector and 39% from the public sector.

Recall of Zinc Messages and Use of Zinc

At follow-up, we examined whether respondents recalled having heard any messages about using zinc for diarrhea treatment. About 36% of caregivers at follow-up had heard or seen at least 1 zinc message, primarily from television and radio. Caregivers who recalled hearing or seeing any zinc message in the last month were more

than 3 times as likely to use zinc (55%) as those who did not recall hearing zinc messages (18%) ($P = .003$). We recognize that this correlation is not indicative of causality.

DISCUSSION

This evaluation revealed that diarrhea treatment behaviors in the 3 study regions in Ghana improved substantially in the 3 years following the implementation of a comprehensive ORS and zinc promotion program. The program included building a local zinc market, training private providers on zinc and ORS, and implementing a mass media campaign. Caregivers reported significantly higher levels of use of ORS with zinc and lower levels of antibiotic use, even after adjusting for potential confounding factors. Previous studies in Benin, Bangladesh, and Nepal found comparable effect sizes, ranging from 5.0 to 22.5 percentage point increases in caregiver use of zinc.[12–14] Our findings are an important contribution to the limited evidence base on the effectiveness of ORS and zinc promotion interventions.

To the best of our knowledge, this study is one of very few evaluations of a comprehensive program seeking to improve diarrhea management. While the study was not designed to evaluate the relative effectiveness of each component of the program, our results suggest that a similar package of interventions has the potential to be applied in other settings where rapid scale-up of use of ORS with zinc is desired.

Our pre-post study design is unable to determine how much of the observed increase in ORS and zinc use is solely attributed to the SHOPS program. We adjusted for possible confounding factors in the multivariate regression analysis; however, there may be other unobservable variables that affected results, including possible spillover effects from other diarrhea management interventions in other regions of Ghana. It is possible, for instance, that the 2012 USAID and UNICEF-funded public-sector trainings, mentioned earlier in this article, may have contributed to increased awareness and use of correct diarrhea treatments in the country. We posit, however, that the SHOPS interventions were likely important drivers of the changes observed in the 3 study regions. This is primarily because the SHOPS interventions were the only ongoing and comprehensive ORS and zinc promotion activities taking place in the survey regions during the study's time frame. Indeed, the public-sector trainings in 2012 were not followed-up with any additional interventions during the study period.

Finally, even though SHOPS primarily focused the provider training component of its interventions on the private sector, caregivers obtained zinc and ORS from both private- and public-sector providers. Thus, engaging both the private and public sectors will be essential to ensure increased access to ORS and zinc.

Because caregivers obtained zinc and ORS from both private and public providers, engaging both sectors will be essential to ensure increased access to and use of appropriate diarrhea treatment.

Recall of zinc messages from the mass media campaign was positively associated with caregiver use of zinc to treat diarrhea. Similar associations were observed in both Nepal[14] and Benin.[15] Due to the cross-sectional nature of our surveys, we cannot assess the directionality of this association: does using zinc predispose a caregiver to remember zinc messages, or does recalling a zinc message predispose a caregiver to use (or report having used) zinc? There may also be other factors, not controlled for in this analysis, that are associated with both zinc use and recall of media messages and that could affect the likelihood of seeking treatment. Further study is required to determine whether this is a causal link and to identify the specific messages and channels that resonate most with different groups of caregivers.

While antibiotic use decreased substantially, it remained high at follow-up.

While antibiotic use decreased substantially from baseline to follow-up, it remained high, even among the subgroup of caregivers who did not report blood with the diarrhea episode. In addition, a high proportion of caregivers who gave ORS with zinc reported treating with antibiotics as well, even in the absence of blood or fever symptoms. It is important to note that our evaluation was not designed to comprehensively assess correct antibiotic use. For instance, some children presenting with both diarrhea and fever may have had another infection (such as otitis media or pneumonia) that warranted antibiotic prescription but was not specifically asked about in our survey. Still, high antibiotic use is a persistent problem in many countries. In Benin, for example, while zinc use grew from 32% to 54% from 2009 to 2011, the proportion of zinc users who also used an antibiotic grew from 11% to 39% during the same time period.[15] In Bihar, India, while the percentage of zinc use tripled from 2011 to 2013, the percentage of antibiotic use also doubled in the same time period—although this increase might reflect better classification of diarrhea treatments (i.e., fewer unknowns) in the 2013 survey.[11] A recent qualitative study in Ghana found that caregivers were accustomed to using antibiotics and felt strongly about continuing to

use them.[24] On the other hand, OTCMS' lack of knowledge of the reasons for limiting antibiotics use and their inadequate negotiation skills also played a big role in the incorrect provision of antibiotics.[24] The SHOPS trainings for private OTCMS emphasized that antibiotics should not be prescribed for acute diarrhea without blood in the stool and should only be used when appropriate, i.e., in the presence of bloody diarrhea or shigellosis, per WHO/UNICEF guidelines.[2] The trainings also highlighted problems associated with inappropriate use of antibiotics, and SHOPS reinforced these messages during post-training supportive supervision visits. Yet, through mystery client surveys conducted in 2014, the project found that 29% of trained providers (data not published) continue to incorrectly prescribe antibiotics. Additional targeted studies, from both the caregiver and provider (prescribing) perspectives, are needed to refine the estimates of levels of incorrect antibiotic use, to better understand reasons for this ongoing area of concern, and to develop interventions to address these issues.

Study Limitations

It is worth noting a few important limitations to our study. First, the pre-post design precludes attributing observed changes in outcomes to the interventions. While we controlled for possible confounding factors in the regression analysis, other unobservable factors may have influenced the results. Second, the baseline and follow-up surveys were conducted during different seasons (May–June and August–September). It is possible that some seasonal factors, such as nutritional status, disease incidence, and household disposable income, may have differed between the 2 seasons and therefore have affected the results. Third, all outcome variables are based on recall of survey respondents and may therefore be subject to recall bias and information bias due to the misclassification of certain treatments. We attempted to mitigate these risks by using an elaborate visual aid to assist caregivers in accurately identifying treatments and by building verification questions into the survey instrument.

CONCLUSION

From 2011 to 2015, the USAID-funded SHOPS project implemented a comprehensive program in Ghana to introduce and promote the use of ORS and zinc to treat acute childhood diarrhea. The SHOPS package of interventions included the development and airing of a mass media campaign to generate demand for ORS and zinc as well as working with private-sector providers, public-sector policy makers, and local manufacturers to increase availability of affordable zinc to caregivers of children under 5. This study showed substantial increases in the use of ORS and zinc by caregivers and decreases in antibiotics use. A similar package of interventions has the potential to be applied in other settings to achieve rapid scale-up of use of ORS and zinc. Additional global efforts need to be dedicated to further reduce persistent use of antibiotics, especially in cases of non-bloody diarrhea. Although the SHOPS project has ended, USAID is currently supporting another program to scale up use of ORS and zinc in Ghana, and 2 local manufacturers, M&G and Phyto-Riker, are manufacturing and distributing zinc to the private and public sectors. Going forward, an important area of research would be to determine which of the program components are most cost-effective and potentially most scalable, to help donors and program implementers prioritize investments amid shrinking budgets.

Acknowledgments: We gratefully acknowledge Malia Boggs and the Office of Health, Infectious Diseases, and Nutrition, Global Health Bureau, USAID, for supporting the interventions and research discussed in this report. We also thank the team at Business Interactive Consulting Limited (BiG) for their hard work and dedication to collecting high-quality, complete data for this evaluation. In particular, we acknowledge the leadership of Mallam Abdul-Fattah Twahir-Akinyele throughout the fieldwork. We appreciate Vicki MacDonald and Saiqa Panjsheri of Abt Associates and the leadership and guidance they provided while managing the SHOPS interventions in Ghana. We thank Randall Juras, Minki Chatterji, and Catherine Clarence of Abt Associates for their detailed quality assurance and technical reviews, and for providing valuable feedback that strengthened the paper. We appreciate K. P. Srinath's (Abt SRBI) inputs regarding sampling design and calculating sampling weights for the analysis, and Emily Sanders' (formerly of Abt Associates) contributions in analyzing the baseline survey data. In addition, we thank Clare Wolfowitz for editing an earlier draft of the paper. Finally, we would like to acknowledge the tireless work of SHOPS/Ghana Chief of Party Joseph Addo-Yobo and of SHOPS/Ghana Program Coordinator for Diarrhea Management Odartei Lamptey, whose leadership in implementing SHOPS interventions in Ghana has been invaluable to ensure the availability and use of oral rehydration salts and zinc to treat childhood diarrhea. This research was conducted under the Strengthening Health Outcomes through the Private Sector (SHOPS) Project, which is funded by the United States Agency for International Development (USAID) under Cooperative Agreement No. GPO-A-00-09-00007-00. The authors' views do not necessarily reflect the views of USAID or the United States government.

Competing Interests: None declared.

REFERENCES

1. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000–13, with

projections to inform post-2015 priorities: an updated systematic analysis. Lancet. 2015;385(9966):430-440. CrossRef. Medline

2. World Health Organization (WHO); United Nations Children's Fund (UNICEF). Clinical management of acute diarrhea: WHO/UNICEF joint statement. Geneva: WHO; 2004. Available from: http://www.who.int/maternal_child_adolescent/documents/who_fch_cah_04_7/en/
3. Bhutta ZA, Bird SM, Black RE, Brown KH, Gardner JM, Hidayat A, et al. Therapeutic effects of oral zinc in acute and persistent diarrhea in children in developing countries: pooled analysis of randomized controlled trials. Am J Clin Nutr. 2000;72(6):1516-1522. Medline
4. Bhutta ZA, Black RE, Brown KH, Gardner JM, Gore S, Hidayat A, et al. Prevention of diarrhea and pneumonia by zinc supplementation in children in developing countries: pooled analysis of randomized controlled trials. Zinc Investigators' Collaborative Group. J Pediatr. 1999;135(6):689-697. CrossRef. Medline
5. Fontaine O. Effect of zinc supplementation on clinical course of acute diarrhoea. J Health Popul Nutr. 2001;19(4):339-346. Medline
6. Baqui AH, Black RE, El Arifeen S, Yunus M, Chakraborty J, Ahmed S, et al. Effect of zinc supplementation started during diarrhoea on morbidity and mortality in Bangladeshi children: community randomised trial. BMJ. 2002;325(7372):1059. CrossRef. Medline
7. Walker CL, Black RE. Zinc for the treatment of diarrhoea: effect on diarrhoea morbidity, mortality and incidence of future episodes. Int J Epidemiol. 2010;39(Suppl 1):i63-i69. CrossRef.
8. Das BP, Deo SK, Jha N, Rauniar GP, Naga Rani MA. Knowledge, attitudes and practices (KAP) regarding the management of diarrhea by pharmacists and licensed drug sellers in eastern Nepal. Southeast Asian J Trop Med Public Health. 2005;36(6):1562-1567. Medline
9. Ellis AA, Winch P, Daou Z, Gilroy KE, Swedberg E. Home management of childhood diarrhoea in southern Mali--implications for the introduction of zinc treatment. Soc Sci Med. 2007;64(3):701-712. CrossRef. Medline
10. Zwisler G, Simpson E, Moodley M. Treatment of diarrhea in young children: results from surveys on the perception and use of oral rehydration solutions, antibiotics, and other therapies in India and Kenya. J Glob Health. 2013;3(1):010403. CrossRef. Medline
11. Walker CLF, Taneja S, Lamberti LM, Black RE, Mazumder S. Public sector scale-up of zinc and ORS improves coverage in selected districts in Bihar, India. J Glob Health. 2015;5(2):020408. Medline
12. Lamberti LM, Taneja S, Mazumder S, LeFevre A, Black RE, Walker CL. An external evaluation of the Diarrhea Alleviation through Zinc and ORS Treatment (DAZT) program in Gujarat and Uttar Pradesh, India. J Glob Health. 2015;5(2):020409. Medline
13. Larson CP, Saha UR, Nazrul H. Impact monitoring of the national scale up of zinc treatment for childhood diarrhea in Bangladesh: repeat ecologic surveys. PLoS Med. 2009;6(11):e1000175. CrossRef. Medline
14. Wang W, MacDonald VM, Paudel M, Banke KK. National scale-up of zinc promotion in Nepal: results from a post-project population-based survey. J Health Popul Nutr. 2011;29(3):207-217. CrossRef. Medline
15. Sanders E, Banke K, Williams J, MacDonald V. Introducing zinc through the private sector in Benin: evaluation of caregiver knowledge, attitudes, and practices, 2009 to 2011. Bethesda (MD): Abt Associates; 2013. Available from: http://shopsproject.org/trackfile.php?node=11063&path=sites/default/files/resources/SHOPS%20Benin%20Caregiver%20Report%2026%20August%202013%20revised.pdf
16. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. Lancet. 2010;375(9730):1969-1987. CrossRef. Medline
17. Ghana Statistical Service; Ghana Health Service; ICF International. Ghana demographic and health survey, 2014. Rockville (MD): ICF International; 2015. Available from: http://dhsprogram.com/publications/publication-FR307-DHS-Final-Reports.cfm
18. Strengthening Health Outcomes through the Private Sector Project. Ghana program profile. Bethesda (MD): Abt Associates; 2015. Available from: http://www.shopsproject.org/resource-center/ghana-program-profile
19. Ghana Statistical Service. 2010 population and housing census: summary report of final results. Accra (Ghana): Ghana Statistical Service; 2012. Available from: http://www.statsghana.gov.gh/docfiles/2010phc/Census2010_Summary_report_of_final_results.pdf
20. Kish L. A procedure for objective respondent selection within the household. J Am Stat Assoc. 1949;44(247):380-387. CrossRef
21. El-Khoury M, Hatt L, Gandaho T. User fee exemptions and equity in access to caesarean sections: an analysis of patient survey data in Mali. Int J Equity Health. 2012;11(1):49. CrossRef. Medline
22. Pitchforth E, van Teijlingen E, Graham W, Fitzmaurice A. Development of a proxy wealth index for women utilizing emergency obstetric care in Bangladesh. Health Policy Plan. 2007;22(5):311-319. CrossRef. Medline
23. StataCorp. Stata Statistical Software. College Station, TX: StataCorp LP; 2011.
24. Rosapep L, Banke K, Sanders E. The influence of customer-medicine seller transactional dynamics on childhood diarrhoea management: a qualitative study in Ghana. Manuscript submitted for publication.

Peer Reviewed

Received: 2016 Jan 28; **Accepted:** 2016 May 13

Cite this article as: El-Khoury M, Banke K, Sloane P. Improved childhood diarrhea treatment practices in Ghana: a pre-post evaluation of a comprehensive private-sector program. Glob Health Sci Pract. 2016;4(2):264–275. http://dx.doi.org/10.9745/GHSP-D-16-00021

© El-Khoury et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00021

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

Success Providing Postpartum Intrauterine Devices in Private-Sector Health Care Facilities in Nigeria: Factors Associated With Uptake

George IE Eluwa,[a] Ronke Atamewalen,[a] Kingsley Odogwu,[a] Babatunde Ahonsi[b]

41% of women delivering in the social franchise private facilities chose the postpartum IUD. Factors associated with acceptance included lower education, higher parity, and being single. Scale-up of postpartum IUD services in both public and private facilities has the potential to significantly increase use of long-acting reversible contraception in Nigeria.

ABSTRACT

Background: Use of modern contraceptive methods in Nigeria remained at 10% between 2008 and 2013 despite substantive investments in family planning services. Many women in their first postpartum year, in particular, have an unmet need for family planning. We evaluated use of postpartum intrauterine device (IUD) insertion and determined factors associated with its uptake in Nigeria.

Methods: Data were collected between May 2014 and February 2015 from 11 private health care facilities in 6 southern Nigerian states. Women attending antenatal care in participating facilities were counseled on all available contraceptive methods including the postpartum IUD. Data were abstracted from participating facility records and evaluated using a cross-sectional analysis. Categorical variables were calculated as proportions while continuous variables were calculated as medians with the associated interquartile range (IQR). Multivariate logistic regression analysis was used to identify factors associated with uptake of the postpartum IUD while controlling for potential confounding factors, including age, educational attainment, marital status, parity, number of living children, and previous use of contraception.

Results: During the study period, 728 women delivered in the 11 facilities. The median age was 28 years, and most women were educated (73% had completed at least the secondary level). The majority (96%) of the women reported they were married, and the median number of living children was 3 (IQR, 2–4). Uptake of the postpartum IUD was 41% (n = 300), with 8% (n = 25) of the acceptors experiencing expulsion of the IUD within 6 weeks post-insertion. After controlling for potential confounding factors, several characteristics were associated with greater likelihood of choosing the postpartum IUD, including lower education, having a higher number of living children, and being single. Women who had used contraceptives previously were less likely to choose the postpartum IUD than women who had not previously used contraception (adjusted odds ratio, 0.68; 95% confidence interval, 0.55 to 0.84).

Conclusion: A high percentage (41%) of women delivering in private health care facilities in southern Nigeria accepted immediate postpartum IUD insertion. Scale-up of postpartum IUD services is a promising approach to increasing uptake of long-acting reversible contraceptives among women in Nigeria.

INTRODUCTION

The postpartum period is a particularly vulnerable time for women for unintended pregnancy, with studies reporting pregnancy rates of 6% to 40% within the first postpartum year, depending on the population,[1-6] and unmet need for modern contraceptives at 61%.[7] Intrauterine devices (IUDs), including the TCu380A copper-bearing IUD and the levonorgestrel intrauterine system, confer similar contraceptive protection as that obtained with tubal ligation[7-9] but are reversible and low-cost, thus making them an

[a] Marie Stopes International Organization, Abuja, Nigeria.
[b] United Nations Population Fund, Accra, Ghana.
Correspondence to George IE Eluwa (George.Eluwa@mariestopes.org.ng; dreluwag@gmail.com).

appealing contraceptive choice. Postpartum IUD insertion, in particular, is ideal for some women because the IUD does not interfere with breastfeeding; the timing is convenient for both women and the health care provider; and postpartum insertion is associated with less discomfort and fewer side effects than interval insertion (i.e., insertion of the IUD 6 weeks or more after delivery).[10] In addition, postpartum IUD insertion affords a unique opportunity to address the contraceptive needs of women with limited access to medical care since the delivery and postpartum period may be one of the few times such women are in contact with medical services.[7]

Safety of early postpartum IUD insertion has been studied since the 1960s[11] and the procedure is practiced worldwide[7,12]; however, less is known about postpartum IUD uptake.[13] Concerns over the possible risk of infection, bleeding, higher expulsion rates, and even provider reimbursements have limited use of the procedure. Barriers to uptake include cost, lack of provider knowledge or availability, 2-visit protocols for insertion, and misconceptions about IUDs.[11,13,15-17]

Nigeria is the seventh most populous country in the world; in 2015, the population was over 178 million people[17] and the total fertility rate (TFR) was 5.5 children per woman.[18] There has been minimal change in the TFR over the last 10 years, with TFR in 2003 reported at 5.7 children per woman.[18] TFR is higher in rural areas (6.2) than in urban regions (4.7).[18] The contraceptive prevalence rate (CPR) increased marginally between 2003 and 2013, from 13% to 15%.[18] Only 10% of married women use a modern method of contraception, and use of long-acting reversible contraceptives (LARCs) is reported to be around 1%[18] (0.2% for implants[19] and 0.8% for IUDs[18]). The aim of this study was to determine key factors associated with uptake of postpartum IUD insertion in Nigeria. Such information is useful for informing, planning, and providing targeted programming for scale-up of LARCs in Nigeria.

PROGRAM DESCRIPTION

Marie Stopes International Organization, Nigeria supports a social franchise network for private health care providers in the country to deliver quality family planning services at affordable cost. Health care providers within the network are trained on how to provide LARCs to clients in addition to a wide range of other methods. To address a gap in provision of postpartum family planning services, 11 health care providers within the network (1 provider in each of 11 facilities), who provided obstetric services but not postpartum family planning services, were preselected for competency-based training on postpartum IUD service provision.

Postpartum IUD insertion is ideal for some women for many reasons including convenient timing.

The competency-based training consisted of 2 days of didactic training and 3 days of practicum sessions both with models and with clients. Providers were required to competently insert 5 postpartum IUDs on the models before being allowed to do the insertions with clients under supervision.

To address a gap in postpartum family planning service provision in Nigeria, selected social franchise network providers received competency-based training in postpartum IUD services.

In addition, all providers received routine (monthly) supportive supervision and mentoring after the training. Gynecologists who had been trained in postpartum IUD insertion conducted supportive supervision. Furthermore, to ensure quality postpartum IUD services were maintained during the study period, internal quality technical assurance (QTA) exercises were conducted twice a year (or more frequently for underperformers) by the Clinical Services Department of Marie Stopes International Organization, Nigeria, while external QTA exercises were conducted at least once a year by the Department of Obstetrics and Gynaecology, University of Benin Teaching Hospital, Edo State. Persistent underperformers were de-franchised from the network. QTA exercises focused on different thematic areas, including client focus, infection prevention, incidence reporting, medical emergency, technical competency (regarding insertion of postpartum IUDs), and supply management. After scoring providers in each thematic area, the auditors developed action plans for each provider in suboptimal thematic areas.

MATERIALS AND METHODS

This study was conducted in South East and South South Nigeria among 11 private health care providers between May 2014 and February 2015. The states included Anambra, Abia, Delta, Ebonyi, Edo, and Enugu. All women who attended antenatal care at the 11 facilities were counseled on all available methods of contraception including the postpartum IUD. Women who presented at labor also received counseling about family planning methods including the postpartum IUD. Women who met medical eligibility criteria for IUD insertion and had no contraindications to IUD use were offered the postpartum IUD.

Exclusion criteria included women with duration of ruptured membranes greater than 12 hours, prolonged labor, fever at presentation to the facility, postpartum hemorrhage, or signs of genital infections. All women offered postpartum IUDs provided written consent for the procedure. The women paid approximately US$5 for the procedure.

All providers used the TCu380A IUD (Pregna International Ltd., Mumbai, India), which they inserted either manually with their hands while the patient was still in the delivery room (post-placental insertion) or with Kelly's forceps within 48 hours of delivery of the placenta according to the training manual. Given the large size of the postpartum uterus, providers were instructed to insert the IUD and the string completely into the uterus, with the IUD placed at the fundus of the uterus. In cases where the string was still visible, the string was tucked under the cervix.

Clients were taught how to check for the string to ensure the IUD had not been dislodged. All clients who accepted the postpartum IUD were given a 6-week postpartum follow-up appointment and were clinically assessed to determine if the IUD was still in place or had been expelled. Providers also checked for signs of infection at the follow-up visit. Clients were counseled to come back to the facility if they noticed an expulsion to have another IUD inserted, if willing, or to choose another method of contraception.

Demographic and reproductive health data were collected using a standardized client intake form. Data collected included educational attainment, parity, number of living children, and previous use of contraception. Data were extracted from the client intake forms and entered into Microsoft Excel. This was then imported into STATA 13.1 for statistical analysis.

41% of women delivering during the study period accepted the postpartum IUD.

Analysis included descriptive statistics with 95% confidence intervals (CIs) performed on quantitative data. Categorical variables were calculated as proportions, whereas continuous variables were calculated as medians with the associated interquartile range (IQR). Uptake of postpartum IUD was defined as the proportion of women who accepted the postpartum IUD among all those eligible for the method. Expulsion rate was defined as the proportion of women with an expelled IUD among those who had received the postpartum IUD. Chi-square test was used to test statistical significance between categorical variables, while the Wilcoxon rank-sum test was used for continuous variables. Bivariate logistic regression analysis was used to test associations between demographic and reproductive health variables, and uptake of postpartum IUD. Variables significant at $P \leq .20$ were considered for inclusion in multivariate logistic regression models to identify factors independently associated with uptake of the postpartum IUD while controlling for potential confounders, including age, educational attainment, marital status, parity, number of living children, and previous use of contraception. Variables attaining significance at $P \leq .05$ in the multivariate analysis were retained, based on the likelihood ratio test. The Nigerian Institute of Medical Research granted ethical approval for the study.

RESULTS

Background Characteristics

A total of 728 women delivered in the 11 facilities between May 2014 and February 2015. The median age was 28 years (IQR, 24–32 years). Most women had some level of education: 38% had achieved a tertiary-level education (post-secondary) and 35% had completed the secondary level. The large majority (96%) of the women were married. The median parity was 3 (IQR, 2–5), and the median number of living children was also 3 (IQR. 2–4). About one-third (36%) of the women had previously used contraception, all of whom were married.

Postpartum IUD Uptake

Of the 728 women delivering during the study period, 41% (n = 300) of them accepted postpartum IUD insertion. About one-fourth (26%, n = 77) of the IUDs were inserted manually as immediate post-placental insertions, while the majority (74%, n = 223) were inserted within 48 hours of delivery with the use of forceps (Table 1). About 8% of women who chose the postpartum IUD (n = 25) experienced expulsion of the IUD, with the majority of the expulsions occurring among those inserted with forceps (72% with forceps vs. 18% manually; $P = .78$).

Factors Associated With Postpartum IUD Uptake

Table 2 outlines results from the multivariate logistic regression analysis of factors independently associated with uptake of the postpartum IUD. After controlling for potential confounding

TABLE 1. Characteristics of Clients Delivering in the Social Franchise Clinics (N = 728), by Uptake of the Postpartum IUD, Southern Nigeria, May 2014–February 2015

	Accepted PPIUD (n = 300)	Rejected PPIUD (n = 428)	*P* Value
Age, years			
< 25, No. (%)	50 (16.7)	112 (26.2)	
≥ 25, No. (%)	250 (83.3)	316 (73.8)	.002
Median (IQR)	29 (26, 34)	28 (24, 32)	< .001
Educational level, No. (%)			
None/primary	99 (33.0)	59 (13.8)	
Secondary	113 (37.7)	183 (42.8)	
Tertiary	88 (29.3)	186 (43.5)	< .001
Marital status, No. (%)			
Single	22 (7.3)	7 (1.6)	
Married	278 (92.7)	421 (98.4)	< .001
Parity			
0–1, No. (%)	8 (2.7)	101 (23.6)	
2–3, No. (%)	70 (23.3)	199 (46.5)	
4–5, No. (%)	149 (49.7)	98 (22.9)	
≥ 6, No. (%)	73 (24.3)	30 (7.0)	< .001
Median (IQR)	4 (3, 5)	3 (2, 4)	< .001
No. of living children			
0–1, No. (%)	9 (3.0)	102 (30.2)	
2–3, No. (%)	106 (35.3)	172 (50.9)	
4–5, No. (%)	151 (50.3)	58 (17.2)	
≥ 6, No. (%)	34 (11.3)	6 (1.8)	< .001
Median (IQR)	4 (3, 5)	2 (1, 3)	< .001
Previous use of contraception, No. (%)			
No	219 (73.0)	250 (58.4)	
Yes	81 (27.0)	178 (41.6)	< .001
Insertion technique, No. (%)			
Manual	77 (25.7)	NA	
Forceps	223 (74.3)	NA	
PPIUD expelled, No. (%)			
No	275 (91.7)	NA	
Yes	25 (8.3)	NA	

Abbreviations: IQR, interquartile range; NA, not applicable; PPIUD, postpartum intrauterine device.
P value derived from chi-square test for categorical variables and from Wilcoxon's rank-sum test for continuous variables.

TABLE 2. Multivariate Analysis of Factors Associated With Postpartum IUD Uptake, Southern Nigeria, May 2014–February 2015

	Crude OR (95% CI)	Adjusted OR (95% CI)	*P* Value
Age, years			
<25	1	1	
≥25	1.77 (1.22, 2.57)	1.01 (0.61, 1.67)	.97
Educational level			
Tertiary	1	1	
Secondary	1.31 (0.92, 1.84)	1.05 (0.68, 1.64)	.82
None/primary	3.55 (2.35, 5.35)	2.03 (1.20, 3.42)	.008
Marital status			
Married	1	1	
Single	4.76 (2.01, 11.29)	6.76 (1.82, 25.07)	.004
Parity			
0–1	1	1	
2–3	4.44 (2.06, 9.59)	1.99 (0.48, 8.28)	.34
4–5	19.20 (8.94, 41.20)	6.30 (1.36, 28.72)	.02
≥6	30.72 (13.32, 70.88)	5.81 (1.15, 29.27)	.03
No. of living children			
0–1	1	1	
2–3	6.95 (3.39, 14.40)	4.56 (1.19, 17.45)	.03
4–5	29.51 (14.00, 62.20)	8.30 (1.97, 35.03)	.004
≥6	64.22 (21.30, 193.61)	17.76 (3.07, 102.85)	.001
Previous contraceptive use			
No	1	1	
Yes	0.72 (0.61, 0.85)	0.68 (0.55, 0.84)	<.001

Abbreviations: CI, confidence interval; IUD, intrauterine device; OR, odds ratio.

factors, women with no formal education or only a primary level of education were more likely to choose the postpartum IUD than women who had a tertiary level of education (adjusted odds ratio [AOR], 2.03; 95% CI, 1.20 to 3.42; $P=.008$). There was no difference in uptake between those with secondary level education and those with a tertiary level (AOR, 1.05; 95% CI, 0.68 to 1.64; $P=.82$). Women with parity 4–5 (AOR, 6.30; 95% CI, 1.36 to 28.72; $P=.02$) and ≥6 (AOR, 5.81; 95% CI, 1.15 to 29.27; $P=.03$) were more likely to accept the postpartum IUD than women with parity ≤1. Compared with those who had 0–1 living child, those with 2–3 living children were more likely to choose the postpartum IUD (AOR, 4.56; 95% CI, 1.19 to 17.45; $P=.03$). The same was true for women with 4–5 living children (AOR, 8.30; 95% CI, 1.97 to 35.03; $P=.004$) and women with 6 or more living children (AOR, 17.76; 95% CI, 3.07 to 102.85; $P=.001$) when compared with women with 0–1 living child. Women who had used

contraceptives previously were less likely than women who had not to choose the postpartum IUD (AOR, 0.68; 95% CI, 0.55 to 0.84; $P<.001$). Compared with married women, single women were more likely to choose the postpartum IUD (AOR, 6.76; 95% CI, 1.82 to 25.07; $P=.004$). Age was not associated with postpartum IUD uptake.

DISCUSSION

The postpartum period is an ideal time to start contraception because motivation to adopt contraception at this time is high and it is convenient for both the client and the provider.[20] Nearly two-thirds of women in their first postpartum year, however, have an unmet need for family planning.[21]

To the best of our knowledge, this is the first study to demonstrate the feasibility of providing postpartum IUD services among private health care providers and to determine factors associated with uptake of the postpartum IUD in Nigeria. We made several important observations. First and foremost, training providers in postpartum IUD counseling and insertion techniques resulted in a high acceptance rate: 41% of women delivering during the study period chose to use the postpartum IUD. Many women in Nigeria have limited access to health services, which may explain the high uptake of the postpartum IUD in this study. A study in Colombia reported that 95% of women who expressed the desire for immediate postpartum IUD insertion had it done compared with 45% of those who opted for delayed insertion,[7] suggesting barriers to use when insertion is delayed. High uptake in our study may also be attributable to staff motivation, supportive supervision, and a manageable client-provider ratio in the private health facilities compared with public health facilities that are understaffed and demotivated with a client-provider ratio of 19 and 95 per 100,000 for doctors and nurses, respectively.[21,22]

Second, the rate of expulsion was low (8%) and consistent with or lower than expulsion rates reported in other published studies,[10,23-25] indicating a high standard of insertion technique among the trained providers in this study. While expulsion rates with post-placental IUD insertion appear to be higher than with interval insertion, studies have concluded that immediate postpartum IUD insertion is safe and effective and the benefits outweigh the disadvantage of the increased risk of expulsion,[7] particularly in settings with limited access to health services. It has also been suggested that expulsion rates are associated with the experience of the provider, irrespective of type of institutions and training levels.[12,26,27] The 8% expulsion rate observed in our study indicates that 92% of clients who accepted the postpartum IUD continued on a highly effective method.

The third key observation of our study is that previous use of contraception does not necessarily translate to acceptability of the postpartum IUD; in fact, in our study women who had never previously used contraception were significantly more likely to accept postpartum IUD insertion than women who had used contraception in the past. Women who had used contraception in the past may have been comfortable with their previous method, and thus desired using that same method of contraception. However, a study among young Kenyan females[28] showed no association between previous use of contraception and uptake of contraception. More research is needed to understand the association between previous use of contraception and uptake of the postpartum IUD.

Finally, several factors emerged as being independently associated with uptake of the postpartum IUD, including education, parity, number of living children, and marital status. These findings have salient implications for family planning programs in Nigeria. Women with primary or no formal education were more likely to use the postpartum IUD than women with tertiary-level education. This finding is in contrast with most studies in Nigeria that have shown that contraceptive use is higher among those with higher levels of education.[18,19] However, those studies report analyses at univariate and bivariate levels while we report our findings using multivariate analysis. The higher likelihood of postpartum IUD use among those with lower education in our study may be related to the appeal of receiving contraception immediately after delivery, particularly since those with primary or no formal education were more likely to be of lower income status and therefore likely had more difficulty accessing health services. It may also be attributable to the fact that those with lower education had the highest parity and number of living children among the study group; our study also showed that the higher the number of living children or parity, the more likely the client would accept the postpartum IUD. Such women may be more motivated to

Women with lower education were more likely to use the postpartum IUD than those with higher education.

The expulsion rate of 8% in this study was consistent with or lower than rates reported in other published studies.

Single women were more likely to use the postpartum IUD than married women.

limit childbearing than women with lower parity or number of living children. These findings are similar to that of other studies.[21,22,29] Finally, our study showed that single women were 7 times more likely to accept the postpartum IUD than married women. While studies have shown more single women use contraceptives compared with married women, disaggregation of data usually shows the contraception methods most often used by single women are short-acting methods such as condoms and pills.[18,19] Further studies are needed to understand the higher uptake of IUD use among single women in our study setting.

Postpartum IUD service delivery has the potential to address unmet need and increase contraceptive use among women in Nigeria.

Despite substantial investments in family planning programs over the last 10 years, Nigeria's modern contraceptive prevalence rate remains unchanged at 10% and only about 1% of this is for LARCs.[18] Furthermore, unmet need is high at 20%.[19] Postpartum IUD service delivery has the potential to address unmet need and increase contraceptive use among women in Nigeria and should be considered for scale-up in both public and private facilities.

Limitations

This study was cross-sectional in nature with the use of program data and thus should be interpreted with caution. Data on unwanted pregnancies and abortions among clients were not available; such factors may have influenced the uptake of contraception, especially among single women. While data on previous use of contraception were collected, the type of contraception was unknown and this may have influenced uptake of the postpartum IUD. Data on expulsion rates were collected over the first 6 weeks after insertion only, and thus our expulsion rates may be underreported. Lastly, this study was conducted exclusively among women who sought service from private facilities and suggests that they may be of higher socioeconomic status than women who would seek services from public services. While our results are promising, data on the socioeconomic status of clients were not available. The cost of US$5 for the postpartum IUD may be a barrier to uptake of this service among women attending public facilities and should be taken into consideration if this is to be implemented in public facilities.

CONCLUSION

Our study documents the first time postpartum IUD contraception has been implemented in Nigeria on the scale reported here, demonstrating that postpartum IUD service delivery has the potential to make a significant contribution to much higher uptake of long-acting reversible contraception in Nigeria. Uptake of the postpartum IUD was 41%; lower education, high parity and number of living children, and being single were good predictors of women who accepted the method. With appropriate training, this procedure can be very successful given that expulsion of IUD after insertion was only 8%, indicating that 92% of acceptors would continue with a highly effective means of long-acting contraception when leaving the delivery facility.

Acknowledgments: This study was made possible by the generous support from the American people through the United States Agency for International Development (USAID) under the terms of Cooperative Agreement AID-OAA-A-10-00059; Support for International Family Planning Organizations (SIFPO). The contents are the responsibility of Marie Stopes International and Marie Stopes International Organization, Nigeria, and do not necessarily reflect the views of USAID or the United States Government.

Competing Interests: None declared.

REFERENCES

1. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 121: Long-acting reversible contraception: implants and intrauterine devices. Obstet Gynecol. 2011; 118(1):184-196. CrossRef. Medline
2. Chen BA, Reeves MF, Hayes JL, Hohmann HL, Perriera LK, Creinin MD. Postplacental or delayed insertion of the levonorgestrel intrauterine device after vaginal delivery: a randomized controlled trial. Obstet Gynecol. 2010;116(5):1079-1087. CrossRef. Medline
3. Shulman JJ, Merritt CG. Postpartum contraception: subsequent pregnancy, delivery, and abortion rates. Fertil Steril. 1976; 27(1):97-103. CrossRef. Medline
4. Ogburn JAT, Espey E, Stonehocker J. Barriers to intrauterine device insertion in postpartum women. Contraception. 2005; 72(6):426-429. CrossRef. Medline
5. Templeman CL, Cook V, Goldsmith LJ, Powell J, Hertweck SP. Postpartum contraceptive use among adolescent mothers. Obstet Gynecol. 2000;95(5):770-776. Medline
6. Grimes DA, Lopez LM, Schulz KF, van Vliet HA, Stanwood N. Immediate post-partum insertion of intrauterine devices. 2010; (5):CD003036. CrossRef. Medline
7. Rowe PJ, Boccard S, Farley TMM, Peregoudov S. Long-term reversible contraception. Twelve years of experience with the TCu380A and TCu220C. Contraception. 1997;56(6):341-352. CrossRef. Medline
8. Harper CC, Blum M, de Bocanegra HT, Darney PD, Speidel JJ, Policar M, et al. Challenges in translating evidence to practice: the provision of intrauterine contraception. Obstet Gynecol. 2008;111(6):1359-1369. CrossRef. Medline
9. Stanek AM, Bednarek PH, Nichols MD, Jensen JT, Edelman AB. Barriers associated with the failure to return for intrauterine device insertion following first-trimester abortion. Contraception. 2009;79(3):216-220. CrossRef. Medline

10. Washington CI, Jamshidi R, Thung SF, Nayeri UA, Caughey AB, Werner EF. Timing of postpartum intrauterine device placement: a cost-effectiveness analysis. Fertil Steril. 2015;103(1):131-137. CrossRef. Medline
11. Burnhill MS, Birnberg CH. Uterine perforation with intrauterine contraceptive devices. Review of the literature and cases reported to the National Committee on Maternal Health. Am J Obstet Gynecol. 1967;98(1):135–140. CrossRef. Medline
12. Peterson HB, Xia Z, Hughesa JM, Wilcox LS, Tylora LR, Trussell J. The risk of pregnancy after tubal sterilization: findings from the U.S. Collaborative Review of Sterilization. Am J Obstet Gynecol. 1996;174(4):1161-1170, discussion 1168-1170. CrossRef. Medline
13. Kapp N, Curtis KM. Intrauterine device insertion during the postpartum period: a systematic review. Contraception. 2009; 80(4):327-336. CrossRef. Medline
14. Whitaker AK, Endres LK, Mistretta SQ, Gilliam ML. Postplacental insertion of the levonorgestrel intrauterine device after cesarean delivery vs. delayed insertion: a randomized controlled trial. Contraception. 2014;89(6):534-539. CrossRef. Medline
15. Bergin A, Tristan S, Terplan M, Gilliam ML, Whitaker AK. A missed opportunity for care: two-visit IUD insertion protocols inhibit placement. Contraception. 2012;86(6):694-697. CrossRef. Medline
16. Goodman S, Hendlish SK, Benedict C, Reeves MF, Pera-Floyd M, Foster-Rosales A. Increasing intrauterine contraception use by reducing barriers to post-abortal and interval insertion. Contraception. 2008;78(2):136-142. CrossRef. Medline
17. WPR [Internet]. [place unknown]: World Population Review; c2016. Nigeria population 2015; [cited 2015 Aug 1]. Available from: http://worldpopulationreview.com/countries/nigeria-population
18. National Population Commission (NPC) [Nigeria]; ICF International. Nigeria demographic and health survey 2013. Abuja (Nigeria): NPC; 2014. Co-published by ICF International. Available from: https://dhsprogram.com/pubs/pdf/FR293/FR293.pdf
19. Federal Ministry of Health (MOH) [Nigeria]. National HIV & AIDS and reproductive health survey (NARHS Plus II, 2012). Abuja (Nigeria): MOH; 2013.
20. Xu JX, Rivera R, Dunson TR, Zhuang LQ, Yang XL, Ma GT, et al. A comparative study of two techniques used in immediate postplacental insertion (IPPI) of the Copper T-380A IUD in Shanghai, People's Republic of China. Contraception.1996; 54(1):33-38. CrossRef. Medline
21. Ogungbekun I, Ogungbekun A, Orobaton A. Private health care in Nigeria: walking the tightrope. Health Policy Plan. 1999; 14(2):174–181. Medline
22. Chankova S, Nguyen H, Chipanta D, Kombe G, Onoja A, Ogungbemi K, et al. A situation assessment of human resources the public health sector in Nigeria. Bethesda (MD): Abt Associates; 2006. Available from: http://pdf.usaid.gov/pdf_docs/Pnadh422.pdf
23. Lopez LM, Grey TW, Chen M, Hiller JE. Strategies for improving postpartum contraceptive use: evidence from non-randomized studies. Cochrane Database Syst Rev. 2014;(11):CD011298. CrossRef. Medline
24. Apanga PA, Adam MA. Factors influencing the uptake of family planning services in the Talensi District, Ghana. Pan Afr Med J. 2015;20:10. CrossRef. Medline
25. Anate M. Factors influencing family planning use in Ilorin, Nigeria. East Afr Med J. 1995;72(7):418-420. Medline
26. Eroğlu K, Akkuzu G, Vural G, Dilbaz B, Akin A, Taşkin L, et al. Comparison of efficacy and complications of IUD insertion in immediate postplacental/early postpartum period with interval period: 1 year follow-up. Contraception. 2006;74(5):376-381. CrossRef. Medline
27. Hubacher D, Olawo A, Manduku C, Kiarie J. Factors associated with uptake of subdermal contraceptive implants in a young Kenyan population. Contraception. 2011;84(4):413-417. CrossRef. Medline
28. Bronner PF. A clinical trial of the Delta-T intrauterine device: immediate postpartum insertion. Contraception. 1983; 28(2):135-147. CrossRef. Medline
29. Bonilla Rosales F, Aguilar Zamudio ME, Cázares Montero MdeL, Hernández Ortiz ME, Luna Ruiz MA. [Factors for expulsion of intrauterine device Tcu380A applied immediately postpartum and after a delayed period]. Rev Med Inst Mex Seguro Soc. 2005;43(1):5-10. Spanish. Medline

Peer Reviewed

Received: 2016 Mar 1; **Accepted:** 2016 May 13

Cite this article as: Eluwa GIE, Atamewalen R, Odogwu K, Ahonsi B. Success providing postpartum intrauterine devices in private-sector health care facilities in Nigeria: factors associated with uptake. Glob Health Sci Pract. 2016;4(2):276–283. http://dx.doi.org/10.9745/GHSP-D-16-00072

© Eluwa et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00072

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

ORIGINAL ARTICLE

Partnerships for Policy Development: A Case Study From Uganda's Costed Implementation Plan for Family Planning

Alyson B Lipsky,[a] James N Gribble,[b] Linda Cahaelen,[c] Suneeta Sharma[b]

The development and launch of the costed implementation plan (CIP) in Uganda was successful in many ways. However, it would have benefitted from more focus on long-term partnership development critical for executing the CIP and by including district health officers—key players in executing the plan—more substantially in the process. Using a partnership approach sets the stage for ensuring that the right people are contributing to both development and execution.

ABSTRACT

In global health, partnerships between practitioners and policy makers facilitate stakeholders in jointly addressing those issues that require multiple perspectives for developing, implementing, and evaluating plans, strategies, and programs. For family planning, costed implementation plans (CIPs) are developed through a strategic government-led consultative process that results in a detailed plan for program activities and an estimate of the funding required to achieve an established set of goals. Since 2009, many countries have developed CIPs. Conventionally, the CIP approach has not been defined with partnerships as a focal point; nevertheless, cooperation between key stakeholders is vital to CIP development and execution. Uganda launched a CIP in November 2014, thus providing an opportunity to examine the process through a partnership lens. This article describes Uganda's CIP development process in detail, grounded in a framework for assessing partnerships, and provides the findings from 22 key informant interviews. Findings reveal strengths in Uganda's CIP development process, such as willingness to adapt and strong senior management support. However, the evaluation also highlighted challenges, including district health officers (DHOs), who are a key group of implementers, feeling excluded from the development process. There was also a lack of planning around long-term partnership practices that could help address anticipated execution challenges. The authors recommend that future CIP development efforts use a long-term partnership strategy that fosters accountability by encompassing both the short-term goal of developing the CIP and the longer-term goal of achieving the CIP objectives. Although this study focused on Uganda's CIP for family planning, its lessons have implications for any policy or strategy development efforts that require multiple stakeholders to ensure successful execution.

INTRODUCTION

Partnerships between practitioners and policy makers are a necessary strategy to address complex challenges that require multiple stakeholders to work together toward the same goal,[1,2] including the development and execution of global health policies and programs such as national costed implementation plans (CIPs).[1,3] CIPs are planning and management tools, developed through a government-led consultative approach, that detail the activities needed over multiple years, executed by a range of organizations, to meet program goals as well as the costs associated with the activities.[4]

Since 2009, many countries have used CIPs as an approach to create a multiyear map designed to help governments achieve their family planning goals. Specifically, a CIP can help determine the human, financial, material, and technical resources needed, and it can be used to justify resource mobilization.[5] Ideally, CIPs effect change by translating broad family planning goals into "concrete programs and policies."[5] CIPs aim to help countries unify stakeholders behind this strategy, raise the profile of family planning, and leverage financial and technical resources from multiple

[a] RTI International, Health Policy Project, Washington, DC, USA.
[b] Palladium, Health Policy Project, Washington, DC, USA.
[c] U.S. Agency for International Development, Washington, DC, USA.
Correspondence to Alyson B Lipsky (alipsky@rti.org).

stakeholders. Family planning leaders in Uganda launched their first CIP in November 2014 after conducting a vibrant consultative process.[6] This process provided a unique opportunity to examine the development of a CIP through the lens of partnership.

This article applies a partnership evaluation framework to assess the extent to which Uganda's CIP development process depended on stakeholder engagement and commitment to shared goals. It pushes the CIP development process, which was born out of strategic planning and budgeting processes,[7] to another level, seeking to understand whether a partnership approach might strengthen both the development process and the subsequent execution. It thus looks at the presence of partnership factors and their effect on partners' perceptions of their work. The article also explores how these factors might affect execution and provides guidance to those embarking on CIP development in other countries.

We begin the article by introducing a definition of partnership from the literature, then briefly explain what CIPs are. We used a partnership evaluation framework as the methodology to analyze the CIP process, examine the Ugandan context and CIP development, discuss the findings from the research, and make recommendations for how CIP development and execution can be strengthened when treated as a partnership. We conclude by discussing the implications of using a partnership framework more explicitly as practitioners develop family planning CIPs and other types of health strategies and policies.

DEFINING PARTNERSHIPS AND COSTED IMPLEMENTATION PLANS

Partnerships take many forms, making it difficult to develop one single definition. While there is a variety of partnership definitions in the literature (for example, see Buse and Walt, 2000[8]), generally partnerships can be defined as "joint initiatives between the public sector, nongovernmental organizations and the corporate sector."[8] Partnerships can be further defined according to 2 dimensions: mutuality and organization identity.[9] Mutuality refers to how partners rely on each other to advance a common cause. Mutuality does not presume that power dynamics are equal between partners, but that each actor has rights and responsibilities that "seek to maximize benefits for each party."[9] Organization identity, on the other hand, refers to each organization's unique traits in the partnership, especially the organizations' ability to maintain their core mission and values over the long term.[9]

Costed implementation plans (CIPs) translate broad family planning goals into concrete programs and policies.

Often partnership definitions include such factors as having a degree of reciprocity between partners, clear objectives, and mutual responsibilities to advance shared interests.[7] These shared interests are limited only by one's imagination and can include service delivery, infrastructure development, capacity building, economic development, and policy.[10] Policy partnerships between governments and NGOs are those that "design, advocate for, coordinate, or monitor public policies. Policy partnership structures can vary from informal issue-specific networks to formal cross-sectoral committees, task forces, or special commissions."[10]

This study aimed to understand whether a partnership approach could strengthen both the development process of CIPs and their subsequent execution.

Partnerships can be critical for policy or strategy execution. Within family planning, in 2004 the U.S. Agency for International Development (USAID) launched and promoted the "Strategic Pathway to Reproductive Health Commodity Security" (SPARHCS) to improve availability of and access to commodities. The approach includes partnership guidelines for working across government, the private sector, and donors not only to develop a strategy but also to execute the strategy.[11] SPARCHS was successfully used in many countries to plan, prioritize, and execute strategies to improve access to reproductive health commodities.[11] A number of global family planning partnerships have been formed in recent years, such as the global Family Planning 2020 (FP2020) partnership and the Ouagadougou Partnership. However, there has been little exploration of family planning policy partnerships at the country level. The CIP development process is an example of one such partnership.

CIPs evolved out of a need to unify diverse stakeholders around a shared strategy.

CIPs for family planning are a recent development that evolved out of a perceived need to unify diverse stakeholders around a shared strategy to achieve family planning goals at a national or subnational level. Since 2009, at least 20 countries have developed CIPs.[12] In most cases, they have followed a common systematic approach, including establishing a national task force and following a 10-step, customizable process (Box 1).[4,13] FP2020 led a global effort to develop a standardized approach to crafting CIPs and engaged those international

BOX 1. Typical 10-Step Costed Implementation Plan (CIP) Development Process

PHASE I: PLAN

Step 1: Obtain government and key stakeholder buy-in.
Step 2: Detail roadmap and secure resources for CIP development.

PHASE II: DEVELOP

Step 3: Conduct a family planning situational analysis.
Step 4: Detail and describe a technical strategy with sub-activities and timeline.
Step 5: Estimate resources and costs.
Step 6: Identify financing gaps.
Step 7: Secure final approval and launch the plan.

PHASE III: EXECUTE

Step 8: Set up and manage institutional arrangements for implementation.
Step 9: Design and implement performance-monitoring mechanisms.
Step 10: Develop and implement a resource mobilization plan.

Source: Health Policy Project 2015.[7]

organizations that have been developing CIPs since 2009.

Although the CIP development process is not explicitly promoted as a partnership, the development process requires mutuality and organization identity, and thus is in practice a partnership. The outcomes of partnerships depend on more than just funding and technical inputs; they are affected by "the institutions and incentives governing the execution of policies and programs, including informal rules, regulations, controls, and structures."[9] Thus, using a partnership approach to analyze CIP development can provide useful insights to help ensure that the partnership itself is well positioned to apply the CIP and contribute to the achievement of FP2020 goals.

FRAMEWORK FOR EVALUATING PARTNERSHIPS

The purpose of this evaluation was to look at the rules of engagement and relationships within the partnership that developed Uganda's CIP. Capturing the complexity of partnership requires a multifaceted evaluation methodology. Our analysis draws on part of a framework developed to assess a global family planning consortium (personal communication with Dr. Jennifer Brinkerhoff, Professor of Public Administration and International Affairs, The George Washington University, January 2015) and identifies several categories of factors that affect partnership effectiveness. The full framework outlines 5 overarching categories on which to assess partnerships[9]:

1. Presence of prerequisites and success factors
2. Degree of partnership
3. Outcomes of the partnership relationship
4. Partner performance
5. Efficiency and strategy

Because this study looked only at the CIP development process, we focused on the first category of factors—presence of prerequisites and success factors (Box 2). Nonetheless, we included one additional factor—ownership—later as an area of analysis after it emerged as a theme in the key informant interviews. Although ownership is not included in Brinkerhoff's partnership evaluation framework, it has been cited[14] as important for policy development, execution, and sustainability; thus, we added it to our framework.

BOX 2. Presence of Prerequisites and Success Factors Affecting Partnership Effectiveness

1. Perceptions of partners' tolerance for sharing power[9]
2. Partners' willingness to adapt to meet the partnership's needs: perception of receptivity to new solutions to improve the partnership, its value, and day-to-day performance; speed and flexibility in addressing the need for corrective action; accommodation of special requests among the partners; responsiveness of partners to unforeseen situations[9]
3. Existence of partnership champions: existence of champions within each partner organization and within the partnership as a whole; focus of champions' advocacy (internal to a partner organization, within the partnership, externally)[9]
4. Trust: character-based perceptions of integrity, honesty, moral character, reliability, confidentiality, as appropriate, etc.; competence-based perceptions of competence in prescribed/assumed skill areas, understanding of partnership, etc.[9]
5. Confidence: use of standard operating procedures, contractual agreements, and their degree of formality[9]
6. Senior management support: direct participation; provision of resources and support to organization members participating in the partnership[9]
7. Ability to meet performance expectations: function of both external constraints and partner capacity[9]
8. Clear goals: consistent identification of partnership goals and mission; regular partner meetings to review, revise, and assess progress in meeting identified goals; shared common vision for the partnership; mutually determined and agreed-upon partnership goals[9]
9. Partner compatibility: knowledge and understanding of partners' missions, operations, and constraints; previous conflict or confrontations among partners; compatible operating cultures (e.g., operating philosophies, management styles, teamwork); compatible constituencies; compatible core values; mechanisms to address incompatibilities[9]
10. Conflict: degree; frequency; extent of conflict avoidance within partnership; presence/absence of one or more dominating partners[9]
11. Ownership: degree to which in-country stakeholders are perceived to be responsible and able to manage the development and implementation of a policy, strategy, or program (emerged as a theme in this study)[14]

CASE STUDY: UGANDA

Uganda developed its CIP over several months in 2014, and the final CIP was launched at a national event in November 2014,[6] with a start date of July 2015.[15] Published by the Ministry of Health (MOH), the CIP identifies 5 priorities (Box 3), and it is estimated to cost US$236 million between 2015 and 2020. If executed as intended, the activities in the CIP will increase the number of women in Uganda using modern contraception from approximately 1.7 million in 2014 to 3.7 million in 2020.[16]

Uganda was selected as a case study for examining CIPs in a partnership framework for several reasons. First, Uganda has a strong enabling environment for family planning and CIPs. Second, it followed the commonly used 10-step CIP process, including establishing a CIP task force. Additionally, its CIP development process included a particularly robust consultative process. Moreover, because the timing was right, Uganda provided an opportunity to assess partnership prerequisites and success factors present during the CIP development process.

Strong Enabling Environment

Uganda's 2011 Demographic and Health Survey (DHS) highlighted the country's high unmet need for family planning.[17] As early as 2012, President Museveni and other high-profile officials at the national level newly expressed strong public support for family planning.[15] The FP2020 global initiative that resulted from the 2012 London Summit on Family Planning provided a structure within which Uganda could set ambitious goals. At the London Summit, Uganda committed to reducing unmet need for family planning from 40% to 10% by 2022 by improving program and service delivery, increasing financial commitments and expenditures, and addressing

BOX 3. Uganda Costed Implementation Plan (CIP) Priorities

1. Priority #1: Increase age-appropriate information about, access to, and use of family planning among young people ages 10–24 years.
2. Priority #2: Promote and nurture change in social and individual behavior to address myths, misconceptions, and side effects, and improve acceptance and continued use of family planning to prevent unintended pregnancies.
3. Priority #3: Implement task sharing to increase access, especially for rural and underserved populations.
4. Priority #4: Carry out mainstream implementation of family planning policy, interventions, and delivery of services in multisectoral domains to facilitate a holistic contribution to social and economic transformation.
5. Priority #5: Improve forecasting, procurement, and distribution of commodities, and ensure full financing for commodity security in the public and private sectors.

Source: Uganda Ministry of Health, 2014.[15]

policy and political challenges.[15] As a result of these commitments, the Ugandan government was obligated to take action on family planning. Finally, local pressure to develop a comprehensive national plan for family planning was growing—discussions between the government, civil society, and international partners started as early as May 2013 and culminated in a national meeting in September 2013 at which a leading coalition of family planning service providers called for the MOH to develop a national family planning strategy. Within the region, Kenya, Tanzania, and Zambia had already adopted CIPs,[18-20] and donors were prepared to provide support in developing a CIP in Uganda. Then, in early 2014, one donor provided initial funding for the development of a national plan for family planning before the CIP development process officially began.[15]

Development of a Task Force as Part of the CIP 10-Step Process

Uganda's MOH established and chaired a CIP task force comprising major family planning stakeholders.

Although not all countries establish task forces to develop CIPs, Uganda did take this approach. As part of Step 1 of the 10-step process (Box 1), Uganda's MOH established and chaired a CIP task force in May 2014 comprising major family planning stakeholders—donors, advocates, and implementing partners. Specifically, the task force included the MOH and national-level stakeholders, such as the Partners in Population and Development–Africa Regional Office; Uganda Family Planning Consortium; Reproductive Health Uganda; Program for Accessible Health, Communication and Education; Uganda Health Marketing Group; the United Nations Population Fund (UNFPA); and USAID. Establishing the CIP task force reflected the importance of organization identity; a strong CIP requires different perspectives. Further, some level of mutuality was needed because of the important role NGOs and donors play in family planning service delivery in Uganda. Thus, the Ugandan government could not be the only organization selecting activities for inclusion in the CIP.

In June 2014, the MOH officially requested donor support from both multilateral and bilateral funding agencies for the CIP development process. Donor support was committed in June 2014, and the task force formed the technical support team (TST), which included a Ugandan consultant and support from 2 international partners. The TST developed a roadmap, and shared it with the task force for approval. Throughout CIP development, the task force was responsible for managing the process, including holding meetings and workshops, making overall strategy decisions, approving deliverables, facilitating approval of the CIP itself, and coordinating actors at the national and subnational levels. The TST was responsible for technical work, including drafting documents for the task force to review and approve.

Engaging in a Vibrant Consultative Process

As part of engaging a range of stakeholders, the TST held a series of more than 30 national and subnational consultations between July and August 2014, focusing on 9 technical areas. To determine the technical areas for the consultations, the TST proposed several areas to the task force based on global best practices, Uganda's key priorities, and data on the current family

planning and policy landscape in the country. The task force made the final decision on which areas the consultations would address. The selected technical areas comprised[15]:

- Contraceptive security
- Human resources
- Health systems management
- Advocacy
- Social and behavior change communication
- General family planning service delivery
- Youth-friendly family planning/reproductive health services
- Integration of family planning services into other health services and sectors
- Decentralization

Each consultation followed a similar structure that fostered active participation: presentations on the technical area, followed by group work to identify family planning priorities and practical solutions to achieving them. Participants elected representatives to serve as points of contact for the task force and the TST as work on the CIP moved forward. To solicit local views of family planning challenges, the TST also held subnational consultations. In addition, the TST held focus group discussions with youth, DHOs, development partners, Government of Uganda sector ministries, and local community members, but these stakeholders were not part of the technical consultations.

The CIP was developed through an iterative process between the TST, the task force, and the representatives elected as part of the consultation process. As data from the consultations came in, the TST created a draft activity list that the technical area experts reviewed using a simple prioritization tool to assess each activity's potential impact and feasibility and to finalize the CIP's priorities (Box 3). Once the CIP priorities and the activity list were finalized, the TST completed the costing using a Microsoft Excel-based tool (available at www.familyplanning2020.org), and the CIP was drafted. The task force reviewed the activity list and CIP throughout the drafting process.

EVALUATION METHODS

After selecting the partnership evaluation framework, we reviewed the TST's published and unpublished project documents; government reports, such as the most recent DHS and the CIP; and other materials regarding family planning services in Uganda. Using a deductive qualitative approach to assess the Uganda CIP process, we developed a semi-structured interview guide to assess the 10 partnership prerequisites and success factors outlined in the evaluation framework. We used the interview guide with both Ugandan and international stakeholders. The interview guide asked key informants about their experiences and perceptions regarding partnership and the CIP process, including probes for follow-up. The Futures Group's Internal Research Review Committee reviewed and approved the study's research protocol.

One of the authors and a consultant on the evaluation conducted 22 in-depth interviews, with informants sampled in a 2-stage process. The first stage took place in February and March 2015, and was a purposeful sample consisting of 12 task force and TST members. The researchers then asked these informants to identify individuals who were not task force members but were peripherally involved in developing the CIP and important for CIP execution. Based on recommendations from the informants, the interviewers spoke with representatives from 3 faith-based organizations (FBOs) and 7 DHOs (1 representative from each organization/office) in June 2015. The interviewers did not conduct interviews with youth, local community members, or Government of Uganda sector ministries. The sampling method produced a minimum sample based on expected reasonable coverage.

Uganda's CIP was developed through an iterative and collaborative process.

The interviews were conducted via phone, Skype, or in person; they lasted between 30 minutes and 1 hour. The interviewers took notes, and we supplemented the interviews with audio recordings when possible. We did not transcribe the audio recordings. All the key informants gave verbal permission to participate in the assessment and to be recorded when applicable. All interviews were confidential, with identifying information removed from the interview notes and summaries.

We developed the primary codes for analysis according to the selected evaluation framework. We then read and coded the notes. After the initial coding, we read the notes again to determine what, if any, additional codes were needed. Once coding was completed, we reviewed data and identified themes.

This evaluation and the framework itself are focused on the inner workings of the partnership, not necessarily on contextual issues—in this case, broader issues within Uganda that might affect the partnership's ability to achieve its goals (e.g., participation, inclusion, transparency, accountability). The framework includes external constraints as a factor; however, this evaluation was limited to key informant interviews, meaning that if the evaluation participants did not mention a constraint, it is not represented in the findings.

FINDINGS

The findings reveal that participants' perspectives were often aligned with how involved they were in the CIP development process and their relationship to the task force. The CIP development process involved 3 key types of relationships: (1) relationships within the task force itself, (2) relationships between the task force and the TST, and (3) relationships between the task force and the people who participated in the consultations. The Table summarizes the degree to which each prerequisite and success factor was present in the 3 main relationship types in the CIP development process. Several partnership factors had high presence, one factor had low presence (which was positive since the factor pertained to conflict), and several had mixed representation across the 3 relationships.

Partnership Factors With High Presence Across All 3 Relationships

Factors present to a high degree in all 3 relationships consisted of: (1) partners' willingness to adapt to meet the partnership's needs, (2) existence of partnership champions, (3) ability to meet performance expectations, (4) clear goals, (5) senior management support, and (6) partner compatibility.

Partners' willingness to adapt to meet the partnership's needs. Adaptability across all 3 relationships was characterized by task force members' and consultation participants' willingness to learn from one another about priorities and differences in technical approaches. During task force meetings and the consultations, the majority of the informants noted a culture of learning that allowed partners to have differences of opinions without halting the process. Lively discussions at task force meetings, between the task force and the TST, and during the national and subnational consultations exemplified this culture of learning, allowing for different perspectives to be aired and deliberated (Box 4).

Existence of partnership champions. Some high-level champions took an extraordinary interest in supporting and promoting Uganda's CIP in different ways. For example, advocacy champions were successful in getting the CIP on the agenda in the first place. They came from NGOs and donors—and some champions ended up serving on the task force. After the task force had been established, key informant interviewees stated that there was no consensus that the group should focus on developing a CIP specifically. However, national-level champions serving on the task force convinced the other task force members that a CIP would be the best approach because it would both serve as a national family planning policy and estimate the cost of conducting key activities.

BOX 4. What Did Willingness to Adapt Look Like When Developing the 2014 Uganda Costed Implementation Plan?

1. Task force and technical support team (TST) members disagreed about the necessity of subnational consultations, yet after discussing their respective concerns, the subnational consultations were held.
2. Two international partners on the TST previously had used slightly different methodologies for supporting costed implementation plan (CIP) development. TST members reconciled their approaches and took principles from each to ensure the CIP was developed efficiently while meeting Uganda's needs.
3. During the national and subnational consultations, information flowed freely. Faith-based organizations, in particular, appreciated the opportunity to dispel some myths around natural family planning.
4. During the national and subnational consultations, implementers were given an opportunity to discuss policy barriers hindering certain activities that might be helpful, such as youth-friendly services. In return, policy makers had an opportunity to address the challenges that implementers face and identify ways to address them.

TABLE. Evaluation of Partnership Success Factors and Prerequisites for the 2014 Uganda Costed Implementation Plan by Types of Relationships

	Types of Relationships		
Factors	**Within the CIP Task Force**	**Between CIP Task Force and TST**	**Between CIP Task Force and Consultation Participants**
Factors with high presence across all 3 relationships			
Partners' willingness to adapt to meet partnership's needs	High	High	High
Existence of partnership champions	High	High	High
Ability to meet performance expectations	High	High	High
Clear goals	High	High	High
Senior management support	High	N/A	High
Partner compatibility	High	High	High
Factors with low presence across all 3 relationships			
Conflict (degree, frequency, conflict avoidance, dominating partner)	Low	Low	Low
Factors with mixed presence across the 3 relationships			
Perception of partners' tolerance for sharing power	Low	Medium	Low
Trust	High	Medium	Medium
Confidence in procedures	Low	Medium	Low
Ownership	High	High	Low

Abbreviations: CIP, costed implementation plan; NA, not applicable; TST, technical support team.

Champions among the donors serving on the task force were able to secure the requisite funding for the CIP's development. Task force members stated there were also champions who ensured the technical quality of the CIP—numerous key informants noted the importance of the TST and one of the donors in this area.

Ability to meet performance expectations. Most key informants indicated that they had been able to meet performance expectations regarding CIP *development*. However, all key informants reported having concerns about meeting performance expectations during the CIP's *execution* phase. They recognized that, first and foremost, they needed to secure new funding and that funding mechanisms needed to be established. They concluded that the MOH will need strong long-term leadership capacity to drive the performance and management of the CIP's execution. Additionally, to actually execute the activities in the CIP, partners will need to strengthen capacity, especially the capacity to work across sectors, since the CIP calls for a multisectoral approach. Although informants identified some external constraints, such as the brief enactment of Uganda's Anti-Homosexuality Act in 2014, they expect external constraints to play a larger role during the execution phase. For example, one informant noted that as Uganda gears up for the 2016 elections, it will be increasingly difficult to sustain the attention of politicians and government officials.

Surveyed CIP participants agreed that the MOH needs long-term leadership capacity to drive successful execution of the Uganda CIP.

Clear goals. The clear, overarching goal for the task force and the TST was to develop and launch a CIP. Task force and TST key informants noted that the second step in the CIP process—

developing a roadmap—helped in clarifying more specific goals for the task force and the TST. For example, the task force was responsible for approving the concept note and terms of reference for the CIP development process, whereas the TST was responsible for data collection, analysis, and drafting. The task force members interviewed agreed that the process needed to emphasize stakeholder engagement to ensure the CIP included their priorities.

Senior management support. A high degree of senior management support existed at the national level. Informants from the task force reported that most of the task force participants were the senior management from their respective organizations; these task force members provided strategy, funding, and oversight. The MOH task force participants provided overall guidance and kept MOH leadership aware of CIP progress. Additionally, the MOH assigned people from the reproductive health office to work with the task force and the TST, and 2 staff from the budget and planning department to work with the TST. Informants noted that some senior management from partner organizations played a key role at the inception stage by making sure that the task force was formed and achieving consensus for the CIP. Donor partner task force members were able to secure funds (e.g., funds to hire the national consultant, hold the subnational consultations, and support the launch). Some senior management, in addition to participating in the task force, also met with the TST regularly. Senior management support for consultation participants was largely limited to providing transport funds, yet more participation from senior management was not necessarily expected at this stage.

Partner compatibility. At the task force level, partners brought specific skills to the process, and the task force leveraged their comparative advantages. The task force relied on donor partners for their ability to fund the activity, advocacy partners for their technical expertise and history of working for family planning within Uganda, and others for their work with family planning service providers. Further, the perception of compatibility was high because all partners interviewed believed they had the same core values, such as recognizing the importance of family planning. However, even though there was a perception of compatibility during CIP development, many informants anticipate that this compatibility will be tested and perhaps strained once they begin to execute the CIP, especially as NGO implementers begin to compete for funds.

Partnership Factor With Low Presence Across All 3 Relationships

Conflict. Informants reported little conflict during CIP development but anticipate more during CIP execution. Throughout the CIP process, informants noted moments of tension and disagreement but no significant conflict. Task force and TST members stated that there was some tension while the task force was preparing the launch, as some partners who worked in similar areas jockeyed for greater visibility at the launch. Interviewees reported that the MOH stepped in and made the final decisions about visibility. Informants also reported tension when the task force was not prepared to pay per diems or provide transport funds at some consultations. The MOH worked with one of the donors represented on the task force to secure the needed funds. Conflicts over technical differences were resolved amicably by working through the task force, enabled by the culture of learning described earlier.

Partnership Factors With Mixed Representation Across the 3 Relationships

The partnership factors that had mixed representation across the 3 relationships consisted of: (1) perception of partners' tolerance for sharing power, (2) trust, (3) confidence, and (4) ownership.

Perception of partners' tolerance for sharing power. Some tolerance for sharing power was present between the task force and the TST. Interviewees from the TST agreed that although much responsibility was delegated to the TST, it reported to the task force and ultimately to the MOH. The data indicate that whereas there was a high level of participation by task force members, the TST, and the consultation participants, power remained with the MOH. Interviewees noted that the MOH was open to solutions proposed by partners, including recommendations that came out of the consultations. However, interviewees also perceived that because Uganda's CIP was going to be owned by the MOH, the MOH also would exercise ultimate authority, including making final decisions regarding the technical components present in the CIP.

Moreover, during the CIP process, although the majority of funding came from donors, the task force—and the MOH in particular—guided how the resources were used. The task force took advantage of donor funds available for certain activities—in particular, the subnational consultations, which were held because the task force wanted to ensure that the CIP included community consultations. Ultimately a donor was able to make funds available for them.

Trust. Trust was strong within the task force and between the task force and the TST. Task force informants indicated a high level of trust within the group due to previous working relationships among task force members and the preparatory work they had done together. Their joint experience meant that members had realistic expectations for each organization's capacity and the role of each partner. Furthermore, task force members trusted each other's commitment to the mission.

Trust between the task force and the TST grew over time. At the beginning of the process, the TST members interviewed agreed that they had to run their decisions by the task force. As the TST demonstrated over time that it was fulfilling its responsibilities and making itself available for meetings, the task force trusted that the TST was acting in its best interest and gave the TST some autonomy to make minor adjustments without task force clearance.

Finally, informants that took part in the technical consultations perceived that the MOH was interested in learning from them because they were allowed to comment, and note takers were present for all consultation sessions. However, informants also perceived that trust was waning due to the length of time that had passed between the launch of the CIP process and action. Probing revealed that consultation participants expected the plan to be funded and initiated immediately upon the launch of the CIP because of donor presence at some of the consultations; however, they had not seen any CIP follow-up.

Confidence. Confidence was highest between the task force and the TST, which benefitted from clearly defined terms of reference, but was weak with regard to the consultations. Informants reported that, with few exceptions, minimal institutional agreements or arrangements were established for the CIP development process. For instance, informants from the task force and TST stated that roles and responsibilities between the task force and the TST were clearly defined and had a clear timeline, which helped govern the partnership. Furthermore, there was a discrete contract between one of the donors and the national consultant that allowed the latter to work on the CIP for a specific period of time. Overall, however, informants noted there were no contractual agreements between task force participants or between the task force and consultation participants. Also, no consultation participants received any partnership guidelines. DHOs interviewed suggested that their lack of engagement was a function of how Uganda works; they are expected to fall into line with MOH directives.

Ownership. Although ownership is not part of Brinkerhoff's partnership evaluation framework, as mentioned earlier, it was a dominant theme that emerged from the key informant interviews. Within the task force, members perceived that the MOH took leadership of the CIP process and that other task force members were meant to support the MOH. The members thought this MOH leadership demonstrated that the CIP was important. Additionally, the task force and TST members interviewed recognized that even though the task force was committed to obtaining diverse perspectives, it had ultimate ownership over the decisions about what went into the CIP. The TST's role was to collect and consolidate data from the consultations and present recommendations to the task force. These roles and responsibilities were clear from the start and gave each party the autonomy needed to fulfil its role. Nevertheless, informants noted that to sustain MOH ownership of the CIP's execution, the MOH will need greater support from its senior management. For example, although the MOH had assigned 2 people from its Budget and Planning Office to work with the TST, their involvement was limited due to competing interests from their regular responsibilities.

District health officers lacked a sense of ownership over the CIP.

In contrast, the DHOs interviewed did not perceive that they had ownership of the CIP. Although they were aware of several national and regional consultations, district representation was limited because the task force prioritized other groups—primarily NGOs seen to have technical expertise in key areas, such as youth, contraceptive security, and human resources. The DHO informants also noted that although the TST interviewed them while they were attending a national family planning conference, they were not included as experts in the technical areas of the CIP development. Rather, the DHOs

Willingness to share power might not be a necessary prerequisite for successful partnerships when partners anticipate government ownership of the final product.

interviewed believe that NGOs dominated the process, with little input from the districts, resulting in limited input from DHO implementers and allowing the NGOs to exercise too much influence over the direction of the plan.

DISCUSSION

Using a partnership evaluation framework highlighted several opportunities to strengthen the CIP development process in Uganda, which could have implications for CIP execution. Lessons learned from the process in Uganda could help inform practitioners in other countries developing family planning CIPs and other types of health strategies and policies. The CIP itself, by definition, clearly addresses funding and capacity building, and it includes a timeline for when activities should be executed.[15] However, the development process in Uganda was focused on a short-term strategy that emphasized the CIP launch, rather than a long-term strategy that includes the development of key relationships that could serve as a springboard for the CIP's execution—specifically, relationships between the task force and all stakeholders responsible for executing the CIP in the future.

Advantages of Focusing on the CIP Launch

Because the CIP development process was a short-term strategy, the partnership was able to achieve several partnership prerequisites and success factors to a high degree, including a willingness to adapt to meet partnership needs, the existence of partnership champions, the ability to meet performance expectations, clear goals, senior management support, and partner compatibility. These factors were supported by a strong enabling environment that facilitated the establishment of the task force, a vibrant consultative process and culture of learning, active involvement of task force members, and availability of donor funding. Furthermore, the MOH's ownership of the process demonstrated its commitment to developing the CIP and encouraged partners to participate fully in the entire process. However, clear roles and responsibilities were focused on developing the CIP—not necessarily on CIP execution.

Key informants from all 22 in-depth interviews perceived that power was not shared equally in the partnership, yet none of the task force members or consultation participants interviewed expected the MOH to share power because the end product was a government-owned policy. This sentiment was stated clearly by one informant who said, "The MOH took the lead. It's a document of the MOH; we are supporting the MOH." Thus, the willingness to share power might not be a necessary prerequisite when partners anticipate government ownership of the final product.

Challenges Due to Lack of Long-Term Strategy for Stakeholder Relationships

While there were advantages to keeping the task force focused on the goal of developing the CIP, this short-term focus resulted in challenges regarding the long-term strategy. For example, regarding the existence of champions, some people took extraordinary interest and action in supporting Uganda's CIP in a variety of ways. TST members were technical champions; however, the TST is meant to only support CIP development, so its members should be seen mainly as short-term champions. It is not clear that these champions have sustained their efforts beyond the launch. For instance, the CIP calls for a National Steering and Coordination Committee for Family Planning-CIP,[15] yet as of June 2015, there was no sign that it had been established, and the task force has not met since the CIP's launch in November 2014 (personal communication with Dr. Nichole Zlatunich, Senior Program Advisor, Palladium, September 2015). This absence has heightened concerns about the CIP's execution and whether key stakeholders will support its goals, strategies, and activities.

In fact, many key informants stated that momentum has already been lost, even as the national government and international partners recently completed an analysis of the financial gap for executing the CIP. For example, one informant stated, "Even with the CIP in place, we don't know what the next step is. … The development process was vibrant. We are losing the vibrancy because the MOH is supposed to be driving the CIP, but I don't know what is going on. I've asked, but I don't have an answer." Another informant noted, "If leadership is not taken up by the MOH, then there will be problems in implementation." These concerns suggest that in relying on international support to develop the CIP, the national government was not fully prepared to provide the ongoing in-country leadership needed to execute it.

As to trust, by the time of the CIP launch, trust had been developed between the task force

and the TST. One TST informant noted, "These relationships are very personal, and they're built over time." However, trust between the task force and the DHOs was not as strong. DHOs, who comprise a key group of implementers, felt that they had been excluded from the development process. One DHO informant commented, "It was not clear which role the districts were supposed to be playing." This dynamic seems to be a reflection of the relationship between the national government and the districts in Uganda, where, despite a decentralized system of government, districts receive little autonomy or guidance.[21] This situation could pose challenges to execution, as districts will have a key role to play in executing the CIP. If the task force had also chosen a long-term goal, e.g., improving the use of modern contraceptives, task force membership might have also included DHOs to ensure that implementers' concerns were appropriately addressed in the CIP. The role of DHOs will be especially important when, as is always the case, changes occur in MOH staffing at the national level.

Because there was little deliberate focus on developing relationships that could support and strengthen CIP execution, partnership governing processes in Uganda remain informal or undocumented. Thus, confidence (in standard operating procedures and agreements between institutions) was mixed—no agreements came about for the partnership as a whole, despite the presence of some standard operating procedures, which applied mainly to the consultations but not to the relationships between partners. Additionally, there was no significant conflict during the development process, so it is difficult to assess what impact any future conflict may have on Uganda's efforts to execute the CIP.

Similarly, the partners were able to meet expectations of CIP development, but informants were concerned about their ability to meet the expectations for execution as laid out in the CIP, such as securing funding. Uganda's gap analysis found a total financial gap of about US$113 million across all 6 years of the CIP. Given that the total cost for the CIP is US$235.8 million, less than half of the costs in the CIP are covered by currently planned funding between 2015 and 2020.[16] Addressing conflict and incompatibilities between partners and developing capacity along all levels of Uganda's health system will need to be addressed. Although clear goals exist, they were focused on developing the CIP, not necessarily on how to prepare for execution. Anxieties that informants voiced about funding, decision making, and execution suggest that the factors above will likely become more critical once Uganda begins executing the CIP and relies on partners for discrete tasks laid out in the CIP. An informant stated, "The CIP has just been launched; the issue of reduced funding will be more relevant when implementation takes place." These concerns will require sustained senior management support, including thought leadership, developing partnership guidelines and standard operating procedures, and mobilizing resources.

RECOMMENDATIONS

Use a long-term strategy in conjunction with a short-term strategy to set the stage for successful CIP execution. The ultimate aim for the CIP is that it be executed effectively. Thus, its development process should be framed as the first phase of a long-term strategy or process, which could include a multiyear partnership to facilitate successful execution. Currently, the CIP development process is billed as a consultative process; in Uganda, this process was extensive. However, a consultative process may not be enough to ensure that the CIP is actually executed.

Uganda's CIP calls for all stakeholders to work together to align their programs with the goals outlined in the CIP,[15] implying an ongoing partnership between the Ugandan government and stakeholders. Moreover, there is precedent for including policy and strategy development as part of a partnership. For example, multi-organizational cross-sector social partnerships, which are becoming increasingly common as a way to address environmentally sustainable development, regularly create strategic plans as a first phase of a long-term partnership; once the plan is developed, the partnership continues with execution.[22]

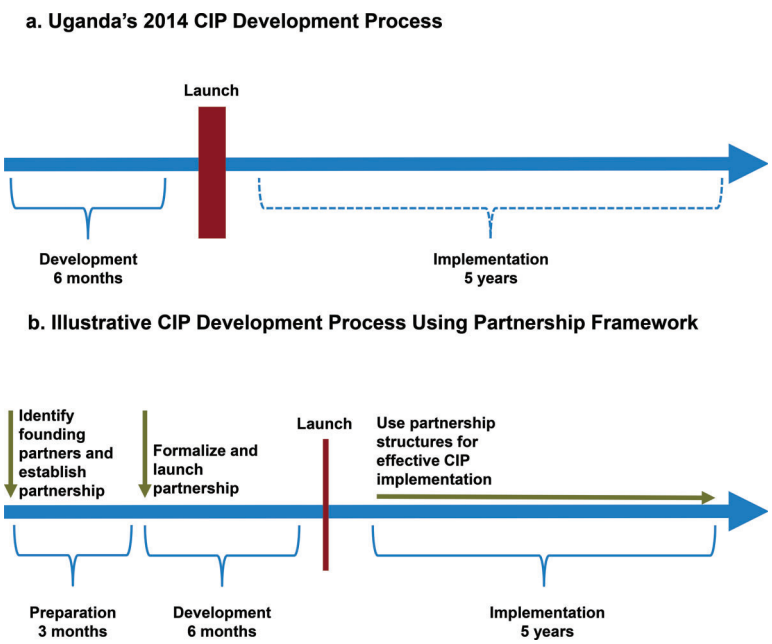
Use a partnership approach to help address key challenges. The top portion of the Figure shows Uganda's actual CIP development process along a basic timeline. The formal process included a 6-month development process, followed by a national launch and then the multiyear execution phase, which Uganda has just started. The bottom portion of the Figure shows an illustrative CIP development process that uses a partnership approach. With such an

approach, the country lead and technical support partners would spend time before the development process officially begins to ask key questions that may not be asked when embarking on a short-term strategy focused on launching a policy document. Key questions when engaging in a long-term partnership might include the following: What is the ultimate goal? Given that goal, who should be the founding partners? What kinds of agreements between institutions are most appropriate for fostering partnership and demonstrating commitment? What kinds of structures and operating procedures should be in place to address execution challenges and disagreements between partners, and encourage dialogue?

At the early stages, partnership guidance may be largely informal,[23] yet the impact of emphasizing a partnership from the beginning can be significant simply because it demonstrates partner commitment to supporting the CIP in the long term and ensures a fully inclusive process. For example, in Uganda, including the CIP execution in the partnership's terms of reference would help ensure that those first partners had included all implementers (DHOs, in Uganda's case). Although it is too late to hold a consultation for the DHOs so they could contribute to the CIP, it is possible to select some DHO personnel to serve on the task force once the task force begins meeting again or to include selected DHO personnel on the Steering Committee, thus ensuring that the viewpoints of the district implementers are heard at the national level and facilitating communication between the national and district governments.[24] While developing the CIP, the task force thus would also focus on formalizing the partnership relationships, establishing standard operating procedures, and identifying long-term roles and responsibilities so partner organizations, including districts, can begin making internal institutional arrangements to ensure they will be able to sustain their involvement.

Partnership thinking could also encourage country actors to begin contemplating early on

FIGURE. Uganda's 2014 CIP Development Process Compared With an Illustrative CIP Development Process Using a Partnership Framework



Abbreviation: CIP, costed implementation plan.

how to build the data collection, costing, and analysis expertise capacities needed to monitor CIP performance and revise it as needed so that the country is not so reliant on international expertise. Once the CIP execution phase begins, partnership structures can be used to help with some of the key execution challenges identified by informants, mainly by providing a clear mechanism through which partners can raise issues and jointly address common challenges.

Create partnership structures that can hold partners accountable to their commitments. Ideally, a partnership approach would result in structures that hold partners accountable to their commitments. A variety of practical steps can be taken to address accountability within partnerships. Having decided on partnership goals, developing a short list of indicators at the execution and organization levels to measure and report on partnership progress can help keep partners aligned and ensure accountability between them.[25] Web-based technologies are providing more workable platforms to make this goal achievable. For example, DHIS2 is a web-based open-source health management information system being used around the world and within organizations for data management and analysis, monitoring and evaluation, and other tasks.[26]

Just as important is creating a "backbone support organization"—a separate organization and staff responsible for supporting CIP development and execution.[25] More than a coordinating committee, it would be tasked with supporting partners in meeting their commitments, providing venues for dialogue, ensuring regular communication, and developing and maintaining a rigorous process for decision making.[25] It would apply pressure to various partners when needed, mediate conflict when it arises, and "frame issues in a way that presents opportunities as well as difficulties."[25]

© Health Policy Project

Ugandan officials celebrate the launch of the costed implementation plan (CIP).

CONCLUSION

Although the CIP development process in Uganda was not executed as a partnership, using a partnership evaluation framework to assess its development shows that many partnership prerequisites and success factors existed and serves as an example for other countries that are developing long-term strategies that contribute to national and international family planning commitments and goals. Using a partnership framework may facilitate the next and most important step after development of the CIP—execution of the CIP. By ensuring that partners feel a long-term commitment, a partnership framework can result in institutions making arrangements for participation that extend beyond the CIP's development and into its execution. Additionally, using the partnership framework can help establish transparent and accountable operating procedures and encourage building national capacity for data collection, analysis, and costing. Overall, including all relevant partners at the task force level can strengthen the partnership—specifically, relationships between DHOs and the MOH. However, a partnership approach, just like any other methodology or tool, is not a "silver bullet"—it would need to be executed with careful consideration and attention to the specific context to ensure it is used effectively.

While this article focuses on only one example of strategy development, many policy and strategy development efforts face some of the same funding, capacity, and sustainability challenges that became evident during the process of developing Uganda's CIP.[27] These challenges are long term and will always be present—the key is being able to address them when they arise during execution. Using a partnership approach can help ensure that supportive relationships exist. A strong partnership will leverage each member organization's comparative advantage to fill gaps in funding and capacity as needed in a manner that strengthens the partnership and its

member organizations and furthers policy and strategy execution.[1,23]

Acknowledgments: The authors would like to express our sincere appreciation to all key informants who made time for this study. This study was made possible by the Health Policy Project, a 5-year cooperative agreement funded by the U.S. Agency for International Development (USAID) under Agreement No. AID-OAA-A-10-00067, beginning September 30, 2010. The authors' views expressed in this publication do not necessarily reflect the views of USAID or of the United States Government.

Competing Interests: None declared.

REFERENCES

1. Brinkerhoff JM. Government–nonprofit partnership: a defining framework. Public Adm Dev. 2002;22(1): 19-30. CrossRef
2. Hood JN, Logsdon JM, Thompson JK. Collaboration for social problem-solving: a process model. Bus Soc. 1993;32(1): 1-17. CrossRef
3. United States Agency for International Development (USAID). USAID's global health strategic framework: better health for development. Washington (DC): USAID; 2012. Available from: https://www.usaid.gov/sites/default/files/documents/1864/gh_framework2012.pdf
4. Zlatunich N. Costed implementation plans for family planning. Washington (DC): Health Policy Project; 2013. Available from: http://www.healthpolicyproject.com/pubs/253_CostedImplementationPlanBrief.pdf
5. Buse K, Walt G. Global public-private partnerships: part I--a new development in health? Bull World Health Organ. 2000;78(4): 549-561. Medline
6. Health Policy Project [Internet]. Washington (DC): Health Policy Project; c2014. Government of Uganda launches the Uganda family planning costed implementation plan, 2015-2020; 2014 Dec [cited 2015 Jul 14]; [about 2 screens]. Available from: http://www.healthpolicyproject.com/index.cfm?ID=UgandaCIP
7. Health Policy Project. Costed implementation plans for family planning: the basics. Washington (DC): Health Policy Project; 2015. Available from: http://www.healthpolicyproject.com/pubs/812_CIPTheBasicsFINAL.pdf
8. Kickbusch I, Quick J. Partnerships for health in the 21st century. World Health Stat Q. 1998;51(1): 68-74. Medline
9. Brinkerhoff JM. Assessing and improving partnership relationships and outcomes: a proposed framework. Eval Program Plann. 2002;25(3): 215-231. CrossRef
10. Brinkerhoff DW, Brinkerhoff JM. Public-private partnerships: perspectives on purposes, publicness, and good governance. Public Adm Dev. 2011;31(1): 2-14. CrossRef
11. Hare L,Hart C,Scribner S,Shepherd C,Pandit T,Bornbusch A, editors. SPARHCS: strategic pathway to reproductive health commodity security. A tool for assessment, planning and implementation. Baltimore (MD): Information and Knowledge for Optimal Health (INFO) Project/Center for Communication Programs, Johns Hopkins Bloomberg School of Public Health; 2004. Available from: http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/SPARHCS_all_eng.pdf
12. Family Planning 2020 [Internet]. Washington (DC): Family Planning 2020; c2015. Costed implementation plans: strengthening investments in family planning; 2015 [cited 2016 Feb 24]; [about 4 screens]. Available from: http://www.familyplanning2020.org/microsite/cip
13. Health Policy Project. Costed implementation plans for family planning: 10-step process for CIP planning, development, and execution. Washington (DC): Health Policy Project; 2015. Available from: http://www.healthpolicyproject.com/pubs/808_CIPstepprocessFINAL.pdf
14. Palen J, El-Sadr W, Phoya A, Imtiaz R, Einterz R, Quain E, et al. PEPFAR, health system strengthening, and promoting sustainability and country ownership. J Acquir Immune Defic Syndr. 2012;60 (Suppl 3): S113-S119. CrossRef. Medline
15. Uganda Ministry of Health (MOH). Uganda family planning costed implementation plan, 2015-2020. Kampala (Uganda): Uganda MOH; 2014. Available from: http://www.healthpolicyproject.com/ns/docs/CIP_Uganda.pdf
16. Zlatunich N, Couture T. 2015 gap analysis for Uganda family planning costed implementation plan, 2015-2020. Washington (DC): Futures Group, Health Policy Project; 2015. Available from: http://www.healthpolicyproject.com/pubs/840_UgandaCIPbrief.pdf
17. Uganda Bureau of Statistics. Uganda demographic and health survey 2011. Kampala (Uganda): Uganda Bureau of Statistics; 2012. Available from: https://dhsprogram.com/pubs/pdf/FR264/FR264.pdf
18. Ministry of Public Health and Sanitation (MOPHS) [Kenya]. National family planning costed implementation plan: 2012-2016. Nairobi (Kenya): MOPHS; 2012. Available from: http://ec2-54-210-230-186.compute-1.amazonaws.com/wp-content/uploads/2014/02/Kenya_National_Family_Planning_Costed_Implementation_Plan_2012-2016.pdf
19. Ministry of Health and Social Welfare (MOHSW) [Tanzania]. National family planning costed implementation program. Dar es Salaam (Tanzania): MOHSW; 2010. Available from: http://www.fhi360.org/sites/default/files/media/documents/national-fp-costed-implementation-plan-tanzania-main-text.pdf
20. Republic of Zambia. Family planning services: integrated family planning scale-up plan 2013-2020. Lusaka (Zambia): Ministry of Community Development Mother and Child Health; 2013. Available from: http://www.healthpolicyproject.com/ns/docs/CIP_Zambia.pdf
21. Uganda Governance, Accountability, Participation and Performance Program (GAPP). Governance, accountability, participation and performance (GAPP) program baseline report. Kampala (Uganda): RTI International, Uganda GAPP; 2013.
22. Clarke A, Fuller M. Collaborative strategic management: strategy formulation and implementation by multi-organizational cross-sector social partnerships. J Bus Ethics. 2010;94 (Suppl 1): 85-101. CrossRef
23. Brinkerhoff J. Partnership for international development: rhetoric or results? Boulder: Lynne Rienner Publishers; 2002.
24. Williamson RT, Duvall S, Goldsmith AA, Hardee K, Mbuya-Brown R. The effects of decentralization on family planning: a framework for analysis. Washington (DC): Futures Group, Health Policy Project; 2014. Available from: http://www.healthpolicyproject.com/pubs/445_FPDecentralizationFINAL.pdf
25. Kania J, Kramer M. Collective impact. Stanford Soc Innov Rev. 2011;9(1): 36-41. Available from: http://ssir.org/articles/entry/collective_impact
26. DHIS2 [Internet]. Oslo (Norway): DHIS2; [cited 2016 Feb 24]. Available from: https://www.dhis2.org
27. Bhuyan A, Jorgensen A, Sharma S. Taking the pulse of policy. Washington (DC): Futures Group, Health Policy Initiative, Task Order 1; 2010. Available from: http://pdf.usaid.gov/pdf_docs/Pnadx728.pdf

Peer Reviewed

Received: 2015 Sep 29; **Accepted:** 2016 Mar 22

Cite this article as: Lipsky AB, Gribble JN, Cahaelen L, Sharma S. Partnerships for policy development: a case study from Uganda's costed implementation plan for family planning. Glob Health Sci Pact. 2016;4(2):284–299. http://dx.doi.org/10.9745/GHSP-D-15-00300

© Lipsky et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-15-00300

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

FIELD ACTION REPORT

Family Planning Counseling in Your Pocket: A Mobile Job Aid for Community Health Workers in Tanzania

Smisha Agarwal,[a,b] Christine Lasway,[a] Kelly L'Engle,[a,c] Rick Homan,[a] Erica Layer,[d] Steve Ollis,[d] Rebecca Braun,[a] Lucy Silas,[d] Anna Mwakibete,[e] Mustafa Kudrati[e]

Using mobile job aids can help CHWs deliver integrated counseling on family planning and HIV/STI screening by following a step-by-step service delivery algorithm. Lessons learned during the pilot led to the development of additional features during scale-up to exploit the other major advantages that mHealth offers including:

- **Better supervision of health workers and accountability for their performance**
- **Improved communication between supervisors and workers**
- **Access to real-time data and reports to support quality improvement**

Abstract

To address low contraceptive use in Tanzania, a pilot intervention using a mobile job aid was developed to guide community health workers (CHWs) to deliver integrated counseling on family planning, HIV, and other sexually transmitted infections (STIs). In this article, we describe the process of developing the family planning algorithms and implementation of the mobile job aid, discuss how the job aid supported collection of real-time data for decision making, and present the cost of the overall system based on an evaluation of the pilot. The family planning algorithm was developed, beginning in June 2011, in partnership with the Tanzania Ministry of Health and Social Welfare based on a combination of evidence-based tools such as the Balanced Counseling Strategy Plus Toolkit. The pilot intervention and study was implemented with 25 CHWs in 3 wards in Ilala district in Dar es Salaam between January 2013 and July 2013. A total of 710 family planning users (455 continuing users and 255 new users) were registered and counseled using the mobile job aid over the 6-month intervention period. All users were screened for current pregnancy, questioned on partner support for contraceptive use, counseled on a range of contraceptives, and screened for HIV/STI risk. Most new and continuing family planning users chose pills and male condoms (59% and 73%, respectively). Pills and condoms were provided by the CHW at the community level. Referrals were made to the health facility for pregnancy confirmation, injectable contraceptives, long-acting reversible contraceptives and HIV/STI testing. Follow-up visits with clients were planned to confirm completion of the health facility referral. The financial cost of implementing this intervention with 25 CHWs and 3 supervisors are estimated to be US$26,000 for the first year. For subsequent years, the financial costs are estimated to be 73% lower at $7,100. Challenges such as limited client follow-up by CHWs and use of data by supervisors identified during the pilot are currently being addressed during the scale-up phase by developing accountability and incentive mechanisms for CHWs and dashboards for data access and use.

BACKGROUND

Family planning use protects the health of women and their children by spacing births, preventing unwanted or high-risk pregnancies, reducing the need for abortions, and preventing mother-to-child transmission of HIV/AIDS, ultimately leading to a reduction in maternal and child deaths.[1,2] One critical determinant of adoption and continuation of contraceptives is overall client satisfaction with family planning services.[3] Therefore, provision of good-quality contraceptive services is vital to reducing unmet need for family planning. This includes broadening method choice and ensuring that any health concerns related to family planning are adequately addressed. Additionally, community-based

[a] FHI 360, Durham, NC, USA.
[b] University of North Carolina, Gillings School of Global Public Health, Chapel Hill, NC, USA.
[c] University of San Francisco, School of Nursing and Health Professions, San Francisco, CA, USA.
[d] D-tree International, Dar es Salaam, Tanzania.
[e] Pathfinder International, Dar es Salaam, Tanzania.
Correspondence to Smisha Agarwal (smishaa@gmail.com).

family planning programs can bring quality contraceptive information and products to families in their communities, rather than requiring them to visit a health facility, thereby facilitating access to family planning services.[4] Furthermore, evidence suggests that integration of family planning services with maternal health care and HIV/AIDS services is feasible and can result in overall improvements in contraceptive use as well as in antiretroviral therapy initiation in pregnancy, HIV testing, and quality of services.[5]

In Tanzania, current contraceptive use is low; 34.4% of women of reproductive age use any form of contraception, and only 27.4% use modern contraceptive methods.[6] Further, over a quarter of women report unmet need for family planning.[6] A review of family planning use in Tanzania identified widespread community misconceptions about contraceptives and poor confidence in the competence of community service providers as key factors limiting adoption.[2]

To address these service delivery gaps, FHI 360, Pathfinder International, and D-tree International (referred to as the "partnership"), with funding from the United States Agency for International Development (USAID), collaborated to develop a mobile phone job aid to assist community health workers (CHWs) in Tanzania with delivering family planning services. The impetus for this effort was a growing body of research showing that use of mobile phones to deliver health services by CHWs is feasible and well-received by the community and the health worker, and it can potentially result in improvements in adherence to service delivery protocols.[7–10] The family planning mobile job aid program was planned to integrate with Pathfinder International's successful community home-based care program,[11] which was already using mobile job aids for case management of people living with HIV.

The partnership began initial development of the mobile job aid in June 2011. At that time, CHWs were using paper-based job aids and paper reporting forms, which posed significant challenges for service provision, data management, and reporting. The paper flip charts used for counseling women about contraceptive methods did not provide step-by-step guidance for the CHWs, and they were often cumbersome to carry. CHWs were required to record client data using multiple paper forms and to physically submit these to the health facility nurse, who would then physically submit the information to the district reproductive health coordinator. This led to considerable lag time between the point of collecting data from the client and reporting it at the district level, and potential for data loss. The mobile job aid was developed to address these challenges.

The purpose of this article is to describe our process for developing the family planning mobile job aid and to present data from a study evaluating the effectiveness of the pilot program in supporting collection of real-time data for decision making. Additionally, we present the cost of developing this system to facilitate an understanding of potential cost savings and efficiencies that might be possible through scale-up of such a system.

COMPONENTS OF THE MOBILE JOB AID

The mobile job aid provides 3 main functions:

- **Decision-support tool:** An algorithm guides CHWs to effectively counsel, screen, and provide health facility referrals for pregnancy, sexually transmitted infections (STIs) including HIV, and family planning services.
- **Data collection and management tool:** Electronic forms help the CHW record routine data on services provided to the client, use of contraceptives by the client, and referrals to other health services. Information about each client is recorded at the point of care and then either sent through a general packet radio service (GPRS) linkage to a central database hosted at the CommcareHQ server (the platform used to develop the mobile job aid) or stored in the phone to be uploaded to the server when the CHW returns to the clinic. These data can be immediately accessed by the district-level health staff.
- **Short message service (SMS)-based management tool:** An SMS feature supports both the supervisors and the CHWs by issuing reports and reminders about the performance of the CHWs in the field. For example, the phone is designed to send SMS-based weekly status reports to CHW supervisors including the number of clients visited, number of new family planning users by contraceptive method, and number of referrals and completed follow-up visits made by CHWs. It is also designed to send SMS-

Poor community confidence in the competence of CHWs is one key factor limiting contraceptive adoption in Tanzania.

A mobile job aid was developed to assist CHWs in Tanzania with providing integrated family planning and HIV counseling and services.

Mobile phone applications may help CHWs adhere to service delivery protocols.

based reminders to CHWs for followup visits to specific clients.

PROCESS OF DEVELOPING THE MOBILE JOB AID

Stakeholder Engagement

We developed the mobile job aid and implemented the study to evaluate its effectiveness in close collaboration with the Tanzania Ministry of Health and Social Welfare (MOHSW) at the national and district levels. For the evaluation of the tool, the team worked with the MOHSW to select the study sites and CHWs. Staff from the MOHSW were among the trainers who introduced the job aid to the CHWs and supervised the CHWs on a daily basis. Monthly meetings were held with CHWs and supervisors to assess progress and understand challenges. Finally, data were first shared with the MOHSW at all levels for their recommendation for next steps in implementation.

Development of the Algorithm

The family planning mobile job aid was built using CommCare. CommCare uses JavaRosa, an open-source mobile and web platform designed for data collection. It was deployed on Nokia X2-02 phones, provided by the project to CHWs at the time of training. The algorithm for the mobile job aid is composed of 5 forms that link with each other depending on the choices the clients make:

- Registration form
- Service form for registered clients who are new to family planning
- Service form for registered clients who are continuing family planning users
- Follow-up forms for all clients
- Referral completion form

D-tree International programmed the initial algorithm on the CommCare platform and conducted various tests with the team to ensure that the phone application matched the paper-based version of the algorithm.

The algorithm is a combination of evidence-based tools, including the Balanced Counseling Strategy Plus Toolkit from the Population Council,[12] the Decision-Making Tool for Family Planning Clients and Providers from the World Health Organization,[13] and the pregnancy checklist for family planning clients from FHI 360.[14] The partnership, together with the MOHSW, reviewed potential tools and agreed on criteria for tool selection. These criteria included the potential ease of use by CHWs, alignment with national family planning service protocols, and practicability as a mobile job aid.

Figure 1 depicts the overall algorithm that guides the CHW through a series of steps: screening the client for pregnancy, counseling for a contraceptive method of choice and male condoms, providing contraceptives or facility referral for contraceptives that cannot be given at the community level, and conducting STI/HIV screening. If the client is already using contraceptives, the algorithm skips to the follow-up form in Figure 2. Finally, for clients that have been referred to the health facility, the CHW conducts a follow-up visit to assess whether the client completed the referral and requires any further services (Figure 3).

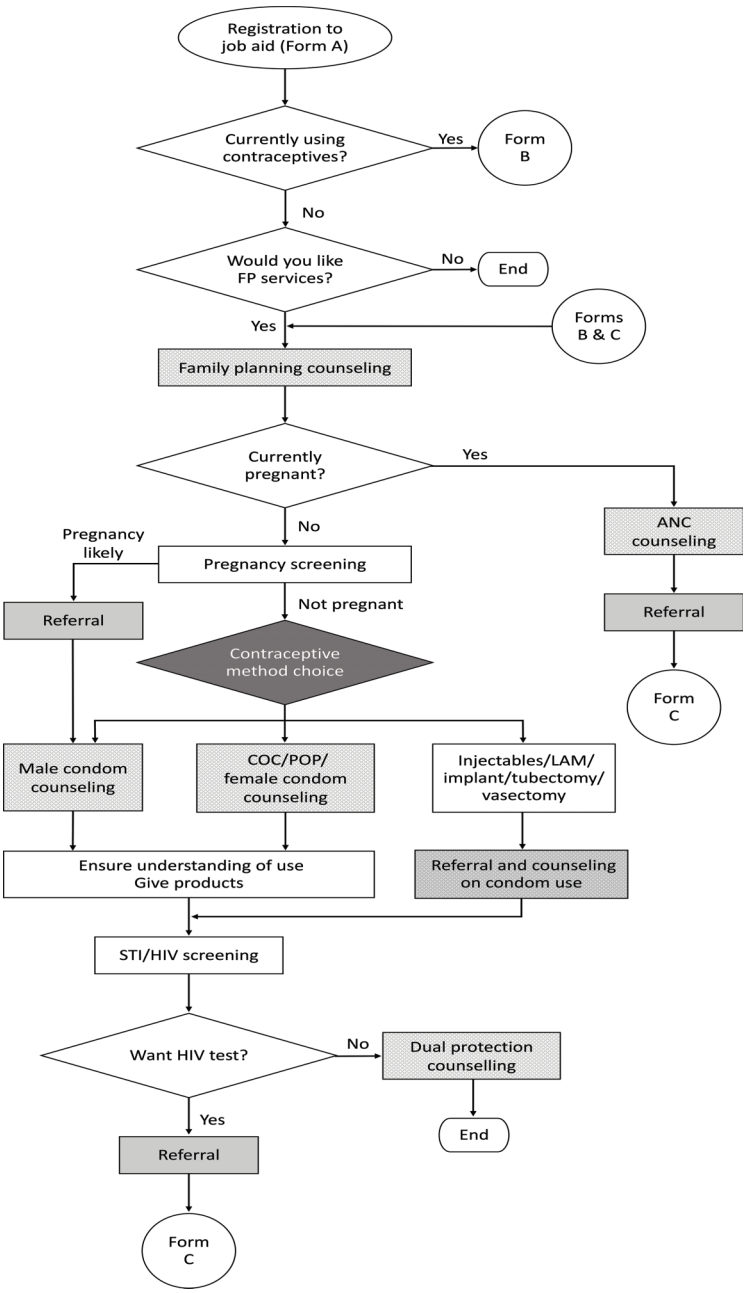
Usability Testing and Refinement

The team worked with health facility supervisors to identify 6 highly motivated and well-performing CHWs from the Kinondoni municipal district in Dar es Salaam, Tanzania, to test the usability and functionality of the initial version of the tool for a period of 6 months, starting July 2012. This refinement period explored operational issues such as client reactions and the functionality of the tool. Through an iterative process involving use of the job aids by the CHWs, feedback, and field observations, the application was modified to better fit the needs of CHWs in the field.

MOBILE JOB AID INTRODUCTION AND TRAINING

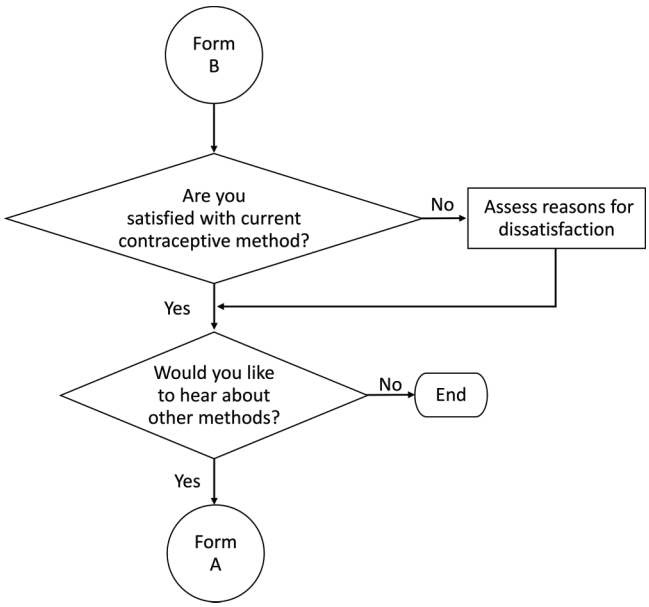
The district health management teams were introduced to the mobile job aid in an orientation session with the assistance of the MOHSW. All CHWs included in the pilot study received Nokia X2-02 mobile phones for the purpose of training and use during the study. CHWs and supervisors were trained over a period of 10 days, comprising 5 days of classroom training and 5 days of practical training in the field. Classroom training consisted of a family planning refresher training for 2 days, followed by 3 days of training using the mobile job aid. After completion of the training, the CHWs and supervisors started using the job aids at their sites. Support on the use of the tools was provided on a regular basis for 6 months, between January 2013 and July 2013.

FIGURE 1. Family Planning Counseling Algorithm



Abbreviations: ANC, antenatal care; COC, combined oral contraceptive; FP, family planning; LAM, lactational amenorrhea method; POP, progestin-only pill; STI, sexually transmitted infection.

FIGURE 2. Follow-Up Algorithm to Assess Satisfaction With Current Contraceptive Choice



PROCESS EVALUATION OF THE MOBILE JOB AID

The results of the feasibility study, which included baseline and follow-up surveys and in-depth interviews with clients, CHWs, and facility supervisors, are presented in a separate manuscript.[15] Here, we focus on data collected as part of routine electronic data collection during the process of service delivery.

Site Selection

The use of the mobile job aid was implemented in 3 health facilities in 3 different wards of Ilala district in the Dar es Salaam region. The team and MOHSW purposively selected the implementation sites to represent sites where Pathfinder had established community-based care services for people living with HIV. Each health facility had 1 CHW supervisor and 5 to 13 CHWs. A total of 25 CHWs participated in the pilot study. This cohort of CHWs can be considered representative of the CHWs in Ilala district.

Data Sources

Throughout the pilot period, the CHWs used the mobile job aids not only to provide counseling but also to enter data on the choices the clients made and the counseling messages that were provided to them. This system captured data on the number of new clients, average number of CHW visits per client, type of service sought, number of referrals completed, and other critical variables defined by the algorithm. In addition to this monitoring system, data on the incremental costs associated with the intervention were collected by retrospectively reviewing project documents.

FINDINGS

Background Characteristics of Family Planning Clients

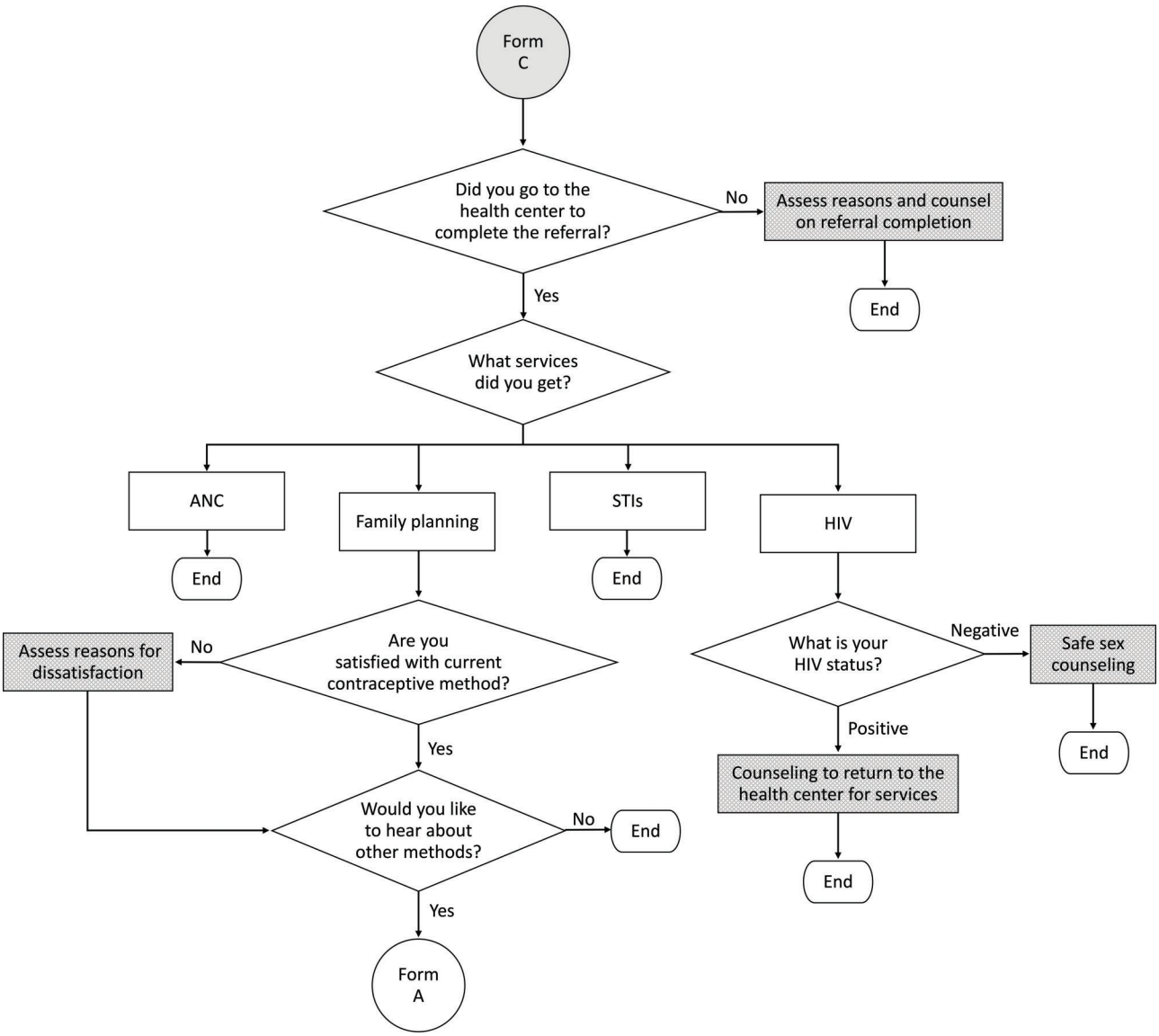
Over the 6-month implementation period, 710 clients were registered and received family planning counseling using the mobile job aid: 455 clients (64%) who were already using some form of contraception (continuing users) and 255 (36%) who were not using any contraceptives (new users). Over a quarter of all users were male, and over 90% were married (Table 1). The majority (over 70%) of users were between ages 20 and 39 years.

Contraceptive Choices

Continuing Users

The 455 clients who were already using contraception received a total of 1,044 follow-up visits

FIGURE 3. Referral Completion Algorithm for Clients Who Received a Health Facility Referral



Abbreviations: ANC, antenatal care; STIs, sexually transmitted infections.

from the CHWs over a period of 6 months. At the time of the first visit by the CHW, nearly 35% of the continuing users were using condoms and 38% were using oral contraceptive pills (Table 1).

New Users

The 255 new clients received a total of 269 follow-up visits from the CHWs. During the visits, new clients were asked whether they would like family planning information. After receiving client consent to

TABLE 1. Demographic Characteristics, Contraceptive Choices, and HIV Testing of Continuing and New Family Planning Clients (N = 710)

	Continuing Users (n = 455) No. (%)	New Users (n = 255) No. (%)
Marital status		
Married	435 (95.6)	233 (91.4)
Not married	20 (4.4)	22 (8.6)
Sex		
Male	124 (27.3)	71 (27.8)
Female	331 (72.7)	184 (72.2)
Age, years		
15–19	37 (8.1)	26 (10.2)
20–29	169 (37.1)	106 (41.6)
30–39	182 (40.0)	79 (31.0)
≥40	67 (14.7)	44 (17.3)
Type of contraceptive method used[a]		
Male condoms	158 (34.7)	88 (34.5)
Pills (COCs or POPs)	173 (38.0)	61 (23.9)
Medium- or long-acting methods (DMPA injectables, implants, IUD)	57 (12.5)	54 (21.2)
Female condoms	60 (13.2)	17 (6.7)
Other (LAM, SDM, tubal ligation)	7 (1.5)	6 (2.4)
No method chosen	NA	29 (11.3)
Recently tested for HIV		
Yes	331 (72.8)	149 (58.4)
No	124 (27.2)	106 (41.6)

Abbreviations: COCs, combined oral contraceptives; DMPA, depot medroxyprogesterone acetate; IUD, intrauterine device; LAM, lactational amenorrhea method; POPs, progestin-only pills; SDM, Standard Days Method.
[a] For continuing users, type of method used at the time of the first visit by the CHW; for new users, the type of method selected after counseling by the CHW.

receive family planning information (n = 244), CHWs screened the clients for whether they were currently pregnant. The majority (n = 232) of clients stated they were planning to have a baby in the near future, and so these clients were educated on short-acting contraceptive methods. The remaining 12 clients were educated on long-acting contraceptives and permanent methods.

Clients were also asked whether they had support from their partner to use contraception. Of the 244 clients, 20 clients stated they did not have partner support. Based on their response, all clients were additionally counseled on methods that do or do not require cooperation by the partner. After this initial counseling, clients were asked whether they would like to choose a contraceptive method. Once clients chose a method, CHWs provided further counseling about their chosen method, including indications, contraindications, and possible side effects, if applicable. Even after making a choice,

clients were asked if they would like to know about other methods, so information and counseling on all contraceptive methods was available to them.

The large majority of new family planning clients proceeded with making a contraceptive choice as shown in Table 1. Similar to continuing users, male condoms (35%) and pills (24%) were the most preferred contraceptive choice of new users, followed by medium-acting (injectables) or long-acting reversible contraceptives (LARCs) (21% combined). For clients who chose pills or condoms (male or female), the CHW provided the client with that method. Clients choosing injectables or LARCs were referred to the health facility.

HIV Counseling and Testing

All 710 clients received education, risk assessment, and pretest counseling for HIV and other STIs. The majority of both the continuing users (73%) and the new users (58%) said they had been recently tested for HIV. Those who said they had not been recently tested were assessed for HIV risk and counseled to get tested for HIV. Among those who had been recently tested and were willing to share their test results, 57% of the 276 continuing users and 54% of the 138 new users, tested HIV positive. The high percentage of individuals with HIV in the study is due to the fact that the mobile job aid intervention was piloted as part of Pathfinder's community home-based care for people living with HIV/AIDS program. The clients were asked whether they were receiving HIV-related service at a health facility or at home, and the data were recorded. If clients were not receiving any care, they were registered for home-based HIV care services. If needed, clients were referred to the health facility for further testing services.

Most continuing and new family planning clients chose to use male condoms or pills.

Referral Services

Clients were referred to the health facility for services such as HIV/STI testing and contraceptive methods that could not be directly provided by the CHW at the community level. For example, 21% of new family planning users and 28% of continuing family planning users were referred for HIV testing/STI services. Referral completion rates and satisfaction with services received at the referral center were measured as reported by the client and entered into the mobile job aid. If the CHW did not follow-up with the client about the referral, these data were not collected. Of the clients who received referrals *and* follow-up by the CHWs within 6 months (n = 77), nearly 50% had completed their referrals.

Only about half of the CHW clients who received referrals to the health facility actually completed their referrals.

Cost Assessment

Table 2 presents the costs associated with implementing the family planning mobile job aid with

TABLE 2. Total Financial Costs Associated With Implementing the Family Planning Mobile Job Aid in 3 Pilot Facilities

Phase	Total Cost (US$)
Deployment	
Sourcing equipment	1,875
Adaptation of the paper-based job aids to electronic format	13,500
Training of 25 CHWs and 3 supervisors	3,522
Operational (annual costs)	
Service provision, reporting, and supervision	1,014
IT support and troubleshooting	3,600
SMS & Internet access fees, replacement of handsets	2,494
Total resource requirement for first year (deployment and operational phases)	**26,005**
Total resource requirement for subsequent years (operational phase only)	**7,107**

Abbreviations: CHWs, community health workers; SMS, short message service.

25 CHWs and 3 supervisors across the 3 pilot health facilities. About 850 unique clients were served during the period of the pilot intervention. Costs for the deployment phase consisted of equipment purchases (e.g., mobile phones), adaptation of the paper-based job-aids to an electronic format, and training of the CHWs and supervisors on how to use the devices. The operational phase is focused on the monthly resources (primarily labor) and other supplies (primarily SMS fees and Internet access) required to keep the system operational. Costs of intervention design, stakeholder engagement, and content development were not included in this analysis. The results presented here reflect the actual financial costs incurred to support the deployment and operation of the mobile job aid intervention.

The total value of resources required to implement the mobile job aid is estimated to be US$26,005 in the first year (Table 2). Over 50% of the financial costs in the first year correspond to the cost of adapting the existing paper-based job aids and reporting forms to an electronic version compatible with the handheld device. The training of CHWs and supervisors is estimated to require 14% of the resources in the first year. Financial costs in subsequent years ($7,107) are estimated to be 73% lower than in the initial year ($26,005), and approximately 51% of these costs are for IT support and field troubleshooting. It should be noted that these costs reflect program costs under trial settings. Larger-scale implementation of a similar project would require additional management and infrastructure support, which would add to the overall costs.

© Ogango K'omolo/FHI 360

A community health worker in Kipawa, Dar es Salaam, uses a mobile phone job aid to provide integrated family planning and HIV/STI counseling to a client.

DISCUSSION

Our experience from this pilot study suggests that the use of a mobile-based integrated counseling algorithm is feasible and can potentially result in improvements in community-based family planning service delivery. As part of this process, we were able to bring together diverse stakeholders to identify best practices and to develop a systematic algorithm that combined counseling for reproductive health, family planning, and STIs/HIV. The usability testing and refinement phase ensured that the job aid was well-received by the CHWs and the clients.

The mobile tool guides CHWs through the algorithm step-by-step and prevents skipping over critical questions and information during counseling. Additionally, it allows for immediate collection and digitization of the data, and it facilitates easier data use across different levels of the health system. Preliminary research on the use of such tools by CHWs suggests that real-time data collection can influence CHW motivation and improve accountability.[16] As depicted in this paper, data from routine service delivery can be used to understand who the clients are, their contraceptive preferences, and the services for which they are being counseled and referred. The use of routine monitoring data can also help identify areas where the program can be improved.

Lessons Learned

While the counseling algorithm can support the systematic delivery of information about a wide range of contraceptives, actual client use of contraceptives is still influenced by the contraceptive knowledge of the CHWs, the client's readiness to start using contraception, and the availability of contraceptives methods. Even though LARCs and injectables are more prevalent in the current method mix in Tanzania than previously,[17] most people in our study received either male condoms or oral contraceptive pills. It is possible that CHWs counsel more extensively on methods such as pills and condoms because they are more familiar with these methods. It is also plausible that clients chose pills and condoms over other methods because they were immediately available from the CHW and did not

require a health facility visit. In contrast, to obtain injectables, LARCs, or permanent methods, clients had to go to the health facility. These data emphasize the need to continue training CHWs on balanced and comprehensive counseling techniques. The mobile job aid should serve as an adjunct—not a substitute—for continued investments in human resources and health systems. Additionally, systems to encourage CHWs to follow-up on clients more systematically are critical. Our study suggested that less than 50% of the clients who were referred to the health facility were followed-up by the CHWs to confirm referral completion.

Integrated delivery of family planning with other health services is identified as a key strategic goal of the Tanzania MOHSW.[17] In practice, integration requires the development of comprehensive packages of multiple health services, making the job aid more complex. For purposes of implementation by CHWs, it is critical to balance the content of such a package to what is critical to service delivery to avoid making it time consuming and unwieldly. As such, efforts are ongoing to further refine the family planning algorithm presented here.

While the collection of routine service provision data makes data available to districts, it does not mean that the data are actually used at the district level. The SMS component of our intervention was intended to support the district staff in decision making. However, no additional accountability mechanisms were developed to facilitate or monitor data use at that level. Additionally, our study generated a considerable amount of routine data for each client who was registered to the system. However, use of these data for meaningful analytics was challenging due to multiple skip patterns in the algorithm and some variability in storing and recording the data. A priori understanding of what data are critical to decision making and use of data dashboards can help to alleviate some of these challenges.

Finally, data on completion of referrals by clients were self-reported and recorded only if the CHW returned to the client to follow-up. The CHWs have mobile connectivity but these data are not linked to the health facilities. This limits the assessment of referral completion. Strengthening facility-level health information systems (HIS) and integration of the job aid with the HIS can yield more accurate data on referral completion and other critical outcomes when the client actually visits the health facility.

The Way Forward and Scale-Up

Since this initial pilot project was launched, Pathfinder and D-tree have scaled up this work with 250 CHWs in northwest Tanzania. Several challenges identified during the pilot stage, such as poor follow-up of clients by CHWs and limited use of data at all levels of the health system, are being addressed. Modifications have improved systems for CHW motivation, supervision, and access to data for decision making. To motivate CHWs and hold them accountable for completing their work, a pay-for-performance system was implemented that provides additional mobile phone minutes to CHW stipends for meeting targets for registering a minimum number of new clients each month and completing 75% or more of scheduled follow-up visits. A custom supervisory application was developed for supervisors at health facilities that allows them to review CHW performance in real time, communicate about family planning outreach services and method stock, and view aggregate government reports. In contrast to the SMS management tool developed for the original job aid, which provided static weekly messages, this mobile app provided real-time data to supervisors and allowed them to connect with CHWs in the field in real time, strengthening the relationship and providing both CHWs and supervisors with more dynamic access to information and communication. In addition, CHWs and supervisors are part of a closed user group, which allows users to make free phone calls to other members of the group. This has improved communication and supervision among CHWs, who are often located in remote villages far from the nearest health facility. A "citizen report card" was also added to the mobile application, which assesses client experiences at health facilities after receiving a referral. Data are used to discuss the quality of care at facilities and to engage in constructive dialogue with individuals throughout the health system to develop strategies for quality improvement. Finally, program dashboards have been developed that provide interactive charts and tables summarizing key data from the programmatic level down to patient-level data. This supports program managers and supervisors at the district and regional levels to view data and make programmatic decisions in real time.

The mobile phone initiative has been scaled up from 25 CHWs to 250 CHWs in northwest Tanzania.

Mobile phone applications should serve as an adjunct—not a substitute—for continued investments in human resources and health systems.

CONCLUSION

The use of mobile job aids for delivery of integrated family planning services holds great

promise. However, in order to scale effective programs, a critical appraisal and open discussion of the challenges and solutions is necessary.

Acknowledgments: We thank the Tanzania Ministry of Health and Social Welfare, NIMR, and CHWs and supervisors based in Ilala and Kinondoni Districts, Dar es Salaam, who participated in this study. Effort by author SA was supported by the FHI360-UNC Research Fellowship administered by the Gillings Global Gateway. This study was funded by USAID through the Program Research for Strengthening Services (PROGRESS) project cooperative agreement GPO-A-00-08-00001-00, and the Advanced FP project (AIDOAA-A-12-00047). The funding source played no role in the study design; in the data collection, analysis and interpretation; in the writing of the report; and in the decision to submit the article for publication.

Competing Interests: None declared.

REFERENCES

1. Cleland J, Bernstein S, Ezeh A, Faundes A, Glasier A, Innis J. Family planning: the unfinished agenda. Lancet. 2006; 368(9549):1810–1827. CrossRef. Medline
2. Deutsche Stiftung Weltbevoelkerung (DSW). Family planning in Tanzania: a review of national and district policies and budgets. Arusha (Tanzania): DSW; 2014. Available from: http://www.dsw.org/uploads/tx_aedswpublication/family-planning-tanzania_update.pdf
3. Hutchinson PL, Do M, Agha S. Measuring client satisfaction and the quality of family planning services: a comparative analysis of public and private health facilities in Tanzania, Kenya and Ghana. BMC Health Serv Res. 2011;11(1):203. CrossRef. Medline
4. Foreit J, Raifman S. Increasing access to family planning (FP) and reproductive health (RH) services through task-sharing between community health workers (CHWs) and community mid-level professionals in large-scale public-sector programs: a literature review to help guide case studies. New York: Population Council; 2011. Available from: http://www.popcouncil.org/uploads/pdfs/2011RH_CHWLitRev.pdf
5. Lindegren ML, Kennedy CE, Bain-Brickley D, Azman H, Creanga AA, Butler LM. et al. Integration of HIV/AIDS services with maternal, neonatal and child health, nutrition, and family planning services. Cochrane Database Syst Rev. 2012;9:CD010119. CrossRef. Medline
6. National Bureau of Statistics (NBS) [Tanzania]; ICF Macro. Tanzania demographic and health survey 2010. Dar es Salaam (Tanzania): NBS; 2011. Co-published by ICF Macro. Available from: http://dhsprogram.com/pubs/pdf/FR243/FR243%5B24June2011%5D.pdf
7. Zurovac D, Larson BA, Sudoi RK, Snow RW. Costs and cost-effectiveness of a mobile phone text-message reminder programmes to improve health workers' adherence to malaria guidelines in Kenya. PLoS One. 2012;7(12):e52045. CrossRef. Medline
8. Barrington J, Wereko-Brobby O, Ward P, Mwafongo W, Kungulwe S. SMS for Life: a pilot project to improve anti-malarial drug supply management in rural Tanzania using standard technology. Malar J. 2010;9(1):298. CrossRef. Medline
9. Lund S, Hemed M, Nielsen BB, Said A, Said K, Makungu MH. et al. Mobile phones as a health communication tool to improve skilled attendance at delivery in Zanzibar: a cluster-randomised controlled trial. BJOG. 2012;119(10):1256–1264. CrossRef. Medline
10. Jennings L, Ong'ech J, Simiyu R, Sirengo M, Kassaye S. Exploring the use of mobile phone technology for the enhancement of the prevention of mother-to-child transmission of HIV program in Nyanza, Kenya: a qualitative study. BMC Public Health. 2013;13(1):1131. CrossRef. Medline
11. Pathfinder International. Reproductive health and family planning in Tanzania: the Pathfinder International experience. Watertown (MA): Pathfinder International; 2008. Available from: http://www.pathfinder.org/publications-tools/pdfs/Reproductive-Health-and-Family-Planning-in-Tanzania-The-Pathfinder-International-Experience.pdf
12. Population Council. The balanced counseling strategy plus: a toolkit for family planning service providers working in high HIV/STI prevalence settings. New York: Population Council; 2012. Available from: http://www.popcouncil.org/research/the-balanced-counseling-strategy-plus-a-toolkit-for-family-planning-service
13. World Health Organization (WHO); Johns Hopkins Bloomberg School of Public Health, Center for Communication Programs (CCP). Decision-making tool for family planning clients and providers. Geneva: WHO; 2005. Co-published by CCP. Available from: http://www.who.int/reproductivehealth/publications/family_planning/9241593229/en/
14. FHI 360. How to be reasonably sure a client is not pregnant. Durham (NC): FHI 360; 2015. Available from: http://www.fhi360.org/resource/how-be-reasonably-sure-client-not-pregnant-checklists
15. Braun R, Lasway C, Agarwal S, L'Engle K, Layer E, Silas L. et al. An evaluation of a family planning mobile job aid for community health workers in Tanzania. Contraception. 2016 Mar 30. pii : S0010-7824(15):30019–6. CrossRef. Medline
16. Agarwal S, Perry H, Long LA, Labrique AB. Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: systematic review. Trop Med Int Health. 2015;20(8):1003–1014. CrossRef. Medline
17. United Republic of Tanzania, Ministry of Health and Social Welfare (MOHSF). The national family planning costed implementation program 2010-2015. Dar es Salaam (Tanzania): MOHSF; 2013. Available from: http://www.rchs.go.tz/index.php/en/resources/family-planning/strategy-policy-8/131-national-family-planning-costed-implementation-program-2010-2015-updated-2013/file.html

Peer Reviewed

Received: 2015 Dec 16; **Accepted:** 2016 Mar 15

Cite this article as: Agarwal S, Lasway C, L'Engle K, Homan R, Layer E, Ollis S, et al. Family planning counseling in your pocket: a mobile job aid for community health workers in Tanzania. Glob Health Sci Pract. 2016;4(2):300–310. http://dx.doi.org/10.9745/GHSP-D-15-00393

© Agarwal et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-15-00393.

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

FIELD ACTION REPORT

Enhancing the Supervision of Community Health Workers With WhatsApp Mobile Messaging: Qualitative Findings From 2 Low-Resource Settings in Kenya

Jade Vu Henry,[a] Niall Winters,[b] Alice Lakati,[c] Martin Oliver,[a] Anne Geniets,[b] Simon M Mbae,[c] Hannah Wanjiru[c]

CHWs used WhatsApp with their supervisors to document their work, spurring healthy competition and team building between CHWs in the 2 pilot sites. While there was considerable variation in the number of times each participant posted messages—from 1 message to 270 messages—in total they posted nearly 2,000 messages over 6 months. 88% of messages corresponded to at least 1 of 3 defined supervisory objectives of (1) creating a social environment, (2) sharing communication and information, or (3) promoting quality of services.

ABSTRACT

An estimated half of all mobile phone users in Kenya use WhatsApp, an instant messaging platform that provides users an affordable way to send and receive text messages, photos, and other media at the one-to-one, one-to-many, many-to-one, or many-to-many levels. A mobile learning intervention aimed at strengthening supervisory support for community health workers (CHWs) in Kibera and Makueni, Kenya, created a WhatsApp group for CHWs and their supervisors to support supervision, professional development, and team building. We analyzed 6 months of WhatsApp chat logs (from August 19, 2014, to March 1, 2015) and conducted interviews with CHWs and their supervisors to understand how they used this instant messaging tool. During the study period, 1,830 posts were made by 41 participants. Photos were a key component of the communication among CHWs and their supervisors: 430 (23.4%) of all posts contained photos or other media. Of the remaining 1,400 text-based posts, 87.6% (n = 1,227) related to at least 1 of 3 defined supervision objectives: (1) quality assurance, (2) communication and information, or (3) supportive environment. This supervision took place in the context of posts about the roll out of the new mobile learning intervention and the delivery of routine health care services, as well as team-building efforts and community development. Our preliminary investigation demonstrates that with minimal training, CHWs and their supervisors tailored the multi-way communication features of this mobile instant messaging technology to enact virtual one-to-one, group, and peer-to-peer forms of supervision and support, and they switched channels of communication depending on the supervisory objectives. We encourage additional research on how health workers incorporate mobile technologies into their practices to develop and implement effective supervisory systems that will safeguard patient privacy, strengthen the formal health system, and create innovative forms of community-based, digitally supported professional development for CHWs.

BACKGROUND

With an estimated worldwide shortage of 4.3 million health workers, the World Health Organization has strongly advocated the widespread training of volunteer community health workers (CHWs) as part of a broader strategy to address this human resource crisis.[1] Accompanying the current resurgence of interest in CHW programs are calls for innovative and evidence-based strategies to recruit, train, motivate, and retain these health workers.[2–5] Robust studies suggest that CHWs are capable of effectively performing basic yet vital health care activities, but the services they deliver are not always

[a] UCL Institute of Education, London, United Kingdom.
[b] University of Oxford, Department of Education, Oxford, United Kingdom.
[c] Amref Health Africa, Nairobi, Kenya.
Correspondence to Jade Vu Henry (j.henry.14@ucl.ac.uk).

of high quality and thus fail to generate anticipated health impacts.[6–8] Along with motivational considerations (for example, financial incentives) and factors related to capacity building (such as recruitment and training), a major determinant of effective CHW performance involves the provision of an enabling work environment, including manageable workloads, adequate supplies and equipment, respect from colleagues and the community, and supportive supervision.[9]

Considerable emphasis has been placed on enhancing supervision as a strategy to improve the work environment of CHWs.[8,10,11] While hierarchical models of supervision emphasizing inspection and control were originally promoted to support health workers, more collaborative supervisory strategies are now widely advocated.[9] These strategies, referred to as facilitative or supportive supervision, are presently viewed as best practices and typically involve "… record reviews, observations, performance monitoring, constructive feedback, provider participation, problem solving, and focused education."[10]

Mobile devices may enable supervisors to overcome resource and geographical constraints to monitoring CHW activity.

In the context of current efforts to develop and strengthen programs for CHWs, supervision has been defined as[12]:

> *A process of guiding, monitoring, and coaching workers to promote compliance with standards of practice and assure the delivery of quality care services. The supervisory process permits supervisors and supervisees the opportunity to work as a team to meet common goals and objectives.*

CHW supervisory systems have 3 objectives: quality assurance, communication and information, and supportive environment.

Effective CHW supervisory systems are now viewed in terms of 3 overlapping general objectives[12]:

1. **Quality assurance:** continuous monitoring and improvement of CHW performance through measurement, feedback, and learning to ensure activities adhere to policies and procedures
2. **Communication and information:** communicating, gathering, and sharing information related to CHW activities, health guidelines, and planned events
3. **Supportive environment:** coaching, problem solving, team building, and other activities that provide CHWs with emotional support

Supervision remains among the weakest aspects of many CHW programs.[8] Studies suggest that supervision of CHWs suffers from "… low coverage; low administrative focus; is irregular, unsupportive, and demotivating; and lacks adequate training for supervisors and problem solving or feedback mechanisms for providers."[10] Reported barriers to delivering effective supervision to CHWs include travel expense and logistics for face-to-face meetings, lack of appropriate supervisory tools, inadequate understanding of the roles of CHWs, and the perception that supervision is not a priority area.[12–14] Supervisors frequently lack the training and resources to provide a supportive environment for CHWs and their oversight has remained bureaucratic and punitive.[10] Supervisory systems have been found to be poorly designed, underfunded, and left to the discretion of busy facility staff who fail to understand the role of CHWs.[8] Enhancing the implementation of supportive supervision that is appropriate for CHWs thus remains a critical step toward extending the reach of the health care system to where needs are the greatest.[15]

Widespread use of mobile phones in low-income countries has created momentum to use these devices to strengthen supervisory systems for CHWs,[12,15,16] who often work in households in the community beyond the confines of a health facility.[17] Mobile devices may enable supervisors to overcome resource constraints and geographical distances to monitor CHW activity in real time, provide remote guidance, deliver timely feedback, or send automated motivational messages or reminders.[18] In spite of this widely recognized potential among policy makers, practitioners, and researchers, only a few studies demonstrate the use of mobile devices to support the supervision of CHWs.[19]

In this article, we build on existing research by describing how a group of Kenyan CHWs and their supervisors used the WhatsApp mobile messaging platform for supervision and professional development over a 6-month period. The objectives of our exploratory study were to: (1) document use of the WhatsApp technology to support supervision for CHWs; (2) identify what CHWs and their supervisors used WhatsApp to discuss; and (3) explore how this use relates to current policy guidance on supervision in CHW programs generally.[12]

PROJECT CONTEXT

Data for this study come from a larger mobile learning intervention—mCHW (http://www.mhealthpartners.org/projects/mchw/)—to

strengthen supervisory support for CHWs in Kenya (or "CHVs"—community health volunteers—as they are known in Kenya). The mCHW intervention was designed by education researchers at Oxford University and UCL Institute of Education, in partnership with AMREF Health Africa. By drawing from the disciplinary fields of lifelong learning, computer-supported collaborative work, and mobile learning, mCHW aimed to build on AMREF Health Africa's 3 decades of experience in delivering training and e-learning programs for health workers in sub-Saharan Africa.[26–29] The project involved 3 cycles of design, development, implementation, and evaluation of a mobile learning prototype for CHWs and their supervisors (called the REFER App) that related to child development milestones. The WhatsApp learning group was not specified in the original design of the mobile learning intervention. Rather, it was separate from the prototype and was established at the beginning of the first design cycle, in response to the enthusiasm of project participants who worked in different sites and wished to extend the productive interactions that had taken place during prior face-to-face mCHW workshops.

Site Selection

The mCHW project purposively selected 2 study sites in Kenya. One site was in Makueni, a semi-arid rural county with an estimated 61% of its population living below the poverty level.[30] The second site was based in Kibera, one of the largest urban informal housing settlements in sub-Saharan Africa.[31]

Choice of the Technology Platform

Our choice of WhatsApp reflected existing patterns of technology use in Kenya, where an estimated 49% of mobile phone users use WhatsApp as their preferred mobile messaging tool.[20] This cross-platform application for basic, feature, and smart phones requires a mobile Internet connection to operate, allowing users to send and receive text messages, photos, videos, and audio recordings. Launched in 2009, it has reached 900 million active users around the world in less than 6 years.[21] Popular media attributes the global popularity of WhatsApp to its ease of use and affordability.[22,23] For an annual subscription fee of US$0.99, users communicate with individuals or groups without incurring additional charges other than the cost of data, with no upper limit on the number or length of messages sent or received. Such mobile instant messaging tools are often referred to as "Over the Top" (OTT) applications because they support communication between users irrespective of the cellular network or mobile device being used.[24]

Short message service (SMS)-based communication typically consists of 2-way interaction between a single user and a single receiver, or it requires specialist software and extra costs to enable broadcast services. In contrast, OTT instant messaging tools such as WhatsApp are designed for less costly, multi-way communication, with functionalities that readily support 1- and 2-way interaction at the one-to-one, one-to-many, many-to-one, or many-to-many levels. A recent literature review suggests that most mobile health projects for CHWs employ SMS-based strategies involving 1- or 2-way interaction, whereas few projects have adopted multi-way communication strategies to promote health priorities.[25] Our aim was to understand the dynamics of these multi-way communication exchanges and the nature of supportive supervision that could be realized in such an environment.

Study Participants

We created a WhatsApp group for CHWs, their supervisors (known as community health extension workers, or CHEWs), and the project team members. Each mCHW participant was enrolled as a member of this WhatsApp learning group upon assignment of a project mobile phone and completion of a training session on the use of a (separate) mobile application designed by the project to assess childhood development milestones.

We created a WhatsApp group for CHWs and their supervisors to support communication and team building.

Access to the closed WhatsApp learning group was strictly moderated by the mCHW study manager. Otherwise, communication was informally monitored by the supervisors. There was no fixed schedule for posting new content and all members of the group were encouraged to send messages to the group at any time. It was envisioned that this group would serve as a collaborative learning forum for: (1) team building between Makueni and Kibera participants; (2) additional communication with supervisors; and (3) troubleshooting and sharing experiences related to use of REFER App, the mCHW mobile learning application.

Nearly half of mobile phone users in Kenya use WhatsApp for mobile messaging.

METHODS

This exploratory descriptive study was conducted during the design phases of mCHW, as part of refining the mobile prototype to train and supervise CHWs. The analysis strategy adopted a qualitative research approach and reflects the exploratory and participatory objectives of qualitative inquiry as practiced in naturalistic, nonexperimental settings.[32,33] Our analysis relied on 2 sources of qualitative data: (1) text messages sent in the WhatsApp learning forum, and (2) transcripts of interviews with CHWs and their supervisors.

Text Messages Sent in the WhatsApp Learning Forum

Data Collection and Management

We analyzed the first 6 months of chat logs from the WhatsApp learning group. Electronic data from August 19, 2014, to March 1, 2015, were downloaded from the WhatsApp platform and exported into a Microsoft Access database. We linked each post to a master file containing variables for job titles and the work locales of chat participants and then removed individual identifiers from the data set.

Data Analysis

One researcher used the NVivo data software for qualitative research to analyze the text of the WhatsApp posts. First, the researcher identified themes that emerged by analyzing chat conversations using an inductive, qualitative content analysis process.[34] Three iterations of coding took place as part of this inductive stage of analysis. The first round involved *open coding*, whereby each post was read by the researcher and iteratively assigned 1 or more codes, based on the subject of the message, both on its own and in relation to the posts immediately preceding and following it. This is not intended to suggest that every post carries equal weight with respect to the importance or volume of each message. Some posts contained single words or icons while others were lengthier. Individual posts in their aggregate corresponded to larger episodes and more complex communication exchanges. Our approach to coding and summarizing the content necessarily masks these important nuances of technology use and communication in order to foreground participants' purposes in using WhatsApp, a limitation of which we are aware. The second round involved *categorization*, combining redundant and related codes into broader, higher-order groupings. During the third round of inductive coding, the number of codes/categories was further reduced to formulate general themes, as part of the procedure known as *abstraction*.

This inductive analysis was accompanied by a deductive approach to explore how the use of WhatsApp corresponded to current conceptual thinking about supervision in CHW programs. We drew specifically on work by Crigler, Gergen, and Perry,[12] who have investigated how supervision of CHWs is related to health systems strengthening. They propose that supervision systems specifically designed for CHWs must have the 3 main objectives mentioned previously: (1) quality assurance; (2) communication and information, and (3) a supportive environment.[12] Based on the codes that were assigned during the inductive analysis, each WhatsApp post was therefore allocated to 1 or more groups corresponding to these 3 stated supervisory objectives. Frequency statistics were then calculated for codes and categories using NVivo. Summary tables and graphics were produced using Microsoft Excel.

Transcripts of Interviews With CHWs and Their Supervisors

Data Collection and Management

Semi-structured interview questions were used to explore participants' views on their use of WhatsApp for facilitating supportive supervision. Interviews were undertaken in the local communities, usually at the local health center or dispensary. Fifteen semi-structured interviews (with 4 supervisors and 11 CHWs) were carried out by a second researcher in March 2015. This was followed by 19 additional interviews (with 4 supervisors, 11 CHWs, 2 community leaders, and 2 public health officers) in June 2015.

Questions on the use of WhatsApp were asked as part of a longer interview structure. The entire interviews lasted between 30 and 35 minutes, with discussion of WhatsApp use taking 5 to 10 minutes of this time. We asked about WhatsApp use directly during the interview (e.g., Have you used or do you use WhatsApp to communicate with your CHVs/CHEWs?), but in other cases health workers volunteered their views on WhatsApp without prompting, as part of discussing their role in mCHW more generally.

Data Analysis

These interviews were transcribed and coded by the second researcher for instances of

"WhatsApp," and these events were then process-coded to detail how this mobile messaging tool was used for supportive supervision. This coding took place using NVivo, as part of a more comprehensive coding scheme to analyze broader CHW roles and practices. The subset of interview data on WhatsApp usage is presented here to provide additional insight into the findings from the content analysis of the text messages.

Research Ethics

This study was reviewed by 2 institutional review boards and adhered to the respective codes of ethics adopted by the British Educational Research Association and AMREF Health Africa. Both sets of ethical guidelines require informed consent before data are collected, guarantees of confidentiality and anonymity for participants, as well as the right of participants to withdraw and have their data removed. The ethical protocol, including briefing sheets and informed consent forms, received approval from the lead institution's ethical review board and from AMREF Health Africa.

Care was taken to ensure that all participants understood that they were acting as volunteers and were not obligated to participate in the project. The WhatsApp m-learning group was a closed chat group, and the project study manager moderated strict access. All WhatsApp users were instructed to obtain verbal consent before posting photos of individuals. Prior to conducting the analysis for this paper, personal identifiers were removed from chat logs, and results presented cannot be attributed to any individual participant.

FINDINGS

Description of WhatsApp Users and Number of Messages Posted

During the first 6 months of deployment, a total of 41 individuals joined the WhatsApp learning group and posted at least 1 message. The group was used extensively, with a total of 1,830 posts made during the 6-month study period.

Of the 41 participants, 61% (n=25) were CHWs, while 20% (n=8) were supervisors and 5% (n=2) were from other Ministry of Health entities. The remainder were from the NGO partner organization (n=3, or 7%), the academic partner institutions (n=2, or 5%), and the Community Health Committee (CHC) (n=1, or 2.4%). Participants who were not academic and NGO partners were almost evenly divided between the study sites in Kibera (n=17) and Makueni (n=19). There was considerable variation in the number of times participants posted messages, with 1 individual sending as many as 270 messages, while others posted only once during the 6-month study period (Figure 1).

The number of times participants posted messages to WhatsApp ranged from 1 to 270.

CHWs posted 48% (n=872) of all messages, with 1 CHW alone posting 12% (n=218) of these messages (Figure 2). One supervisor posted 15% (n=270) of all messages, with the remaining supervisors posting 11% (n=198) of messages, for a combined total of 26% (n=468). The NGO and academic partners each posted roughly 7% of the total number of messages each (n=130 and n=132, respectively), while other MOH representatives at the district and local level posted 10% (n=179) of messages and the local CHC leader 3% (n=49) of messages.

Interviews suggested that in general the use of WhatsApp was viewed very positively and was taken up very easily by participants. For example, 1 supervisor remarked:

> *WhatsApp has been the best thing ever and I wouldn't have guessed the community health volunteers would adapt WhatsApp the way they did.*

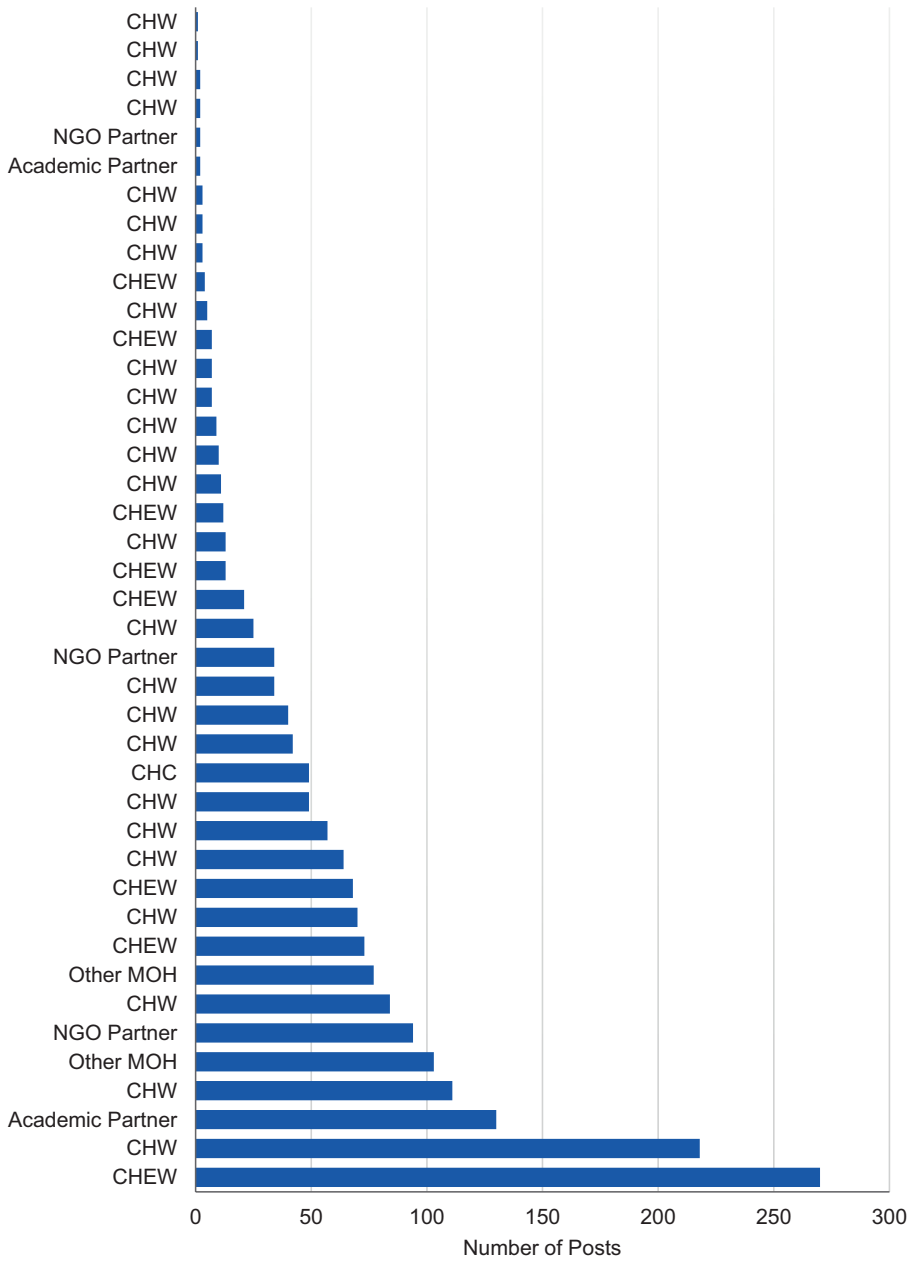
Relation of WhatsApp Posts to Supervision Objectives

Using inductive analysis, we grouped the 1,830 total posts into 36 categories (Table 1). After excluding posts of photos, icons, video, and audio (n=430), we then conducted deductive data analysis to explore the extent to which the remaining 34 types of coded posts could be grouped into the 3 stated objectives of CHW supervision: (1) quality assurance, (2) communication and information, and (3) supportive environment. At least 19 of the 34 categories of codes that we generated during the inductive analysis phase described practices that related to the overall objectives of supervision, with 1,227 of 1,400 (87.6%) coded posts assigned to at least 1 of these supervision objectives (Table 2). Categories created to characterize the substantive areas of the posts, such as "disability" and "malnutrition," were not included in this analysis. Supervision-related posts were most commonly related to the objective of creating a supportive environment (64.7%), followed by communication and information (33.4%) and quality assurance (19.0%).

41 members of the WhatsApp group posted 1,830 messages over 6 months.

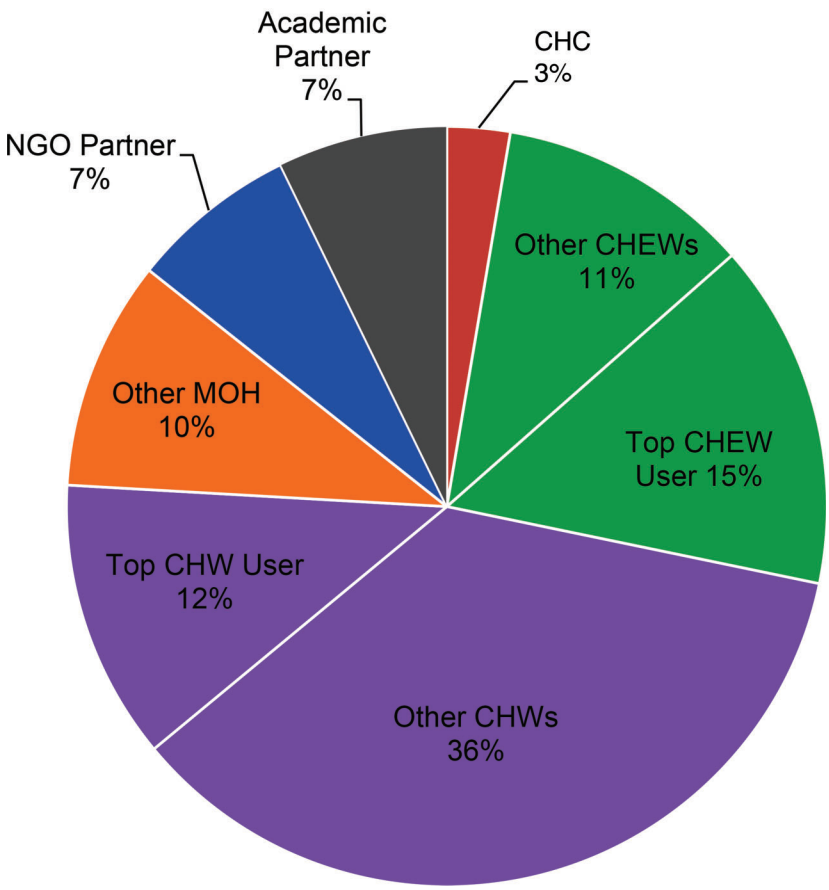
88% of WhatsApp posts corresponded to at least 1 of 3 supervision objectives.

FIGURE 1. Number of Messages Posted by Each WhatsApp Learning Group Participant, Kibera and Makueni, Kenya, August 19, 2014 – March 1, 2015 (N=1,830 Messages)



Abbreviations: CHC, Community Health Committee; CHEW, community health extension worker; CHW, community health worker; MOH, Ministry of Health.

FIGURE 2. Percentage of All WhatsApp Learning Group Messages Posted by Job Type of Senders, Kibera and Makueni, Kenya, August 19, 2014 – March 1, 2015 (N=1,830 Messages)



Abbreviations: CHC, Community Health Committee; CHEW, community health extension worker; CHW, community health worker; MOH, Ministry of Health.

Supervision for a Supportive Environment

Of the 1,400 text-based posts, almost two-thirds (n = 906) corresponded to the provision of a supportive environment—that is, providing CHWs with emotional and motivational guidance, mentorship, and assistance with problem solving. Interviews with participants suggested that the WhatsApp group was well-suited to promote a supportive environment for health workers:

> *It has helped me do my supportive supervision a little bit for the community health volunteers, more so for the ones [community health volunteers] who share what they have done or what have they done extra.*

Within this context, participants confirmed that they viewed the WhatsApp environment as an opportunity for mutual learning:

> *The person I am chatting with educates me, and also I educate her or him so it helps me. You know, some send photos and explain about them; therefore, I learn.*

Most of the WhatsApp posts corresponded to the supervision objective of providing a supportive environment.

TABLE 1. Coding Scheme to Describe Messages Posted by WhatsApp Learning Group Participants, Kibera and Makueni, Kenya, August 19, 2014 – March 1, 2015– (N = 1,830 Posts, Codes Listed in Alphabetical Order)

Code	Description	No. of Posts[a]	Code	Description	No. of Posts[a]
Chain letter	Generic message forwarded to members	12	**Mobile app**	References to child developmental milestones or the project app	46
Clarifications	Corrections to a prior post	11	**Mobile phone**	Operational aspects of using mobile phones	113
Community development	Community mobilization efforts in Kibera or Makueni	35	**Moral support**	Condolences and encouragement in response to challenges or hardships	133
Disability	Documentation of disabled child's developmental milestones	111	**Mutual learning**	Informal learning, peer learning, and knowledge exchange	108
Encouragement and praise	Encouragement and praise in response to a prior post	281	**Other health initiatives**	References to health programs other than childhood disability, malnutrition, or water and sanitation	110
Evidence	Documentation of CHW practice	14	**Other media**	Posts containing only icons, videos, or audio and exclusive of text	19
Follow-up	Responses to a prior post or event	120	**Photos**	Posts of photos	411
Fundraising and donations	Collection or distribution of money or objects	16	**Photo captions**	Posts containing descriptions of photos	183
Greetings	Hellos, welcome messages, and holiday wishes	215	**Referral**	Referrals of patients to CHEW or health facility	79
Health education	CHW efforts to educate community	31	**Religion**	Bible verses, blessings, and other references to faith	108
Household visits	Encounters during CHW household visits	51	**Reporting**	CHW descriptions of patient encounters or community work	100
Inspiration	Words to motivate forum participants	48	**Reprimand**	Posts that discipline or challenge other WhatsApp participants	16
Job offers and professional development	Employment announcements and outside training	22	**Requesting information**	Solicitation of additional information from others	83
Kibera-Makueni exchange	Communication between Kibera & Makueni participants	137	**Security**	References to community violence, fires, or other disturbances	4
Kenya	Nation building	8	**Service**	Statements about community service	6
Logistics and planning	Time, date, location, and agenda of meetings and other events	186	**Thanks**	Expressions of gratitude	304
Malnutrition	Descriptions of work with malnourished children	16	**Training**	Formal learning opportunities	122
mLearn project	References to the mLearn project and its site visits, conferences and training activities	297	**Water and sanitation**	Initiatives to promote clean water and hygiene	42

[a] More than 1 code may have been assigned to any 1 post, so percentages will not total to 100%.

TABLE 2. Categories and Frequency of Text Messages Posted to the WhatsApp Learning Group by Supervision Objective, Kibera and Makueni, Kenya, August 19, 2014 – March 1, 2015

Supervision Objective	Categories of Posts	No. of Posts	% of All Posts (N = 1,400)[a]
Supportive environment	Encouragement and praise Greetings Inspiration Kibera-Makueni exchange Moral support Mutual learning Religion Thanks	906	64.7%
Communication and information	Evidence Job offers and professional development Logistics and planning Reporting Requesting information Training	467	33.4%
Quality assurance	Follow-up Health education Household visits Referral Reprimand	266	19.0%
Any supervision objective	Any of the above codes	1,227[b]	87.6%[b]

[a] Denominator includes all posts except those containing photos or other media.
[b] More than 1 code may be assigned to any 1 post, so percentages will not total to 100%.

These participants also highlighted the importance of being able "to put different worlds together" to promote learning and motivation:

> *There's the exchange of ideas, and people get to learn that these people are working on this project and there's kind of a competition … which is very healthy. So we have the Makueni, [and] we have Kibera. They [Makueni health workers] post this article [about] what they have visited, and Kibera [workers] also feel they don't want to be left behind, [so] they do the same. Makueni, the same. And this is very healthy.*

Supervision for Communication and Information

Supervisors are expected to keep CHWs informed about new guidelines and planned events, as well as to gather service statistics to document the work of these health care providers. Posts related to communication and information, which relates to these data collection efforts and educational activities, accounted for 467 of the 1,400 messages (33.4%). In particular, we found the forum was useful for communicating information related to logistics and planning as well as training. One supervisor explains:

> *I think it has been a platform for us to communicate, and actually I can say it has reduced some costs when it comes to communicating with the community health volunteers because if I know people are in the [WhatsApp] group, I don't have to SMS everyone because the SMSs have a cost.*

With respect to information sharing, WhatsApp was particularly useful during emergency outbreaks. One supervisor describes her experience during a cholera outbreak:

The WhatsApp group was particularly useful to share information and obtain guidance during emergency outbreaks.

> *So the communication is good between us [the supervisors] and the community health workers. We really communicate and in case there is any problem, like when there was this outbreak of cholera, we really shared a lot. You give the information you know, they [the CHWs] give you what they know, and [you] can advise "do this, do this, concentrate on this area," so that that thing [cholera] can end. This [is] through the WhatsApp.*

Supervision for Quality Assurance

Quality assurance supervisory activities relate to the "adherence to norms and guidelines and the provision of adequate supplies." Because a supervisor is often the only regular contact that the CHW has with the formal health system, there is an expectation that the supervisor will make sure that a CHW understands his/her tasks and can perform them to an acceptable standard.[12] There were fewer messages posted to the WhatsApp learning group to promote quality assurance, comprising 19.0% (n = 266) of 1,400 messages. The supervisors felt these posts helped them to be more aware of what CHWs were doing—and not doing—in the community:

> *[WhatsApp] has made me learn a thing or two, it has made me get to know characters as far as community health volunteers are concerned, and how they communicate, and [has made me get to know] the other sides of community health volunteers. And I can even gauge performance when it comes to community health volunteers.*

The WhatsApp platform has proven particularly useful in allowing supervisors to gain a better understanding of the situation on the ground, as well to give feedback to CHWs, as part of an overall supervision process:

> *The key role of giving feedback [to CHWs] is to know how we are progressing in doing referrals and doing monitoring. What I know [is] this project is targeting the under-6 who are disabled, so we are able through this feedback [cycle] to know how many children are affected and how many are not affected, and if the children are affected, we are able to make a timely intervention.*

In addition, the interview accounts suggested that interaction related to supervision for the quality of services may have taken place via communication channels other than the WhatsApp learning forum that was established by mCHW members.

Participants from both study sites described the creation of additional WhatsApp groups corresponding to different sets of users, including 1 forum exclusively for public health officers:

> *In case you are stuck, you don't know what to do here, you don't know what to do anyway, you just communicate immediately [with other public health officers] and you will get the information immediately. So it has really made our work to be easy. … We have our own [WhatsApp group] icon here, then we can even communicate with other colleagues [apart from the mCHW learning group].*

Another supervisor reported:

> *We have several [WhatsApp groups] for different projects. We have even one for [health care provider] staff here where we are [in the facility], [and] we have one for other [purposes] like hypertension.*

Beyond the learning group, supervisors also revealed that they regularly used voice calls and WhatsApp in general to communicate one-on-one with individual CHWs to understand more about the services provided to households.

Supervision in the Context of CHWs' Everyday Practices

The 36 categories of posts that were generated during the first 2 rounds of inductive coding (Table 1) are revisited here to provide additional contextual insight into the supervisory interactions that took place between WhatsApp participants. Overall, these categories of codes illustrate how interactions were courteous, encouraging, and linked to the practices of CHWs as health cadres and community leaders. As shown in Table 3, 26 of the 36 categories of posts can be grouped to reveal 3 broad themes: posts about the mCHW learning intervention, posts about other CHW practices unrelated to the mCHW learning intervention, and posts for team building and community development.

Posts About the mCHW Learning Intervention

Of 1,400 text posts, 31.1% contained messages related to roll out of the mCHW intervention. This was one of the primary motivations for setting up the WhatsApp group. A CHW from Makueni posted:

> *Hi kibra team sometimes u may think we are quiet but u experienced our big challenge is on charging phones, so we realy [sic] request [researcher's name removed to maintain confidentiality] to put more effort on those "sollarchagers" plz [sic]*

Participants sent messages related to passwords and airtime for the project and sent photos and feedback on mCHW training sessions. CHWs also used the WhatsApp group to document actual household visits involving use of the mCHW application to assess developmental milestones of children with disabilities:

TABLE 3. Categories and Frequency of Messages Posted to the WhatsApp Learning Group by Broad Theme Related to CHWs' Everyday Practices, Kibera and Makueni, Kenya, August 19, 2014 – March 1, 2015

Theme	Categories of Posts	No. of Posts With at Least 1 Code in Category	% of Posts in Category (N = 1,400)[a]
Posts about mCHW learning intervention	Disability mLearn project Mobile app	435	31.1%
Posts about other CHW practices unrelated to the mCHW learning intervention	Follow-up Health education Household visits Malnutrition Other health initiatives Referral Reporting Water and sanitation Training	445	31.8%
Posts for team building and community development	Community development Fundraising and donations Greetings Inspiration Job offers and professional development Kibera-Makueni exchange Kenya Moral support Mutual learning Religion Service Security Thanks	819	58.5%

[a] More than 1 code may be assigned to any 1 post, so percentages will not total to 100%.

> *[Child's name removed to maintain confidentiality] nine months old. she tends to put all what she holds to her mouth. she always scores a pass in her milestones*

CHWs shared photos to the WhatsApp group that captured their use of the mCHW mobile application, along with motivational messages of congratulations and encouragement to keep up the good work.

Posts About Other CHW Practices Unrelated to the mCHW Intervention

The WhatsApp posts during this study period were not only about the mCHW learning intervention; there were 445 of 1,400 (31.8%) posts that provided feedback related to other ongoing CHW practices. This included administrative and clinical guidance on how to follow-up with or investigate related conditions, such as malnutrition, experienced by children:

> *Thank you [name removed to maintain confidentiality] for posting this information and for the support you have given so far to improve the nutritional status of the baby. I would suggest you refer the Baby to Kikuyu Eye Hospital. I [will] call the team members to come up with more suggestions…*

Participants also used the WhatsApp group to communicate about their ongoing work in water

Photos posted to WhatsApp often formed the basis of communication between CHWs and their supervisors.

and sanitation, HIV prevention, maternal and child health, and other health initiatives:

> *Hi all let's continue educating our community more on proper hygiene and wearing gloves when handling any body fluids rember [sic] to wash your hands with ranning [sic] clean water and soap. wish u all good healthy times.*

Their posts also documented their health education work during community meetings such as "action days" and "dialogue days," their household visits to care for the elderly, and their presentations at elementary schools.

Posts for Team Building and Community Development

With 59% of posts relating to team building and community development, the WhatsApp group served as an informal community of learners.

Although a substantial number of the posts were devoted to health-related matters, the contributions of the participants to the WhatsApp platform also served to enact an informal and supportive community of learners. Of 1,400 posts, 58.5% related to what we categorized as team building and community development. For example, there were multiple exchanges between the 2 different study sites. Many posts contained enthusiastic announcements related to other training opportunities and job opportunities, as well as reminders about upcoming meetings and workshops. Words of welcome, along with messages of encouragement, praise, and thanks, were commonly posted in response to individual posts to the forum. There were the occasional chain letters, and a multitude and variety of emoticons and small images corresponding to applause, approval, and the various holiday seasons were embedded into the text of many postings.

There was also a more sober side to the community-building efforts. The CHWs and their supervisors often posted messages related to community service, a vision for the nation of Kenya, religious prayers, and other allegories intended to inspire and motivate the group. These messages were usually sent in response to posts about the fires, rioting, and personal tragedies that occurred multiple times during the course of the short study period. In those situations of hardship, group participants used the WhatsApp platform to coordinate the logistics of delivering financial and moral support to those other members of their community.

Use of Photos in WhatsApp Communication and Supervision

Photos were a key component and often the basis of the communication that took place among CHWs and their supervisors: of the total 1,830 posts made during the study period, 23.5% (n=430) contained photos or other media and an additional 10.0% (n=183) contained comments or captions related to those photos. Supervisors posted photos of supervisory visits, meetings, and training sessions that had taken place that day, followed by words of praise, motivation, and appreciation. CHWs posted photos to document the quality of services they delivered, with posted messages often referring to the photos as "evidence" of CHW work practices in the community:

> *It is the evidence of whatever we do in the community. It has been the best evidence. If I assess a child, I take a photo, or if I have attended any sick person in the community and I post on WhatsApp. … If we [in Kibera] don't post, they will say in Makueni we don't work, we don't see their work.*

CHWs posted photos of their practice, followed by captions describing the content of the photos. Supervisors followed up with guidance, encouragement, and/or thanks while fellow CHWs added words of praise and encouragement. One supervisor explained:

> *So it has really been useful to give that drive to the community health volunteers to perform tasks. The other issue is that like right now every community health volunteer takes a photo when they go to a household, then they post there, then they explain to us what they are doing there.*

A more thorough understanding of what these photos depict, why they are preferred over text-based forms of reporting, and how they are used by groups would be useful as part of strengthening current forms of public health reporting and health information systems.

CONCLUSION

This study attempted to provide a snapshot of the content that was posted in a WhatsApp group by a cohort of CHWs and their supervisors during a 6-month period. At this preliminary stage, the grouping of the 36 categories of posts into broad themes associated with supervision (Table 2) and

CHW practices (Table 3) is intended to provide insight into the kinds of messages that are sent by participants, rather than to develop formal typologies. We recognize that there may be alternative ways to assign the categories into those larger groupings. Furthermore, this analysis does not assess or predict the likelihood or intensity with which CHWs and their supervisors will use an instant messaging platform. Our findings show that there was considerable variation in the number of posts contributed by each of the 41 participants. This could be due to the staggered dates that participants joined the group, which corresponded to the operational roll-out of the mCHW learning intervention. Alternatively, there may be personal preferences or power dynamics related to factors such as gender, age, or position in the community that influence the extent to which CHWs and their supervisors will engage with the WhatsApp group.

Findings from other studies have suggested that providers use multi-way communication channels for education and practice in a range of health settings.[35,36] Our content analysis of the messages that were actually posted by CHWs and their supervisors demonstrates how they employed mobile instant messaging technology. They used this tool to exchange information and create content that corresponded to their roles as both health workers and community leaders. These interactions also correspond to stated objectives of supervisory systems for CHWs—that of quality assurance, communication and information, and creating a supportive environment. While there is general consensus about these 3 broad objectives, there is less clarity about whether a single individual should carry out all of such functions.[37] It has been suggested that new approaches to CHW supervision should allocate the various functions of supervision to different parties while making use of mobile technology.[12]

Our preliminary investigation demonstrates that with minimal training, CHWs and their supervisors tailored the multi-way communication features of this mobile instant messaging technology as part of enacting virtual one-to-one, group, and peer-to-peer forms of supervision, and they switched channels of communication depending on the supervisory objectives. We encourage additional research on how CHWs and their supervisors incorporate WhatsApp and other mobile technologies into their practices to support the development and implementation of effective supervisory systems that will safeguard patient privacy, strengthen the formal health system, and create innovative forms of community-based, digitally supported professional development for CHWs.

Acknowledgments: The work reported in this paper was funded through the UK Economic and Social Research Council and Department for International Development, under the ESRC-DFID Joint Scheme for Research on International Development, ref. ES/J018619/2.

Competing Interest: None declared.

REFERENCES

1. World Health Organization (WHO). The world health report 2006: working together for health. Geneva: WHO; 2006. Available from: http://www.who.int/whr/2006/en/
2. Raven J, Akweongo P, Baba A, Baine SO, Sall MG, Buzuzi S, et al. Using a human resource management approach to support community health workers: experiences from five African countries. Hum Resour Health. 2015;13(1): 45. CrossRef. Medline
3. Brunie A, Wamala-Mucheri P, Otterness C, Akol A, Chen M, Bufumbo L, et al. Keeping community health workers in Uganda motivated: key challenges, facilitators, and preferred program inputs. Glob Health Sci Pract. 2014;2(1): 103-116. CrossRef. Medline
4. Haines A, Sanders D, Lehmann U, Rowe AK, Lawn JE, Jan S, et al. Achieving child survival goals: potential contribution of community health workers. Lancet. 2007;369(9579): 2121-2131. CrossRef. Medline
5. Rowe AK, de Savigny D, Lanata CF, Victora CG. How can we achieve and maintain high-quality performance of health workers in low-resource settings? Lancet. 2005;366(9490): 1026-1035. CrossRef. Medline
6. Stekelenburg J, Kyanamina SS, Wolffers I. Poor performance of community health workers in Kalabo District, Zambia. Health Policy. 2003;65(2): 109-118. CrossRef. Medline
7. Perez F, Ba H, Dastagire SG, Altmann M. The role of community health workers in improving child health programmes in Mali. BMC Int Health Hum Rights. 2009;9(1): 28. CrossRef. Medline
8. Lehmann U, Sanders D. Community health workers: what do we know about them? The state of the evidence on programmes, activities, costs and impact on health outcomes of community health workers. Geneva: World Health Organization; 2007. Available from: http://www.who.int/hrh/documents/community_health_workers.pdf
9. Jaskiewicz W, Tulenko K. Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. Hum Resour Health. 2012;10(1): 38. CrossRef. Medline
10. Hill Z, Dumbaugh M, Benton L, Källander K, Strachan D, ten Asbroek A, et al. Supervising community health workers in low-income countries--a review of impact and implementation issues. Glob Health Action. 2014;7:24085. CrossRef. Medline
11. Winch P, Bhattacharyya K, Debay M, Sarriot EG, Bertoli SA, Morrow RH. Improving the performance of facility- and community-based health workers. Calverton (MD): The Child

With minimal training, CHWs and their supervisors tailored WhatsApp to enable virtual one-to-one, group, and peer-to-peer supervision.

Survival Technical Support Project; 2003. Available from: http://pdf.usaid.gov/pdf_docs/Pnadd769.pdf

12. Crigler L, Gergen J, Perry H. Supervision of community health workers. In: Perry H,Crigler L, editors. Developing and strengthening community health worker programs at scale: a reference guide and case studies for program managers and policymakers. Baltimore (MD): Jhpiego; 2014. p. 10.1–10.26. Available from: http://www.mchip.net/sites/default/files/MCHIP_CHW%20Ref%20Guide.pdf
13. Tulenko K, Møgedal S, Afzal MM, Frymus D, Oshin A, Pate M, et al. Community health workers for universal health-care coverage: from fragmentation to synergy. Bull World Health Organ. 2013;91(11): 847-852. CrossRef. Medline
14. Global Health Workforce Alliance; World Health Organization (WHO). Global experience of community health workers for delivery of health related Millennium Development Goals: a systematic review, country case studies, and recommendations for integration into national health systems. Geneva: WHO; 2010. Available from: http://www.who.int/workforcealliance/knowledge/resources/chwreport/en/
15. Columbia University, The Earth Institute. One million community health workers: technical task force report. New York: The Earth Institute; [2013]. Available from: http://1millionhealthworkers.org/files/2013/01/1mCHW_TechnicalTaskForceReport.pdf
16. Vital Wave Consulting. mHealth for development: the opportunity of mobile technology for healthcare in the developing world. Washington (DC): UN Foundation-Vodafone Foundation Partnership; 2009. Available from: http://www.unfoundation.org/what-we-do/issues/global-health/mhealth-report.html
17. Derenzi B, Borriello G, Jackson J, Kumar VS, Parikh TS, Virk P, et al. Mobile phone tools for field-based health care workers in low-income countries. Mt Sinai J Med. 2011;78(3): 406-418. CrossRef. Medline
18. Callan P, Miller R, Sithole R, Daggett M, Altman D. mHealth education: harnessing the mobile revolution to bridge the health education and training gap in developing countries. Cork (Ireland): iheed Institute; 2011. Available from: http://www.himss.org/ResourceLibrary/ResourceDetail.aspx?ItemNumber=10586
19. Agarwal S, Perry HB, Long LA, Labrique AB. Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: systematic review. Trop Med Int Health. 2015;20(8): 1003-1014. CrossRef. Medline
20. Adika O. 49% of Kenyan mobile users are on WhatsApp. Techweez [Internet]. 2014 Mar 5 [cited 2015 Jul 21]. Available from: http://www.techweez.com/2014/03/05/49-of-kenyans-mobile-users-on-whatsapp/
21. Statista: The Statistics Portal [Internet]. Hamburg (Germany): Statistica GmbH. WhatsApp: number of monthly active users 2015; [cited 2015 Oct 27]. Available from: http://www.statista.com/statistics/260819/number-of-monthly-active-whatsapp-users/
22. Gara T. What is WhatsApp? One highly addicted user explains. Wall Street Journal [Internet]. 2014 Feb 19 [cited 2015 Jul 21] . Available from: http://blogs.wsj.com/corporate-intelligence/2014/02/19/what-is-whatsapp-one-highly-addicted-user-explains/
23. Bilton N. The messaging app wars are just getting started. New York Times [Internet]. 2014 Mar 3 [cited 2015 Jul 21]. Available from: http://bits.blogs.nytimes.com/2014/02/26/the-messaging-app-wars-are-just-getting-started/?_r=0
24. O'Hara KP, Massimi M, Harper R, Rubens S, Morris J. Everyday dwelling with WhatsApp. In: Proceedings of the 17th ACM conference on computer supported cooperative work & social computing. New York: Association for Computing Machinery (ACM); 2014. p. 1131-1143. CrossRef
25. Källander K, Tibenderana JK, Akpogheneta OJ, Strachan DL, Hill Z, ten Asbroek AH, et al. Mobile health (mHealth) approaches and lessons for increased performance and retention of community health workers in low- and middle-income countries: a review. J Med Internet Res. 2013;15(1): e17. CrossRef. Medline
26. Sharples M. The design of personal mobile technologies for lifelong learning. Comput Educ. 2000;34(3-4): 177-193. CrossRef.
27. Kukulska-Hulme A, Sharples M, Milrad M, Arnedillo-Sanchez I, Vavoula G. Innovation in mobile learning: a European perspective. Int J Mobile Blended Learn. 2009;1(1): 13-35. CrossRef.
28. Stahl G, Koschmann T, Suthers D. Computer-supported collaborative learning: an historical perspective. In: Sawyer RK, editor. Cambridge handbook of the learning sciences. Cambridge (UK): Cambridge University Press; 2006. p. 409-426. Available from: http://gerrystahl.net/cscl/CSCL_English.pdf
29. Koschmann TD. Toward a theory of computer support for collaborative learning. J Learn Sci. 1994;3(3): 219-225. CrossRef.
30. Population Action International (PAI). Population dynamics, environment, and sustainable development in Makueni county. Washington (DC): PAI; 2013. Available from: http://pai.org/wp-content/uploads/2014/07/PAI_Makueni.pdf
31. African Population and Health Research Center (APHRC). Population and Health dynamics in Nairobi's informal settlements: report of the Nairobi cross-sectional slums survey (NCSS) 2012. Nairobi (Kenya): APHRC; 2014. Available from: http://aphrc.org/wp-content/uploads/2014/08/NCSS2-FINAL-Report.pdf
32. Creswell JW. Research design: qualitative, quantitative, and mixed methods approaches. 4th edition. Thousand Oaks (CA): SAGE Publications; 2014.
33. Seale C. Quality in qualitative research. Qual Inq. 1999;5(4): 465-478. CrossRef.
34. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs. 2008;62(1): 107-115. CrossRef. Medline
35. Pimmer C, Linxen S, Gröhbiel U. Facebook as a learning tool? A case study on the appropriation of social network sites from mobile phones in developing countries. Br J Educ Technol. 2012;43(5): 726-738. CrossRef.
36. Pander T, Pinilla S, Dimitriadis K, Fischer MR. The use of Facebook in medical education--a literature review. GMS Z Med Ausbild. 2014;31(3): Doc33. CrossRef. Medline
37. Bradley S, Kamwendo F, Masanja H, de Pinho H, Waxman R, Boostrom C, et al. District health managers' perceptions of supervision in Malawi and Tanzania. Hum Resour Health. 2013;11(1): 43. CrossRef. Medline

Peer Reviewed

Received: 2015 Dec 4; **Accepted:** 2016 Apr 5; **First Published Online:** 2016 May 26

Cite this article as: Henry JV, Winters N, Lakati A, Oliver M, Geniets A, Mbae SM, et al. Enhancing the supervision of community health workers with WhatsApp mobile messaging: qualitative findings from 2 low-resource settings in Kenya. Glob Health Sci Pract. 2016;4(2):311–325. http://dx.doi.org/10.9745/GHSP-D-15-00386

© Henry et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-15-00386

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

SHORT REPORT

Declining HIV Prevalence in Parallel With Safer Sex Behaviors in Burkina Faso: Evidence From Surveillance and Population-Based Surveys

Fati Kirakoya-Samadoulougou,[a] Nicolas Nagot,[b] Sekou Samadoulougou,[a] Mamadou Sokey,[c] Abdoulaye Guiré,[c] Issiaka Sombié,[d] Nicolas Meda[e]

HIV prevalence among pregnant women ages 15–49 declined from 7.1% to 2.0% in urban areas between 1998 and 2014, and from 2.0% to 0.5% in rural areas between 2003 and 2014; similar declines were reported in the Demographic and Health Surveys. During the same time period, individuals reported safer sex behaviors, including delayed sexual debut and reduced number of sex partners among youth, as well as increased condom use at last sex with nonmarital partners among men and women ages 15–49.

ABSTRACT

Objective: To investigate trends in HIV prevalence and changes in reported sexual behaviors between 1998 and 2014 in Burkina Faso.

Methods: We obtained data on HIV prevalence from antenatal care (ANC) surveillance sites (N = 9) that were consistently included in surveillance between 1998 and 2014. We also analyzed data on HIV prevalence and reported sex behaviors from 3 population-based surveys from the Demographic and Health Surveys (DHS), conducted in 1998–99, 2003, and 2010. Sex behavior indicators comprised never-married youth who have never had sex; sex with more than 1 partner; sex with a nonmarital, non-cohabiting partner; condom use at last sex with a nonmarital, non-cohabiting partner; and sex before age 15. We calculated survey-specific HIV prevalence with 95% confidence intervals (CIs) and used the chi-square test or chi-square test for trend to compare HIV prevalence across survey years and to analyze trends in reported sex behaviors.

Results: HIV prevalence among pregnant women ages 15–49 decreased by 72% in urban areas, from 7.1% in 1998 to 2.0% in 2014, and by 75% in rural areas, from 2.0% in 2003 to 0.5% in 2014. HIV declined most in younger age groups, which is a good reflection of recent incidence, with declines of 55% among 15–19-year-olds, 72% among 20–24-year-olds, 40% among 25–29-year-olds, and 7% among those ≥30 years old (considering urban and rural data combined). Data reported in the DHS corroborated these declines in HIV prevalence: between 2003 and 2010, HIV prevalence dropped significantly—by 89% among girls ages 15–19, from 0.9% (95% CI, 0.2 to 1.6) to 0.1% (95% CI, 0.0 to 0.4), and by 78% among young women ages 20–24, from 1.8% (95% CI, 1.6 to 3.0) to 0.4% (95% CI, 0.0 to 0.7). During the same time period, people reported safer sex behaviors. For example, significantly higher percentages of never-married youth reported they had never had sex, lower percentages of sexually active youth reported multiple sex partners, and lower percentages of youth reported having sex before age 15. In addition, the percentage of men ages 20–49 reporting sex with a nonmarital, non-cohabiting partner declined significantly, while condom use at last sex with such a partner increased significantly among both men and women ages 15–49.

Conclusions: Both ANC surveillance and population-based surveys report sharp declines in HIV prevalence in Burkina Faso between 1998 and 2014, accompanied by improvements in reported risky sex behaviors.

[a] Université catholique de Louvain, Brussels, Belgium.
[b] Institut National de la Sante et de la Recherche Medicale (INSERM), UMR 1058, and Montpellier University, Montpellier, France.
[c] Conseil National de Lutte contre le Sida (CNLS), Ouagadougou, Burkina Faso.
[d] Organisation Ouest Africaine de la Santé, Bobo-Dioulasso, Burkina Faso.
[e] Centre MURAZ, Bobo-Dioulasso, Burkina Faso.
Correspondence to Fati Kirakoya-Samadoulougou (fati.kirakoya@uclouvain.be).

INTRODUCTION

HIV prevalence in Burkina Faso declined substantially over the past 10 to 15 years, from 2.2% in 2001 to 1.0% in 2012, according to a recent report from the Joint United Nations Programme on HIV/AIDS

(UNAIDS).[1] Changes in HIV prevalence result from the balance between deaths to people with HIV and incident cases of HIV in the population (along with migration patterns). Declines in HIV incidence can occur with improvements in risky sexual behaviors or antiretroviral therapy (ART) coverage and adherence among people living with HIV. Indeed, by reducing viral loads, ART reduces a person's infectiousness through sexual transmission, and thus HIV incidence in the population.[2] However, scale-up of ART coverage in Burkina Faso is too recent to have contributed to a decrease in prevalence among 15–24-year-olds during the last decade.

There is considerable discussion in the literature about the declining trend in HIV prevalence among young pregnant women in sub-Saharan Africa in relation to sexual behaviors.[3-5] In a study assessing progress in reducing HIV prevalence among young people in 30 countries around the world, Botswana, Côte d'Ivoire, Ethiopia, Kenya, Malawi, Namibia, and Zimbabwe showed a statistically significant decline of 25% or more in HIV prevalence among young antenatal care (ANC) attendees between 2000 and 2008.[5] Moreover, in 8 countries with significant declines in HIV prevalence in either ANC surveillance surveys or national surveys, significant changes were also observed in sexual behavior in either men or women for at least 2 of 3 sexual behavior indicators (sex before age 15, multiple partners, and reported condom use among youth). Although the study could not establish causal associations between changes in sexual behavior and trends in HIV prevalence, it concluded that the observed changes were encouraging.[5]

In this article, we analyze the possible factors behind the considerable HIV decline in Burkina Faso with a focus on changes in sexual behavior.

METHODS

We analyzed trends in HIV prevalence in Burkina Faso over a 16-year period. Data came from national ANC surveillance surveys conducted between 1998 and 2014 as well as from national surveys conducted by the Demographic and Health Surveys (DHS) program in 1998–99, 2003, and 2010. We also analyzed trends in reported sex behaviors from the DHS.

The HIV serosurveillance system of pregnant women was established in Burkina Faso in 1997, initially with 3 urban sites. The system evolved over time, covering 5 urban sites in 1998 and 10 urban and rural sites in 2003 (6 in urban areas and 4 in rural areas). Since 2004, 13 sites have been included in the surveillance system (the same 10 sites from 2003 plus 3 additional sites, for a total of 7 in urban areas and 6 in rural areas). The progressive increase in sentinel sites was meant to provide a roughly representative picture of levels and trends in HIV prevalence throughout the country. To avoid potential bias as a result of expanding ANC surveillance over time, only data from those urban sites that were consistently included in surveillance between 1998 and 2014 (i.e., 5 urban sites) and the rural sites included between 2003 and 2014 (i.e., 4 rural sites) were included in the analysis. Pregnant women presenting for the first time for their current pregnancy at the participating ANC sites during the survey period were enrolled in an anonymous unlinked HIV serosurvey.

Improvements in risky sex behaviors can reduce HIV incidence.

We also obtained data from the DHS on HIV prevalence and reported sexual behavior. As reported elsewhere, the DHS was designed to obtain national and regional estimates of HIV prevalence and associated sociodemographic and behavioral indicators among women and men.[6] Briefly, the DHS surveys followed a 2-stage selection process, in which a random sample of clusters from the most recent national sample frame was first selected. In the second stage, all households were listed and the final systematic random sample of households was selected. During the main fieldwork, eligible women (ages 15–49) and men (usually ages 15–59) were selected for HIV testing. In the Burkina Faso DHS, the sample was selected in 2 stages, stratified by area (urban and rural) with enumeration areas (EAs) as the first-stage sampling units and households as the second-stage sampling units.

We assessed trends in 5 key indicators related to sexual behaviors, in addition to the percentage of young people ages 15–24 years who reported having ever tested for HIV and the percentage of young people who reported knowing a formal source of condoms. The behavioral indicators were:

- The percentage of never-married young women and men ages 15–24 who have **never had sex**
- The percentage of young people (ages 15–24) who have had **sex with more than 1 partner** in the last 12 months among all

We analyzed trends in HIV prevalence in Burkina Faso from ANC surveillance and DHS surveys, along with trends in reported sex behaviors.

young people who have been sexually active in the last 12 months

- The percentage of respondents who have had **sex with a nonmarital, non-cohabiting partner** in the last 12 months among all respondents reporting sexual activity in the last 12 months
- The percentage of respondents who reported **using a condom the last time they had sex with a nonmarital, non-cohabiting partner** among those who have had sex with such a partner in the last 12 months
- The percentage of young women and men ages 15–24 who have had **sex before age 15**

Between 1998 and 2014, HIV prevalence declined among pregnant women ages 15–49 in both urban and rural areas.

To describe HIV prevalence trends by data source, we calculated survey-specific HIV prevalence with 95% binomial confidence intervals (CIs). To determine the relative proportional change in prevalence across survey year, the difference between estimates from the earlier and later rounds was divided by the earlier estimate. When comparing HIV prevalence across survey years, we used the chi-square test or the chi-square test for trend. Trends in reported sexual risk behavior were analyzed using the same tests.

HIV prevalence declined most in younger age groups.

RESULTS

Trends in HIV Prevalence

The number of pregnant women ages 15–49 years included in the ANC surveillance surveys varied from 2,010 in 1998 (from urban areas only) to 3,129 in 2014 (from urban and rural areas), with a maximum of 3,276 in 2008 (urban and rural). Between 1998 and 2003, HIV prevalence declined among 15–49-year-old pregnant women in urban areas (data not collected in rural areas) from 7.1% to 3.5%, a decline of 51% (Figure 1). While prevalence increased somewhat in urban areas between 2003 and 2006, from 3.5% to 4.0%, by 2007, prevalence had begun to decline again and continued to drop—to 2.0% in 2014. HIV prevalence among pregnant women in rural areas followed similar trends, falling from 2.0% in 2003 to 0.5% in 2014 (Figure 1).

Age-specific data were available between 2007 and 2014. These data (urban and rural areas combined) indicate HIV prevalence declined most in younger age groups with declines of 55% among 15–19-year-olds, 72% among 20–24-year-olds, 40% among 25–29-year-olds, and 7% among those ≥30 years old (Figure 2).

The decline in HIV prevalence among pregnant women in the ANC surveillance surveys was

FIGURE 1. Trends in HIV Prevalence Among Pregnant Women Ages 15–49 Surveyed at Urban and Rural Antenatal Sentinel Surveillance Sites, Burkina Faso, 1998 to 2014

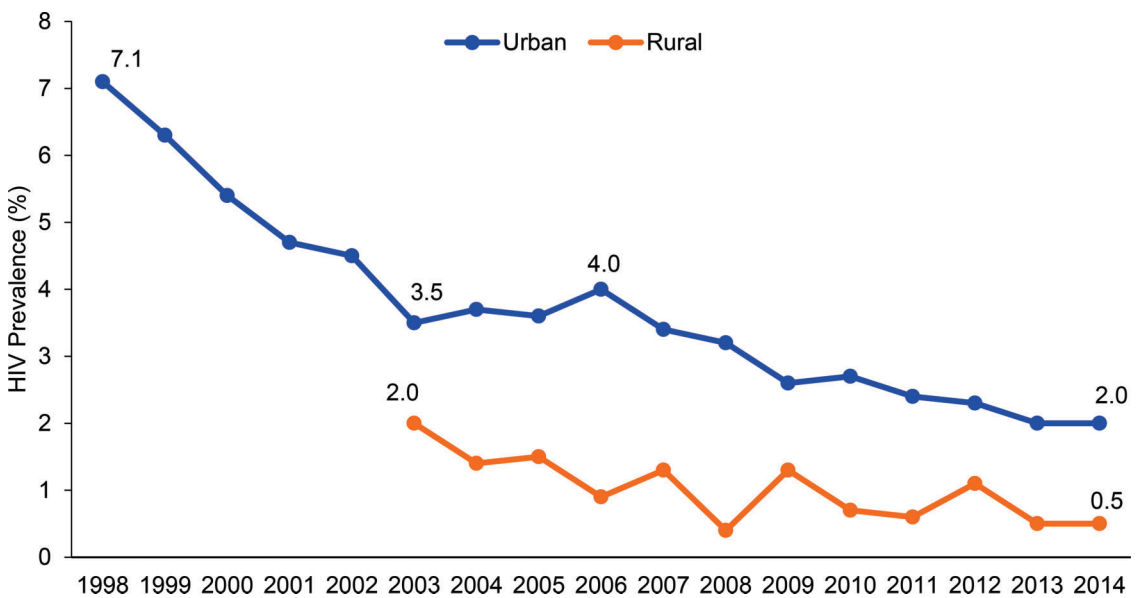
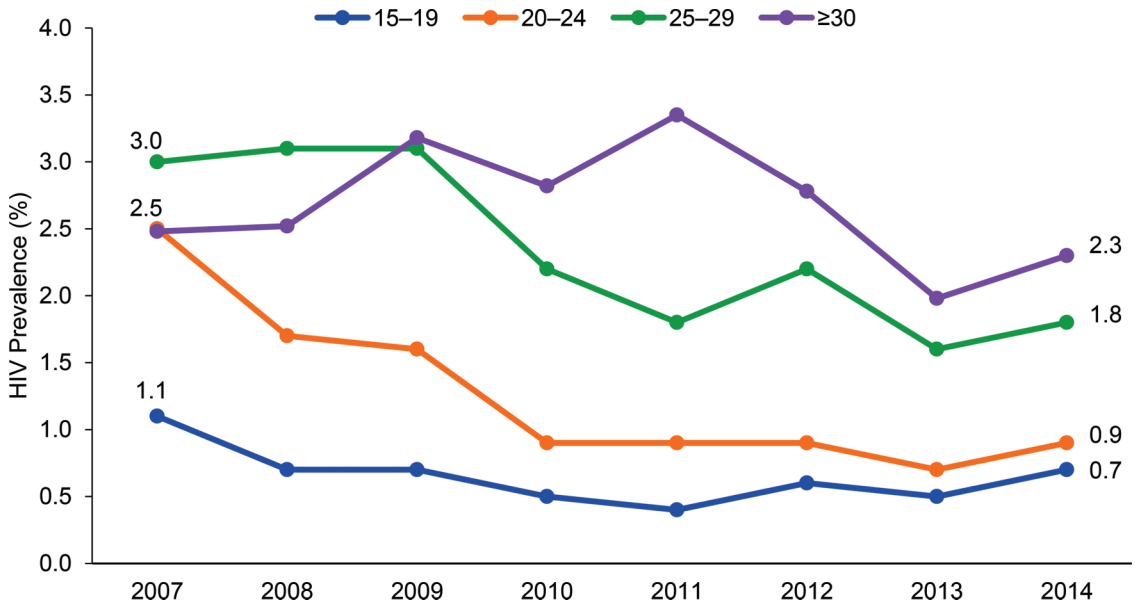


FIGURE 2. Trends in HIV Prevalence Among Pregnant Women Ages 15–49 Surveyed at Urban and Rural Antenatal Sentinel Surveillance Sites, by Age Group, Burkina Faso, 2007 to 2014



consistent with HIV prevalence data collected by the DHS. Between the 2003 and 2010 DHS, HIV prevalence among girls ages 15–19 dropped by 89% ($P=.04$), from 0.9% (95% CI, 0.2 to 1.6) to 0.1% (95% CI, 0.0 to 0.4) (Figure 3). Among young women ages 20–24, prevalence declined by 78% ($P=.001$) over the same time period, from 1.8% (95% CI, 1.6 to 3.0) to 0.4% (95% CI, 0.0 to 0.7), and among women ages 25–29, it dropped by 52%, from 2.5% (95% CI, 1.1 to 3.8) to 1.2% (95% CI, 0.5 to 1.8).

Among men, the decline in HIV prevalence was much less marked among the younger age groups but more substantial among the older groups. For example, among boys ages 15–19, HIV prevalence decreased by 43% between 2003 and 2010, from 0.7% (95% CI, 0.0 to 1.5) to 0.4% (95% CI, 0.0 to 0.9) , whereas for men ages 25–29 HIV prevalence declined significantly by 82% ($P=.001$), from 2.8% (95% CI, 0.9 to 4.7) to 0.5% (95% CI, 0.0 to 1.2) (Figure 3).

Trends in Sexual Behaviors

The percentage of never-married adolescents ages 15–19 who reported they had **never had sex** increased significantly between 2003 and 2010 among both girls and boys: for girls, from 76.1% to 82.4% ($P<.001$); for boys, from 74.4% to 82.1% ($P<.001$) (Figure 4A). The percentage of never-married young women ages 20–24 who reported never having had sex also increased significantly over the same time period, from 32.7% to 40.0% ($P<.001$). Among never-married young men ages 20–24, the increase was smaller and not statistically significant: 32.8% in 2003 to 33.8% in 2010 ($P=.68$).

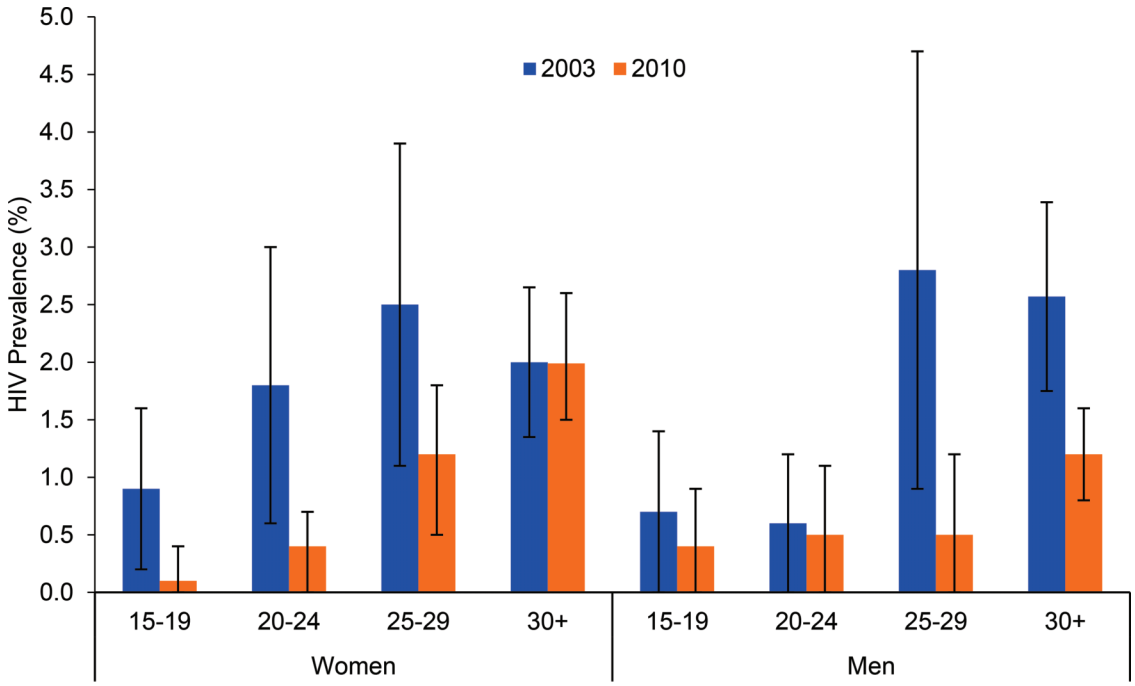
The percentage of never-married adolescents who reported they had never had sex increased significantly between 2003 and 2010.

The percentage of sexually active girls ages 15–19 who reported having **multiple partners** in the last year fell from 7.9% to 2.4% ($P<.001$) between 1998–99 and 2010, whereas a smaller decline was observed among sexually active young women ages 20–24 (1.5% in 1998–99 to 1.1% in 2010; $P=.04$) (Figure 4B). Substantial declines were observed among sexually active males ages 15–19 and 20–24 during the same time period: from 43.7% to 13.1% ($P<.001$) and from 36.4% to 17.4% ($P<.001$), respectively.

The percentage of youth reporting multiple sex partners declined significantly between 1998 and 2010.

The percentage of sexually active women ages 15–49 reporting engaging in **sex with a non-marital, non-cohabiting partner** in the last year has always been quite low and has remained stable during the study period (8.3% in 1998–99 to 7.9% in 2010). The percentage of sexually

FIGURE 3. Trends in HIV Prevalence (With 95% Confidence Intervals) Among Women and Men Surveyed in the Demographic and Health Surveys, by Age Group, Burkina Faso, 2003 and 2010



The percentage of sexually active men ages 20–24 and 25–49 who reported having sex with a nonmarital partner declined significantly between 1998 and 2010, while it remained stable and low among women.

active boys ages 15–19 who reported engaging in sex with a nonmarital, non-cohabiting partner in the last 12 months also remained unchanged (94.1% in 1998–99 to 94.2% in 2010), whereas the percentages declined significantly from 73.8% to 65.8% ($P=.009$) among young men ages 20–24 and from 20.0% to 17.1% ($P<.001$) among older men ages 25–49 (Figure 5A).

The percentage of women and men ages 15–49 who have had sex with a nonmarital, non-cohabiting partner in the last 12 months who said they used a **condom the last time they had sex** with such a partner increased significantly between 1998–99 and 2010, from 38.6% to 59.0% ($P<.001$) among women and from 57.4% to 73.9% among men ($P<.001$). This percentage increased significantly among girls ages 15–19, from 38.6% in 1998–99 to 52.6% in 2010 ($P<.001$), as well as among boys ages 15–19, from 45.3% to 67.7% ($P<.001$). Similar trends were also evident among men and women in older age groups (Figure 5B).

Among both young women and men ages 15–24, the percentage having **sex before age 15** declined between 1998–99 and 2010: from 11.2% to 9.3% ($P=.02$) among young women and from 7.6% to 1.9% ($P<.001$) among young men.

HIV testing rates among men increased significantly between 2003 and 2010, increasing most in younger age groups—by 67.4% among 15–19-year-olds ($P<.001$) and 66.0% among 20–24-year-olds ($P<.001$), compared with 63.5% among 25–49-year-olds ($P<.001$) (Figure 6). Overall, 27.3% (95% CI, 25.5 to 29.2) of women ages 15–24 were ever tested for HIV in 2010. Unfortunately, HIV testing among women was not collected in 2003, so analysis of trends is not possible.

The percentage of adolescent girls and boys ages 15–19 who reported **knowing a formal source of condoms** increased from 44.3% to 73.1% ($P<.001$) and from 63.1% to 85.0% ($P<.001$), respectively, between 2003 and 2010. The percentage among young women and men

FIGURE 4. Reported Sex Behaviors of Youth Ages 15–24, by Sex and Age Group, Burkina Faso, 2003 and 2010

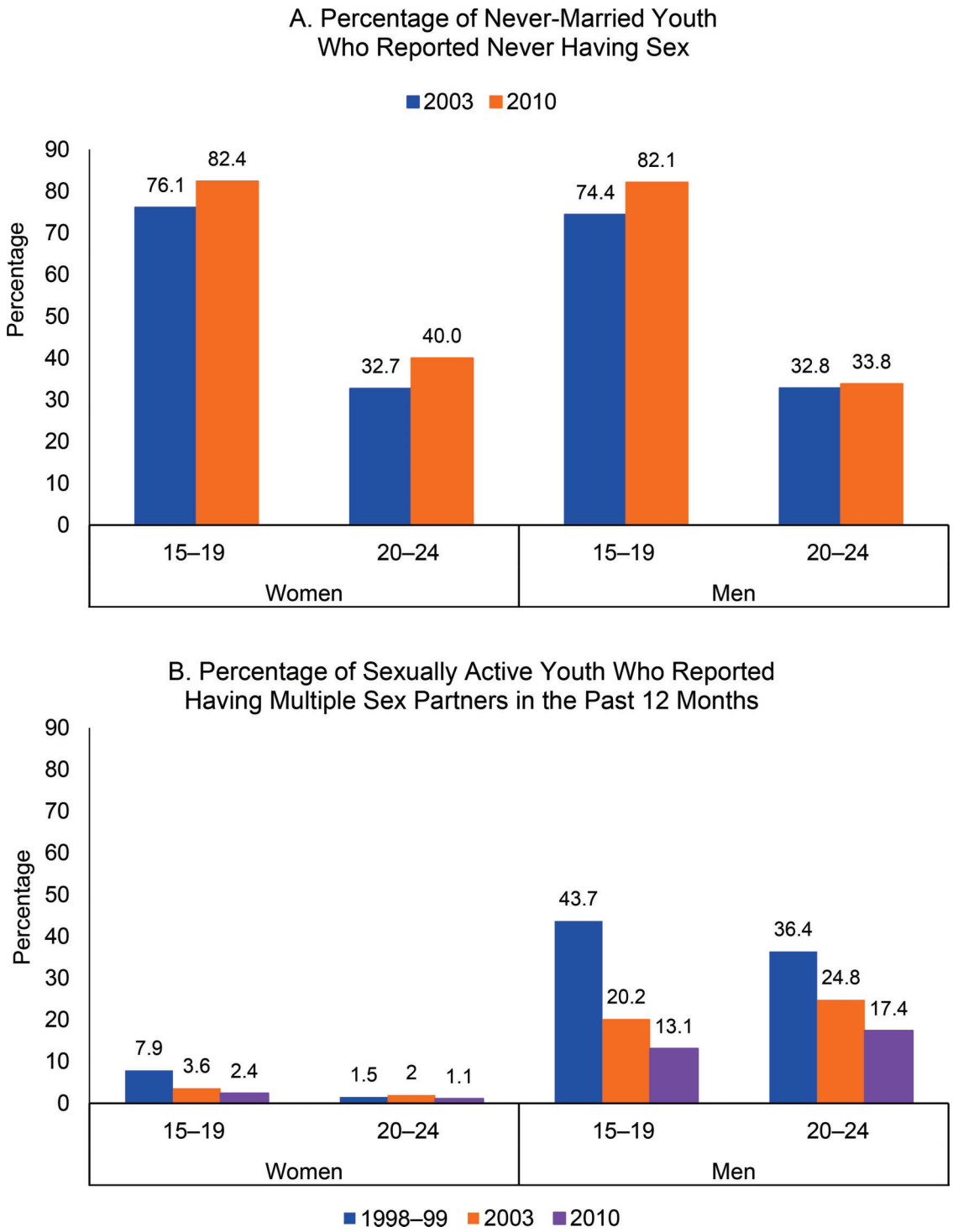


FIGURE 5. Reported Sex Behaviors Among Sexually Active Women and Men Ages 15–49, by Sex and Age Group, Burkina Faso, 1998–99 to 2010

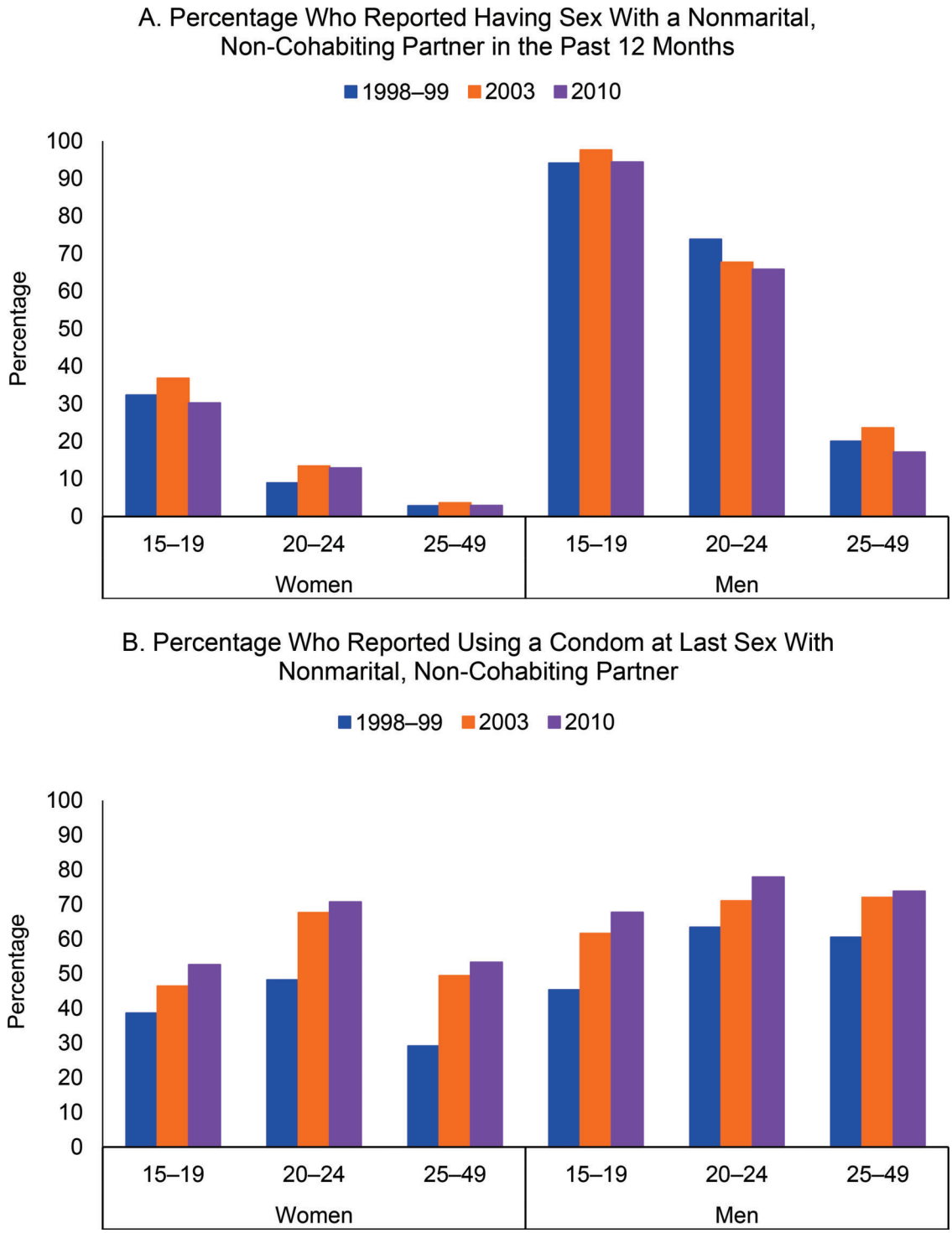
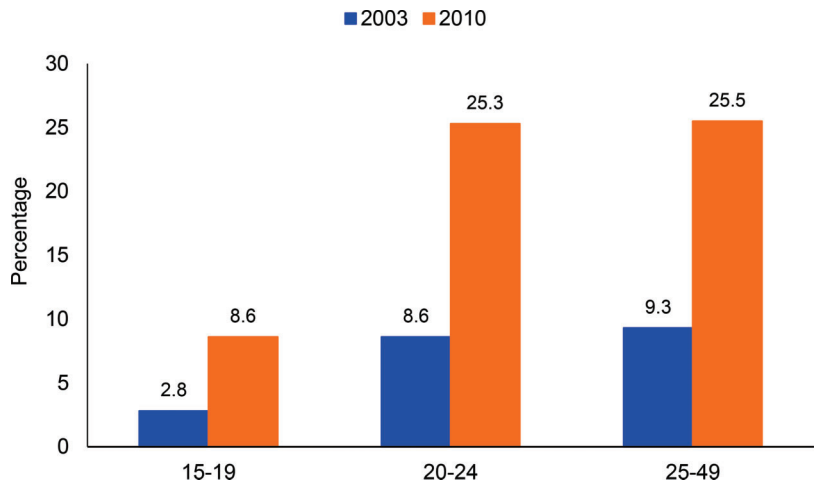


FIGURE 6. Percentage of Men Who Have Ever Received an HIV Test, by Age Group, Burkina Faso, 2003 and 2010



ages 20–24 increased from 49.6% to 79.6% ($P<.001$) and from 83.3% to 96.9% ($P<.001$), respectively, between 2003 and 2010.

DISCUSSION

We analyzed and assessed, for the first time, all data available on trends in HIV prevalence in Burkina Faso from the onset of the epidemic. These data provide a consistent picture of a decline in HIV prevalence among pregnant women ages 15–49 starting in 1998 and continuing up to 2003, from 7.1% to 3.5%, followed by further decline after 2007 to 2.0% in 2014. National DHS data also indicate a reduction of HIV prevalence in the country. The declining trend in HIV prevalence among pregnant women, particularly those ages 15–19 described here, is consistent with data from several other sub-Saharan African countries during a similar time period.[3-5,7,8]

We also presented the first comparisons of data on trends in sexual behavior of comparable populations over time since the onset of the HIV epidemic. The percentage of never-married young women and men ages 15–24 who have never had sex increased substantially during precisely the same time period as when HIV prevalence dropped. Furthermore, the percentage of young individuals reporting having multiple partners decreased, particularly among males, while reported condom use at last sex with non-regular partners increased. Taken together, these trends suggest that the reduction in HIV prevalence was, at least in part, due to a reduction in HIV incidence but also to a strong decline in HIV prevalence among older men (who are usually partners of younger women). Indeed, HIV prevalence among young people ages 15–24 can provide useful indications of trends in HIV incidence, and behavior change among older people, particularly men, could cause reductions in prevalence among young people. The results of these nationwide surveys are consistent with cross-sectional surveys of HIV prevalence and risky behaviors in other countries, all of which demonstrate that the most common behavioral changes involved delays in sexual initiation,[9] reductions in sex outside of marriage,[3,10] declines in number of sex partners, and increases in condom use.[4,11,12]

The temporal order of these changes in behavior and declines in HIV prevalence after 2007 is supported by programmatic efforts occurring during that time. From 2006 to 2010, Burkina Faso established an HIV strategic framework with central coordination. The number of sites for the prevention of mother-to-child transmission of HIV (PMTCT) rose to 780 in 2007, 3 times higher than in 2006, and climbed to 1,226 in 2010. From 2007 onwards, awareness campaigns on female and male condom use were active in all sectors (e.g., schools, health centers,

The percentage of men and women ages 15–49 who reported using a condom at last sex with a nonmarital partner increased significantly between 1998 and 2010.

The percentage of youth who reported having sex before age 15 declined significantly between 1998 and 2010.

and public places). Moreover, the number of health facilities with a counseling center and a voluntary testing center tripled between 2006 and 2007, from 284 to 837, continuing to increase to 1,305 in 2010.[13]

The decline in HIV prevalence in the Burkina Faso DHS was much higher among young women than young men. In 2010, HIV prevalence among young men was as high, or higher, than among women, which is very unusual. In Africa as a whole, women ages 15–24 are infected with HIV at rates 2.5 times that of young men.[14] The gap in HIV decline between men and women may be linked to the scale-up of PMTCT programs. Access to PMTCT can lead to enhanced preventive behavior such as condom use or choice of partners. HIV infection among young women may also be influenced by the risk behavior or infectivity of their sexual partners, who are usually a few or more years older than them.[15-17] In our analysis, we observed a substantial decline in HIV prevalence among older men ($\geq$25 years) along with a lower percentage of adults ($\geq$25 years) reporting 2 or more sexual partners in the last year and an increase in reported condom use. The higher prevalence in young men than young women in Burkina Faso may also reflect to some extent HIV transmission among men who have sex with men. Indeed, Burkina Faso is a country that has very high rates of male circumcision (88.7% in 2010 and 90.4% in 2003 among males ages 15–49); the relatively low prevalence and incidence of HIV in the country is generally credited with the high rates of male circumcision. Accordingly, the transmission dynamic of HIV is probably more a function of most-at-risk people such as sex workers and men who have sex with men. Changes in sexual behaviors have also been accompanied by a reduction of HIV incidence among female sex workers in West Africa. A recent study among female sex workers ages 18–25 years in Burkina Faso showed that combining peer-based prevention and care within the same setting markedly reduced HIV incidence through reduced risky behaviors.[18] This reduction in HIV cases among female sex workers likely has an impact on HIV prevalence in the general population since more than half of new HIV cases in sub-Saharan Africa are linked with female sex worker contacts.[19]

Declines in HIV prevalence were coincident with reductions in sexual risk behavior in Burkina Faso.

Limitations

Although HIV decline in Burkina Faso was paralleled with safer sexual behaviors, these findings have limitations. Data collected on sexual behaviors over time may be subject to social desirability bias, as prevention programs can change the social norms regarding sexual behavior.[20] In addition, although the HIV prevalence data from the ANC surveillance surveys confirm the trends observed in the DHS data, pregnant women are not representative of the general population. In general, estimates based on pregnant women tend to overestimate HIV prevalence among all women at young ages, due to selection for sexual activity,[21] as we observed in the current study. The Burkina Faso DHS sample may also be biased due to differential non-response in the survey and/or exclusion of most-at-risk persons. Finally, the current analysis cannot establish a causal association between changes in sexual behavior and trends in HIV prevalence. Although HIV incidence was certainly reduced among young people ages 15–25, we cannot exclude the potential role of mortality in this age group: individuals who get infected with HIV at 19–20 years can die of the infection by 25 years if they do not receive treatment.

CONCLUSION

Findings from the current study are consistent with previous work indicating that observed declines in HIV prevalence or incidence were coincident with reductions in sexual risk behavior in countries with generalized HIV epidemics.[12] The broad range of HIV education and prevention programs in Burkina Faso that made use of national media along with school- and workplace-based activities and other interpersonal communication interventions may have contributed to the declines in HIV prevalence by helping to reduce risky sex behaviors among youth. Results were particularly encouraging among young women; stronger interventions targeting young men are needed to reinforce the control of the HIV epidemic in Burkina Faso.

Acknowledgments: We thank the DHS Program for providing the national survey data for Burkina Faso. We also gratefully acknowledge helpful comments provided during peer review.

Competing Interests: None declared.

REFERENCES

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). Global report: UNAIDS report on the global AIDS epidemic 2013. Geneva: UNAIDS; 2013. Available from:

http://www.unaids.org/sites/default/files/media_asset/UNAIDS_Global_Report_2013_en_1.pdf

2. Baggaley RF, White RG, Hollingsworth TD, Boily MC. Heterosexual HIV-1 infectiousness and antiretroviral use: systematic review of prospective studies of discordant couples. Epidemiology. 2013;24(1):110–121. CrossRef. Medline
3. Halperin DT, Mugurungi O, Hallett TB, Muchini B, Campbell B, Magure T, et al. A surprising prevention success: why did the HIV epidemic decline in Zimbabwe? PLoS Med. 2011;8(2): e1000414. CrossRef. Medline
4. Kirby D. Changes in sexual behavior leading to the decline in the prevalence of HIV in Uganda: confirmation from multiple sources of evidence. Sex Transm Infect. 2008;84 Suppl 2:ii35-ii41. CrossRef. Medline
5. International Group on Analysis of Trends in HIV Prevalence and Behaviours in Young People in Countries most Affected by HIV. Trends in HIV prevalence and sexual behaviour among young people aged 15-24 years in countries most affected by HIV. Sex Transm Infect. 2010;86 Suppl 2:ii72-ii83. CrossRef. Medline
6. Corsi DJ, Neuman M, Finlay JE, Subramanian S. Demographic and health surveys: a profile. Int J Epidemiol. 2012; 41(6):1602–1613. CrossRef. Medline
7. Bello GA, Chipeta J, Aberle-Grasse J. Assessment of trends in biological and behavioural surveillance data: is there any evidence of declining HIV prevalence or incidence in Malawi? Sex Transm Infect. 2006;82 Suppl1:i9-i13. CrossRef. Medline
8. Kayeyi N, Fylkesnes K, Michelo C, Makasa M, Sandøy I. Decline in HIV prevalence among young women in Zambia: national-level estimates of trends mask geographical and socio-demographic differences. PLoS One. 2012;7(4):e33652. CrossRef. Medline
9. Marsh KA, Nyamukapa CA, Donnelly CA, Garcia-Calleja JM, Mushati P, Garnett GP, et al. Monitoring trends in HIV prevalence among young people, aged 15 to 24 years, in Manicaland, Zimbabwe. J Int AIDS Soc. 2011;14:27. CrossRef. Medline
10. Stoneburner RL, Low-Beer D. Population-level HIV declines and behavioral risk avoidance in Uganda. Science. 2004; 304(5671):714–718. CrossRef. Medline
11. Fylkesnes K, Musonda RM, Sichone M, Ndhlovu Z, Tembo F, Monze M. Declining HIV prevalence and risk behaviors in Zambia: evidence from surveillance and population-based surveys. AIDS. 2001;15(7):907–916. CrossRef. Medline
12. Gregson S, Gonese E, Hallett TB, Taruberekera N, Hargrove JW, Lopman B, et al. HIV decline in Zimbabwe due to reductions in risky sex? Evidence from a comprehensive epidemiological review. Int J Epidemiol. 2010;39(5):1311–1323. CrossRef. Medline
13. Nikiema DE. Prise en charge thérapeutique des personnes vivant avec le VIH et territorialités: exemple du Burkina Faso [doctoral thesis]. Descartes (France): Université Paris-Est; 2008. Available from: https://halshs.archives-ouvertes.fr/tel-00462158/document
14. United Nations Children's Fund (UNICEF): Eastern and Southern Africa [Internet]. Nairobi (Kenya): UNICEF Regional Office for Eastern & Southern Africa (ESARO). Preventing HIV infection among adolescents and young people; [cited 2016 May 27]. Available from: http://www.unicef.org/esaro/5482_HIV_prevention.html
15. Katz I, Low-Beer D. Why has HIV stabilized in South Africa, yet not declined further? Age and sexual behavior patterns among youth. Sex Transm Dis. 2008;35(10):837–842. CrossRef. Medline
16. Kelly RJ, Gray RH, Sewankambo NK, Serwadda D, Wabwire-Mangen F, Lutalo T, et al. Age differences in sexual partners and risk of HIV-1 infection in rural Uganda. J Acquir Immune Defic Syndr. 2003;32(4):446–451. Medline. Full-text article available from: http://meta.wkhealth.com/pt/pt-core/template-journal/lwwgateway/media/landingpage.htm?issn=1525-4135&volume=32&issue=4&spage=446
17. Gregson S, Nyamukapa C, Garnett G, Mason PR, Zhuwau T, Caraël M, et al. Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in rural Zimbabwe. Lancet. 2002;359(9321):1896–1903. CrossRef. Medline
18. Traore IT, Meda N, Hema NM, Ouedraogo D, Some F, Some R, et al. HIV prevention and care services for female sex workers: efficacy of a targeted community-based intervention in Burkina Faso. J Int AIDS Soc. 2015;18:20088. CrossRef. Medline
19. Alary M, Lowndes CM. The central role of clients of female sex workers in the dynamics of heterosexual HIV transmission in sub-Saharan Africa. AIDS. 2004;18(6):945–947. CrossRef. Medline
20. Catania JA, Gibson DR, Chitwood DD, Coates TJ. Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies of sexual behavior. Psychol Bull. 1990;108(3):339–362. CrossRef. Medline
21. Zaba B, Gregson S. Measuring the impact of HIV on fertility in Africa. AIDS. 1998;12 Suppl 1:S41-S50. Medline. Full-text article available from: http://meta.wkhealth.com/pt/pt-core/template-journal/lwwgateway/media/landingpage.htm?issn=0269-9370&volume=12&issue=&spage=S41

Peer Reviewed

Received: 2016 Jan 19; **Accepted:** 2016 May 25

Cite this article as: Kirakoya-Samadoulougou F, Nagot N, Samadoulougou S, Sokey M, Guire A, Sombie I, et al. Declining HIV prevalence in parallel with safer sex behaviors in Burkina Faso: evidence from surveillance and population-based surveys. Glob Health Sci Pract. 2016; 4(2):326–335. http://dx.doi.org/10.9745/GHSP-D-16-00013

© Kirakoya-Samadoulougou et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00013

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

INNOVATION

Handwashing With a Water-Efficient Tap and Low-Cost Foaming Soap: The Povu Poa "Cool Foam" System in Kenya

Jaynie Whinnery,[a] Gauthami Penakalapati,[a] Rachel Steinacher,[a] Noel Wilson,[b] Clair Null,[a] Amy J Pickering[c]

The new handwashing system, designed with end user input, features an economical foaming soap dispenser and a hygienic, water-efficient tap for use in household and institutional settings that lack reliable access to piped water. Cost of the soap and water needed for use is less than US$0.10 per 100 handwash uses, compared with US$0.20–$0.44 for conventional handwashing stations used in Kenya.

Using an interactive and iterative design approach involving representative end users, we created a new handwashing system in Kisumu, Kenya, to make handwashing convenient and economical in areas without reliable piped water. The innovative and adaptable system, branded as Povu Poa ("Cool Foam" in Kiswahili), integrates a cost-effective foaming soap dispenser with a hygienic, water-frugal water tap in a secure and affordable design.

BACKGROUND

Handwashing with soap and water reduces the spread of respiratory and diarrheal disease, the 2 leading causes of death in children under 5 years old.[1-5] Studies estimate that handwashing with soap can reduce acute respiratory infections by 21% and the risk of diarrhea by 40%.[6,7]

In settings without piped water, refilling water containers and securing soap for handwashing requires constant user effort and expense, creating barriers to handwashing with soap. In Kenya, for example, 78% of the population lacks access to household piped water,[8] and the prevalence of handwashing with soap after contact with feces is estimated to be 15%.[6]

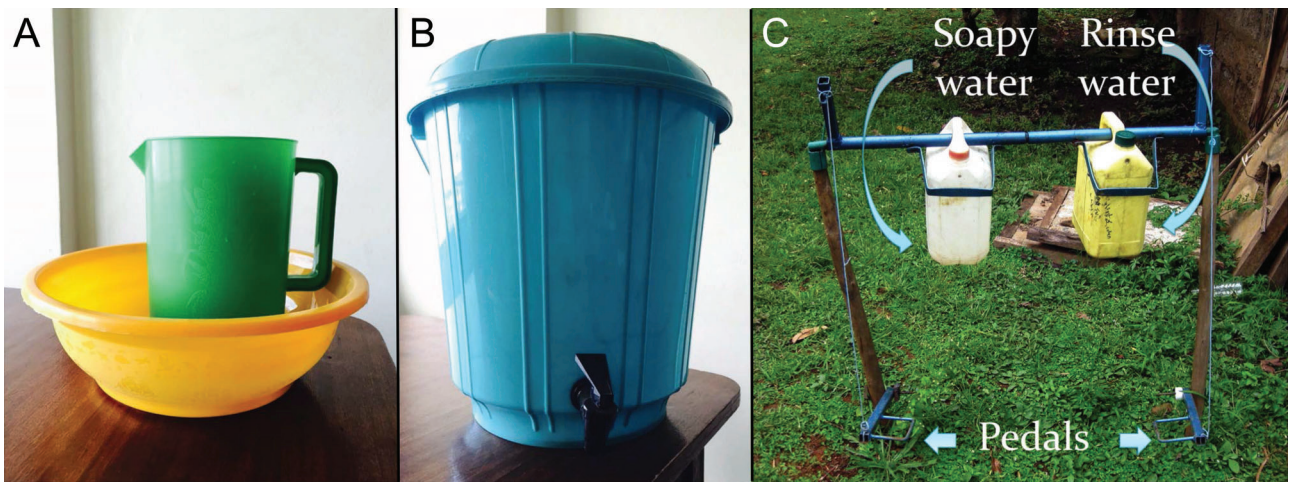
People are more likely to wash their hands at critical times if they have a dedicated place with soap and water.[9] Conventional handwashing stations in Kenya, such as a jug and basin (Figure 1A) or a bucket with a tap (Figure 1B), are prone to soap theft, are cumbersome and unhygienic, and are not water-efficient. Alternative handwashing systems aim to provide affordable, water-efficient, and dedicated locations for handwashing. For example, the "leaky tin" dispenses water from a hole near the base of a container when a person removes a plug, and the "tippy tap" dispenses water by tipping the container when a person pulls on the attached string lever or steps on a foot pedal. However, difficulties with soap provision and security remain. The dual tippy tap integrates separate containers for soapy water and rinse water into a single system to address these issues (Figure 1C).[10] The soapy water mixture, a 50:1 water-to-powdered soap ratio, increases the lifetime of the soap and is an effective cleansing agent.[11] Still, the dual tippy tap has several shortcomings: it can become unstable over time, it requires frequent maintenance, the metal components are prone to theft, and the hardware is not particularly attractive.

INNOVATION PROCESS

We began our design process by conducting in-depth interviews and focus group discussions with potential users in low-income, peri-urban areas of Kisumu, including household members in 5 households, students and teachers in 3 primary schools, and health care workers in 2 clinics. Users preferred hand washing systems that were easy to operate and refill with water, a tap that allowed them to control the flow of water, and a portable unit that they could store inside

[a] Innovations for Poverty Action, Kenya, Kisumu, Kenya.
[b] Catapult Design, San Francisco, CA, USA.
[c] Stanford University, Stanford Center for Innovation in Global Health, Stanford, CA, USA.
Correspondence to Amy J Pickering (amyjanel@gmail.com).

FIGURE 1. Conventional Handwashing Stations in Kenya



(A) jug and basin; (B) bucket with a tap; (C) dual tippy tap that dispenses soapy water and plain water.

their home or institutions at night to prevent theft. We then created a series of handwashing system prototypes in response to user needs and iteratively developed the designs with multiple rounds of input from end users based on their experiences testing the various features.

After multiple rounds of user-focused testing with various handwashing components and systems, the final product we developed was a desirable, robust, affordable, and water-frugal system that integrates a secure soap dispenser with rinse water. We developed 2 configurations of the system, both of which are currently marketed under the brand Povu Poa ("Cool Foam" in Swahili).

- The Povu Poa **bucket model** is composed of two 20-liter buckets stacked vertically, which can be set on any level surface and easily disassembled for transport and security (Figure 2A).
- The Povu Poa **pipe model** is a light, highly portable 5-liter pipe that can be hung from a wall, fencepost, tree, or other standing structure and that can be plumbed to larger water tanks and drainage systems (Figure 2B).

Both Povu Poa models integrate the water-frugal swing tap to dispense water (Figure 3A) and the accordion soap foamer that mixes soapy water with air to create a foam (Figure 3B). Runoff water from handwashing collects in the lower bucket for the bucket model or a separate basin for the pipe model (not shown).

78% of the population in Kenya lacks access to household piped water, creating barriers to handwashing with soap.

KEY PRODUCT FEATURES OF THE POVU POA HANDWASHING SYSTEM

- **Soap security:** The soap foamer is attached to the system, preventing theft.
- **Affordability:** Just 5 g of powdered or liquid soap mixed with 250 mL of water can provide 100 uses for US$0.10 (cost includes soap and water).
- **Hygienic:** The innovative swing-tap design is bidirectional and can be used with the back of the hand or wrist, limiting recontamination of hands after handwashing.
- **Water-frugality:** The water flow is sufficient for handwashing while providing a 30-77% reduction in water usage compared with conventional methods.
- **Scalability:** Components are specifically designed for low-cost mass production and deployment, estimated at US$12 per unit.
- **Adaptable:** The 2 handwashing station configurations can be adapted to meet different

The handwashing system we developed, marketed under the brand Povu Poa, comes in 2 configurations: a bucket and a pipe model.

FIGURE 2. Configurations of the Povu Poa Handwashing System

(A) bucket model design; (B) pipe model design.

The Povu Poa system uses 30%–77% less water than conventional handwashing stations used in Kenya.

needs and preferences (Figure 4) and can be used in households and institutional settings, such as schools and health centers.

SOAP AND WATER EFFICIENCY TESTING

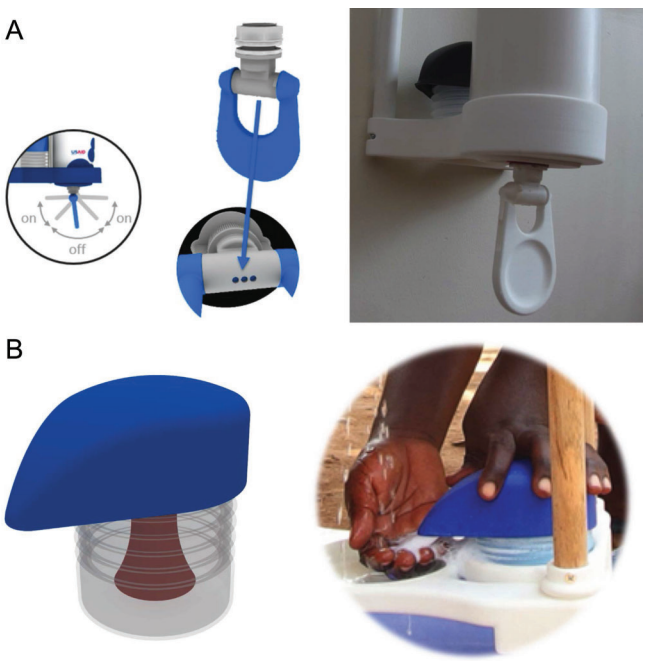
We tested the water and the soap efficiency of the Povu Poa pipe and bucket prototypes alongside 6 handwashing systems commonly used in Kenya, such as the dual tippy tap and a jug and basin. At the beginning of each test, the system being evaluated was filled to capacity with water. For each test, research assistants from Innovations for Poverty Action washed their hands with soap and water for 20 seconds. Handwashing events continued intermittently until the water reservoir was empty. The total volume of water and handwash count were used to calculate water quantity per use. Before and after weights of the soap were used to calculate the amount of soap per use. Actual soap costs were used along with user-provided water prices.

The Povu Poa pipe model would pay for itself in about 2.5 years for a family of 5.

The Povu Poa systems used 30% to 77% less water compared with the conventional systems tested, providing approximately 14 to 15 uses per 5 liters of water compared with 4 to 10 uses from the other systems (Table). The Povu Poa systems also used 94% to 99% less soap than the other tested systems, providing approximately 15,000 uses per US$1 spent on soap compared with approximately 500 to 1,600 uses with conventional systems. Overall the cost for soap and water with the Povu Poa is less than US$0.10 per 100 uses, compared with US$0.20 to US$0.44 per 100 uses for other systems tested. The water-frugal tap provides approximately 60 and 14 uses between refills for the bucket and pipe model, respectively.

Based on these results and our estimated mass production cost of US$12 for the Povu Poa pipe model, the pipe model would pay for itself in approximately 2.5 years for a family of 5 who each wash their hands 3 times per day using a jug and basin. When considering the soap foamer alone, at a mass production price of US$3, the

FIGURE 3. Water- and Soap-Dispensing Elements of the Povu Poa Handwashing System



(A) Users can operate the Povu Poa Swing Tap hygienically with the back of their hand. The swing tap dispenses water from up to 3 holes; users can control the amount and flow of water coming from these holes based on how far forward or backward they pull/push the tap. (B) The Povu Poa Soap Foamer creates foam by mixing soapy water and air.

FIGURE 4. Potential Adaptations to the Povu Poa Handwashing System

TABLE. Water and Soap Efficiency for the Povu Poa Handwashing Prototypes Compared With Other Handwashing Devices

	Soap Type	Water Quantity per Use (mL)	No. of Uses per 5 L of Water	No. of Uses per US$1 Spent on Water	Amount of Soap per Use (g)	No. of Uses per US$1 Spent on Soap	Cost in US$ for Soap and Water per 100 Uses
Povu Poa pipe model	Soapy water made with Omo brand powdered soap	357	14	1,064	0.03	14,865	$0.10
Povu Poa bucket model	Soapy water made with Omo brand powdered soap	333	15	1,140	0.03	15,696	$0.09
Dual tippy tap	Soapy water made with Omo brand powdered soap	625	8	608	0.96	500	$0.37
Jug and basin	Multipurpose bar soap (Toyo brand)	513	10	741	0.49	1,600	$0.20
Sink with metal tap	Multipurpose bar soap (Toyo brand)	1,429	4	266	0.71	1,100	$0.47
20 L barrel with metal tap	Locally made liquid soap	690	7	551	1.90	800	$0.30
20 L barrel with plastic tap	Locally made liquid soap	1,000	5	380	2.85	550	$0.44
15 L bucket with plastic tap	Multipurpose bar soap (Toyo brand)	833	6	456	0.89	900	$0.33

soap foamer would pay for itself in just 1 year using the same assumptions and the calculated cost savings of soap.

CURRENT AND FUTURE WORK

We have produced 200 Povu Poa systems in Kenya and are currently field testing them in several locations.

In focus group discussions, approximately 80% of participants stated they would purchase a Povu Poa product, suggesting the aspirational value of the product. We have produced 200 Povu Poa systems in Kenya and are currently field testing them in peri-urban households, schools, and health clinics to assess long-term usage (up to 1 year of evaluation) and durability. To assess demand for the product, Povu Poa units are currently being sold to households at randomized price points, ranging from US$1 to US$12, to determine the price that most low-income users are willing and able to pay. Next steps include finalizing the design for mass production of the Povu Poa system, partnering with a plastics manufacturer, and identifying effective sales and distribution strategies.

Acknowledgments: This manuscript was made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government. We would like to thank Jemima Akinyi Okal for excellent fieldwork assistance and Pavani Ram for input on the design process.

Competing Interests: None declared.

REFERENCES

1. Bhutta ZA, Das JK, Walker N, Rizvi A, Campbell H, Rudan I, et al. Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? Lancet. 2013;381(9875):1417-1429. CrossRef. Medline
2. Bowen A, Agboatwalla M, Luby S, Tobery T, Ayers T, Hoekstra RM. Association between intensive handwashing promotion and child development in Karachi, Pakistan: a cluster randomized controlled trial. Arch Pediatr Adolesc Med. 2012;166(11):1037-1044. CrossRef. Medline

3. Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. Lancet Infect Dis. 2003;3(5):275-281. CrossRef. Medline
4. Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. Trop Med Int Health. 2006; 11(3):258-267. CrossRef. Medline
5. Walker CL, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA, et al. Global burden of childhood pneumonia and diarrhoea. Lancet. 2013;381(9875):1405-1416. CrossRef. Medline
6. Freeman MC, Stocks ME, Cumming O, Jeandron A, Higgins JP, Wolf J, et al. Hygiene and health: systematic review of handwashing practices worldwide and update of health effects. Trop Med Int Health. 2014;19(8):906-916. CrossRef. Medline
7. Aiello AE, Coulborn RM, Perez V, Larson EL. Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis. Am J Public Health. 2008;98(8):1372-1381. CrossRef. Medline
8. United Nations Children's Fund (UNICEF); World Health Organization (WHO). Progress on sanitation and drinking water: 2015 update and MDG assessment. New York: UNICEF; 2015. Co-published by WHO . Available from: http://www.unicef.org/publications/files/Progress_on_Sanitation_and_Drinking_Water_2015_Update_.pdf
9. Luby SP, Haldexsr AK, Tronchet C, Akhter S, Bhuiya A, Johnston RB. Household characteristics associated with handwashing with soap in rural Bangladesh. Am J Trop Med Hyg. 2009;81(5):882-887. CrossRef. Medline
10. Arnold BF, Null C, Luby SP, Unicomb L, Stewart CP, Dewey KG, et al. Cluster-randomised controlled trials of individual and combined water, sanitation, hygiene and nutritional interventions in rural Bangladesh and Kenya: the WASH Benefits study design and rationale. BMJ Open. 2013;3(8):e003476. CrossRef. Medline
11. Amin N, Pickering AJ, Ram PK, Unicomb L, Najnin N, Homaira N, et al. Microbiological evaluation of the efficacy of soapy water to clean hands: a randomized, non-inferiority field trial. Am J Trop Med Hyg. 2014;91(2):415-423. CrossRef. Medline

Peer Reviewed

Received: 2016 Jan 27; **Accepted:** 2016 May 13

Cite this article as: Whinnery J, Penakalapati G, Steinacher R, Wilson N, Null C, Pickering AJ. Handwashing with a water-efficient tap and low-cost foaming soap: the Povu Poa "Cool Foam" system in Kenya. Glob Health Sci Pract. 2016;4(2):336–341. http://dx.doi.org/10.9745/GHSP-D-16-00022

© Whinnery et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00022

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

TAKING EXCEPTION

Fertility Awareness Methods Are Not Modern Contraceptives: Defining Contraception to Reflect Our Priorities

Kirsten Austad,[a,b] Anita Chary,[a] Alejandra Colom,[c] Rodrigo Barillas,[d] Danessa Luna,[e] Cecilia Menjívar,[f] Brent Metz,[g] Amy Petrocy,[h] Anne Ruch,[i] Peter Rohloff[a,i]

A recent article in GHSP calls for classifying fertility awareness methods as ''modern contraceptives'' despite their inferiority. We believe in a rights-based approach, which considers the real-world conditions that many women face, including constrained sexual agency and low baseline reproductive health literacy. We must demonstrate true commitment to increasing access to the most effective and reliable contraceptive methods.

See related article by Malarcher.

INTRODUCTION

Unintended pregnancy is both a global public health challenge and an important human rights issue.[1] Worldwide 40% of pregnancies are unintended.[2] These unintended pregnancies pose significant health risks to women because of the obstetrical risks of multiple births, short interpregnancy intervals, and unsafe abortions, as well as because they worsen poverty-related inequalities. Addressing this unmet need for family planning mandates a coordinated response of dedicated human resources, economic investment, and application of the best-available scientific evidence. Highly efficacious and safe methods of contraception including injectable and oral contraceptives, sterilization, and long-acting reversible contraceptives (LARCs), comprising implants and intrauterine devices (IUDs), are key to this effort.

Global data on the use of various forms of contraception are important for understanding rates of unplanned pregnancies, monitoring unmet contraceptive needs, and tracking user preferences. For this reason, the term ''modern contraceptives'' has been introduced as an umbrella term grouping together barrier methods, injectable and oral contraceptives, LARCs, and sterilization. While no precise consensus on the term ''modern contraceptives'' exists, one compelling definition claims they ''are technological advances designed to overcome biology'' that ''enable couples to have sexual intercourse at any mutually desired time.''[3]

In the March 2016 issue of *Global Health: Science and Practice*, Malarcher et al.[4] advocate, on behalf of the United States Agency for International Development (USAID), that fertility awareness methods (FAMs) should be included in the definition of modern contraceptives. We see this proposed change in terminology as a step in the wrong direction toward the goal of fulfilling every woman's right to plan her family.

DRAWBACK OF FAMS

The argument for FAMs as modern contraceptives hinges on the assertion that they are ''effective at pregnancy prevention.'' Malarcher et al. support this claim by citing similar typical-use effectiveness rates for the Standard Days Method and TwoDay Method as barrier methods, and for the Lactational Amenorrhea Method (LAM) as injectable and combined oral contraceptives. The authors, however, fail to highlight that

[a] Wuqu' Kawoq | Maya Health Alliance, Santiago Sacatepéquez, Guatemala.
[b] Boston Medical Center, Department of Family Medicine, Boston, MA, USA.
[c] Population Council, Guatemala City, Guatemala.
[d] Asociación Alas, Antigua, Guatemala.
[e] Asociación Generando Equidad (ASOGEN), Chimaltenango, Guatemala.
[f] University of Kansas, Department of Sociology, Lawrence, KS, USA.
[g] University of Kansas, Center for Latin American and Caribbean Studies, Lawrence, KS, USA.
[h] Friendship Bridge, Panajachel, Guatemala.
[i] SewHope, Petén, Guatemala
[i] Brigham and Women's Hospital, Division of Global Health Equities, Boston, MA, USA.
Correspondence to Peter Rohloff (prohloff@partners.org).

FAMs are outperformed by LARCs with efficacy rates of 99.95% for the currently available implant, 99.8% for the levonorgestrel IUD, and 99.2% for the copper IUD, all within the first year of use.[5] These differences become even more pronounced when extended over the decades of a woman's reproductive lifetime, a time frame more relevant to patients.

Also missing from Malarcher et al.'s article is a discussion of the significant limitations of FAMs that limit their real-world utility. Both the Standard Days Method and TwoDay Method assume that a woman has the agency to say no to intercourse during her fertile period, a choice not available to the 10% to 50% of women who experience sexual violence and coercion worldwide.[6] This limitation is of particular importance for adolescent girls, up to one-third of whom report that their first sexual experience was forced, according to the World Health Organization's (WHO's) "World Report on Violence and Health."[7]

Additionally, LAM is by definition only a temporary solution to be used in the immediate 6-month postpartum period. Six months is shorter than the medically recommended interpregnancy interval of about 3 years,[8] and thus LAM must, at best, be conceived as only a bridge to a longer-term method. Moreover, LAM is ineffectual for the 20% to 81% of eligible women who will begin menstruating before 6 months postpartum, despite exclusive breastfeeding.[9] Sudden return of menses during a period in which a woman anticipated she would have had reliable contraception leaves her vulnerable to an unplanned pregnancy.

TIERED-EFFICACY COUNSELING AND POLICY

Malarcher and colleagues also argue that redefining FAMs as modern contraceptives will facilitate increased investments in their introduction and provision. But in what way does that prioritization of resources serve the needs of vulnerable women? Ideally, family planning counseling should be non-directive. It should help a woman clarify her unique desires and preferences, and it should effectively provide her with the information necessary to make her informed personal choice. To this point, research shows that the *absolute effectiveness* of a method for pregnancy prevention is *the most important factor* cited by end users when choosing a method, even over other considerations such as side effects.[10,11]

An important aid in educating women on their choices is the evidence-based WHO tiered-efficacy graphic, which provides pictures of all contraceptive methods in 4 rows, beginning with the most effective types (LARCs and sterilization) in the top row and ending with the least effective methods (withdrawal and spermicides) in the bottom row. Despite such visual aids, communicating actual-use failure rates in a way women can easily understand can be difficult.[12,13] Clearly communicating to women which forms of contraception are most effective and reducing barriers to their access must be public health priorities.

Categorizing FAMs as modern contraceptives, as Malarcher et al. seek to do, is counterproductive to these goals. Their proposed shift in terminology risks sending an incorrect message to women, medical providers, and policy makers that we should think of all contraceptive methods as equally effective under real-world conditions. For a useful analogy within another field of medicine, consider a patient with high cholesterol for which there are 2 treatments, one of which is 20 times more effective than the other at preventing deadly heart attack and stroke (roughly the same efficacy of LARCs vs. non-LARCs for pregnancy prevention[14]). In this situation, the patient is best served if the physician first draws attention to the most effective treatment, including a fair assessment of side effects and other drawbacks, and then continues on to the entire list of less efficacious options, none of which need be withheld if the patient's values and goals are not met by the first-line treatment. We should approach undesired fertility with this same seriousness and with the same fair assessment of efficacy data because decisions about contraception can also be lifesaving. This is true for many of the 47,000 women who die each year seeking unsafe abortions for undesired pregnancies, which are largely preventable by existing, highly efficacious contraceptive methods.

In this discussion, it is important not to place the most effective contraceptive methods such as LARCs in opposition to other family planning methods. We do not mean to suggest that the capacity for provision of these most effective contraceptive methods should completely replace teaching on FAMs. However, all modern, non-FAM methods require intentional investments in infrastructure and human capital. Terminology

"Modern contraceptives" is an umbrella term describing barrier methods, injectables, oral contraceptives, implants, IUDs, and sterilization.

We see Malarcher and colleagues' call for fertility awareness methods to be classified as modern contraceptives as a step in the wrong direction.

The Standard Days Method and TwoDay Method assume women have the agency to say no to sex during her fertile period.

The Lactational Amenorrhea Method is only a temporary solution to be used in the immediate 6-month postpartum period.

Method effectiveness is the most important factor cited by end users when choosing a method.

The proposed shift in terminology for fertility awareness methods sends an incorrect message that we should think of all contraceptives as equally effective under real-world conditions.

that overestimates the real-world efficacy of FAMs may serve to undermine these necessary investments, such as securing supply chains for LARCs and increasing trained providers, which underlie the current crisis of access to family planning in many low- and middle- income countries. In the final analysis, this end may be best served by replacing the vocabulary of modern and traditional contraception with a classification system based solely on method effectiveness, such as that provided by the WHO tiered-efficacy chart. Vulnerable women around the world are best served both by individualized counseling and national or regional policies that prioritize the most effective methods of pregnancy prevention, as women themselves continue to request.[10,11]

A RIGHTS-BASED APPROACH

The best solution may be to replace the vocabulary of modern vs. traditional contraception by classifying methods solely on their effectiveness.

Maintaining choice in decisions regarding contraception is fundamental—a point which Malarcher and colleagues do effectively point out—and one which is a basic issue of human rights.[15] A woman may choose any method of contraception for reasons as varied as personal perception of side effects, cultural norms, religious beliefs, or prior negative experience with a method, all of which must be respected.

The core challenge is teaching counselors to remain sensitive to these factors while also clarifying misinformation about effective contraception. For example, studies have catalogued a multitude of factual misperceptions among end users about LARCs, such as beliefs that IUDs cause infertility or chronic pelvic pain or that they lead to reproductive malignancies.[16] If we do not develop effective techniques for ensuring that women correctly understand the medical facts, then we are providing "free choice" in name only. Categorizing FAMs as modern contraceptive techniques, by overestimating their real-world effectiveness and the level of autonomy and agency that women can exercise when deploying them, only exacerbates this central issue.

ON THE GROUND

The authors of this piece are united by our work for reproductive justice in Guatemala. A lower-middle-income country, Guatemala provides a case study of the systemic barriers that compromise women's ability to plan their fertility. Guatemala has one of the highest total fertility rates in Latin America. According to a large-scale national survey, 56% of women do not want to have more children. One in 3 Guatemalan women has an unmet need for a modern contraceptive method (excluding FAMs), and this need is even more marked among indigenous women and adolescent girls.[17]

The utility of FAMs is greatly restricted in Guatemala, because many women have limited power to choose whether or not to engage in sexual intercourse. Sexual violence was a commonly used military weapon during the country's civil war from 1960 to 1996 and remains unsettlingly prevalent today. Similarly, poor understanding of fertility means that FAMs often fail to meet the family planning needs of adolescents, who give birth to 1 in every 5 children born in Guatemala.[17] The country's Ministry of Education, tasked with offering sexual education in public schools since 2010, has delayed its implementation under pressure from religious authorities and prominent political figures. As a result, women have little access to formal public sexual health education necessary to help them make more informed reproductive choices. Many of our patients, clients, and beneficiaries report that sex and sexuality were taboo topics within their households when they grew up, and women's baseline understanding of their menstrual and fertility cycles are low. Promoting FAMs within these contexts of constrained sexual agency and low baseline reproductive health literacy is an immediately dangerous strategy.

We strongly believe tiered-efficacy family planning efforts are part of the solution to these pressing human rights problems. How we talk about contraception reflects our priorities to women and to the global health community. Terminology used to classify methods should reflect women's desires for highly efficacious contraception and should reflect the realities of women's social positions and restricted agency in many settings. This end is best served by clearly stating that modern contraceptive methods and FAMs are *not* equal tools. We hope that USAID and other policy and funding agencies will work to expand women's access to safe and effective contraceptive technology, in defense of the human right to reproductive freedom.

Acknowledgments: The authors thank members of their respective institutions who provided valuable feedback on this article, including David Flood, Nora King, Sarah Messmer, and Boris Martinez.

Competing Interests: None declared.

REFERENCES

1. Stanback J, Steiner M, Dorflinger L, Solo J, Cates W Jr. WHO tiered-effectiveness counseling is rights-based family planning. Glob Health Sci Pract. 2015;3(3):352-357. CrossRef. Medline
2. Sedgh G, Singh S, Hussain R. Intended and unintended pregnancies worldwide in 2012 and recent trends. Stud Fam Plann. 2014;45(3):301-314. CrossRef. Medline
3. Hubacher D, Trussell J. A definition of modern contraceptive methods. Contraception. 2015;92(5):420-421. CrossRef. Medline
4. Malarcher S, Spieler J, Short Fabric M, Jordan S, Starbird E, Kenon C. Fertility awareness methods: distinctive modern contraceptives. Glob Health Sci Pract. 2016;4(1):13-15. CrossRef. Medline
5. United States Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). Effectiveness of family planning methods. Atlanta (GA): CDC; 2015. Available from: http://www.cdc.gov/reproductivehealth/unintendedpregnancy/pdf/contraceptive_methods_508.pdf
6. World Health Organization (WHO). Understanding and addressing violence against women: overview. Geneva: WHO; 2012. Available from: http://apps.who.int/iris/bitstream/10665/77434/1/WHO_RHR_12.37_eng.pdf
7. Krug E, Dhlberg L, Mercy J, Zwi A, Lozano R. World report on violence and health. Geneva: World Health Organization; 2002. Available from: http://www.who.int/violence_injury_prevention/violence/world_report/en/
8. Conde-Agudelo A, Rosas-Bermúdez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. JAMA. 2006;295(15):1809-1823. CrossRef. Medline
9. Van der Wijden C, Manion C. Lactational amenorrhoea method for family planning. Cochrane Database Syst Rev. 2015;(10): CD001329. CrossRef. Medline
10. Snow R, García S, Kureshy N, Sadana R, Singh S, Becerra-Valdivia M, et al. Attributes of contraceptive technology: women's preferences in seven countries. In: Ravindran TKS,Berer M, Cottingham J, editors. Beyond acceptability: users' perspectives on contraception. London: Reproductive Health Matters for the World Health Organization; 1997. Available from: http://whqlibdoc.who.int/publications/0953121003.pdf
11. Tolley EE, McKenna K, Mackenzie C, Ngabo F, Munyambanza E, Arcara J, et al. Preferences for a potential longer-acting injectable contraceptive: perspectives from women, providers, and policy makers in Kenya and Rwanda. Glob Health Sci Pract. 2014;2(2):182-194. CrossRef. Medline
12. Eisenberg D, Secura G, Madden T, Allsworth J, Zhao Q, Peipert J. Knowledge of contraceptive effectiveness. Am J Obstet Gynecol. 2012;206(6):479:e1-e9. CrossRef. Medline
13. Kopp Kallner H, Thunell L, Brynhildsen J, Lindeberg M, Gemzell Danielsson K. Use of contraception and attitudes towards contraceptive use in Swedish women: a nationwide survey. PLoS One. 2015;10(5):e0125990. CrossRef. Medline
14. McNicholas C, Madden T, Secura G, Peipert JF. The contraceptive CHOICE project round up: what we did and what we learned. Clin Obstet Gynecol. 2014;57(4):635-643. CrossRef. Medline
15. World Health Organization (WHO). Ensuring human rights in the provision of contraceptive information and services: guidance and recommendations. Geneva: WHO; 2014. Available from: http://www.who.int/reproductivehealth/publications/family_planning/human-rights-contraception/en/
16. Russo JA, Miller E, Gold MA. Myths and misconceptions about long-acting reversible contraception (LARC). J Adolesc Health. 2013;52(4 Suppl):S14-S21. CrossRef. Medline
17. Ministerio de Salud Pública y Asistencia Social (MSPAS); Instituto Nacional de Estadísticas (INE); ICF International. Encuesta nacional de salud materno infantil 2014-2015. Guatemala City (Guatemala): MSPAS; 2015. Available from: http://dhsprogram.com/pubs/pdf/PR57/PR57.pdf

Peer Reviewed

Received: 2016 Feb 12; **Accepted:** 2016 May 17

Cite this article as: Austad K, Chary A, Colom A, Barillas R, Luna D, Menjivar C, et al. Fertility awareness methods are not modern contraceptives: defining contraception to reflect our priorities. Glob Health Sci Pract. 2016;4(2):342–345. http://dx.doi.org/10.9745/GHSP-D-16-00044

© Austad et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00044

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

TAKING EXCEPTION

Response to Austad: Offering a Range of Methods, Including Fertility Awareness Methods, Facilitates Method Choice

Shawn Malarcher,[a] Madeleine Short Fabic,[a] Jeff Spieler,[b] Ellen H Starbird,[a] Clifton Kenon,[a] Sandra Jordan[a]

When selecting a contraceptive method, women and men consider various attributes in addition to effectiveness, such as side effects, return to fertility, level of medical intervention, and interference with sexual activity. Offering a range of methods, including fertility awareness methods that meet the standard to be considered modern, helps to address these considerations, facilitating method choice.

See related article by Austad.

We appreciate the "Taking Exception" article by Austad and colleagues[1] and their critical review of the important issue of contraceptive classification first introduced in our March 2016 *Global Health: Science and Practice* (GHSP) article, "Fertility Awareness Methods: Distinctive Modern Contraceptives."[2] We support the authors' assertion that contraceptive effectiveness is a crucial concern for family planning program managers and potential contraceptive users. We also agree that, as with all other contraceptives, fertility awareness methods (FAMs) have limitations that make them less appropriate for some women. We firmly disagree, however, with the idea that the contraceptive needs of all women and their partners can be met by a limited set of contraceptives prioritized according to one attribute—effectiveness. Once again, we assert that family planning programming should be based first and foremost on voluntary and informed contraceptive choice. We further argue our position by discussing a few points raised by Austad et al.

FAMS AS MODERN CONTRACEPTION NOT A NEW IDEA

Austad et al. refer to the concepts put forth in our original GHSP commentary as reclassifying the Standard Days Method (SDM) and Lactational Amenorrhea Method (LAM) from traditional to modern contraceptives. In fact, the United States Agency for International Development (USAID) has never considered these methods traditional. They are scientifically based and tested approaches that draw on traditional practices. LAM and SDM have been classified as modern methods for decades. Indeed, USAID has supported the Demographic and Health Surveys to collect and report data on LAM as a modern method since 1998 and on SDM since SDM programming began being taken to scale in the mid-2000s.

MODERN/TRADITIONAL DICHOTOMY USED FOR PROGRAM PLANNING AND REPORTING—NOT FOR COUNSELING

We agree with the authors that family planning clients should be given comprehensive and accurate information on contraceptive options, including method effectiveness rates and what those rates mean. We also acknowledge that the ability to provide accurate and comprehensive information remains a serious challenge for many programs. The classification of "modern" and "traditional" is, however, meaningless for the purposes of counseling. Counseling tools such as the World Health Organization's "Decision-Making Tool"[3] and the Population Council's "Balanced Counseling Strategy"[4] make no reference to "modern" and "traditional." Rather, these terms are used by program managers and decision makers to distinguish those methods that are supported by programs and those contraceptive users who are counted by indicators used for measuring progress toward national and international goals. By

[a] United States Agency for International Development, Office of Population and Reproductive Health, Washington, DC, USA.
[b] Independent Consultant, Washington, DC, USA.
Correspondence to Shawn Malarcher (smalarcher@usaid.gov).

arguing that LAM, SDM, and the TwoDay Method (TDM) should be classified as "traditional" methods, Austad and colleagues are, in effect, arguing that these methods should not be supported by organized family planning programs. Recognizing these methods as "modern" increases the likelihood that FAMs will be included in programs, that counseling will include FAMs, and that clients will have the information to decide which method—whether FAMs or another method—can help them meet their fertility intentions.

MEDICAL INTERVENTION FACILITATES, BUT NOT REQUIRED FOR, PREGNANCY PREVENTION

Austad and colleagues support the definition for modern contraception put forth by Hubacher and Trussell: "technological advances designed to overcome biology" that "enable couples to have sexual intercourse at any mutually desired time."[5] This definition argues that averting pregnancy requires medical intervention, specifically in the form of a "technology." USAID has supported technological advances in contraceptive development for decades and has contributed to the development of some of the most effective methods on the market, including implants and intrauterine devices (IUDs). At the same time, we recognize that there will always be some women who are unwilling or unable to use devices or drugs. Our work to support the development of scientifically based, effective means to meet the needs of men and women who prefer nonmedical ways of regulating their fertility led to the development of LAM, SDM, and TDM. The proposal by Hubacher and Trussell, and supported by Austad et al., means, in effect, that approaches used by men and women who prefer contraception based on a nonmedical intervention could *never* be recognized as "modern" contraception and, as argued earlier, that these methods would be left out of programming and actively discouraged by providers. These women and men would never be counted as "contraceptive users" by international standards and their choice would never be supported by programming efforts.

FAMS SHOULD BE OFFERED WITHIN THE CONTEXT OF A BROAD METHOD MIX

All counseling should start by identifying and attempting to meet the needs of the individual client. Studies show that a woman is more likely to continue using a method when she is able to access her preferred method, even if that method is not the most effective method available.[6] Austad et al. imply that USAID is suggesting prioritizing FAM over other contraceptives. In fact, USAID consistently and resolutely promotes and supports provision of method choice, which includes long-acting reversible contraception, permanent methods, post-coital methods, barrier methods, and fertility awareness methods.

LAM and SDM have been classified as modern methods for decades.

The modern/traditional contraceptive classification system is useful only for program managers and decision makers—not for the purposes of counseling clients.

Women are more likely to continue using contraception when they can use their preferred methods, even if those methods are not the most effective ones.

SIDE EFFECTS ARE REAL AND A COMMON CAUSE OF DISCONTINUATION

Austad and colleagues dismiss women's concerns about contraceptive side effects noting, "… research shows that the *absolute effectiveness* of a method for pregnancy prevention is *the most important factor* cited by end users when choosing a method, even over other considerations such as side effects." This statement does not accurately capture the conclusions of the work cited. In Snow et al. (1997),[7] the conclusions of the evidence review on users' perspectives on fertility regulation were captured as:

- *Contraceptive users lack complete information about both methods and services.*
- *Women's and men's needs and preferences for contraception change over time and vary with the person's stage of life.*
- *Universally, women and men would like a method that is safe and effective, but it is not clear what these concepts mean. Side effects and health concerns (particularly with respect to hormonal methods) and method failure (particularly with respect to barrier methods and periodic abstinence) are the major reasons why women discontinue or do not use contraception.*
- *Individual perspectives and preferences vary widely and defy generalisation.*
- *The limited range of methods available in many developing countries necessarily limits people's perceptions and preferences.*
- *Research on people's reactions to a hypothetical method does not usually yield information predictive of subsequent use or behaviour with the method.*
- *There is a particular lack of information about the perspectives of men, adolescents, women having an abortion, especially repeat abortion, and women in the post-partum period.*

The influence of method-related side effects experienced by women is real. Castel and Askew

TABLE. Ways to Classify Commonly Used Contraceptives for Consideration by Countries and Family Planning Programs

Classification System	Female Ster.	Vas.	Im-plant	Copper IUD	Hormonal IUS	Inject-able	OCP	ECP, 1.5 mg LNG	Male Condom	Female Condom	Dia-phragm	LAM	SDM	TDM	Rhythm/ Calendar Method	With-drawal
Modern or traditional	M	M	M	M	M	M	M	M	M	M	M	M	M	M	T	T
Level or tier of effectiveness	1	1	1	1	1	2	2	3[a]	3	3	3	2	3	3	4	4
Need for programme support	Hi	Hi	Hi	Hi	Hi	Me	Lo	Lo	Lo	Lo	Lo	Me	Me	Me	No	No
Duration of labelled use	P	P	LA	LA	LA	MA	SA	SA	SA	SA	SA	MA	SA	SA	SA	SA
Male- or female-controlled, or both	FC	MC	FC	FC	FC	FC	FC	FC	MC	FC	FC	FC	Both	Both	Both	MC
Coitally dependent/related	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y
Need for surgical procedure to use	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N
Presence of hormones	N	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	N	N
Client's ability to discontinue without needing a provider	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Return to fertility after discontinuation of method	U	U	I	I	I	D	I	I	I	I	I	D	I	I	I	I

Abbreviations of contraceptive methods: ECP, emergency contraceptive pill; IUD, intrauterine device; IUS, intrauterine system; LAM, Lactational Amenorrhea Method; LNG, levonorgestrel; OCP, oral contraceptive pill; SDM, Standard Days Method; Ster., sterilization; TDM, TwoDay Method; Vas., vasectomry.

[a] If 100 women used progestin-only ECPs, one would likely become pregnant (from *Family Planning: A Global Handbook for Providers*, 2011 update). Please note that effectiveness in ECP studies was computed on women's use after one act of protected intercourse, which is different from analyses of other contraceptive effectiveness studies.

Legend:

Modern or traditional: M, modern; T, traditional.

Level or tier of effectiveness: 1, 2, 3, or 4 (as per *Family Planning: A Global Handbook for Providers*, 2011 update)

Need for programme support: Hi, high (requires clinic setting with trained and skilled providers); Me, medium (can be provided in non-clinical setting by trained and skilled providers); Lo, low (can be provided in community distribution programmes, over the counter, or in informal settings); No, none.

Duration of labelled use: P, permanent; LA, long-acting; MA, medium-acting; SA, short-acting. Note: Medium-acting is not a commonly used category but is presented here to distinguish it from the methods which are labelled for a lesser period of effect.

Male- or female-controlled, or both: MC, male-controlled; FC, female-controlled; Both, requires cooperation of both the man and the woman.

Coitally dependent/related (requires specific intervention at the time of intercourse): Y, yes; N, no.

Need for surgical procedure to use: Y, yes; N, no.

Presence of hormones: Y, yes; N, no.

Client's ability to discontinue without reliance on a provider: Y, yes; N, no.

Return to fertility after discontinuation of method: I, immediate; D, delayed; Ne, never; U, uncertain success after reversal.

Source: Developed by the World Health Organization for a consultation on contraceptive classification and presented at the 2016 International Conference on Family Planning; 2016 Jan 25–28; Nusa Dua, Indonesia.

(2015) found that 38% of women with an unmet need for modern contraception discontinued using a modern contraceptive in the past.[8] They also note that one-third of women who start using a modern contraceptive method will stop using it in the first year, and over half before 2 years. Method-related concerns are one of the most common reasons for discontinuation. Women reporting method-related reasons for not using a modern method account for about two-thirds of unmet need in sub-Saharan Africa (67%) and South Central Asia (71%), and for 79% of unmet need in Southeast Asia.[9]

Effectiveness is one important attribute users consider when selecting a contraceptive method. There are, however, many other aspects that women and men prioritize when choosing a contraceptive method, such as side effects, return to fertility, level of medical intervention, and effect on sexual activity (Table). Offering a range of methods, including FAMs, helps to address these considerations, facilitating method choice.

Effectiveness is only one important attribute among many that users consider when selecting a contraceptive method.

Competing Interests: None declared.

REFERENCES

1. Austad K, Chary A, Colom A, Barillas R, Luna D, Menjívar C, et al. Fertility awareness methods are not modern contraceptives: defining contraception to reflect our priorities. Glob Health Sci Pract. 2016;4(2):342-345. CrossRef
2. Malarcher S, Spieler J, Fabic MS, Jordan S, Starbird EH, Kenon C. Fertility awareness methods: distinctive modern contraceptives. Glob Health Sci Pract. 2016;4(1):13–15. CrossRef. Medline
3. World Health Organization (WHO), Department of Reproductive Health and Research. Decision-making tool for family planning clients and providers: a resource for high-quality counselling. Geneva: WHO; 2005. Available from: http://www.who.int/reproductivehealth/publications/family_planning/9241593229index/en/
4. Leon FR, Vernon R, Martin A, Bruce L. The balanced counseling strategy: a toolkit for family planning service providers. New York: Population Council; 2008. Available from: http://www.popcouncil.org/research/the-balanced-counseling-strategy-a-toolkit-for-family-planning-service3
5. Hubacher D, Trussell J. A definition of modern contraceptive methods. Contraception. 2015;92(5):420–421. CrossRef. Medline
6. Pariani S, Heer DM, Arsdol MDV. Does choice make a difference to contraceptive use? Evidence from east Java. Stud Fam Plann. 1991;22(6):384–390. CrossRef. Medline
7. Snow R, García S, Kureshy N, Sadana R, Singh S, Becerra-Valdivia M, et al. Attributes of contraceptive technology: women's preferences in seven countries. In: Ravindran TKS, Berer M, Cottingham J, editors. Beyond acceptability: users' perspectives on contraception. London: Reproductive Health Matters for the World Health Organization; 1997. Available from: http://whqlibdoc.who.int/publications/0953121003.pdf
8. Castle S, Askew I. Contraceptive discontinuation: reasons, challenges, and solutions. New York: Population Council; 2015. Co-published by Family Planning 2020 (FP2020). Available from: http://ec2-54-210-230-186.compute-1.amazonaws.com/wp-content/uploads/2016/02/FP2020_ContraceptiveDiscontinuation_SinglePage_Revise_02.15.16.pdf
9. Darroch JE, Sedgh G, Ball H. Contraceptive technologies: responding to women's needs. New York: Guttmacher Institute; 2011. Available from: https://www.guttmacher.org/report/contraceptive-technologies-responding-womens-needs

Peer Reviewed

Received: 2016 Apr 8; **Accepted:** 2016 May 27

Cite this article as: Malarcher S, Fabic MS, Spieler J, Starbird EH, Kenon C, Jordan S. Response to Austad: offering a range of methods, including fertility awareness methods, facilitates method choice. Glob Health Sci Pract. 2016;4(2):346–349. http://dx.doi.org/10.9745/GHSP-D-16-00115

© Malarcher et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00115

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

LETTER TO THE EDITOR

Perinatal Mortality Due to Pre-Eclampsia in Africa: A Comprehensive and Integrated Approach Is Needed

Moshood Omotayo,[a] Katherine Dickin,[a] Rebecca Stolzfus[a]

See related article by Hodgins.

In a recent *Global Health: Science and Practice* editorial, Hodgins identified key steps to "take a big chunk out of the wedge of maternal, newborn, and stillbirth mortality attributable to eclampsia/pre-eclampsia," calling for early case identification with more frequent antenatal care (ANC) contacts, effective management of complications in pregnant women that progress to life-threatening states, and timely delivery.[1]

The editorial is an important call to action and we agree with its proposals; however, there are complementary programmatic issues that must also be considered in crafting an integrated strategy for addressing the burden of perinatal morbidity and mortality attributable to hypertensive disorders in pregnancy in Africa. These include: (a) strengthening management of preterm neonates, (b) strengthening delivery of secondary prevention through ANC, and (c) integrating primary prevention into ANC delivery.

STRENGTHENING PRETERM MANAGEMENT

Effective surveillance and timely delivery as a strategy to address the burden of pre-eclampsia will likely increase incidence of medically indicated preterm births. Without concomitant action to strengthen the system to care for babies born too soon, the reduction in perinatal mortality might be limited. Preterm birth remains the single leading cause of neonatal mortality globally,[2] and preterm infants are at greater risk of morbidity and neurodevelopmental delay. Despite evidence of low-cost measures that can reduce the scourge of this condition, adoption of these measures has been limited in low-income countries,[3] leading to unacceptably high numbers of newborn deaths attributable to preterm births. Although studies have shown that increases in medically indicated cesarean deliveries and iatrogenic preterm births have been associated with reduction in maternal and neonatal mortality,[4,5] this has been in the context of health systems with capacity for effective management of preterm neonates.

STRENGTHENING DELIVERY OF SECONDARY PREVENTION THROUGH ANC

We agree with Hodgins that revisiting the policy on the recommended number of ANC visits in the third trimester is important, and we furthermore suggest that addressing current challenges and quality issues in pre-eclampsia screening and diagnosis in primary health care facilities is essential. Improving community demand for ANC should be emphasized. Regular and accurate blood pressure and proteinuria measurement in ANC is still the mainstay of pre-eclampsia detection and surveillance, but there are important coverage and quality gaps in these procedures in Africa, even when women present for ANC. Only 57% of pregnant women who had up to 4 ANC visits had urine samples collected, according to Demographic and Health Survey (DHS) data from 29 African countries (calculated from Hodgins 2014[6]). This represents an upper limit of the proportion of women that had urinary protein tests. Although an average of 78% coverage of blood pressure measurement was reported in the same analyses, studies in Africa have reported high levels of digit bias and other observer errors among nurses.[7,8] In addition to assuring supply of functional sphygmomanometers and urinalysis testing kits, it is necessary to provide preservice and in-service training, continuous supportive supervision, and incentives to improve relevant skills for screening and diagnosis of hypertensive disorders in pregnancy in primary health care facilities.

INTEGRATING PRIMARY PREVENTION INTO ANC DELIVERY

Integrating programs for primary prevention of pre-eclampsia into ANC, i.e., preventive calcium supplementation and low-dose aspirin in pregnancy, is essential. Primary

[a] Cornell University, Ithaca, NY, USA.
Correspondence to Moshood Omotayo (moo6@cornell.edu).

preventive programs hold the promise of reducing the *incidence* of pre-eclampsia, without the risk of increasing the burden of preterm delivery, particularly in communities with inadequate dietary calcium intake, as is the case in many African communities.[9] Integration of calcium supplements and low-dose aspirin into essential commodity supply chains, preservice and in-service training, supervision of health care workers in primary health care facilities, and community-based ANC programming all are critical for coverage, quality, and utilization of primary preventive programs. Although there are important clinical and implementation research issues that still need to be resolved for optimal calcium supplementation, functional programs can be designed and implemented with what is known.[10] Strong preventive programming alone will address only a fraction of the problem,[11] but it is a vital component of the mix because it reduces the need for more expensive lifesaving interventions requiring higher-level personnel.

By integrating primary preventive programming with strengthened capacity for case detection, timely patient transfer and delivery, and effective management of preterm neonates, maternal, stillbirth, and perinatal health indicators can be improved simultaneously.

Competing Interests: None declared.

REFERENCES

1. Hodgins S. Pre-eclampsia as underlying cause for perinatal deaths: time for action. Glob Health Sci Pract. 2015;3(4): 525–527. CrossRef. Medline
2. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet. 2015;385(9966):430–440. CrossRef. Medline
3. Vogel JP, Souza JP, Gülmezoglu AM, Mori R, Lumbiganon P, Qureshi Z, et al. Use of antenatal corticosteroids and tocolytic drugs in preterm births in 29 countries: an analysis of the WHO Multicountry Survey on Maternal and Newborn Health. Lancet. 2014;384(9957):1869–1877. CrossRef. Medline
4. Goldenberg RL, McClure EM, MacGuire ER, Kamath BD, Jobe AH. Lessons for low-income regions following the reduction in hypertension-related maternal mortality in high-income countries. Int J Gynaecol Obstet. 2011;113(2):91–95. CrossRef. Medline
5. Lisonkova S, Hutcheon JA, Joseph KS. Temporal trends in neonatal outcomes following iatrogenic preterm delivery. BMC Pregnancy Childbirth. 2011;11(1):39. CrossRef. Medline
6. Hodgins S, D'Agostino A. The quality-coverage gap in antenatal care: toward better measurement of effective coverage. Glob Health Sci Pract. 2014;2(2):173–181. CrossRef. Medline
7. Ayodele OE, Sanya EO, Okunola OO, Akintunde AA. End digit preference in blood pressure measurement in a hypertension specialty clinic in southwest Nigeria. Cardiovasc J Afr. 2012; 23(2):85–89. CrossRef. Medline
8. Urassa DP, Nystrom L, Carlstedt A, Msamanga GI, Lindmark G. Management of hypertension in pregnancy as a quality indicator of antenatal care in rural Tanzania. Afr J Reprod Health. 2003; 7(3):69–76. CrossRef. Medline
9. World Health Organization (WHO). Guideline: calcium supplementation in pregnant women. Geneva: WHO; 2013. Available from: http://www.who.int/nutrition/publications/micronutrients/guidelines/calcium_supplementation/en/
10. Omotayo M, Dickin K, O'Brien K, Neufeld L, De-Regil LM, Stoltzfus R. Calcium supplementation to prevent preeclampsia: translating guidelines into practice in low-income countries. Adv Nutr. 2016;7(2):275–278. CrossRef. Medline
11. Mol BW, Roberts CT, Thangaratinam S, Magee LA, de Groot CJM, Hofmeyr GJ. Pre-eclampsia. Lancet. 2016;387(10022):999–1011. CrossRef. Medline

Received: 2016 Feb 19; **Accepted:** 2016 Mar 2

Cite this article as: Omotayo M, Dickin K, Stolzfus R. Perinatal mortality due to pre-eclampsia in Africa: a comprehensive and integrated approach is needed. Glob Health Sci Pract. 2016;4(2):350–351. http://dx.doi.org/10.9745/GHSP-D-16-00054

© Omotayo et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00054.

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

LETTER TO THE EDITOR

Editors' Response to Omotayo: Research Needed on Better Prevention of Pre-Eclampsia

See related article by Omotayo.

We appreciate points made by Omotayo and colleagues[1] in their comment on our earlier GHSP editorial on pre-eclampsia and perinatal mortality.[2] They draw attention to deficiencies in the care of preterm newborns that can limit the impact of other elements of a comprehensive approach to pre-eclampsia. In settings accounting for the greatest burden of mortality attributable to preterm birth, a large proportion of births are in health facilities lacking capabilities for neonatal intensive care. Nevertheless, core elements of good care of preterm and very small newborns can still feasibly be delivered in settings with limited resources.

Kangaroo mother care (KMC) was originally developed in response to limited access to incubators and other elements of neonatal intensive care but was subsequently documented to give better outcomes than conventional high-tech care.[3] Consequently, KMC is now being promoted in high-income countries due to its effectiveness, not merely as a low-cost alternative. From this experience, it's evident that much can be done, even in very resource-constrained settings, to improve key elements of care of preterm and very small newborns, notably:

- Good *thermal care*—maximizing skin-to-skin contact
- Conscientious and capable attention given to *feeding*—relying on breastmilk only, to the extent appropriate, and providing any needed support, e.g., breastmilk expression and cup feeding or tube feeding
- Vigilance, through good *nursing care*, to pick up complications early and respond appropriately

Omotayo et al. further elaborate on a point made in the editorial about expected impact from systematic antenatal screening for pre-eclampsia followed by timely delivery. Goldberg and colleagues[4] have argued persuasively that these factors account for the bulk of the decline in pre-eclampsia–related deaths experienced in high-income countries over the past century.

Their third main argument is that more can be done to prevent pre-eclampsia from developing in the first place, pointing specifically to aspirin and calcium supplementation. Certainly for those at particular risk, notably women with a previous history of pre-eclampsia,[5] low-dose aspirin is effective. But the proportion of serious outcomes of pre-eclampsia preventable with this intervention is relatively modest. Of greater potential population impact would be widespread uptake of antenatal calcium supplementation.[6] Available evidence suggests that in populations with low calcium intake, all-cause newborn mortality could be reduced by as much as 30% with near universal coverage of this intervention.

But the problem is the dose of calcium. The current recommendation from the World Health Organization for antenatal supplementation is 1500–2000 mg (3–4 tablets) of elemental calcium per day. At a weight of 1.25 g/tablet, that translates to a pound and a half of tablets per pregnancy. Furthermore, at this dosing, the cost for antenatal calcium supplementation is close to an order of magnitude greater than for antenatal iron-folate supplementation.

There is reason to believe that a closer-to-physiologic dosing of 500 mg of elemental calcium per day may give similar benefit.[7] But available evidence is not yet sufficient to warrant changing the current recommendations. In the meantime, this practical problem of weight, bulk, and cost constitutes an important barrier for provision in the low-resource settings where this intervention could give the greatest benefit.

What is needed is a dose-finding study to determine if a lower dose can reduce risk of serious pre-eclampsia outcomes such as perinatal death to a similar degree to that which has been documented with high-dose supplementation.

It's time for one our donor partners (e.g., the United States Agency for International Development, the Bill & Melinda Gates Foundation, or the National Institutes of Health) to step up to the plate to fund the needed research to remove this formidable barrier. –*Global Health: Science and Practice*

REFERENCES

1. Omotayo M, Dickin K, Stolzfus R. Perinatal mortality due to pre-eclampsia in Africa: a comprehensive and integrated approach is needed. Glob Health Sci Pract. 2016;4(2):350-351. CrossRef
2. Hodgins S. Pre-eclampsia as underlying cause for perinatal deaths: time for action. Glob Health Sci Pract. 2015; 3(4):525-527. CrossRef. Medline
3. Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane Database Syst Rev. 2014;(4):CD002771. CrossRef. Medline
4. Goldenberg R, McClure E, Macguire ER, Kamath BD, Jobe AH. Lessons for low-income regions following the reduction in hypertension-related maternal mortality in high-income countries. Int J Gynaecol Obstet. 2011;113(2):91–95. CrossRef. Medline
5. Coomarasamy A, Honest H, Papaioannou S, Gee H, Khan KS. Aspirin for prevention of preeclampsia in women with historical risk factors: a systematic review. Obstet Gynecol. 2003; 101(6):1319-1332. Medline
6. Villar J, Abdel-Aleem H, Merialdi M, Mathai M, Ali MM, Zavaleta N, et al; World Health Organization Calcium Supplementation for the Prevention of Preeclampsia Trial Group. World Health Organization randomized trial of calcium supplementation among low calcium intake pregnant women. Am J Obstet Gynecol. 2006;194(3):639-649. CrossRef. Medline
7. Hofmeyr GJ, Belizán JM, von Dadelszen P; Calcium and Pre-eclampsia (CAP) Study Group. Low-dose calcium supplementation for preventing pre-eclampsia: a systematic review and commentary. BJOG. 2014;121(8):951-957. CrossRef. Medline

The problem: feasibility of delivery of the currently recommended high dose for calcium supplementation.

The solution: a study to determine if low-dose calcium also works.

Cite this article as: Editors' response to Omotayo: research needed on better prevention of pre-eclampsia. Glob Health Sci Pract. 2016; 4(2):352–353. http://dx.doi.org/10.9745/GHSP-D-16-00136

© Global Health: Science and Practice. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00136

GHSP GLOBAL HEALTH: SCIENCE AND PRACTICE
Dedicated to what works in global health programs
OPEN ACCESS

LETTER TO THE EDITOR

Optimism for the UN Proclamation of the Decade of Action on Nutrition: An African Perspective

Richmond Aryeetey[a]

On Friday, April 1, 2016, the United Nations (UN) General Assembly proclaimed 2016 to 2025 as a decade of action on nutrition.[1] Writing as an African living and working in sub-Saharan Africa, where up to 11% of gross domestic product (GDP) is lost to malnutrition[2] and where malnutrition is declining rather too slowly for anyone's liking, this proclamation really captured my attention. Another reason this is significant for me and, I reckon, for many others is that this year also marks the beginning of the Sustainable Development Goals (SDGs),[3] which articulate achieving zero hunger and the even-more aspirational dream of ending all forms of malnutrition by the year 2030. Later this year in August in Rio de Janeiro, Brazil, the Nutrition for Growth Summit will also bring more attention to efforts to eliminate malnutrition around the world. Considering these and other events congregating around such a short duration, it would appear to an outside observer that the world is set for a momentous delivery of something really big for nutrition.

Excited as I am about how all the chips are falling in place, a key question remains on my mind: Do we have the key ingredients to deliver the goods, come 2025 or 2030? My mind goes back to 2008 when the *Lancet* published the first series on maternal and child nutrition, which subsequently triggered the formation of the Scaling Up Nutrition (SUN) Movement.[4,5] SUN has become a collective global movement harnessing capacities across governments, civil society, UN agencies, donors, business, and researchers to improve nutrition in countries with the highest burden and vulnerability to malnutrition.[6]

Six years ago, when the SUN Movement was established, many of us in the nutrition community were caught up in the fever of the moment. We became excitedly optimistic that we were finally going to make a major dent in the malnutrition situation in the developing world, and especially in the so-called "high-burden" countries. Although there are signs of significant progress being made through the movement, the "2015 Global Nutrition Report" points to a rather slow rate of change as well as persistant gaps, including insufficient financing and suboptimal country-level capacity needed to address malnutrition at sufficient scale.[7,8] But we now have only a couple more years to commemorate a decade of action for the SUN Movement. And in sub-Saharan Africa in particular, we still have a long way to go.

The UN General Assembly proclamation clearly identifies the framework within which the malnutrition situation could be addressed in the next 10 years. However, in the particular case of Africa, I would like to share a few thoughts on what I consider to be missing in the soup, based on past experience. First is that Africans must be at the forefront of the efforts to address malnutrition in Africa. There is a lot of investment already in nutrition in Africa. What is missing is leadership by Africans to make the investment work for the African situation. Much more progress would have been achieved already if African governments had sufficiently prioritized nutrition and made available sustained and adequate financial commitment from their treasuries to address malnutrition. This is especially needed when too many of the countries that are off-course in meeting global nutrition targets are in Africa. Such commitments should be married to a strong process of ensuring accountability for achievement of realistic but sufficiently ambitious targets to address malnutrition in all its forms. Further, African nutrition scientists must take leadership of the evidence economy and generate policy options for decision makers. As the saying goes, "It is never too late to do the right thing." The time has come to stop having more of the usual situation in which the Global North is driving the efforts to address malnutrition, with Africans playing catch-up.

Second, we have spent much time on repeating research to understand the determinants and characteristics of malnutrition; in some cases, the research agenda is driven from outside Africa and not designed

[a] University of Ghana School of Public Health, Accra, Ghana.
Correspondence to Richmond Aryeetey (raryeetey@ug.edu.gh).

to answer questions relevant to the African.[9,10] A key gap waiting to be filled is for African scientists to use systematic approaches to generate policy options for decision making. A decade is too short to do more of the same: analysis and review of the nutrition situation. The available resources will be best used in implementation of existing, proven nutrition-specific and nutrition-sensitive technologies, including biofortification of commonly consumed staples,[11] promoting dietary diversity, multiple micronutrient supplementation, and scaling up social safety net programs for the most vulnerable in society.[5,12] Despite our fears, we should not shy away from the risk of failing. We can learn from our failures. But even more importantly, we can still touch the lives of those who do not show statistically significant improvement.

Third, our governments must be pushed, through grassroots civic movements such as the country SUN civil society networks and traditional and religious leadership, to invest more in nutrition than they are currently doing. The projected economic growth patterns in resource-poor countries will be depleted quickly without governments investing to consolidate the gains that could be made.

Finally, more effort should be invested in promoting collaboration across various stakeholders within the African region. Cross-country experience and best-practice sharing can enhance faster progress and reduce costs of program implementation. Within countries, more collaboration across agencies and sectors (government, donors, civil society, research, and the UN) is warranted.

Africans must be at the forefront of efforts to address malnutrition in Africa.

Governments must invest more in nutrition.

Collaboration across countries can enhance faster progress and reduce program implementation costs.

Competing Interests: None declared.

REFERENCES

1. United Nations (UN) [Internet]. New York: UN; c2014. Calling attention to chronic hunger, General Assembly decides 2016-2025 will be decade of action on nutrition; 2016 Apr 1 [cited 2016 May 1]. Available from: http://www.un.org/press/en/2016/ga11770.doc.htm
2. International Food Policy Research Institute (IFPRI). Global nutrition report 2014: actions and accountability to accelerate the world's progress on nutrition. Washington (DC): IFPRI; 2014. Available from: https://www.ifpri.org/publication/global-nutrition-report-2014-actions-and-accountability-accelerate-worlds-progress
3. Sustainable Development Goals: 17 Goals to Transform Our World [Internet]. New York: United Nations; c2016 [cited 2016 May 1]. Available from: http://www.un.org/sustainabledevelopment/
4. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al; Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008;371(9608): 243-260. CrossRef. Medline
5. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al; Maternal and Child Undernutrition Study Group. What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008;371(9610):417-440. CrossRef. Medline
6. Scaling Up Nutrition [Internet]. Geneva: SUN Movement Secretariat; c2015. The vision of the SUN Movement is a world without hunger and malnutrition; [cited 2016 May 1]. Available from: http://scalingupnutrition.org/about
7. International Food Policy Research Institute (IFPRI). Global nutrition report 2015: actions and accountability to advance nutrition and sustainable development. Washington (DC): IFPRI; 2015. Available from: http://globalnutritionreport.org/the-report/
8. Fanzo JC, Graziose MM, Kraemer K, Gillespie S, Johnston JL, de Pee S, et al. Educating and training a workforce for nutrition in a post-2015 world. Adv Nutr. 2015;6(6):639-647. CrossRef. Medline
9. Lachat C, Roberfroid D, Van den Broeck L, Van den Briel N, Nago E, Kruger A, et al. A decade of nutrition research in Africa: assessment of the evidence base and academic collaboration. Public Health Nutr. 2015;18(10):1890-1897. CrossRef. Medline
10. Van Royen K, Lachat C, Holdsworth M, Smit K, Kinabo J, Roberfroid D, et al. How can the operating environment for nutrition research be improved in sub-Saharan Africa? The views of African researchers. PLoS One. 2013;8(6):e66355. CrossRef. Medline
11. Gurmu F, Hussein S, Laing M. The potential of orange-fleshed sweet potato to prevent vitamin A deficiency in Africa. Int J Vitam Nutr Res. 2014;84(1-2):65-78. CrossRef. Medline
12. Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al; Lancet Nutrition Interventions Review Group; Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet. 2013;382(9890):452-477. CrossRef. Medline

Peer Reviewed

Received: 2016 Apr 19; **Accepted:** 2016 May 17

Cite this article as: Aryeetey R. Optimism for the UN proclamation of the decade of action on nutrition: an African perspective. Glob Health Sci Pract. 2016;4(2):354–355. http://dx.doi.org/10.9745/GHSP-D-16-00117

© Aryeetey. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are properly cited. To view a copy of the license, visit http://creativecommons.org/licenses/by/3.0/. When linking to this article, please use the following permanent link: http://dx.doi.org/10.9745/GHSP-D-16-00117

Knowledge for Health Project
Johns Hopkins Bloomberg School of Public Health
Center for Communication Programs
111 Market Place, Suite 310
Baltimore, MD 21202
Phone: 410-659-6134
Fax: 410-659-6266
Email: editorialoffice@ghspjournal.org
Web: www.ghspjournal.org