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RESEARCH AND EVALUATION REPORT

The Data Management Improvement Collaborative in Uganda

JUNE 2011

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Robert Kyeyagalire, University Research Co., LLC
Rosamund Southgate, Department of Public Health and Primary Care, University of Oxford
Edward Broughton, University Research Co., LLC
Nigel Livesley, University Research Co., LLC
Esther Karamagi, University Research Co., LLC

DISCLAIMER

The views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development (USAID) or the United States Government.

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ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral therapy
CPT	Cotrimoxazole Preventive Therapy
HC	Health Center
HCI	USAID Health Care Improvement Project
HIV	Human Immunodeficiency Virus
IHI	Institute for Healthcare Improvement
MoH	Ministry of Health
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PLWH	People living with HIV and AIDS
QI	Quality improvement
TB	Tuberculosis
UMHS	University of Michigan Health System
URC	University Research Co., LLC
US	United States
US$	United States Dollars
USAID	United States Agency for International Development
USh	Ugandan Shillings
WHO	World Health Organization
Wt	Weight

EXECUTIVE SUMMARY

Background

The high burden of HIV/AIDS in Uganda is compounded by a substantial deficit in health care workers. To address the problem, the United States Agency for International Development (USAID) Health Care Improvement Project (HCI) and the Ugandan Ministry of Health launched in October 2009 a series of quality improvement (QI) collaboratives in groups of health facilities to improve the quality and efficiency of the care provided in HIV clinics.

One intervention was the "data management collaborative." This intervention focused on improving the clinic's medical records systems and processes. The underlying hypothesis for the intervention was that improving the quality of records systems would make clinics more efficient, reduce waiting times for clients, and allow staff more time to focus on providing quality clinical care. These effects, in turn, should lead to higher levels of client retention and better clinical outcomes. Seventeen sites around the towns of Jinja and Mbale in the central-east area of Uganda were recruited. Coaching visits by HCI staff were carried out every two months until the second learning session in June 2010. This study describes this intervention and analyzes its costs and benefits.

Methods

A pre-/post-intervention study was conducted involving nine of the 17 HIV clinics in the data management collaborative. Standardized tools were used to record retrieval time, record completeness, number of clients seen per staff member per week, and staff time saved at baseline and follow-up at each site. Information was obtained on the QI interventions introduced at each site and the costs incurred by implementing the interventions. Costs were compared to monetary value of the staff time saved as a result of the interventions.

Results

Record retrieval time decreased significantly from baseline to follow-up at all sites. Changes in record completeness and the number of clients seen per staff member per week showed little association with these improvements or with any specific type of intervention within the collaborative. Seven clinics closed earlier at follow-up, producing a staff-time cost saving of up to 690,000USh (US$310) per clinic day or the equivalent of 1.0-5.8 additional staff members on site each clinic day. A cost-benefit analysis using these data showed a net benefit of 185,869,607USh (US$82,535) from the collaborative over 12 months.

The monetary value of staff time saved was the most important input variable in the cost-benefit model. A 1% decrease in staff-time cost savings would cause a 1.3% decrease in the cost-benefit difference. Among the specific collaborative cost components, cost to HCI of coaching trips and the coordination of the collaborative (19,767,546USh or US$8778) had the greatest effect on the overall result, with a 1% increase in the cost of coaching/coordination causing a 0.11% decrease in the cost-benefit. Staff-time cost savings at the clinics have a much larger effect on the overall result than do the costs of the collaborative. However, a 10% change in any of the input variables would not change the basic conclusion that the collaborative intervention produced a significant net benefit.

Conclusions

The QI collaborative had a significant positive net benefit in the clinics providing HIV services. If the staff-time savings achieved here were reproduced in all accredited HIV clinics across Uganda this would equate to hiring between 328 and 1902 additional health care workers. We recommended implementing the intervention in HIV clinics throughout the country.

I. INTRODUCTION

A. HIV/AIDS in Uganda

According to the World Health Organization (WHO), the HIV prevalence among adults aged 15-49 years in Uganda is 5.4% [1]. Although the Ugandan Ministry of Health (MoH) states that prevalence is 'stable' [2], it remains higher than the regional East African prevalence of 4.7% and the global average of 0.6% [1].

HIV prevention in Uganda centers on mass media campaigns and school-based education regarding abstinence, fidelity, and encouragement of uptake of counseling and testing. Treatment is provided free of charge at accredited HIV clinics in hospitals and larger health centers (HCs). However, antiretroviral therapy (ART) coverage among people with advanced HIV infection is 33% [1]. The MOH explains that, despite 72% of the households in Uganda living within five kilometers of a health facility, health care utilization is limited due to poor infrastructure, a lack of drugs and other supplies, and the shortage and low motivation of the health care workforce [2].

A 2007 study showed that Uganda has 1.2 doctors and 13.1 nurses and midwives per 10,000 population [1], well below the WHO minimum recommended level of 22.8 health care professionals per 10,000 population [3]. The MoH reported that in November 2008 only 51% of government-approved health care worker posts were filled; a situation it describes as 'critical' [2]. Insufficient training capacity, low remuneration, poor working conditions and international migration were the main reasons cite for the poor recruitment and retention of health care workers across Uganda, particularly in rural settings [2].

Access to medicines is also a significant problem. Approximately 72% of Uganda's 4639 government health units have monthly stock-outs of at least one essential medicine. The 328 units accredited to provide ART are no exception [2, 4]. Despite a recent increase in the number of trained pharmacists employed by the MoH, delays in national procurement (90% of Uganda's drugs are imported) and late ordering by facilities mean that shortages and stock-outs persist [2].

B. Quality Improvement in Health Care

The health workforce deficits described above are not unique to Uganda: the WHO's 2006 World Health Report estimated a global deficit of 4 million health care workers [3]. Health workforce numbers are positively correlated with infant, child, and maternal survival and with positive outcomes in many diseases [3]. Addressing the health care worker deficit is therefore critical, both globally and in Uganda, but will require significant investments of time and money. Since the quality of the health workforce and the organizations for which they work has also been positively associated with health outcomes [3], increasing quality in health care – by improving the efficiency of what health care workers do and reducing waste in care processes – has been proposed as one approach to mitigate the health workforce crisis.

In 2005, the Ugandan MoH established the Quality of Care Initiative with the aim of improving the quality of HIV/AIDS care in Uganda at all levels of care. The initiative was initially supported by the United States Agency for International Development (USAID) Quality Assurance Project and since 2007 by the USAID Health Care Improvement Project (HCI), both managed by University Research Co., LLC (URC), which has significant experience in the field of quality improvement (QI). QI originated in the manufacturing sector in the middle of the Twentieth Century and has since developed and expanded into many industries including health care, where it has become an important part of the international efforts to strengthen health systems and achieve the United Nations' Millennium Development Goals [5].

Modern QI practices focus on redesigning processes to ensure that health care delivery is effective, efficient, and responsive to clients' needs [6]. The four principles of quality management – client focus,

understanding systems and processes, teamwork and use of data – are employed to identify gaps between services actually provided and expectations for services [7]. These gaps are then overcome by making changes to health care systems, using available evidence on best practice. In this way quality of care and associated health outcomes can be improved without necessarily increasing the resources or inputs required.

Industry has developed several models for achieving the QI goals described above. The most commonly used are 'Six Sigma,' developed by Motorola; 'Lean,' developed by Toyota; and the 'Model for Improvement,' developed by Associates in Process Improvement. 'Six Sigma' focuses on reducing defects and minimizing variability in processes through the statistical analysis of current processes, the setting of quantified goals, and the achievement of these goals through strong leadership by champions or 'black belts' [8]. 'Lean' teaches that the expenditure of money or resources on anything other than the creation of value for the customer is a waste. The model describes seven different forms of waste which should be sought for in systems and processes and eliminated [9]. The 'Model for Improvement' consists of two parts: 'three fundamental questions' to set aims, establish measures and select changes for implementation; then the use of the 'Plan-Do-Study-Act cycle' to test the changes [10]. All three models have been applied to the health care setting [11-13], although not all in developing health care systems.

In 1995, the US-based Institute for Healthcare Improvement (IHI) developed the 'improvement collaborative' approach to QI in health care using the principles of the Model for Improvement [13]. This approach involves the linking of multiple teams into a collaborative where ideas can be discussed and the results of interventions are shared. A collaborative can thus test a variety of improvement interventions simultaneously, identify the most effective ones, and rapidly spread them across all participating sites. The approach allowed IHI to address the common problem (which it had observed in health care in the United States) of evidence existing for a particular standard of care but not being widely known about nor routinely practiced [14]. Improvement collaboratives provide a platform for sharing available evidence across many health care facilities.

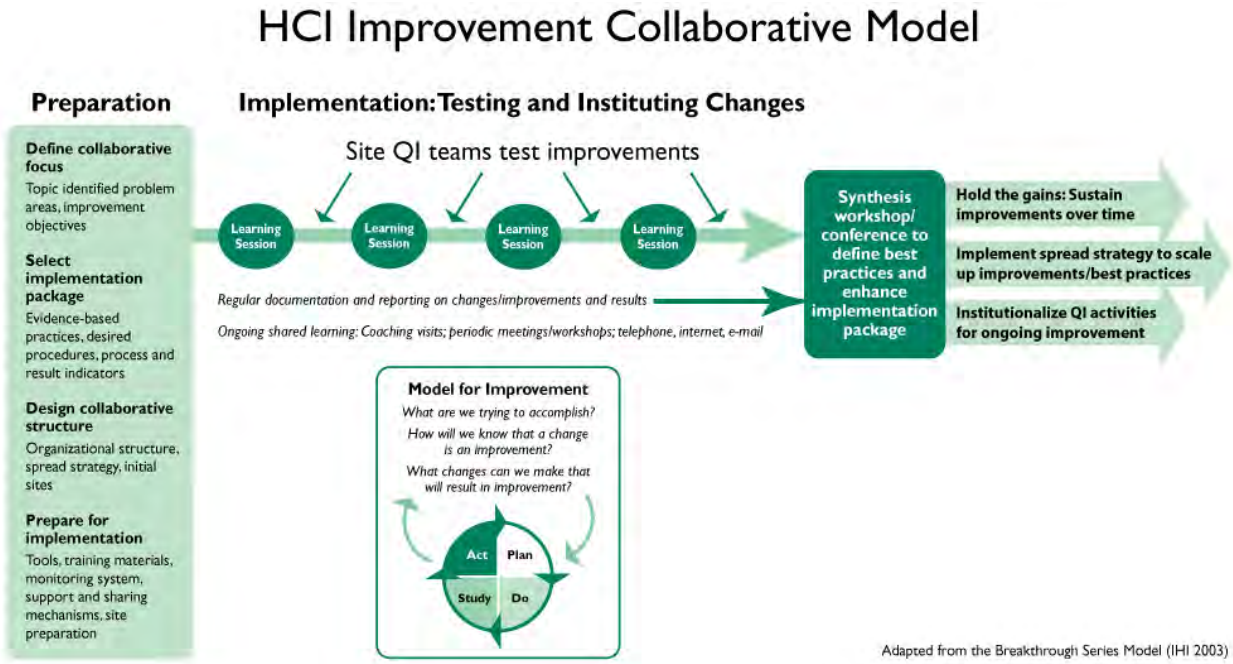
In 2003, USAID began supporting the application of the improvement collaborative approach more broadly in USAID-assisted countries, adapting the IHI model to place greater emphasis on the role of coaches in directing and motivating QI teams and to accommodate local government health care structures [14]. Adaptation of the improvement collaborative began under the Quality Assurance Project and now continues through HCI. HCI's approach to collaborative improvement in health care is described below and summarized in Figure 1.

C. HIV Collaboratives in Uganda

URC has been supporting the MoH to improve care in HIV clinics applying the improvement collaborative approach since the launch of the Quality of Care Initiative in 2005. From an initial 57 sites which started in an HIV care collaborative in 2006, the MoH has progressively increased the number of clinics participating in collaborative improvement to 120 hospitals and health centers across most of the 80 districts in Uganda [4]. The component of the project covered in this study started in October 2009, where these 120 HIV clinics were divided into seven collaboratives, according to region. Each collaborative was coordinated by an HCI staff member and focused on a specific aspect of care, such as data management, coverage, retention, ART, and laboratory services.

Each site participating in a collaborative was asked to establish a 'QI team' at the facility. The QI team consists of three or four staff members who are motivated to learn about QI and maintain momentum for improvement activities in the long term. QI team members may come from any level (or cadre) of staff at the clinic. Three QI team members from each site then attended their collaborative's first learning session. These two-day sessions were held in October 2009 and taught participants the principles and practice of modern QI and the improvement collaborative approach.

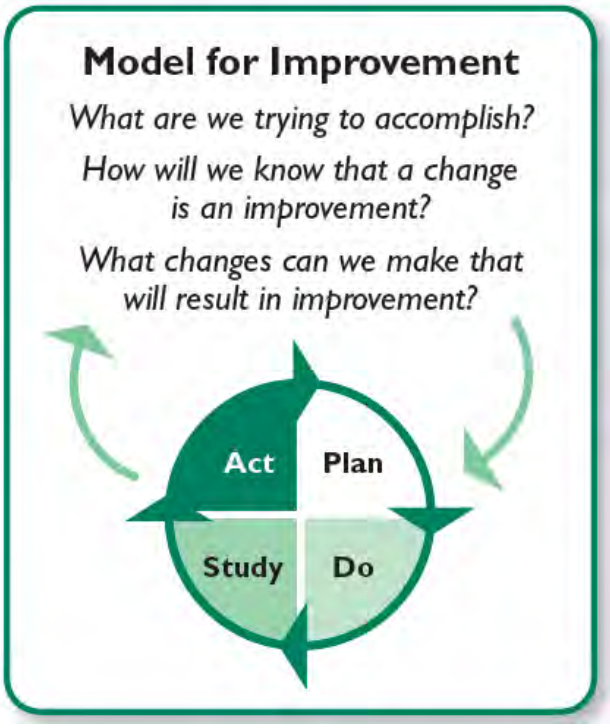
Figure 1: HCI's approach to collaborative improvement



Using the 'Model for Improvement' [16] (shown in Figure 2) as a template, participants learned how to compile a flow chart of the current processes and systems at their facility and how to collect data (such as client waiting times) in order to identify gaps in care processes. Discussion then progressed to identifying causes of gaps and the development, implementation, and evaluation of solutions.

Participants were also trained to use the QI Journal, a tool developed by HCI to guide teams in documenting their improvement work, including decisions made, roles and responsibilities assigned, interventions introduced, and results. Each QI team developed a work plan detailing the interventions they wished to test during the first 'action period'. The learning sessions were facilitated by HCI staff and regional MoH staff who had been trained by HCI in QI methods and coaching. Each learning session was preceded by a half-day stakeholder meeting where the project was introduced to the heads of participating hospitals and health centers and relevant local MoH representatives.

Figure 2: The Model for Improvement



The QI teams then returned to their sites to disseminate the learning and to put the QI methods into action, coordinating their work through monthly QI team meetings. QI team members and clinic staff were not given additional pay or leave for their work but per

diems were paid for learning session attendance. They were also supported through monthly or bi-monthly coaching visits from staff. At these visits, the coach reviewed the team's work plan, discussed barriers to progress, suggested possible solutions to gaps, and shared experiences from other participating sites. After six-eight months, a second learning session was held where experiences were shared in a structured manner. During the learning session, a list of successful interventions/changes was compiled from among the participating teams. Using these ideas, teams then developed another work plan for their site in the next action period.

The data management collaborative focused on improving clinics' medical records systems and processes. The underlying hypothesis for the data management collaborative was that improving the quality of records systems would make clinics more efficient, reduce waiting times for clients, and allow staff more time to focus on providing quality clinical care. These results, in turn, should lead to higher levels of client retention and better clinical outcomes.

Seventeen sites around the towns of Jinja and Mbale in the central-east area of Uganda were recruited for the data management collaborative (see Figure 3). The collaborative's first learning session was held in Mbale in October 2009. Thereafter, coaching visits – shared between the HCI data management collaborative coordinator and an HCI regional coordinator – were carried out every two months until the second learning session in June 2010.

Figure 3: Map of Uganda

Source: www.webscavengers.net [19]

D. Study Aim and Objectives

The aim of this study was to evaluate the processes and impacts of the data management collaborative in Uganda. Although there is a growing body of literature concerning QI in health care, there have been several calls for greater and more rigorous research in this area [17,18]. Consequently this evaluation is not only informative as an internal assessment of HCI work but also adds to an area of the literature where evidence is lacking.

Firstly it provides much-needed evidence for what many consider to be the optimal QI collaborative approach: empowering sites to introduce the interventions they consider most appropriate, rather than having a set list of interventions proscribed by the collaborative project coordinators. Secondly, the evaluation adds to the literature on QI in developing countries, which has previously been described as 'meager' or 'merely sporadic' [17,18], with most QI research being done in Europe and the US [18]. Finally, there is very little literature thus far on the cost-benefits or cost-effectiveness of the improvement collaborative approach; this study aimed to provide some data regarding costs and benefits in the context of Uganda.

Specifically, the three objectives of the study were to:

1. Assess any improvements in HIV clinic efficiency following the collaborative,
2. Assess the cost of the data management collaborative from October 2009 through July 2010, and
3. Identify and describe interventions that have succeeded in improving HIV clinic efficiency.

II. METHODS

A. Sampling

HCI had resources to collect data in nine of the 17 sites. These nine sites were chosen based on the logistics of travel and their general representativeness of the 17. Six of the nine sites were chosen for follow-up analysis in May 2010, again selected by the collaborative coordinator because they represented the full range of clinic sizes, types and locations. These six sites (sites A-F) were named the 'Group 1 sites'. In order to assess the transferability of lessons learned between sites, three sites (sites G-I) were chosen from those without baseline data to be 'Group 2 sites' (again selected to be representative of the range of clinics in the collaborative). Baseline record retrieval times were measured at these three sites in May 2010. The collaborative coordinator discussed the successful Group 1 site interventions with each Group 2 site, identifying those interventions that Group 2 sites had not yet tried but thought might be successful. The sites were then supported by the collaborative coordinator by telephone and in the second learning session, to implement these interventions. Follow-up measurements were taken in July 2010.

B. Indicators

Indicators for the evaluation were developed through discussion with URC staff in Uganda and Bethesda. To fulfill the first objective of the evaluation - to assess improvements in HIV clinic efficiency - four indicators were selected: record retrieval time; record completeness; number of clients seen per staff member per week; and staff time saved. The first two of these indicators are process indicators, directly measuring any changes in the efficiency of records systems. The latter two indicators are outcome measures, selected to assess whether changes in the records management system led to improvements in overall clinic functioning. A more efficient clinic might see more clients, require fewer staff or finish earlier in the day; the two outcome indicators were designed to measure such changes.

C. Tools

Table 1 summarizes the indicators chosen for evaluation of the data management collaborative and the tools used to assess each one.

Table 1: Indicators and tools for data collection

Indicator	Tool
Record retrieval time	Record retrieval tool
Record completeness	Record completeness tool
Clients seen per staff member per week	Structured interview tool
Staff time saved	Structured interview tool
Cost of the collaborative	Structured interview tool
Description of successful interventions	Structured interview tool

The record retrieval tool recorded the time taken by staff to retrieve each client's medical record from the medical record storage system (see Appendix A). Timing started when a client handed in their clinic book on arrival at the clinic and stopped when the client's medical record has been pulled from the filing system. Retrieval times were measured for the first 10-15 clients arriving to the clinic. For all measures in May and July 2010, a minimum of 20 and a maximum of 50 retrieval times were recorded.

Record completeness was measured using a record completeness tool developed after discussion with URC staff in Uganda (see Appendix B). This recorded the completion of clients' HIV/ART cards, the standard medical record card issued by the Ministry of Health and used in all public HIV clinics in Uganda. Six items on the card should be completed for every client at each clinic visit: weight (Wt),

tuberculosis (TB) status, functional status, WHO clinical stage, compliance with Cotrimoxazole preventive therapy (CPT), and date of next visit. The tool recorded how many of these six items were completed at a clients' most recent visit (May, April or March 2010) compared with the visit in October 2009, before the collaborative began. Fifty record cards were used at each site, selected as the first 50 clients seen in October 2010 according to clinic and/or dispensary records. Clients on ART were selected as they were expected to attend monthly so should have visits in both October 2009 and May or April 2010. The first 50 seen in the clinic in October were selected for convenience; it also allowed sites to be assessed on performance in a similar time period. Since record completeness was not considered to vary across the course of a month before the collaborative began and since the staff members were the same at almost every clinic day, this method of sampling was considered acceptable.

The number of clients seen per staff member per week was calculated to assess whether the collaborative had increased the number of clients seen by the clinic team or had allowed the same number of clients to be seen by a smaller clinic team. Information regarding the number of clients seen each week in October 2009 (before the collaborative began) and at follow-up (April 2010) and the number of staff on duty at these times, was obtained by conducting structured interviews with the clinic managers and reviewing clinic attendance registers (see Appendix C for the structured interview form). The average number of clients seen per week per staff member was then obtained by calculating the average number of clients seen per week in the one-month baseline or follow-up period and dividing this by the number of staff members on duty during the month. Staff member time is defined as any time spent at the HIV clinic while on duty as a salaried worker. Volunteers were not included in this calculation.

Data on staff time saved were also obtained from the structured interviews. Average clinic closing times at baseline (October 2009) and follow-up (April 2010) were ascertained along with detailed information on staff mix and numbers. At sites where clinics now closed earlier, details on staff activity during this free time were recorded. If the time was used by staff to carry out tasks necessary to introduce and maintain efficiency interventions (such as pre-packing drugs before clinic to save pharmacy time during clinics) this was taken into account. Where staff numbers and mix had changed, this was also taken into account as extra, or fewer, staff hours. Costs were assigned to staff time savings using estimated average monthly salaries for each level of health care worker (see Appendix D). All costs were expressed in Ugandan Shillings (USh) and converted to United States Dollars (US$). We used the Bank of Uganda mid-market exchange rate of 26th July 2010: 2252 USh = 1 US$.

For the second objective, the costs of the collaborative were calculated from discussions with the collaborative coordinator and HCI financial records. These included the billed costs of the learning session, the costs of the bimonthly coaching visits from December 2009 to April 2010, and the salary of the collaborative coordinator from August 2009 when preparation for the collaborative commenced until the end of April 2009. Staff-time costs to the sites for QI team meetings and coaching visit sessions were determined through the structured clinic manager interview and use of the estimated average salaries for health care workers (Appendix D). Most sites did not retain attendance registers for QI team meetings and coaching session meetings so were asked to estimate attendance at these sessions.

For the third objective, descriptions of interventions introduced at each site were obtained through in-depth questioning using the structured interview. Clinic managers were asked which interventions they believed had been successful in terms of documented improvements in clinic processes or the opinions of the clinic staff. The success of interventions was further considered during analysis of data and is discussed in section IV.

D. Data Collection

The data collection team consisted of a public health physician from the United Kingdom, the collaborative coordinator, and three regional coordinators. Other than the second author (RS), these

were the same individuals who collected baseline data on record retrieval time in October 2009. Training consisted of a meeting to examine and discuss the tools. No issues were reported with the record retrieval tool at baseline. The other tools were discussed, and the exact method of using each was agreed upon. Minor changes were made to the interview form to eliminate ambiguity in the questions.

Follow-up data collection at the six Group 1 sites took place in May 2010. Data collectors were divided into two teams, one team visiting each site on one HIV clinic day to apply the record retrieval time tool, record completeness tool, and structured interview tool. Baseline record retrieval time data had been similarly collected during visits in October 2009.

The three Group 2 sites were visited by a team during the same period in May 2010. Baseline record retrieval data were collected, and the record completeness tool and structured interview tool were applied. Follow-up record retrieval data in the three Group 2 sites were collected by the same data collectors at a visit in July 2010.

Information on the cost of the collaborative was collected during May-June 2010 as described above. All data were entered by one of the data collectors and cross-checked by another to minimize errors. Microsoft Excel© 2003 package was used for all statistical analyses. Data were not aggregated across sites as each site worked independently.

III. RESULTS

A. Record Retrieval Time

The number of records per site that were part of this evaluation is shown in Table 2. Average record retrieval times at baseline and follow-up for Group 1 sites are shown in Figure 4. Reductions in retrieval time were observed at all sites, with a range of 37%-97% reduction compared with baseline (at site A and site F, respectively). Five of the six sites had statistically significant decreases ($p<0.05$; $p<0.001$ at two of the sites). Data were not aggregated as sites varied in clinic layout and format of records systems and introduced differing interventions at different time points.

Table 2: Participating sites and records sample size

Site	Group I or II	Baseline records	Follow-up records
A (health center)	I	15	34
B (hospital)	I	11	34
C (hospital)	I	7	10
D (hospital)	I	16	50
E (health center)	I	12	50
F (hospital)	I	14	50
G (hospital)	II	38	39
H (health center)	II	20	28
I (health center)	II	38	45

Figure 4: Average record retrieval times at Group 1 sites

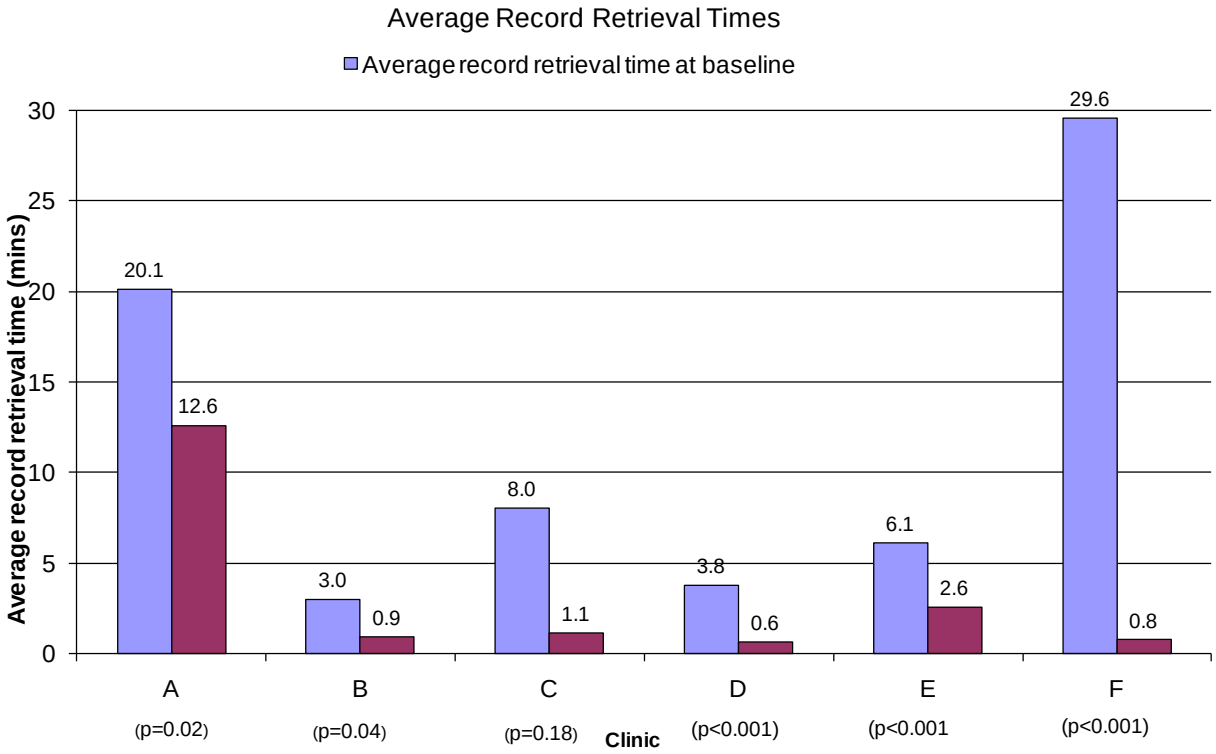


Figure 5 shows average record retrieval time at baseline and follow-up for Group 2 sites. Follow-up retrieval times show reductions of 62% to 74% from baseline; all are statistically significant ($p<0.001$).

Figure 5: Average record retrieval times at Group 2 sites

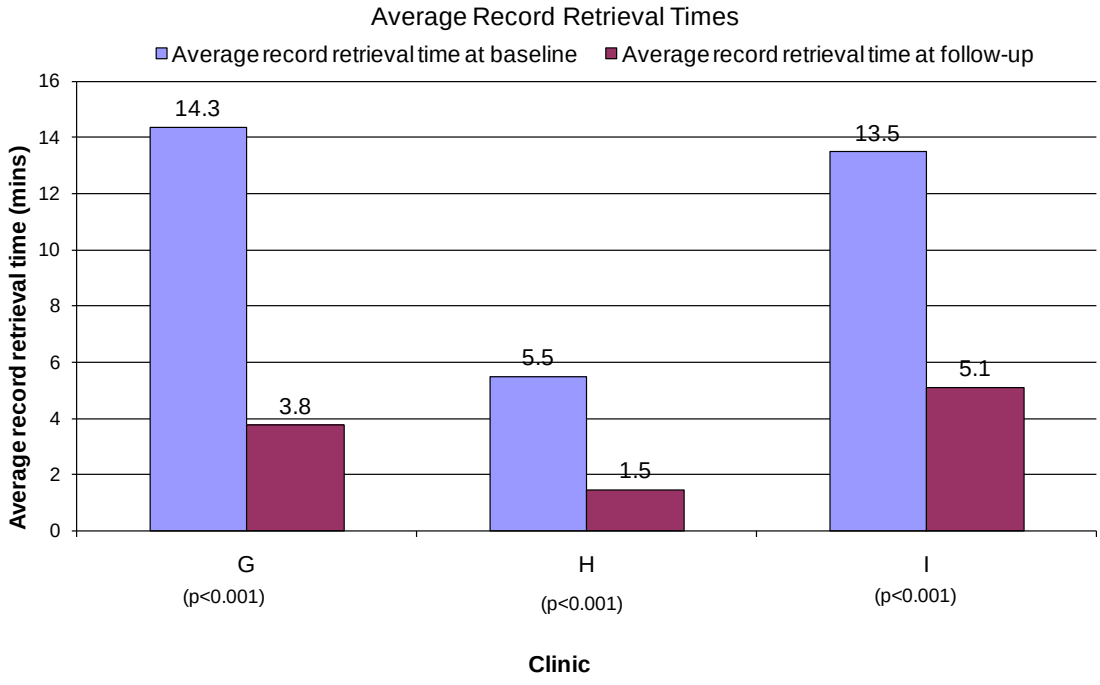


Table 3 shows the average time saved on record retrieval per week at each site, calculated as the average time saved per record retrieved at follow-up less the average time at baseline, and the average number of clients seen per week at each site. Total time savings range from 194 minutes to 52 hours and 22 minutes (3142 min.) per week and represent time freed-up for staff to assume other tasks.

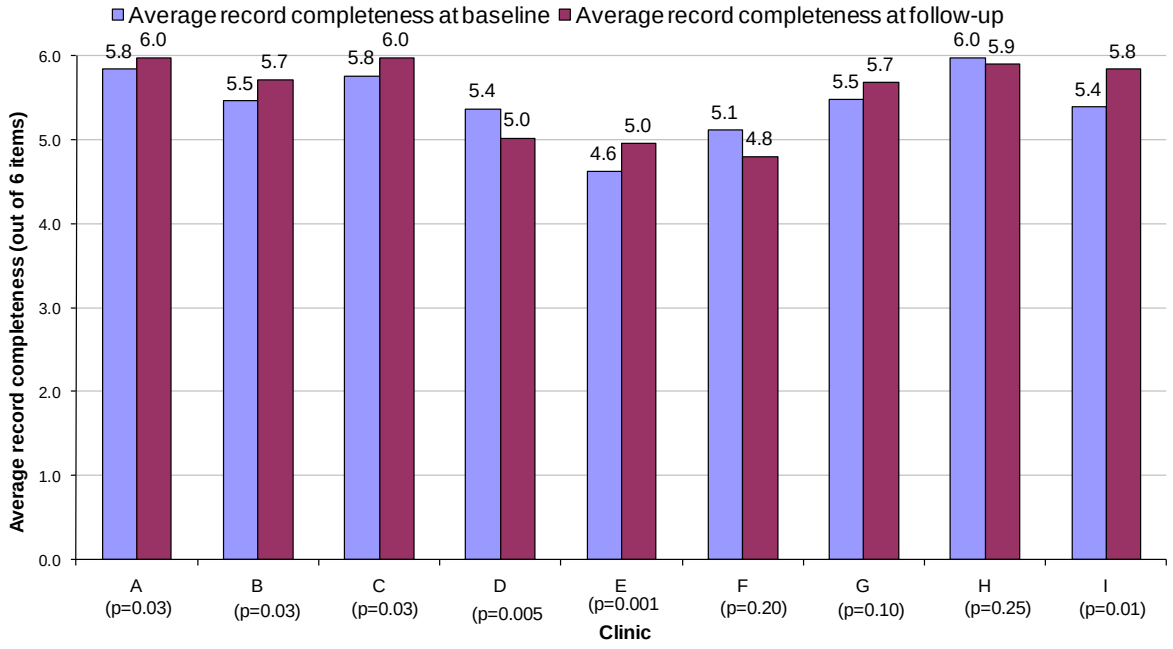
Table 3: Total time saved per week in record retrieval per week at follow-up for all sites

Group	Site	Total time saved in record retrieval per week at follow-up (minutes)
Group 1 sites	A	709
	B	243
	C	980
	D	534
	E	314
	F	3142
Group 2 sites	G	1164
	H	194
	I	1547

B. Record Completeness

Average record completeness at baseline and follow-up for each site is shown in Figure 6. At baseline record completeness ranged from 4.6-6.0 out of a maximum of 6.0; changes at follow-up were small (0.1-0.4). Most improvement was seen in the assessment of TB, including assigning patient a stage according to WHO criteria. Record completeness increased from baseline to follow-up at six sites, with the increase being statistically significant at five of the six sites.

Figure 6: Average record completeness



Of the three sites where average record completeness decreased from baseline to follow up, the reduction was statistically significant at facility D only.

C. Clients Seen per Staff Member per Week

The average number of clients seen per staff member per week at baseline and follow-up at each site is shown in Table 4. Four sites saw more clients per staff member at follow-up than at baseline, four sites saw fewer, and one site did not change.

Results for each individual site were not assessed for statistical significance because, although all clients are seen approximately once a month in clinic, the client load is not spread evenly across the calendar month. It was also observed that there were a varying number of clinics per week at many sites due to public holidays, staff absences, or other reasons. Thus, to be meaningful, average number of clients seen per staff member per *month* over several months would need to be assessed but, since this evaluation occurred after only six months of work by the collaborative, insufficient time had elapsed to measure this.

Table 4: Average number of clients seen per staff member per week

Site	Clients in active care (April 2010)	Baseline			Follow-up			Difference (y-x)
		Clients seen per week	Staff on duty	Clients seen per staff member per week (x)	Clients seen per week	Staff on duty	Clients seen per staff member per week (y)	
A	800	97	7	14	94	5	19	5
B	1079	125	18	7	115	19	6	-1
C	1040	186	5.5	34	142	5.5	26	-8
D	2412	110	9	12	169	16	11	-2
E	668	67	5	13	89	5	18	4
F	1170	143	7	20	109	5	22	1
G	946	114	8	14	110	8	14	0
H	466	43	10	4	48	7	7	3
I	3600	284	10	28	185	14.5	13	-16

(***Note***: All figures are rounded to the nearest whole number)

D. Staff Time Saved

The amount of staff time saved as a result of earlier clinic closing times at follow-up compared with baseline (less any time spent undertaking QI intervention activities) is shown in Table 5. Seven of the nine sites reported shorter clinics at follow-up compared with baseline, with a range of 1-4 hours. At these seven sites, the estimated cost of the time saved - in terms of staff wages - ranged from 150,001USh (US$66) to 689,774USh (US$306) per clinic. Clinic managers reported that the time saved was spent assisting in other areas of the site (except at one site where staff go home early), equating to sites having 1.0-5.8 additional staff members per clinic day (given an eight-hour working day).

Table 5: Staff time and cost savings

Site	Average staff on duty (April 2010)	Staff-hours saved per clinic day	Cost-saving per clinic day (USh)	Cost-saving per clinic day (US$)
A	7	25	689,774	306
B	19	46	679,550	302
C	5.5	16.5	228,411	101
D	16	-60	-1,031,826	-458
E	5	-20	-300,000	-133
F	5	15	375,000	167
G	8	8	150,001	67
H	6	12	213,638	95
I	14.5	44.5	558,527	248

At all seven sites, those interviewed ascribed the change in clinic hours to the QI interventions which they had introduced. Two sites reported longer clinics at follow-up compared with baseline – site D (by two hours) and site E (four hours) - resulting in negative savings in staff time and costs.

E. Cost of the Collaborative

For the nine sites evaluated, the cost of the collaborative to the end of April 2010 was estimated as 54,470,000 Ugandan Shillings (US$ 24,200). A breakdown of costs is shown in Table 6.

Table 6: Costs of the data management collaborative

Item	Cost (USh)	Cost (US$)
Learning Session & Stakeholder Meeting	25,196,090	11,188
Coaching trips & Collaborative Coordinator salary	19,767,546	8778
Site costs for QI team meetings & coaching visits	9,508,958	4222
TOTAL:	**54,472,593 USh**	**$24,189**

F. Description of Interventions

A summary of the interventions introduced at each site is found in Table 7. All but one of the sites altered the way in which records were stored and applied a system of ordering files; the one exception was site C which already had a well-organized records management system. Six of the eight sites arranged their files according to client number while two sites (D and G) chose to order files according to appointment date. Sites A, C, and D also assigned additional staff members to the task of retrieving records. Seven of the nine sites held training on proper completion of the standard HIV/ART card.

Table 7: Description of specific interventions in the data management collaborative

		SITE									
VARIABLE	TYPE	A	B	C	D	E	F	G	H	I	Total
Review records for completeness	COMPLETE				X						
Two people available for searching	HR	X		X	X					X	4
One person responsible	HR		X	X						X	3
Arranged alphabetically	ORDER	X									1
Arranged numerically	ORDER		X			X	X	X	X	X	6
Record # listed in appointment book	ORDER			X							1
Arranged by appointment	ORDER							X	X		2
Stored in cabinet	STORE	X		XX				X		X	4
Stored in separate room	STORE		X			X	X				3
Files missing appointments stored in separate box	STORE								X		1
Current files in box in reception	STORE								X	X	2
Searched in batches	PROCESS	X			X						2
Standard operating procedures	PROCESS		X								1
Appointment system	OTHER		X	X							2
Clients come bi-monthly	OTHER		X	X							2
Staff go to retrieve blood results	OTHER		X								1
Clinicians help with data entry	OTHER		X								1
Triage system	OTHER			X					X		2
Improve client flow system	OTHER									X	1
Outreach for clients	OTHER									X	1
Training in HIV/ART cards	TRAIN	X	X	X		X		X	X	X	7
ENDLINE RETRIEVAL TIME		12.6	0.9	1.1	0.6	2.6	0.8	3.8	1.5	5.1	
PERCENT REDUCTION IN RETRIEVAL TIME		37%	70%	86%	84%	57%	97%	73%	73%	62%	
Total # sites that made changes in record order	8	yes	yes	yes		yes	yes	yes	yes	yes	
Total # sites that made storage changes	8	yes	yes	yes		yes	yes	yes	yes	yes	
Total # sites that did human resource changes	5	yes	yes	yes	yes					yes	
Total # sites that addressed record completeness	1				yes						

IV. DISCUSSION

A. Record Retrieval Time

The marked reductions in record retrieval time at Group 1 sites were significant for all but one site, site C. This was the only site which already had a well-organized records management system and made changes only to the number of staff retrieving files. Additionally, only ten clients attended the clinic at site C on the day of follow-up data collection, reducing the statistical power to detect a difference.

The remaining five 'Group 1' sites achieved significant reductions in retrieval time after all introducing interventions focused on *both*:

1. The order in which records are stored (three sites did not store records in any order at baseline).
2. The physical space where they are stored (four sites did not have a dedicated area for records storage at baseline).

Site F achieved the greatest reduction in retrieval time - a 97% reduction, equating to a saving of over 52 hours of staff time per week at follow-up. This represents a clinically significant improvement (in terms of freeing up large amounts of staff time) as well as a statistically significant one, and, at 0.8 minutes to retrieve a record, may represent the limit of improvement. The reduction was achieved after organizing

records in client number order in filing cabinets in a separate room. At baseline, records were in boxes at the reception in no particular order.

Sites B and E also showed marked improvements after ordering files by client number and storing all records together on dedicated shelves (70% and 58% reductions in time, respectively).

Although site E showed a 58% reduction in retrieval time after switching from appointment date order to client number order, site D achieved a reduction of 84% by switching from client number order to appointment date order. This is possibly due to site D (a hospital) arranging records in batches according to appointment date and then, unlike site E (a health center), in client number order within these batches. The greater improvement at site D may also indicate that ordering records in batches by appointment date is relatively more advantageous to larger facilities; site D had 2412 active clients in April 2010, by far the largest site under evaluation, while site E had only 668.

All Group 2 sites showed a significant reduction in record retrieval time from baseline (May 2010) to follow-up (July 2010) after introducing interventions which had been used successfully at Group 1 sites.

Site G and site H both demonstrated significant improvements after introducing interventions utilized at site D: files were ordered in batches according to appointment date and in number order within batches. In addition, keeping the current day's batch at the reception area reduced retrieval time as well as congestion in the clinics.

Three Group 1 sites allocated an additional staff member to retrieve records, and this was recommended to the Group 2 site I, which previously had only one staff member moving across the busy clinic from reception to the record store and retrieving files. The introduction of a runner to go between the two areas and another staff member to retrieve files had a significant impact on retrieval times.

Thus, significant reductions in the amount of staff time required to retrieve records were achieved with the introduction of simple changes to records systems. Several of the interventions associated with improvements at Group 1 sites were transferred to Group 2 sites with success. This suggests that such improvement interventions could form part of a 'bundle' to be recommended to other HIV clinics looking to improve efficiency.

B. Record Completeness

All six sites which showed an improvement in record completeness held specific training sessions on completion of the HIV/ART card as part of their QI work. Of the three sites where record completeness declined, only one had undertaken HIV/ART card training: site H. At this site, record completion was very good at baseline with an average record completeness of 6.0 (40 records assessed), reducing by 0.1 at follow-up ($p=0.25$), a very small, statistically insignificant difference. The remaining two sites which showed a reduction in record completeness had not undertaken HIV/ART card training, and the reductions in record completeness were greater: 0.4 at site D and 0.3 at site F. This reduction was statistically significant for site D ($p=0.005$).

These results suggest that training in the use of record forms leads to an improvement in record completion. However, the baseline data suggest that staff at most sites already completed most of the records, and therefore, any improvement in record completion would be unlikely to have significant impact on clinic efficiency. Given that over time, a lack of training was associated with reduced record completion, periodic training sessions on use of the HIV/ART card are recommended to maintain good levels of record completion.

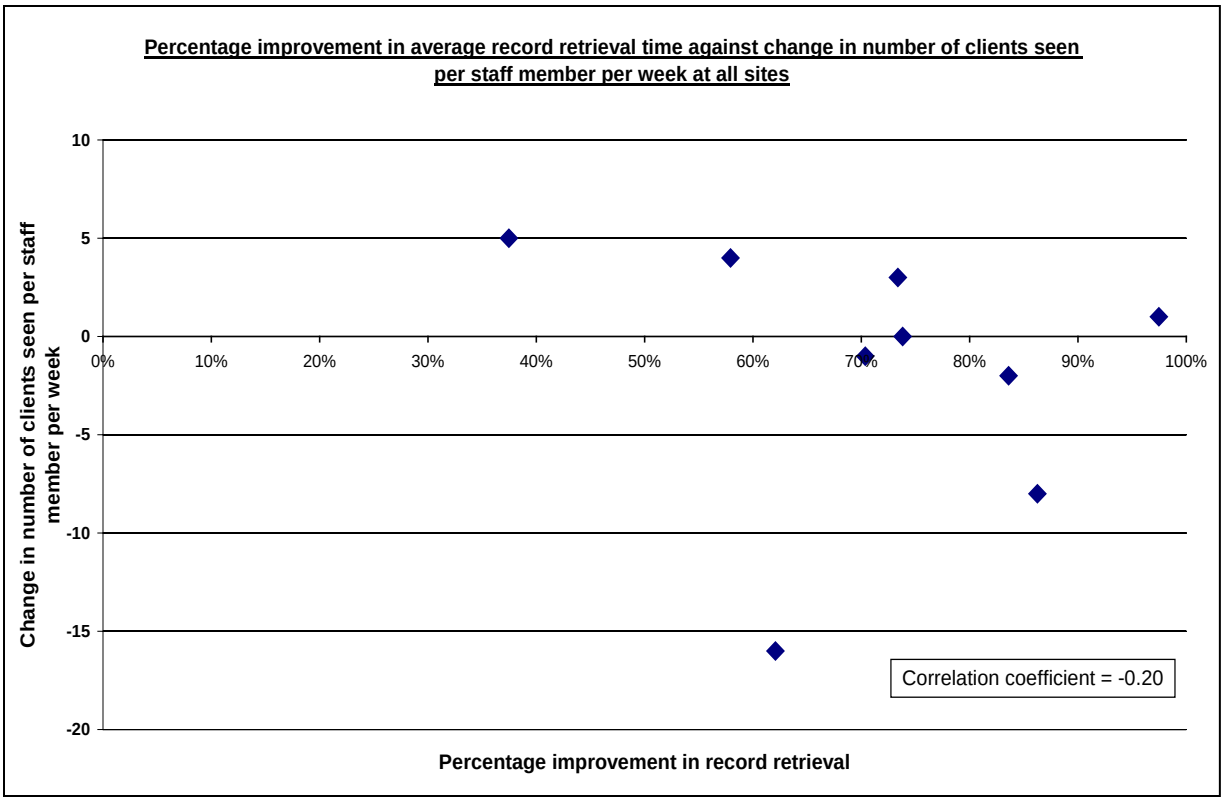
C. Clients Seen per Staff Member per Week

For this outcome indicator the absolute values obtained and the changes in these from baseline to follow-up, were highly variable across the nine sites. The universal improvements seen in average

record retrieval time did not translate into universal improvements in the average number of clients seen per staff member per week as seen in Figure 7. Changes in record completeness were not correlated with changes in this outcome indicator.

Baseline values varied greatly between sites (between 4 and 34 clients per staff member per week) because staff numbers and mix varied vastly across different sites. Clinics were also run in different ways, with a range of protocols, systems, and processes.

Figure 7: Percentage improvement in record retrieval time plotted against changes in average number of clients seen per staff member per week at each site



One possible explanation for the great variation in the changes from baseline to follow-up is that the improvements in processes, such as record retrieval, do not lead to improvements in this particular outcome. Saving over 20 minutes of staff time for each record retrieved at site F does not necessarily allow the clinic team to see more clients. However, allowing the same number of clients to be seen sooner on each clinic day will lead to improvement in the other outcome indicator, staff time saved.

Alternatively, an association may exist but may be obscured by other factors which influence the average number of clients seen per staff member per week. Improvement interventions not specifically aimed at reducing record retrieval times are an example. Three of the four sites with decreased average number of clients seen per staff member per week saw fewer clients per week at follow-up with the same or a reorganization of staff that allowed for a saving of staff time. Sites B and C began seeing stable clients once every two or three months rather than monthly, thus reducing the total number of clinic appointments scheduled each month. Site I commenced outreach visits, seeing a certain number of clients in their home communities rather than in the clinic. Data on exact numbers seen on outreach visits were not available, so were not accounted for in this indicator. In such situations, any improvements in the average number of clients seen per staff member per week resulting from reduced record retrieval time would be hidden or at least reduced by these additional QI interventions.

Alternatively, the time saved through improved records systems may be used by staff to spend longer with each client, rather than to see more clients. In this case the total number of clients seen would not increase but clinical care given to each client might be enhanced. Evidence for this - such as client contact times and long-term health outcomes - was not collected in this evaluation and would be of interest in future studies.

Another factor which may disrupt the relationship between record retrieval time and the average number of clients seen per staff member per week is clinic attendance levels, which can fluctuate in the short term. If fewer clients attend the clinic in a certain period, due to public holidays or other extrinsic reasons, the average number of clients seen per staff member per week will fall, independent of clinic efficiency, if staff numbers remain constant.

This indicator is also vulnerable to external influences on staff numbers. The indicator measured the average number of clients seen per staff member per week in order to detect sites where efficiency improvements have allowed the same number of clients to be seen by a smaller clinic team. However, during the action period, staff were transferred in or out of several sites as part of the overall regional or district human resources strategy to meet the minimum needs of all health facilities and not in direct response to changes in the clinic's efficiency. Since clinic teams are small (generally fewer than ten individuals), the addition or loss of several staff members causes a relatively large change in the denominator of this measure which would require a large change in the numerator - clients seen each week - to balance out. At site F, there was an increase in average number of clients seen per staff member per week, despite fewer clients being seen overall (143 per week at baseline *vs.* 109 at follow-up), because the site gained two staff members. It could be argued that efficiency improvements should have balanced this out by increasing the number of clients the clinic saw each week. However, loss or gain of staff can delay progress (for instance, while additional or replacement QI team members are trained) or may simply be too great in number for efficiency interventions to counter in just six months.

In summary, although introducing interventions to improve data management appear to have improved record retrieval times at evaluation sites, it has not translated into an improvement in this outcome indicator. No one QI intervention (or bundle of several interventions), whether related to improved records systems or not, seems to be associated with improvement in this indicator. The results show that increasing clinical efficiency in this manner is not sufficient alone to increase the number of patients seen per staff member.

D. Staff Time Saved

The fact that clinics now end earlier at seven of the sites, producing time savings equivalent to 1.0-5.8 additional staff members per site, strongly suggests that the data management interventions introduced have improved clinic efficiency. Clinic managers at these sites were all of the opinion that this was due to QI interventions, and all have documented a reduction in average record retrieval time which could partially explain these shorter hours. Three sites closed earlier despite seeing the same number or more clients each week now than at baseline (sites A, G, and H) and three of the four which see fewer clients each week now do so after introducing QI interventions which would explain this: all three (sites B, C, and I) began seeing stable clients every two months instead of monthly, and site I began outreach visits. The only exception is sites F, which closed earlier at follow-up and saw fewer clients each week because, according to the clinic manager, clients had been lost to a neighboring charity-run HIV clinic (Table 8).

Table 8: Average cost-saving in nine clinics in data management collaborative

Site	Average staff on duty (April 2010)	Staff-hours saved per clinic day	Cost-saving per clinic day (USh)	Cost-saving per clinic day (US$)
A	7	**25**	**689,774**	306
B	19	**46**	**679,550**	302
C	5.5	**16.5**	**228,411**	101
D	16	**-60**	**-1,031,826**	-458
E	5	**-20**	**-300,000**	-133
F	5	**15**	**375,000**	167
G	8	**8**	**150,001**	67
H	6	**12**	**213,638**	95
I	14.5	**44.5**	**558,527**	248

The two sites giving negative staff time savings closed later at follow-up than at baseline. The clinic manager at site D reported that clinics finished two hours later at follow-up as clients were coming to the clinic from greater distances, arriving later in the day and preventing the clinic from closing earlier. Site E's clinic closed four hours later at follow-up than at baseline. The clinic manager ascribed this to more clients being seen each week at follow-up. This highlights the reason why the QI collaborative approach recommends the introduction of a selection or 'bundle' of interventions at sites. Site E experienced the greatest increase in number of clients seen during the action period of any site (from 67 per week at baseline to 89 at follow-up, a 33% increase) but, unlike many other sites, only interventions directly aimed at improving record retrieval time were introduced there (see Table 7). It may be that, with such an increase in client numbers, improved record retrieval time is not enough to maintain or improve clinic efficiency. Interventions such as identifying clients stable enough to be seen every two months rather than each month may be required as part of the intervention bundle.

E. Cost of the Collaborative

The cost of the first six months of the data management collaborative was estimated as 54,470,000USh (US$24,200), while staff-time savings for the nine sites at follow-up was valued at a total of 1,560,000USh per clinic day. A twelve-month cost-benefit analysis was performed, taking into account the number of clinics per week at each site and assuming that clinics run for 50 weeks per year and will continue at the current level of quality with no further input. This showed a net benefit of 185,869,607USh per year (US$82,535) of value in staff time freed up to do other work tasks. It should be noted that this is a saving staff time given a monetary value. It is not a direct cash saving by the MoH. Staff at the HIV clinics that closed early were reassigned to other clinical areas at the site and were therefore able to perform other professional duties of value.

One-way sensitivity analysis was performed on both of the cost variables and their components. A 1% increase in the cost of the collaborative would cause only a 0.3% decrease in the cost-benefit difference. A 1% decrease in staff-time cost savings would cause a 1.3% decrease in the cost-benefit difference.

Among the specific collaborative cost components, cost to HCI of coaching trips and of the coordination of the collaborative (19,767,546USh or US$8778) had the biggest effect on the overall

result. A 1% increase in the cost of coaching/coordination would cause a 0.11% decrease in the cost-benefit.

Among the components of the staff-time cost savings, site D had the biggest effect. At this site, staff-time cost savings were negative, i.e., staff costs were greater at follow-up than baseline. A 1% increase in costs there would cause a 0.56% decrease in cost-benefit.

Staff-time cost savings at the clinics have a much larger effect on the overall result than do the costs of the collaborative. However, a 10% change in any of the input variables would not change the basic conclusion that the collaborative intervention produced a significant net benefit.

If a similar collaborative was organized by the MoH, it is estimated that the cost (for nine similar sites) would be lower as regional coordinators could undertake the majority of coaching visits and run local learning sessions. As these personnel are based in the local area, rather than Kampala, travel and staff costs would be lower. In this situation, the cost-benefit would be greater than that seen here, although it is important to note that savings would not necessarily be realized in lower costs to the MoH but as staff members who can be reassigned to other duties.

F. Limitations

The data on clinic closing times (and thus staff time saved), number of staff members on duty, and attendance at QI meetings were self-reported by the clinic managers and thus vulnerable to recall error and social desirability bias. Greater accuracy would have been achieved by collecting data contemporaneously. Steps were taken to minimize this bias, however: data collectors noted the time that clinics closed when they were visited (and these observations matched well with the reports given by staff in the structured interviews); and clinic manager interviews were conducted with at least one other QI team member present so that responses could be corroborated. All data were collected on only one clinic day at each site at baseline and follow-up. However, the day on which data collection visits occurred may not have been reflective of a typical clinic day. Adding visit days would reduce the potential for such random and systematic error.

This study relied on data collected from self-assessment. However, previous collaborative research suggests that bias associated with self-report is minimal: validation studies carried out by HCI in Niger and Ecuador found that self-reported data did not significantly differ from measurements made by external evaluators [6].

V. CONCLUSIONS

This study demonstrated associations between the introduction of QI interventions aimed improving data management systems in HIV clinics and improvements in process and outcome indicators. The study used a variety of information sources to evaluate the data management collaborative, including quantitative measurements of clinic processes, data from clinic registers, and qualitative information from structured interviews. This approach helped to build a comprehensive picture of QI activities at the sites and allowed associations between QI interventions, process indicators, and outcome indicators to be fully explored.

Causal links cannot be proven but the results obtained suggest that certain 'bundles' of QI interventions can improve record retrieval times and record completeness as well as save staff time. These are:

- Arrangement of clinical records: whether by medical record numbers or alphabetically, after sub-division according to appointment date at larger sites
- Storing records in a dedicated area of the clinic
- Allocation of staff to each clinic service, including more than one staff member to retrieve records

Record retrieval times decreased significantly after the introduction of targeted QI interventions, saving

sites between 192 and 3142 minutes (over 52 hours) of staff time per week. While the impressive improvements in this process indicator were not translated into consistent improvements in the outcome indicator, clients seen per staff member per week, this lack of a clear association could be due as much to the multiple other influences upon the number of clients attending HIV clinics and the number of staff available to see them.

In seven of the nine sites, the HIV clinics closed earlier by the end of the action period, and two closed later. Overall the monetary value of the staff time saved was 1,563,000USh (US$690) per clinic day across all sites. Given that staff spent this saved time assisting in other clinical areas or performing other duties, these savings equate to sites having 1.0-5.8 additional staff members per clinic day. If similar time savings were produced in all 328 ART-accredited clinics across Uganda this would equate to hiring between 328 and 1902 additional health care workers.

The findings regarding staff-time saved also highlight the reason why HCI advocates sustained QI work and the introduction of a selection, or bundle, of interventions. Site E closed four hours *later* at follow-up than at baseline but also experienced a greater increase in client numbers than other sites. The productivity increase appeared to be a greater factor determining clinic hours than the interventions implemented to improve record retrieval time.

A twelve-month cost-benefit analysis across the nine sites showed a net benefit of 185,869,607USh per year (US$82,535). Sensitivity analysis showed that staff-time savings at the clinics had a much larger effect on the overall result than the costs of the collaborative. A 10% change in any input variable would not change the basic conclusion that the collaborative intervention produced a significant net benefit.

If a similar collaborative were organized by the MoH, it is expected that costs would be lower, since MoH regional coordinators could undertake program coordination and coaching visits. This would increase the net benefit of the collaborative further and thus free up even more health care worker time.

This evaluation has shown that QI collaboratives can do much to ease the health care worker deficit in Uganda. Cost savings derived from fewer staff being required to run the more efficient clinics may allow greater expenditure on material resources. The Ugandan MoH reports that 72% of public health units currently experience monthly stock-outs of at least one drug [2]; such shortages can have profound effects on health outcomes for people living with HIV/AIDS.

Although further research is required, particularly on long-term health outcomes, this study suggests that the widespread introduction of QI collaboratives in Uganda has the potential to maximize quality in HIV/AIDS care, save money, and save lives.

VI. REFERENCES

1. World Health Organization (WHO). Global Health Observatory [internet]. 2010. Available at: http://www.who.int/gho/en [accessed 29 June 2010].

2. Government of Uganda, Ministry of Health. *National Health Policy: Reducing poverty through promoting people's health*. Kampala: Government of Uganda; 2009. Available at: http://www.health.go.ug/index.php?option=com_content&view=article&id=66:policies&catid=25:the-project&Itemid=85 [accessed 29th June 2010].

3. WHO. *The World Health Report 2006: Working together for health*. Geneva: WHO; 2006.

4. Kyayise AM, Kyeyagalire R, Livesley N, Kirunda I, Tumwesigye B, Kinoti S, Katungu D. Private-for-Profit HIV/AIDS Care in Uganda: An Assessment. *Technical Report*. Published by the USAID Health Care Improvement Project. Bethesda, MD: URC; 2008. Available at: http://www.hciproject.org/node/1075..

5. WHO. Millennium Development Goals [internet]. 2010. Available at: http://www.un.org/millenniumgoals/ [accessed 16th June 2010].

6. Franco LM, Marquez L, Ethier K, Balsara Z, Isenhower W. Results of Collaborative Improvement: Effects on Health Outcomes and Compliance with Evidence-based Standards in 27 Applications in 12 Countries. *Collaborative Evaluation Series*. Published by the USAID Health Care Improvement Project. Bethesda: URC; 2009. Available from: http://www.hciproject.org/node/1057.

7. Massoud R, Askov K, Reinke J, Franco LM, Bornstein T, Knebel E, MacAulay C. A Modern Paradigm for Improving Healthcare Quality. *QA Monograph Series 1(1)*. Published for the U.S. Agency for International Development (USAID) by the Quality Assurance Project. Bethesda, MD; 2001. Available at: http://hciproject.org/node/899.

8. Wikipedia. Six Sigma [internet]. Updated 2010 August 18. Available from: http://en.wikipedia.org/wiki/Six_Sigma [accessed on 19 August 2010].

9. Wikipedia. Lean manufacturing [internet]. Updated 2010 August 19. Available from: http://en.wikipedia.org/wiki/Lean_manufacturing [accessed on 19 August 2010].

10. Institute for Healthcare Improvement. Improvement methods [internet]. Available at: http://www.ihi.org/IHI/Topics/Improvement/ImprovementMethods/HowToImprove/ [accessed on 31 July 2010].

11. Loay Sehwail, Camille DeYong. Six Sigma in health care. *Leadership in Health Services*. 2003; 16(4):1-5.

12. NHS Institute for Innovation and Improvement. Lean thinking [internet]. Available from: http://www.institute.nhs.uk/building_capability/general/lean_thinking.html [accessed on 31 July 2010].

13. Institute for Healthcare Improvement. *The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement. IHI Innovation Series white paper*. Boston: Institute for Healthcare Improvement; 2003. Available from: *http://www.ihi.org/IHI/Results/WhitePapers/THheBreakthroughSeriesIHIsCollaborativeModelforAchieving+BreakthroughImprovement.htm* [accessed 15th June 2010].

14. USAID Health Care Improvement Project. The Improvement Collaborative: An Approach to Rapidly Improve Health Care and Scale Up Quality Services. Bethesda, MD: University Research Co., LLC (URC), 2008. Available from: http://www.hciproject.org/node/1057.

15. HCI Project. Research and Evaluation [internet]. Available from: http://www.hciproject.org/node/1051 [accessed 23rd June 2010].

16. Langley GJ, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. San Francisco: Josey-Bass; 1999.

17. Cretin S, Shortell SM, Keeler EB. An Evaluation of Collaborative Interventions to Improve Chronic Illness Care: Framework and Study Design. *Evaluation Review*. 2004; 28(10):28-51.

18. Leatherman S, Ferris TG, Berwick D, Omaswa F, Crisp N. The Role of Quality Improvement in Strengthening Health Systems in Developing Countries. International Journal for Quality in Health Care. 2010; 22(4): 237-243.

19. The World Factbook. Map of Uganda [internet]. Available from: www.webscavengers.net [accessed 3 July 2010].

APPENDIX A: RECORD RETRIEVAL TOOL

Record Retrieval Tool

ID _____

Site name:

Evaluator name:

Date: (dd/mm/yy)

Number pre-ART clients:

Number ART clients:

Activities at 1st contact point

_____ _____

	ID	ART/ pre-ART	Appointment Yes/No	Time of 1st contact	Time card retrieved	Time taken (mins)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

APPENDIX B: RECORD COMPLETENESS TOOL

Record Completeness Tool

ID _____

Page 1

Site name: _____

Evaluator's name: _____

Date: _____(dd/mm/yy)

	Clinic no.	**October *or* November 2009 visit**							**March *or* April *or* May 2010 visit**							**Comments**
		Follow up date	Wt	TB status	Functional	WHO clinical stage	CPT	***TOTAL*** *(out of 6)*	Follow up date	Wt	TB status	Functional	WHO clinical stage	CPT	***TOTAL*** *(out of 6)*	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																

APPENDIX C: HIV CLINIC MANAGER INTERVIEW FORM: DATA MANAGEMENT COLLABORATIVE

1. Date _____ (dd/mm/yyyy)
2. Site Name: _____
3. Interviewer name: _____
4. Clinic Manager name: _____
5. Total number of active patients registered with clinic:_____
6. Have total staff numbers changed since October 2009? Yes or No.

   If Yes: Please describe ***how*** they have changed *(for example: 1 extra nurse, 1 less pharmacist)* and ***why*** *(for example: a vacancy has been filled, the clinic is busier so more staff are needed)*

7. On average, how many clients were seen in the clinic ***per week*** in April 2010? *(You may need to ask to see the Clinic Register to answer this question)*

8. On average, how many clients were seen in the clinic ***per week*** in October 2009? *(You may need to ask to see the Clinic Register to answer this question)*

9. Currently, how many staff members are on duty on a typical clinic day? Which cadre is each of these staff members?

10. How many staff members would have been on duty on a typical clinic day in October 2009 and before? Which cadre is each of these staff members?

11. Does the clinic now finish earlier in the day compared with October 2009 and before? Yes or No.

    If Yes: Go to Q.12, If No: Go to Q.15

12. What time did the clinic ***used*** to end (on average) and what time does it end ***now*** (on average)?

13. On average, how many working hours does this free-up for each cadre of staff each clinic day?

    (for example: 1 hour for doctors, half an hour for nurses, 15 minutes for auxiliary staff)

14. What do staff do during this free time? *(for example: go to help at a different clinic, go home, don't know)*__ _____***now go to Q.18***

15. Do staff have more spare time in the day now compared with October 2009 and before? Yes or No.

    If Yes: Go to Q.16, If No: Go to Q.18

16. On average, how many more hours of free time are available for each cadre of staff each day?

    (for example: 1 hour for doctors, half an hour for nurses, 15 minutes for auxiliary staff)

17. What do staff do with this free time? *(For example: go to help at a different clinic, go home, don't know)*

18. Has there been a monthly clinic QI team meeting ***every month*** from November 2009 to April 2010? Yes or No.

    If No, please list the months there ***was*** a meeting:_____

19. How long do these QI team meetings usually last? _____(in hours)

20. Who usually attends the QI team meetings? *(Please give the number of each cadre who attend.)*

21. How long do the collaborative coaching sessions usually last? _____(in hours)

22. Who usually attends the collaborative coaching sessions? *(Please give the number of each cadre who attend.)*

23. Please briefly describe the clinic's record management system ***before*** the QI collaborative began. *(For example: where were records stored, in what order, who retrieved them. You may need to consult the clinic's data manager or other staff member to get this information.)*

24. Please briefly describe the clinic's record management system ***now*** and the steps required to change from the previous system to this system. *(e.g.: where records are stored, in what order, who retrieves them. You may need to consult the clinic's data manager or other staff member to get this information.)*

25. What interventions, training or protocols has the clinic introduced to improve completeness of records (if any)?

26. What barriers were encountered in introducing the changes to the record management system and to record completeness, and how were they overcome?

27. What do you (the HIV clinic manager) think has gone well and could be improved?

28. Have you received any feedback from clinic staff on the QI interventions made? Yes or No.

    If Yes, please describe what staff have said:

29. Do you think that any improvements made in record retrieval time and/or record completeness will continue to improve or do you think they have reached their maximum?

30. Has the clinic put any measures in place to ensure that QI interventions are sustainable in the long-term, once HCI/URC involvement has ended? (By this we mean measures such as protocols, policies, continued QI meetings. Please do not suggest these directly to the site manager however.

End of questionnaire

APPENDIX D: HIV CLINIC STAFF SALARY ESTIMATES

Cadre	Monthly wage (USh)	Approximate hourly wage (USh)
Medical Officer/Doctor	750,000	34,091
Clinical Officer/Clinician	550,000	25,000
Nurse/Midwife	400,000	18,182
Data Officer/Records Officer/Data Clerk	200,000	9,091
Nursing Assistant	150,000	6,818
Senior Medical Officer	1,300,000	59,091
Laboratory technician	400,000	18,182
Dispenser/Pharmacist	450,000	20,455
Nursing Officer	550,000	25,000
Driver	200,000	9,091
Receptionist/Secretary/Admin staff	200,000	9,091
Medical Social Worker	600,000	27,273
Accountant	600,000	27,273
Volunteer/Expert Client	0	0

Note:

1. Estimated wages stated here are pre-tax.
2. There are several levels of wage for medical officers and clinical officers; those used here are the lowest level.
3. Conversion of monthly wage to approximate hourly wage assumes that working hours are 9am-5pm and that there are an average of 22 working days per month (= average number of work days per month in 2010, not including Bank Holidays).

USAID HEALTH CARE IMPROVEMENT PROJECT
University Research Co., LLC
7200 Wisconsin Avenue, Suite 600
Bethesda, MD 20814

Tel: (301) 654-8338
Fax: (301) 941-8427
www.hciproject.org