Epidemiology of the Unimmunized Child

Findings from the Grey Literature

Prepared for the World Health Organization

October 2009

IMMUNIZATIONbasics Project

Arlington, VA, USA

This is the same report that was presented to SAGE with some minor corrections of typographical errors.

Acronyms

BCG	Bacillus Calmette-Guerin vaccine
CDC	U.S. Centers for Disease Control and Prevention
DEC	Development Experience Clearinghouse (USAID)
DHS	Demographic and Health Survey
DPT	Diphtheria, pertussis, tetanus vaccine
EPI	Expanded Program on Immunization
FGD	Focus group discussion
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
IMMbasics	IMMUNIZATIONbasics (global USAID-funded project, 2004-2009)
IEC	Information, education, and communication
KAP	Knowledge, attitudes, practices
MICS	Multi-Indicator Cluster Survey
MOH	Ministry of Health
MOI	Missed opportunity for immunization
NGO	Nongovernmental organization
REACH	Resources for Child Health Project (1985-1994)
SAGE	Strategic Advisory Group of Experts (WHO)
STI	Swiss Tropical Institute
UCI	Universal Childhood Immunization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Contents

Acknowledgements 4

1. Background and Objectives 5

2. Methodology 5

    2.1 Identifying and obtaining documents 5

    2.2 Reviewing, summarizing, and analyzing documents 6

    2.3 Descriptions of the documents 6

    2.4 Framework used for classifying factors 7

3. Results 10

    3.1 Immunization system 12

    3.2 Communication and information 17

    3.3 Family characteristics 18

    3.4 Parental attitudes, knowledge, practices 19

    3.5 Findings for urban areas 24

    3.6 Influence of sex gender on immunization 26

    3.7 The main determinants of non-immunization 26

4. Discussion 28

    4.1 Usefulness and reliability of findings 28

    4.2 Possible limitations of findings 29

Annexes

Annex A: Format Used for Extracting Information from the Grey Literature 31

Annex B: System and Client-Related Factors for Non-Immunization in Three Countries 32

Annex C: Documents Included in the Grey Literature Review 37

Figures and Tables

Figure 1: List of Reasons for Non-Immunization 8

Figure 2: Main Factors Associated with Non-Immunization of Children 10

Table 1: Analysis of Factors Associated with Non-Immunization in Urban and Other Areas 25

Table 2: Major Determinants of Non-Immunization (based on the “best” studies) 28

Acknowledgements

This paper was prepared by Monika Sawhney, consultant, and Michael Favin, Technical Officer, IMMUNIZATIONbasics, with technical and other support from Robert Steinglass, the project's Technical Director, Rebecca Fields, Technical Officer, and Lisa Oot, Program Coordinator. They would like to acknowledge the assistance from John Carper, John Snow, Inc. librarian, and Philip Walker, librarian at the Tulane School of Public Health.

1. Background and Objectives

At the request of the World Health Organization (WHO), IMMUNIZATIONbasics (IMMbasics), the global USAID-funded project that supports routine immunization, undertook a review of the "grey literature" on "the epidemiology of the unimmunized child." This effort was complemented by partners working with information from other sources. The Swiss Tropical Institute (STI) analyzed Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) surveys, and the U.S. Centers for Disease Control and Prevention (CDC) analyzed the formally published literature. The review took place from May through August 2009.

IMMbasics established the following broad selection criteria for documents that would be included in this review. Each document (study, review, or report*)* had to*:*

►Address *routine* immunization services
►Describe activities carried out since 1980
►Report on systematically-collected information about unvaccinated children.

During the course of this investigation, several questions arose concerning the precise definitions of grey literature, published literature (which CDC defined as published in a peer-review journal), and whether published or unpublished articles that analyzed survey data should be considered to be within the purview of STI or other partners. The partners communicated directly and via WHO to try to clarify such questions, but the boundaries of each domain were subject to impression, so minor redundancy may have occurred.

The findings from the three reviews will be presented at WHO's Strategic Advisory Group of Experts (SAGE) Meeting in October 2009. Follow-up steps by WHO may include finalizing an examination of the role of sex and gender in immunization coverage and carrying out a review of the effectiveness of program actions designed to address the causes of non-immunization.

In addition this report, IMMbasics is preparing an online archive of all of the documents selected for inclusion. Once completed, this archive will be available from WHO or via the IMMbasics web site (immunizationbasics@jsi.com).

2. Methodology

The IMMbasics Technical Director designated a team of one technical officer and a consultant to undertake the task. He and another senior technical officer contributed documents and ideas and served in an advisory capacity to the process.

2.1 Identifying and obtaining documents. The team searched for documents by:

- Developing the selection criteria described in section 1 above
- Drafting a call for documents and having it posted on the TechNet and Core Group (U.S. health NGOs) web sites, as well as sending it via WHO headquarters to WHO regional offices.
- Having IMMbasics staff search their personal files and archives
- Networking with personal contacts to try to identify and obtain documents

- Carrying out searches on a number of online databases, including Popline, unicef.org, comminit.org, USAID – DEC, the WHO data base, the doctoral dissertation data base, and sociological abstracts.

What Is an "Unimmunized Child"

IMMbasics' understanding is that the generally accepted definition of an "unimmunized child" is a child 12-23 months old who has not received DTP3. This review therefore examined reasons for both dropouts (children who began, but who in had not completed their basic series) and leftouts (children with no immunizations). This review could not maintain consistent definitions of dropouts or leftouts, because the different studies considered children in various age ranges and used different definitions of "too much time" since the last dose.

2.2 Reviewing, summarizing, and analyzing documents. The members of the team developed the attached format (Annex A) for summarizing the relevant information from each document. They began by separately reviewing several of the same documents to test both the format and inter-reader variability. The team accepted those documents that generally fit the established criteria but did reject a small number of documents that described very poor methodology (e.g. extremely leading questions to respondents) or that concerned only broad financial or policy issues that affected the health system. Once they completed most of the summary forms, they systematically reviewed the summaries and coded which documents identified which determinants of non-immunization (see the discussion below). As explained below, they carried out two analyses, one treating every document equally, and a second one based on the 17 most complete and reliable studies (see section 3.7 below).

2.3 Description of the documents. The IMMbasics team reviewed approximately 160 documents from the grey literature. Of these, 126 contained relevant information on the two basic questions this review sought to answer: what groups of children are unimmunized (have no vaccinations or are dropouts/behind schedule) and what are the most common factors or determinants of children being unimmunized? Of the 126 documents (listed in the bibliography at the end of this report), 111 were on immunization in a specific country (or in a few cases, several countries). Fifteen documents were reviews and/or discussions of findings from a large number of country studies.

Of the 126 documents, 47 were from the current decade, with the other 79 produced between 1980 and 1999. There was a spike in missed opportunity and other relevant studies in the late 1980s and early 1990s, possibly in connection with intense global and country focus on the Universal Childhood Immunization (UCI) goal in 1990.

The types of publications fell into four categories. Forty-six (36.5%) were reports or other publications of various organizations, including WHO, the World Bank, ICDDR,B, and the Institute for Development Studies at the University of Sussex. Thirty-four (27.0%) were journal articles from non-peer-review journals, and 32 (25.4%) were project reports. The remaining 14 (11.1%) were meeting presentations and others that did not fit well into one of the previous categories.

Most, but not all, of the documents reported the results of some type of study. Fourteen summarized individual missed opportunity (MOI) studies (including a selection of individual-country MOI studies from the 1980s described in the Weekly Epidemiological Record), and eight were syntheses of multiple MOI studies. The review included eight country "barrier studies" that

examined factors in the health sector and beyond that affect the national immunization program's ability to provide services and reach high coverage. Some studies constituted formative research, conducted as part of a planning process for a new immunization project or initiative; some were program assessments, including coverage surveys; and a fair number were undertaken to understand reasons for falling coverage and/or high dropout, especially in the mid-to-late 1990s.

Sixty-two (53.9%) of the 115 country or regional documents concerned Africa, 38 (33.0%) Asia, 9 (7.8%) Latin America, four (3.5%) the Middle East, and two (1.7%) Europe. India was addressed in 18 documents, Kenya in 11, and Bangladesh in 10. (Annex B contains summaries of the factors related to non-immunization in each of these three countries.) The searches yielded no documents on China and only three on two studies in the Caribbean.

2.4 Framework used for classifying factors. In agreement with our CDC colleagues, this review used the "Classification of Factors Affecting Receipt of Vaccines" from *Vaccines* (3rd edition) to categorize the findings from the grey literature. The main clusters of factors are labeled:

- Immunization System
- Communication and Information
- Family Characteristics
- Parental Attitudes/Knowledge

While this classification sufficed, it did not accommodate well all of the findings from the grey literature. Therefore, it became necessary to add additional specific factors in the list. Figure 1 below contains the original list of factors, with the additional ones that emerged from the grey literature inserted and underlined, mostly in the first and last cluster – immunization system factors and parental attitudes/knowledge.

Figure 1: List of Reasons for Non-Immunization

Immunization System

- Distance (travel conditions/access)
- Security (health workers/parents)
- Appropriateness of time (limited days/hours when vaccination available; sessions begin late/end early)
- Reliability (cancellation of sessions) (provider absent, lack of supplies, fuel; other priorities (both fixed and outreach sessions)
- Availability of curative services/ medicines
- Waiting time
- Use of all opportunities (not screening; refusal to vaccine eligible child – due to false contraindications, fear of giving multiple antigens together, mother from another catchment area, mother forgot card, confusion about appropriate age for the child to be immunized, etc.)
- Health staff's motivation and attitude (performance/competence, knowledge, ability to communicate with mothers)
- Cost and costing policies (official fees)
- Informal, illegal charges, indirect costs such as transportation
- Coordination between different providers
- Quality of vaccination and other services (vaccination area not clean, equipment not clean, waiting area uncomfortable)
- Lack of resources/logistics (funding)/ stock outs, which affects reliability, MOI, cold chain etc.
- False contraindications (particularly sick children, baby too old, and baby under-weight) as factor for health workers &/or parents
- Limited budget because public uses mostly private sector for curative care
- Withdrawal of allowances to staff for routine immunizations

---

Communication and information

- Lack of promotion/follow-up of routine immunization/health communication
- Reception of information on "where and when" of vaccination
- Person-to-person information from trusted health worker or community leader
- Language compatibility between health workers and clients
- Use of mass media according to levels of access and expertise
- Community involvement in planning and managing services in social mobilization/channeling
- Action to dispel misconceptions
- Poor/ineffective communication regarding vaccines and benefits of vaccinations

---

Family characteristics

- Education (maternal and paternal)
- Mother's age
- Family size
- Income/socioeconomic status
- Refugees
- Recent migrants/seasonal migrants
- Language
- Ethnic group (caste/tribe)
- Child's gender
- Birth order
- Residence (urban/rural)
- Residence in un-recognized geographical location/slum
- Access to mass media
- Female-headed household

Parental attitudes/knowledge

- Mistrust of health staff
- Previous positive or negative experience at health services (e.g., turned away, post vaccination abscesses, verbally abused, publically humiliated)
- Familiarity and/or use of other health care services
- Autonomy of women/father or mother-in-law pressuring against/husband refusal
- Peer group pressure for or against vaccination
- Family and social networks
- Perceived susceptibility to disease
- Perceived seriousness of disease
- Perceived safety of vaccine/fear of multiple doses/of vaccination procedures/of dirty needles
- Perceived efficacy of vaccine
- Perception of importance of vaccination for my child's health/attitude that better to treat illness (attitude towards curative and preventive aspects of health care) (Misconception that child growing well so no need for vaccination)
- Feeling of not belonging to the majority social group (that don't fit it and may be unaccepted, embarrassed, physical appearance)
- Fear will be pressured to address other health care needs such as accept family planning, treatment for underweight child
- Fear of being embarrassed, harassed, humiliated, associating with male health worker
- Religious/cultural/social beliefs/norms and rumors (e.g. sterilizes, causes HIV, problem accepting male vaccinators, mothers/newborns don't leave home for period after the birth),
- Fear of side effects
- Demand/acceptability of vaccination
- Parental practical knowledge (not knowing child's age, when need to go, where, hours of operation, who, remembering, misinformation about payment for immunization services
- Social status (bribes, favoritism)
- Scientific knowledge
- Perception that child is too sick, too "weak" for vaccination/fatalism
- Lost/unavailable health cards
- Gender
- Conflicting priorities -- too busy earning money, with family or social obligations, caring for older children, mother is sick, summer travel (when women usually visit their parents house, etc.) or mother sick
- Perception that vaccinations will be given by mobile unit or door to door
- Fear of being exposed as an illegal resident

3. Results

Based on information from the documents reviewed, this section describes the key factors that cause or are associated with non-vaccination of children in developing countries (children having no vaccinations or only some of the vaccinations available to them). Figure 2 below displays the number of projects or programs for which each factor was mentioned as an important factor for non-immunization. The unit of analysis was a project or program. While most documents described only one, a few of the documents described more than one project in depth. Factors with fewer than ten mentions are not included.

The number next to each factor should be considered as no more than a general indication of the importance of the particular factor. The numbers have several limitations, including:

- Different study methodologies made it more or less likely that certain types of factors would be found.
- Coding factors was a somewhat subjective process in that the reader made a judgment on whether a factor mentioned was significant or not, and also on *how* to code particular information. For example, is a mother not knowing the return date in an exit interview a system problem (poor health worker communication), a problem of the mother's poor listening or understanding, or both?
- The list of possible factors contains some redundancy.

Figure 2: Main Factors Associated with Non-Immunization of Children
(cited for 10 or more projects/programs)

Immunization System

- Distance (travel conditions/access) – 49
- Health staff's motivation and attitude (performance/competence, knowledge, ability to communicate with mothers) – 49
- Lack of resources/logistics (funding)/ stock outs, which affects reliability, MOI, cold chain etc. – 48
- False contraindications (particularly sick children, baby too old, and baby under-weight) as factor for health workers &/or parents – 47
- Use of all opportunities (not screening; refusal to vaccine eligible child – due to false contraindications, fear of giving multiple antigens together, mother from another catchment area, mother forgot card, confusion about appropriate age for the child to be immunized, etc.) – 37
- Reliability (cancellation of sessions) (provider absent, lack of supplies, fuel; other priorities (both fixed and outreach sessions) – 34
- Appropriateness of time (limited days/hours when vaccination available; sessions begin late/end early) – 30
- Waiting time – 29
- Informal, illegal charges, indirect costs such as transportation – 21
- Cost and costing policies (official fees) - 10

Communication and information

- Lack of promotion/follow-up of routine immunization/health communication – 13

Family characteristics

- Income/socioeconomic status– 18
- Recent/seasonal migrants - 16
- Education (maternal and paternal) – 15

Parental attitudes/knowledge

- Parental practical knowledge – 58
- Fear of side effects – 47
- Conflicting priorities – 43
- Religious/cultural/social beliefs/norms and rumors - 41
- Perception of importance of vaccination for my child's health/attitude that better to treat illness (attitude towards curative and preventive aspects of health care) – 30
- Perceived efficacy of vaccine – 27
- Lack of interest/motivation – 19
- Lost/unavailable health cards – 18
- Demand/acceptability of vaccination – 15
- Autonomy of women/father or mother-in-law pressuring against/husband refusal – 15
- Perceived safety of vaccine/fear of multiple doses/of vaccination procedures/of dirty needles - 13
- Feeling of not belonging to the majority social group or otherwise being unaccepted, embarrassed) – 13
- Perception that child is too sick, too weak/fatalism – 13
- Previous positive or negative experience at health services (e.g., turned away, post vaccination abscesses, verbally abused, publically humiliated) – 11
- Mistrust of health staff – 11

Based on the counts of factors, service factors and parental attitudes and knowledge emerge clearly as the most important explanations for non-immunization. Although family (demographic or sociological) characteristics were also mentioned frequently, they appear to be underlying or secondary, rather than primary, determinants. For example, family income (i.e. poverty) increases the risk of mothers not having time because of competing priorities, being socially alienated, abused by health workers, encountering financial barriers, and other factors that emerged as some of the most important primary causes of non-immunization. Lack of communications and information did not emerge as a major factor, possibly because the review did not include evaluations of communication efforts to promote immunization. However, insufficient and ineffective health worker communication was mentioned extensively. However, in the breakdown of factors, this was considered under health staff motivation, attitudes, and performance, not under communication, where it fits equally well.

The remainder of section 3 provides a discussion of the main specific factors for non-immunization.

3.1 Immunization system

Distance/travel conditions/access – a factor in 49 projects/programs

Numerous studies have documented inaccessibility of health care services as a barrier to their utilization and an important cause of partial or no vaccination. More than a third of mothers in a six-state survey in Nigeria claimed distance/access as a problem (9), 43% in Siaya, Kenya (31), and 30% in Liberia (12). The 2003 Mozambique study (101) showed distance to services clearly to be the major cause of lack of immunization, which is understandable in such a large country where many facilities had been destroyed in war. A Senegal study found that 71% of children completely vaccinated lived less than 10 kilometers from the nearest health center, while in remote villages only 10% of children were completely vaccinated (41). Poor access emerged as an issue in the GAVI Alliance barrier studies reviewed and undoubtedly affects some portion of the population in almost every country, particularly in rural areas. In conjunction with distance as an issue, poor weather and road conditions, e.g. seasonal rain, mud, and flood, also restrict access to available health services.

Although difficult access clearly is a key barrier to vaccination in many, especially rural, settings, this factor (as others) does not always affect families equally. For families sufficiently motivated, distance simply makes getting their children immunized more difficult, but for others it is a barrier that is too difficult to overcome (48). It is worth considering that in many countries, BCG and DPT1 rates, which can be considered as indicators of access, are over 80 or 90%, yet full coverage rates are significantly lower. So it is possible that when asked, some respondents offer difficult access as a convenient explanation of non-vaccination of their children. Any number of additional factors – such as bad experiences at the vaccination site, misinformation, and fears – may be equally important but are left unsaid.

Health staff's motivation, performance/competence and attitudes – a factor in 49 projects/programs

Attitudes and behavior of health staff are one of the most important and frequently cited factors that discourage full immunization of children. The documents reviewed indicate that in many countries, at least some health workers treat mothers in an unfriendly, disrespectful, or even abusive manner. Health staff in various countries (e.g. Ethiopia [69], Zimbabwe [97]), Niger [54]), Kenya [2]), Bangladesh [15, 56, 91], W. Africa [19], Uganda [17], Benin [102], Nigeria [98]) reportedly scream at mothers who commit such transgressions as forgetting the child's card, missing a scheduled vaccination appointment, or having a dirty, poorly dressed or malnourished child. Mothers feel humiliated – which discourages them from coming back to the health center for further immunizations (15, 17, 30 [Kenya, Burkina Faso], 91, and 98).

While most mothers in Mozambique (101) did not have serious complaints of this nature, a few health workers did treat people badly. One mother reported that "they treat us like dogs." Similarly, in Uganda (17) only a minority (13%) complained about being treated rudely or badly. Over 90% of mothers in the Dominican Republic said that the staff treated them well, despite the majority complaining about having to wait too long and frequent wasted trips because the facility lacked the needed vaccine or the vaccinator was absent (6).

Even in countries where this extreme behavior is not normal, health workers often communicate little and poorly with mothers, so that many mothers leave not knowing when to return and what to do about side effects (93). Over a third of mothers in Liberia said they were not informed about the return date. Health workers in Niger and Burkina Faso did not effectively communicate essential information to mothers before or during vaccination encounters (30). Mothers in Somalia were angry that health workers did not offer them information about side effects (57). Only half of mothers whose children

were vaccinated in Guinea and Malawi were given information about vaccine reactions or the disease vaccinated against (41, 113). The 2008 EPI review in Benin found that one of the principal reasons for non-vaccination was mothers' being unaware of the need to return or when or where to return (115). In Mozambique, three quarters of health workers said they always write the return dates on the child's card, but only one quarter of the cards actually had the return date written (101). In Uganda, however, over 80% of parents claimed that health staff advised them to return for more vaccinations (17), and in Dhaka 29 of 30 mothers leaving a clinic knew the return date (91). Good provider/parent communication was also reported in Armenia (125).

Health workers also mistreat mothers by making them pay small, illicit charges, by arriving late to start vaccinations session, and by ending sessions several hours early, as mentioned above (66, 91, and 98). Such treatment in the long run contributes to dropout. Another aspect of poor treatment of mothers is the long waits that mothers have to endure in many vaccination centers, also described above. Both public scolding and charging (legitimately or not) *appear* to be most common by nurses in Africa, but this behavior is also reported in Bangladesh and elsewhere. Mistreatment of mothers by health workers also emerged as the main cause of under-immunization in Syria (33).

A number of the documents presented evidence that mothers' and families' experiences with health services in general make them more or less inclined to bring their children for immunization (e.g. 39, 64). Clearly, health workers' treatment of mothers – including the manner and effectiveness of their communication with mothers -- is an important determinant of how positively or negatively people assess health services, although the availability of drugs, length of waiting time for services, and satisfaction with how they have been treated are also considerations.

Description of a Vaccination Session in Bangladesh

The following description of a vaccination session in Bangladesh in 1989 may not be typical of sessions there or elsewhere then or now; however, such behavior clearly occurred and still occurs too often. Although clearly there have been changes in Bangladesh in the last 20 years, Khan in 2005 (56) and Perry et al. in 2007 (90) reported not dissimilar behavior by health staff in Dhaka. Perry (91 in 1996), however, reported that mothers in Dhaka considered providers in general to be knowledgeable and friendly.

"The first women arrived at the dispensary at 8 o'clock in the morning. The vaccinator came later and on his own by 9 o'clock. By 9:30 there were over 80 women with babies waiting. The vaccinator, who was extremely busy entering names in two different registers and filling the vaccination cards, received minimal help from the dispensary staff, which is composed of two lady doctors, one pharmacist, a peon and an ayah. The pharmacist showed no interest whatsoever. Immunization had nothing to do with them. The senior lady doctor did not even know that the vaccinator came from EPI. She believed he came from ICDDR, B. By 10 o'clock vaccination had not begun yet. Mothers were getting impatient and babies even more so. It was extremely hot and people were fasting as it was Ramadan. The pharmacist fell asleep on his table. The senior lady doctor was bargaining the price of a sari with a burqa-clad woman peddler. She was not interested in talking about immunization. Rather she voiced her frustrations with her job and complained about the kind of medicine she practiced at the dispensary. She was totally unconcerned with the 80 mothers and crying babies in the room….Mothers who arrived after 10 o'clock were turned away and one woman complained that was the third time it happened to her and said she would not come back….In theory, the clinic is opened till noon."

Source: Blanchet, 1989 (15)

Why do some health workers act in such ways? Several factors appear to be at play. At least in Gambia and Guinea (28, 59), and almost certainly elsewhere, health professionals appear to expect mothers to be responsible for keeping their children healthy, which means not missing appointments and not forgetting their or their child's vaccination record. Some health workers view mothers' coming late for a return date or forgetting the child's card as irresponsible behavior which justifies yelling and or otherwise humiliating the mother.

There is also the issue of social distance, by which some professionals feel a need to reinforce their own status by denigrating others, particularly the poor, unwashed, uneducated, ethnic minority mothers who may not even speak the lingua franca (66). As shown by in-depth interviews of health staff in Mozambique (101), Kenya (2) and Somalia (57), health staff themselves may feel unsupported by the health system (not given sufficient resources, supervision, training; not paid well or on time, not given incentives for routine immunization work), which may increase their tendency to treat mothers the same way. One report on Benin claims that the health staff's hostility towards clients increases along with the scarcity of resources for health services (102).

Another factor mentioned in several documents was the lack of incentives for health workers to carry out routine vaccination when other programs, including vaccination campaigns, do offer incentives. This was reported as a very significant problem in Uganda at the time of the study (1998) (17) and also reported in Ghana (3). Low salaries and delayed pay are reported as problems in Vietnam and elsewhere. There is also a significant shortage of staff in some countries (e.g. Ghana, Zambia) due to migration and the HIV/AIDS epidemic.

Lack of resources/logistics - a factor in 48 projects/programs

A substantial number of studies highlight the fact that vaccination centers report occasional stock outs of vaccines and/or inefficient cold chain (6, 17, 33, and 95 [Jharkhand, Rajasthan]). In Armenia, a survey found that the primary reason for non-immunization was unavailability of vaccine (112). When parents miss work, travel long distances, wait for long hours, and then are denied services because of lack of resources, they are unlikely to be encouraged to continue bring back their child for vaccination. Vaccine stock outs are caused by lack of regular funding, lack of storage capacity, poor ordering and distribution systems, and other reasons (3, 18, 24, 61, 71, 72, 73, 74, 96). Millimouno et al. (66) reported a vicious cycle in Guinea of public health facilities lacking drugs, which drove most people to private providers for curative care, which had the effect of the public immunization program lacking resources, since facilities gained a portion of their funding through providing curative care. People in both Somalia (57) and Kenya (88) were reported much less likely to seek immunization for their children because of the health facilities' frequent stock outs of medicines or failure to offer curative and other services at the time and place of vaccination.

False contraindications - a factor in 47 projects/programs

As described below under missed opportunities, health workers frequently refuse to immunize children eligible to receive one or more immunizations, because of various fears and false beliefs -- that a sick child should not be vaccinated, that a child should not receive multiple vaccinations on the same visit, that the child is over one and therefore "too old" for measles vaccination (107), that underweight children should not be vaccinated, etc. The most common false contraindication concerns immunizing a sick child, which is mentioned in study after study. In Kenya (2), Nigeria (98), Pakistan (118) and many other places, health staff frequently refused to immunize a sick child. Many health workers and 60% of mothers in Mozambique would accept vaccinating a child with fever (117). Health workers express logical reasoning for refusing to immunize sick children: they fear the vaccination being blamed if the child's condition worsens, and they claim they are only doing what the mother wants. In Kenya, nurses said they needed to see the scientific evidence about the safety of immunizing sick children. While such missed opportunities clearly contribute to dropout, how much is unclear, as discussed in the next section.

Many studies indicate that most mothers agree with many of the decisions to deny vaccination, but there is also information that some are upset and frustrated, particularly for such reasons as the child is too old or too young, as in Somalia (57).

Use of all opportunities – a factor in 37 projects/programs

Frequently carried out in the late 1980s and early 1990s, missed opportunities for immunization (MOI) studies appear to be done rarely today. A 1991 review of 11 MOI studies in the Americas and seven in other regions found MOI rates ranging between 41% and 76%. (This means, in effect, that significant numbers of children in health facilities who were eligible for vaccinations that day did not receive them.) The main causes (in order of importance) were: contraindications perceived by health personnel, lack of resources, deficient organization of services, health personnel's attitudes, and response of the population to vaccination.

A separate review of 79 MOI studies in 1993 (59 from developing countries) found a median of 32% MOI (45, 46). The major causes, as described by the authors, were the following:

Failure to administer immunizations simultaneously: This was the major reason in all eight surveys where this factor was specifically assessed (median of 22% of all MOI). This may be an underestimate because many surveys classified this cause as a logistical problem.

False contraindications: Twenty-four of the 27 surveys that assessed this factor found it to be a problem (median 19%). (False contraindications accounted for 55 to 60% of MOIs in the Peru, Guatemala, and Honduras studies [82, 83, and 84]). False contraindications were mentioned as a factor in 18 programs in this review.

Negative health worker attitudes, including fear of wasting vaccine and not screening, were assessed in 11 surveys and found to be major reasons for MOI in all (median 16%).

Logistical problems, such as vaccine shortage, poor clinic organization and inefficient clinic scheduling, were assessed in 11 surveys and found to be important in all (median 10%).

Parental refusal was assessed in nine surveys and found *not* to be important. "In general, lack of parental acceptance of immunization was not an important reason for missed opportunities" (median 3%) (45, 46).

In addition to those causes described by Hutchins et al. (45, 46), the grey literature included multiple mentions of the following:

- Refusal by the health personnel to open a vial for one or two children;
- Mistakes by health workers who lacked the ability to correctly interpret, or the desire to completely follow, the ages, intervals, and doses in the vaccination schedule, particularly for children who had a delayed and/or minimal vaccination history; some health staff also had misconceptions about the ages at which childhood vaccines could be given (e.g. 91);
- Refusal to immunize a child whose caregiver forgot the vaccination card;
- Denial of vaccination to children who live in another district or sub-district (107);
- Denial of measles vaccine if mothers claimed the child already had measles disease.

The effect of MOI on non-vaccination cannot be precisely stated, since some children who are missed are subsequently vaccinated, but clearly MOI are a serious concern in many settings and contribute to both delays in protection and to incomplete immunization.

Reliability - a factor in 34 projects/programs

Although vaccination sessions in health facilities often take place as scheduled, there are problems of cancelled and truncated sessions in many countries. Outreach sessions in particular are frequently cancelled or postponed due to such factors as other demands for the vehicle, a shortage of vaccine or supplies, or lack of per diem (3, 17, 30, 41, 61, 101, 107, 117,125).

In one province of Zimbabwe, a study found the frequent postponement, without notice, of scheduled immunization outreach activities, that certain antigens were given only on certain days, and that children were denied vaccine due to the staff's refusal to open a multi-dose vial (20). Mothers in Niger also described making multiple visits to a vaccination center without getting their children vaccinated (54). Mothers in Kenya (2) stated that the frequent postponement of immunization days made them lose faith in the services and therefore many became hesitant even when services resumed. Perry (90) reports that in Dhaka it is not unusual for mothers to arrive to find that vaccination center closed or the vaccinator absent during normal working hours. For parents who travel long distances in an effort to keep their children vaccinated on schedule, sudden cancellation of sessions may be extremely frustrating and result in delayed or even incomplete vaccination. But this is not always the case. The Dominican Republic study (6) reported that over half of the mothers said that at least once they brought their child for vaccination and the child could not be vaccinated, most commonly due to vaccine stock outs or the health staff not showing up. Yet most mothers there considered vaccination important enough to keep returning.

Although lack of vaccine or supplies may be the cause of cancellation of sessions in facilities, the absence of the provider – for a legitimate reason such as training or attending a meeting, or an unexcused absence – may also result in cancellation of sessions. Staff in Zambia reported "epidemics" of workshops, so that staff could get allowances to supplement their salaries (72).

Reliability goes beyond immunization specifically. Several studies, including PATH/Kenya, reported that people were less likely to bring their children to be immunized at facilities believed might not have a good medicine supply. Documents on West Africa mentioned the deterioration of public health services due to people seeking their curative care in the private sector (19, 66).

Appropriateness of time/limited day/hours (including sessions that begin late and end early) – a factor in 30 projects/programs

Many public health facilities provide immunization services during only limited days and hours, which can constitute a significant barrier for some families to get their children immunized (88). In Somalia, Indonesia and many other countries, vaccinations were available only in the mornings, when many mothers are busiest working. In Lagos in 1993, most facilities offered vaccination only one day a week or one antigen per day (36, 98). Recent IMMUNIZATIONbasics work in Nigeria (see box below) found that only a minority of facilities in Bauchi and Sokoto states were offering routine immunization more than a few times a year (this situation has improved in the past two years). Perry (91) in 1996 reported that "…immunization services are not accessible to mothers [in Dhaka] who work during regular work hours."

Limited Immunization Services

"The total number of government health facilities reported to be functioning in Bauchi State in 2006 was 882 in 323 wards of 20 LGAs (Local Government Areas]. Of these facilities…, approximately 340 provided RI [routine immunization] services for only 1-2 months. Another 210 provided immunization services during 3-6 months in 2006. *Thirty percent, or 262 HFs [health facilities], provided RI services for a minimum of 4 months out of the year…* Available records in Bauchi show that perhaps only ten health facilities in the State provided immunization services every month in 2006. By these records approximately 550 health facilities provide intermittent services and 320 facilities provided no RI [routine immunization] services at all. What emerges from this data is that only a handful of facilities provide regular service; the greater numbers provide RI services on an intermittent and ad hoc basis."

Source: IMMUNIZATIONbasics. NIGERIA Statewide Assessment of Bauchi and Sokoto States BASELINE REPORT, August 2007.

Even on days when vaccination is offered, health staff commonly start vaccination sessions late (because they arrive late, take time to set up for vaccination, or wait until enough mothers have accumulated to begin vaccinating or to give their mandatory health talk) and end early, before the scheduled hour, as mentioned in several of the documents reviewed (see box on page 13). There are various reports in the grey literature of children being denied immunization because of such long waits or restricted hours (e.g. 15).

Waiting time - a factor in 29 projects/programs

Most children who are immunized receive this service in a government health facility. Frequently, such facilities are short staffed (e.g. 20, 24, 72), not efficiently organized, and have to cater to a large population, resulting in long waiting hours for the parents to get their children immunized. While some waiting is unavoidable due to heavy demand, in many cases the waits are exacerbated by health workers not beginning sessions on time, showing favoritism to acquaintances (to jump the line), or delaying to start vaccinating until 'enough' mothers have accumulated for them to provide services or give a health education talk (e.g. 2, 15, 17, 69).

Mothers in Somalia complained vociferously about the amount of time they would have to spend for immunization: traveling, waiting, and then treating their children's side effects if they brought them to be immunized (57). Thirty percent of mothers in Liberia commented on the inconvenience of long waiting times (12). Mothers in Uganda (4) complained that they waited for hours to have their child vaccinated but the vaccinator never showed up. In Niger also mothers complained about waiting too long for services, then being sent away without being served (30)

Many studies examine the waiting time issue by asking about or observing how long people wait. What are more important are people's *perceptions* of whether their wait is "too long." While there are some findings that mothers in some countries do feel they must wait too long for services (e.g. 2, 12, 30), it is not always clear if they perceive this merely as an irritating situation or whether it affects their decision on whether to continue vaccination visits or not.

Informal/indirect or illegal charges - a factor in 21 projects/programs

Vaccinations in most countries are provided free of charge in order to minimize the economic burden on the families to vaccinate their children. The majority of the clients who report cost as a barrier to vaccination highlight transportation costs.

Some health centers, particularly in West Africa and Bangladesh (based on the grey literature), may charge a nominal fee to replace a vaccination card, and some even charge a small fee for the initial card. Demand for unofficial payments is mentioned occasionally (e.g. 59, 61), but this does not appear to be a common occurrence in most countries.

3.2 Communication and information

Lack of promotion/follow-up of routine immunization/health communication - a factor in 13 projects/programs

Communication can play an important role in disseminating information about important health issues and available health care services. Various studies report that parents whose children were not completely immunized suggested lack of promotion or follow-up of routine immunization as a reason for

not getting their children immunized (13, 39, 70, 95 [Jharkhand, Rajasthan], and 99). There are special marketing campaigns, using mass media and significant social mobilization, designed to promote participation in polio campaigns, but many parents report that they did not receive any messages about routine vaccination programs.

As discussed above, there are mixed reports about the quality of communication during vaccination contacts, although usually there is extensive room for improvement. Far too many parents leave sessions without knowing important information about return visits, side effects, etc.

One exception is reported in Zambia, where there is high demand for immunization because of the involvement of Neighborhood Health Committees, local leaders, churches, schools, and opinion leaders (72). Social mobilization committees established for immunization campaigns have been transformed to support routine immunization. Vietnam is also said to have very strong social mobilization that has led to generally high awareness and understanding of immunization (73).

3.3 Family characteristics

Income/socioeconomic status - a factor in 18 projects/programs

Numerous studies on maternal and child health have documented that socio-economic status of the household is strongly associated with child health status and well being. For example, an analysis of data from India's 17 largest states found that poor urban children were ten times more likes to have no immunizations than the richest children; and poor rural children were less likely to be fully immunized and more likely to have no immunizations than the children from the richest households (86). Poverty works in many subtle, insidious ways to hinder children's vaccination.

Impoverished mothers of young children must devote their lives to growing food or earning money to purchase it. Particularly in more urban areas, many mothers work in jobs – in factories, as domestics, as vendors – from which it is difficult or impossible to take time off during work hours for non-emergency, preventive health care for their children. Women who work in agriculture are extremely busy during certain times of the year, so it is equally difficult for them to take time off for preventive health care. Raharjo (94) summarized this issue: "Because of uncertain and time-distant benefits compared with the immediacy of monetary and non-monetary costs, demand for preventive health among poor household is likely to remain poor." This user problem is greatly exacerbated by the inconvenience of times and places for services.

A clinic visit is a social occasion, and mothers who do not fit it with the majority – who are new migrants, from minority ethnic groups, or simply very poor – may not feel comfortable participating. This was noted in several W. African countries (39, 64), including Gambia and Guinea (28, 59, and 66), and with the Vietnamese minority in Cambodia (87). Mothers in Accra reportedly resisted immunization because they lacked nice clothes to wear for such a public occasion (39). Mothers may feel it is socially unacceptable to appear in public with a sick or weak child (66). Such feelings are often reinforced when health workers publically humiliate poor mothers. Mothers in Kenya (2) feared attending vaccination sessions if their child had a skin disease because they thought that other mothers would laugh at them. The study in Jakarta and Surabaya described families of partial and non-immunized children who felt alienated from government services and resented being told to plan their families and get immunized (105). What they wanted was curative services. Most were poor, poorly educated and many were migrants and from an ethnic minority.

As described above, there may or may not be monetary costs for vaccination (for transportation, formal or informal charges), but where there are, they clearly constitute a barrier for poor mothers (mentioned in 9, 39, 56, 72 and many other documents). The US$0.25 charge for a road-to-health card was considered a problem by 35% of the mothers in the Liberia study (12) and also mentioned as an issue

in Burkina Faso (30). In some countries, small fines levied for such transgressions as not following the recommended schedule of antenatal checks have the effect of discouraging utilization by poor mothers (66). Mothers' complaints about charges were most common in West Africa and Bangladesh (e.g. 111). Formal charges were mentioned 10 times, informal charges 20 times. Finally, although it seems logical that poor mothers may have a less complete understanding of the need and importance of vaccination than better off mothers, no specific evidence for this was encountered in the grey literature reviewed.

Recent migrants/seasonal migrants - a factor in 16 projects/programs

Both short- and long-term migration is a common phenomenon in poor and developing countries. New urban migrants may be overwhelmed by their new environment and need to earn cash, so preventive services such as immunization are not a priority (13, 64, and 73). MOH/Vietnam (73) found that migrants from rural areas, fishermen, and homeless children were often missed in surveys, not registered, had poor health knowledge, and low access to immunization and other services. New arrivals in Lucknow, India had not yet acquired the information needed to get their children immunized (76).

Seasonal migrants – people who move to villages for harvesting or come temporarily to urban areas – are also likely to have under-vaccinated children. In West Africa, some mothers live in urban areas but must stay in rural villages for 4 to 6 months a year for the main agricultural season work (66). Such movement makes it hard to obtain services in either area. In urban Lucknow, the most common reason for partial immunization was that one parent had temporarily migrated to earn money (76). Seasonal migration was also described as a barrier to higher coverage in Cambodia (87).

Some generally less important family characteristics mentioned in few of the other studies included residence (urban/rural), family size, birth order and residence, exposure to mass media and households with female headship. Urban residence generally favors higher coverage, but not consistently in all times and places (see section 3.5 below).

Education (paternal and maternal) - a factor in 15 projects/programs

Generally, the studies reviewed supported the conventional wisdom that education, particularly mothers' education, is a positive factor for appropriate utilization of health services, including immunization (14, 16, 47, 89, and 105). However, the relationship is not always clean and consistent, e.g. in one Kenya study fathers' education correlated well with vaccination in urban areas and mothers' education in rural areas (14). In Nigeria, educated people were less likely to immunize their children than illiterates (9). In four countries in W. Africa, education did not seem to affect EPI coverage in a clear-cut way; duration of residence was a much more powerful factor (64). Some more educated men in Dhaka felt vaccination to be un-Islamic because it implied a lack of trust in God (15). In more developed countries, pockets of resistance to vaccination are most likely to be among the best educated and particular religious groups.

3.4 Parental attitudes, knowledge, practices

Parental practical knowledge (not knowing child's age, when and where to go, hours of operation, etc.) - a factor in 58 projects/programs

The authors of many of the studies reviewed appeared to assume that parents need a good understanding of vaccine-preventable diseases, how vaccination works, and the vaccination schedule in order to be highly motivated and able to get their children vaccinated. In some studies (e.g. 9, 47) there indeed are strong correlations between scientific knowledge and good immunization status; however, many well-implemented studies found relatively high immunization coverage among families with extremely low scientific understanding of immunization (6, 17, 59, 94, 101). The bulk of evidence

indicates that such scientific knowledge is not essential. The truly important parental perceptions and knowledge appear to be appreciation of the basic concept that vaccination is good for their child's health and prevents a number of specific diseases, that multiple visits are required for protection, and when and where which child needs to be seen next (e.g. 6, 13, 16, 48, 101).

This is shown clearly in the Mozambique (101), Uganda (17), Rwanda (38) and other studies. As the Uganda study summarizes, there are very low levels of community knowledge and understanding of the "scientific" foundation of immunization, but despite this, over 90% of mothers and fathers "believe immunization is important…[there is] massive good will in the midst of lack of knowledge." Rwandan mothers and other family members had only a modest level of correct knowledge regarding diseases, the schedule, etc., but vaccination rates were very high. The authors concluded that "knowledge of vaccination on the part of parents is not an important factor in vaccination coverage" (38). In the Gambia, "29% of urban and 48% of rural mothers could not correctly name any biomedically vaccinable diseases," yet national coverage was 90% (60).

Raharjo (94), writing about Indonesia, also summarizes this nicely: "There appeared to be no obvious correlation between knowledge about health care and behaviour. The significant difference seemed to be one of attitude….Like the Acehnese, the transmigrants did not know what specific immunizations their children had received or what diseases these covered, or even the precise purpose of immunization. However, they did have much more positive attitudes towards health care generally and immunization. They knew that immunization was 'good for the health of their children' and they wanted it."

Mothers of dropouts in many countries claimed not to know they needed to bring the child back, how many times, or when (2, 3, 5, 25, 93, 95 [Jharkhand]). In one area of Bangladesh, with a 30% dropout rate, 63% of mothers claimed they were not informed about the time and place of EPI sessions (110). With house-to-house immunization campaigns being common in many countries, many parents indicated confusion about whether they needed to take their children to health centers for the remaining vaccinations (54).

Fear of side effects - a factor in 47 projects/programs

Mild side effects, such as fever, redness or rash, are common and normally clear up on their own within a day or two. In many of the studies reviewed, parents mention fear of side effects as a reason for not vaccinating their children, e.g. this was mentioned by mothers in two thirds of the FGDs in Liberia (12) and by many mothers in Somalia (57). Around 30% of mothers of non-immunized children in Armenia mentioned fear of side effects as a reason (112). In some cases, if an older sibling had side effects, parents refused vaccinations for the younger children (13). It is mentioned in a few documents (e.g. 106) that side effects can become a larger issue because fathers or mothers-in-law become very upset and refuse to allow the mother to take the child for more vaccinations.

Although side effects are mentioned in most studies as an aspect of immunization that parents dislike, it appears that many parents, if their motivation is high enough and the services acceptable quality, are nonetheless willing to get their children vaccinated. Some families, however, either because of their own bad experiences or because of what they have heard from trusted acquaintances, do refuse to begin or continue their children's vaccinations because of fear of side effects. Some mothers stated that better health worker communication – warning caregivers about the side effects, what to expect, and what to do – would make side effects less of a problem (57).

Conflicting priorities - a factor in 43 projects/programs

Conflicting priorities appear to be a significant factor affecting families with non-vaccinated or partially vaccinated children; e.g. 31% mothers of children with no immunizations and 14% of those with partial

immunizations in urban Indonesia cited this factor (105). It is difficult for poor parents to travel long distance, wait for long hours and get one of their children vaccinated, when they should be earning money or growing food to be able to provide food for the entire family at the end of the day (13). In some countries, weddings and funerals last up to a week and lead to mothers missing the vaccinations appointments. In many traditional cultures, families observe a period of up to a few months of post-partum seclusion at home and therefore refuse to take the baby out for vaccination. Some women with their children spend two or three months during the summer time at their maternal home, often resulting in children missing couple of doses of required vaccinations. Other conflicting priorities mentioned are taking care of the sick children, or taking care of the older children, not being able to leave older children while traveling to get the younger ones vaccinated, and mothers' illness.

Blanchet (15) found that many mothers in Dhaka worked two or three jobs, were exhausted and overwhelmed, and depend on older children to care for the young ones. Fifteen percent of mothers in Kenyan district claimed that they were too busy to take their children for immunization (35), and 31% of mothers in Dhaka said they couldn't get their children vaccinated because of their work responsibilities (111). Mothers in Somalia complained stridently both about the time required to travel to the vaccination site and the time subsequently needed to treat side effects of vaccination (57). Although mothers in Guinea were well-disposed to getting their children immunized, they still had to negotiate to attend vaccination sessions amidst numerous everyday demands and social relations (66).

<u>Religious/cultural/social beliefs/norms and rumors</u> - a factor in 41 projects/programs

Several studies reported that parents of non-vaccinated children felt that it was against their religious beliefs to get their children immunized (50). Some parents felt that it is God's job to prevent illness and parents' job to seek treatment (15, 19 [Burkina Faso, Togo], 54, 77, and 88). In Uttar Pradesh, many mothers had little belief in the concept of prevention, but the mothers of fully immunized children did have trust in health workers and value prevention (48). Especially some poor and uneducated people report that they did not have their children vaccinated because they had been instructed by the religious and social leaders not to do so (97).

In both Africa and Asia, some parents believe that vaccination is a way to sterilize children so they will not be able to produce children in future (50, 77). Both Uganda studies (4, 17) reported fears and rumors about vaccination (e.g. children were being injected with HIV/AIDS), although these seemed to affect only a minority of people (<10%). In Syria many mothers believed that polio vaccination caused paralysis. In Nigeria some people believed that vaccine might cause infertility, paralysis, abscesses, and infections such as HIV/AIDS (50) or that they were being used as scapegoats to test treatments for certain illness.

Cultural and social aspects also influence people's acceptance of immunization. Several Bangladesh studies reported that some husbands refused or were reluctant to allow the mothers to take their children to male vaccinators (15, 90, and 107). In India, many people believed that health staff promoted vaccination to meet their targets and please their supervisors, not for children's benefit (77).

An interesting phenomenon reported in a few studies was parents' belief that certain children were too small, weak, or malnourished to tolerate vaccination, which they consider to be powerful medicine (13, 59, 77, 87). On the other hand, it was mentioned in several studies (e.g. 90, 94) that some parents saw no need to have their children vaccinated since they were healthy. In the Gambia, mothers who missed clinic sessions were said to fear bringing their children back because the health worker would want to give them more vaccinations at once than the child's body could tolerate (60).

While this barrier, as many others, is real for some families, it is important to remember that coverage rates for the early vaccinations in most countries are between 80% and 95%, so clearly the impact of such beliefs affects only a minority significantly enough so they refuse to have their children vaccinated.

Parents' perception of importance of vaccination for my child's health - a factor in 30 projects/programs

As described above, some parents in various countries feel that their primary role in their children's health is to get them cured when they fall ill – that prevention is up to fate or God. Many of the studies reviewed indicated that some parents did not consider vaccination as an important determinant of their children's health and well-being. Many parents felt that as long as their child was healthy and growing well, they did not need to be vaccinated. Some of them noted that although the previous generations (they themselves, their parents, and their grandparents) were not vaccinated, they led a healthy life, so why should their children be vaccinated?

Perceived efficacy of vaccine - a factor in 27 projects/programs

Trusting the efficacy of vaccines seems can be a major factor in parents' decision to go to the trouble to have their children vaccinated. Mothers in many countries said that vaccination prevented only some of the supposed vaccine-preventable diseases (e.g. measles and pertussis in Somalia) but not all (e.g. measles in Syria). Few respondents in a large survey in Nigeria (9) were convinced of the efficacy of childhood vaccines (this may be an effect of the resistance at the time in northern Nigeria to campaigns). In a study in Punjab Province, Pakistan, 34% of mothers said they doubted the effectiveness of vaccination (22). People in various countries also talked about children who got the disease (particularly measles) despite being vaccinated (e.g. 30 [Kenya], 98, 99). Both mothers and health workers in Somalia believed that the protection from immunization was of limited value because it lasted only for a limited time (57).

Low levels of motivation (among parents) - a factor in 19 projects/programs

In less developed countries and remote areas of other countries, many parents may either have insufficient understanding of the purpose of immunization or may reject it because of some combination of the barriers described in this paper. In Dhaka, 21% of mothers in one study stated that immunizations were not necessary for their children (58). A number of studies reported some parents are poorly motivated or "too lazy" to have their children vaccinated. The issue of "lazy" mothers is an interesting one. Most commonly, this is a judgment of health staff who feels that mothers are shirking their responsibility by not having their children fully immunized. Interestingly, however, a few studies (17, 98, and 101) reported that some of the mothers of fully immunized children criticized mothers of partially or unimmunized children as being too lazy to make the effort to have their children vaccinated.

Lost or forgotten health cards - a factor in 18 projects/programs

Health cards were created to help the health workers and parents keep a track of individuals' service history and to serve as a reminder for people to return for essential and timely health care services. Card retention is good in many, but not all, countries; e.g. over 90% of mothers brought immunization cards with them in Zimbabwe, despite the fact that most came for curative care (120).

Nonetheless, this review found that lost or misplaced cards were a surprisingly common issue that hindered immunization. After some mothers lose their immunization/health cards, they are scared to go back to the health centers for fear of being yelled at by the health staff, made to pay for a new card, and/or asked to return home to retrieve the forgotten card (e.g. 66, 67, 90, and 97). Studies also described how some health workers denied vaccinations if the mother did not have the child's health/immunization card.

Autonomy of women (husband refusal, pressure from father or mother in law) - a factor in 15 projects/programs

Mothers are usually responsible for their children's care, especially for preventive health care, although in some places fathers actually bring children to services or at least participate in the decision to do so. In some countries, particularly but not limited to south Asia, limited autonomy for women even to make the decision to leave the house hinders mothers' ability to seek immunization services for their children (15, 57). In a recent study in India, autonomy of women was found to be a significant factor in determining maternal and child health status. [48]

Previous positive or negative experience with health services - a factor in 11 projects/programs

One's experiences with health care services and health care providers can affect future health care seeking behavior. Negative experiences with preventive services can serve as a barrier towards seeking immunization services. Blanchet (15) described Dhaka slum mothers' low level of confidence and trust in the health services as a major barrier to vaccination. In Cameroon, Brown (16) found that experiences of being denied vaccination because of illness, lost cards, or other bad experiences were important factors in many individual cases of non-immunization. In Somalia, the forceful tactics used in immunization campaigns (threats of fines and arrest) affected many families' willingness to seek routine services (57).

Results from studies also showed that positive behavior of the health workers and satisfactory experiences during vaccination often resulted in mothers bringing back their children for additional vaccinations. Studies in West Africa (39, 64), India (89) and Ecuador (44) found that families with a history of using health services for other reasons had a much higher chance of having their children vaccinated.

As described earlier in this section, indifferent and negative attitudes of health workers can deter mothers from seeking immunization services. Sometimes, mothers and children are turned away because of such reasons as lack of vaccines, shortage of health staff, mothers coming late and/or coming without a health card. Mothers who hear from other people in the community who were subjected to negative treatment also shy away from seeking immunization services for their children. In the Syria study (33), rural mothers said health staff denied immunization without no explanation, urban mothers complained of bad experiences, and semi-urban mothers described maltreatment and indifferences of nurses. A study in Niger reported that many families did not even try to have their children vaccinated after hearing about the bad treatment received by someone else in their community (54).

Other factors related to families

Several other factors related to families had more than ten mentions in the documents. These factors, however, have already been discussed or overlap significantly with other factors, so there will not be a separate section on each one. These factors are:

Demand/acceptability of vaccination – a factor in 15 projects/programs

Perceived (lack of) safety, fear of multiple doses or bad vaccination procedures or materials, which could be related to previous experiences, rumors, poor promotion, etc. - a factor in 13 projects/programs

Perception that child is too sick, too weak for vaccination/fatalism - a factor in 13 projects/ programs
Feeling of not belonging to the majority social group or otherwise being unaccepted, embarrassed) - a factor in 13 projects/programs

Mistrust of health staff, which is related to previous bad experiences, rumors, etc. - a factor in 11 projects/programs

3.5 Findings for urban areas

Twenty of the projects or programs studied were exclusively in urban areas, so a separate analysis was done of factors in these projects. Table 1 below summarizes the factors related to non-immunization in those 20 urban programs and compares them with findings from the remaining 116 projects/programs covered by the grey literature reviewed. These other programs were mostly rural, but some reviews covered a mixture of rural and urban areas.

Table 1: Analysis of Factors* Associated with Non-Immunization in Urban and Other (Rural or Mixed Rural/Urban) Areas

(mentioned for two or more projects/programs)

Main factors associated with non-immunization	*No. of urban projects in which factor mentioned*	*% of urban projects in which factor mentioned (x/20)*	*No. of other projects in which factor mentioned*	*% of other projects in which factor mentioned (x/115)*	*Comments*
Immunization System					
Health staff performance	7	35.0%	42	36.5%	
Appropriateness of time/ days	7	35.0%	23	20.0%	Urban mothers may have less time flexibility.
Lack of vaccine/ supplies	6	30.0%	42	36.5%	
False contraindications	6	30.0%	41	35.7%	
Missed opportunities	6	30.0%	31	27.0%	MOI appear more common in urban areas, perhaps because staff assume it is easy for people to return.
Service reliability	5	25.0%	29	25.2%	
Distance/ access	4	20.0%	45	39.1%	As expected, access is less of a barrier in urban areas.
Waiting time	4	20.0%	25	21.7%	
Informal charges	4	20.0%	17	14.8%	Appears more common in urban areas, perhaps because more a money economy.
Communication & Information					
Lack of promotion	3	15.0%	9	7.8%	
Family Characteristics					
Income	5	25.0%	13	11.3%	
Education	5	25.0%	10	8.7%	Findings imply more education and income differences in urban areas.
Migrants	4	20.0%	10	8.7%	Apparently migration is a urban issue in urban areas.
Parental KAP					
Fear side effects	12	60.0%	35	30.4%	Appears much more important in urban areas
Practical knowledge	10	50.0%	48	41.7%	
Conflicting priorities	9	45.0%	34	29.6%	As expected, more urban mothers are busy earning money
Perceived importance	5	25.0%	25	21.7%	
Beliefs, rumors	4	20.0%	37	32.2%	Appears to be smaller factor in urban areas, perhaps because of higher education, more information
Perceived efficacy	3	15.0%	24	20.9%	
Acceptability	3	15.0%	12	10.4%	
Child too sick, weak	3	15.0%	10	8.7%	Traditional beliefs may persist more in rural areas
Lost/unavailable cards	3	15.0%	15	13.0%	
Women's autonomy	3	15.0%	12	10.4%	
Safety fears	2	10.0%	11	9.6%	
Low motivation	2	10.0%	17	14.8%	

3.6 Influence of sex and gender on immunization

Relatively little information on sex differentials or gender discrimination emerged from the general search of documents on non-immunization in the grey literature. However, several additional documents were found, particularly on India and other parts of south Asia, when a more focused, supplemental search on immunization and gender was made. Gender or sex discrimination does appear to be a factor in some settings (particularly south Asia).

3.6.1 Coverage differentials by sex. Several of the documents reviewed, as well as a number discovered on a special search on immunization and gender, mention discrimination against girl children in health care, immunization, and other areas (7, 56, 86, 100, 109). These documents present data showing that girl children in some parts of India and other parts of south Asia are less immunized and immunized at older ages than boys. However, even within India the patterns vary substantially by state (7), and in many studies low income and rural residence are much stronger predictors of under-immunization than the children's sex (86, 89). Many of the sex differentials are modest – in the range of 2-3% (78, 85 88, 89). Other studies in south Asia and elsewhere find no coverage differences between boys and girls (26, 92). Finally, there is also information in the grey literature that sex differences are more pronounced for curative care, education and other areas in which differential treatment has been studied (85).

3.6.2 Concern over contact with unknown men. Documents on immunization in Uganda (4) and Bangladesh (15, 107) mention that some husbands either prohibit their wives from taking children for vaccination; or that husbands or women themselves are not comfortable with women having to bring children to places where they will be in contact with unknown men. Another source (95) mentions that men in Rajasthan often take their children for immunization, resulting in children often being vaccinated late.

3.6.3 Women's decision-making power. Documents on immunization in Gambia (28), Nigeria (50), Ethiopia (69), and Kenya (79) mentioned that women alone cannot make the decision to have the child immunized and that some husbands refuse permission, particular if the child has previously had side effects.

3.6.4 Conflicting priorities. Conflicting priorities can be considered as an aspect of gender, since in most settings, it is the mother who brings the child for vaccination; yet many mothers have conflicting responsibilities, a situation worsened by the restricted service hours that are set for the providers', not the mothers', convenience. This is mentioned as a factor in non-immunization in 43 of the projects/programs reviewed and is discussed elsewhere in this review (pages 20-21).

3.7 The main determinants of non-immunization

In addition to the analyses based on simple counts of factors mention in the documents, findings from the grey literature were also analyzed by giving more weight to the findings from the most complete, reliable studies (Abila/Kenya [2], AlConde/DR [6], Blanchet/Bangladesh [15], Bukenya/Uganda [17], Fields/Burkina Faso/Niger/Kenya [30], HIID/West Africa [39], IMRB/India [48], Khan/Bangladesh [56], LaFond/Somalia [57], Millimourno/Gambia/Guinea [66], MOH/Ethiopia [69], PATH/Kenya [88], Perry/Bangladesh [91], Roa/India [95], Sheldon/ Mozambique [101], SRI/Indonesia [105], and Talukdar/Bangladesh [107]. In addition, Pillsbury (93) and Health Access International (41) provided particularly useful synopses of multiple studies. Each of these studies had most or all of the following characteristics:

- Had a limited number of clear questions that the study was intended to answer

- Used qualitative methods to seek explanations, not just associations, of factors with immunization status

- Used observation as well as questioning

- Interviewed both mothers/caregivers and health staff

- Employed multiple information-gathering methods, both qualitative and quantitative

- Linked determinants to children's vaccination status, i.e. fully immunized, partially immunized (dropouts or delayed), and no immunizations

- Reported findings from all methods and audiences in an integrated manner, i.e. organizing the findings by "what did we learn from all methods and audiences to answer each of our key questions?"

- Took steps to encourage honest, unbiased answers, for example, avoiding the use of health workers in uniform as interviewers; they used earlier responses to open-ended questions and observations to construct survey questions, so that they included community and health worker concepts and concerns and not just those of the researchers.

A review of these studies yielded a list of three "most important" underlying (secondary) factors and six "most important" primary factors. Interestingly, it appears that *every one of these nine factors has both a "services" side and a "family" side*, i.e. those that were health-system related had a corresponding family factor and vice versa. These key determinants of non-vaccination (not in order of importance) are shown in Table 2 below.

Across countries and times, these appear to be the most important factors leading to children receiving no immunizations or only some of their basic series of vaccinations. However, in one specific setting, the main factors cannot be predicted based on global information. The main problem in one place may be health workers' poor treatment of mothers (Lagos, Kenya); while in another (Uganda) it's that the health workers stopped receiving their incentive for doing outreach, so outreach rarely occurred; or in Cambodia it was the health services failure to make sufficient accommodation for the Vietnamese minority. MOI were quite significant almost everywhere they were examined but were not found at all in a study in Zimbabwe. Thus, any one factor may range from extremely important to having no importance, which is why it is important to examine these factors in the specific setting where an immunization program is concerned about its coverage and/or dropout rates.

The information in the documents reviewed did not allow for a complete analysis of the main reasons for leftouts, as opposed to dropouts. However, the reviewers' impression is that the general risk and causal factors are somewhat different. Leftouts are most likely related to such factors as: difficult access, inconvenient hours, negative beliefs/rumors/misinformation, minority status; whereas the main reasons for dropouts are likely to be: poor treatment/bad experiences, missed opportunities, fears (of side effects, of abuse due to a lost card or missed appointment), and lack of understanding of need to return or when to return.

Table 2: Major Determinants of Child Non-Immunization in Developing Countries
(based on the "best"* studies)

Major Risk Factors (secondary factors)	Corresponding/reinforcing factors
Place of residence (rural, distant from a health facility) (family factor)	Insufficient facilities; unreliable services/outreach, restricted/inconvenient service hours (service factors)
Poverty (family factor)	Health worker attitudes and behavior; charges (official and unofficial) (service factors)
Mothers' education (family factor) [Although mothers' education was commonly associated with children's immunization status, some studies found little or even a reverse correlation]	Insufficient/ineffective IEC, engagement with community leaders and groups (service factors)
Major Causal Factors (primary factors)	**Corresponding Reinforcing factors**
Bad experiences at health facility/outreach, leading to fears, negative expectations, and lack of trust (family factor)	Health worker attitudes and behavior, side effects, stock outs (service factors)
Competing priorities (too busy) (family factor)	Restricted/inconvenient hours, difficult access, unreliable services (service factors)
Missed opportunities to immunize (service factor)	Parents' attitudes and fears (e.g. to have sick child immunized), although in most cases parents accept health staff's recommendation
Fears/rumors (family factor)	Insufficient/ineffective IEC, engagement with community leaders and groups (service factors)
Lack of appreciation of basic benefit of vaccination (family factor)	Insufficient/ineffective IEC, engagement with community leaders and groups (service factors)
Lack of understanding of need for multiple doses, when and where to return, that immunization protects against certain specific diseases (family factor)	Poor health worker communication; insufficient/ ineffective IEC, engagement with community leaders and groups (service factors)

*2, 6, 15, 17, 30, 39, 48, 56, 57, 66, 69, 88, 91, 95, 101, 105, 107

4. Discussion

4.1 Usefulness and reliability of study findings

The "epidemiology of the unimmunized child" implies two basic questions:

- What are the demographic or family characteristics that appear to put children at risk of being unimmunized (to have no vaccinations or to be dropouts/behind schedule) and

- Why are these child unimmunized? What are the more immediate, direct causes of individual children being either partially immunized or not immunized at all?

The situations, purposes, design and execution of the studies reported in the grey literature varied widely. Some were either designed or implemented in ways that limited or biased the type of information that they would find. Studies that used one approach, particularly closed-ended questions based on their own perceptions of what was important, were unlikely to uncover certain potentially important determinants. Formative research for the USAID-funded Measles Initiative in

Kenya (circa 1992-93) illustrated this issue. A health facility assessment – consisting of observations and interviews with health staff and clients (carried out by health professionals) – found that staff carried out their immunization tasks well and that most clients were satisfied.

"However, focus group discussions with mothers painted an entirely different picture. Mothers described harassment and maltreatment by health workers, as well as practices contrary to KEPI [Kenya EPI] procedures, such as turning away a child who was sick or lacked a child health card. These conflicting findings suggest that while current training and supervision may be succeeding in imparting technical information, the client perspective is not respected under routine circumstances." (30)

Although a few documents that fit the general inclusion criteria were excluded from the analysis due to poor methodology/unreliable findings, most documents from the "grey literature" encountered that described or explained the epidemiology of the unimmunized child were included. However, as described above, in summarizing and generalizing findings from the documents reviewed, the IMMbasics team did give special consideration to the findings of those more complete and reliable studies.

4.2 Possible limitations of findings

Although the authors of this report aimed to work systematically and objectively, there are nonetheless a few potential limitations to the accuracy of the findings.

4.2.1 The documents and review process: While the team tried to cast a wide net to identify appropriate documents written since 1980, they are well aware that they located and reviewed only a portion – possibly a small one – of the appropriate documents. Undoubtedly many other appropriate documents sit in files and on shelves and in files of ministries of health and other organizations in developing countries. While the team does not believe that reviewing the more complete universe of evidence would change the major conclusions, they cannot be certain. Other potential limitations are the reviewers' accuracy in extracting key factors from documents and reviewer bias. While the team certainly intended to be objective, the process involved many subjective judgments and interpretations of what was important and what was not, so there is no guarantee that another team reviewing the same documents might not reach slightly different conclusions.

4.2.2 Need to consolidate findings: Just as the best studies utilize several methods to gather information from several types of people, so do the findings of the grey literature need to be consolidated with those from the peer-reviewed, published literature and analysis of survey findings.

4.2.3 Difficulty in generalizing: It is extremely difficult to generalize the findings from over a hundred documents on over 30 countries, over a 30-year period, using different methodologies, covering different populations, etc. While the team strongly believes that the main determinants of non-immunization found should inform the areas of inquiry in future research, they also are convinced that situation- and location-specific research is needed -- with great care taken to avoid bias, leading questions, and assumptions – basically followed the principles of the best studies that are mentioned above.

4.2.4 Unreliable findings: Many of the studies reviewed have limitations. The MOI studies, for example, reveal a lot about what happens to caregivers and children who come to health facilities but nothing about those who do not. Studies that use health workers in uniform to ask close-ended questions to families are not likely to uncover real, true, valid answers, as illustrated very well by the box above on the Kenya study. The health workers are often not trained or expected to probe for more than respondents' initial responses or to seek explanations. It's very easy for a mother to give

the easiest answers or the ones that they think the interviewer wants to hear – that the health facility is too far, that they are too busy – rather than the real answer – that the health worker humiliated her by commenting on her babies' dirty clothes or by yelling at her for forgetting the vaccination card, or that she was told that there was no vaccine when she came to the health facility. As mentioned above, the team tried to keep such considerations in mind, by putting more stock in the findings from what appeared to be the more rigorously designed studies.

4.2.5 Multiple, interacting factors: The questions are simple – what children are unvaccinated and why? – but the answers are complicated, often involving a multiplicity of interacting factors. Clearly, there are certain sociological factors that put children at risk of non-immunization – place of residence, mother's education, family income – but it is the interaction of multiple factors, in very personal ways, that leads to the decision of one particular family to have its children fully vaccinated or not. In some cases of non-immunization, the explanation may have one simple cause; e.g. the father prohibited the mother to return after the child had a fever following vaccination, or the mother cannot possible get away from work during vaccination hours and isn't sufficiently motivated to find another way. However, in many instances, the mother or parents themselves may not be able to articulate the reasons, since they are likely to be some combination of beliefs, perceptions, knowledge and experiences.

ANNEX A
Format Used for Extraction of Information from the Grey Literature

Reviewer: Date:

Document identification information (for citation):	
· **Name of document**	
· **Author(s) and affiliations, if stated**	
· **Institution(s) (publisher)**	
· **Date of document**	
· **Other?**	
Country(ies) of work	
Purpose of inquiry (e.g., context; formative research, evaluation, other)	
Research question(s)	
Description of methodology	
· **Methods**	
· **Sample size, composition (including target groups), how selected**	
· **Who conducted the information-gathering**	
· **Geographic scope**	
Key findings and reasons for non-immunization (If possible, prioritize the main 3-5 factors identified)	
Based on key findings, designate and describe any of the following that apply. If possible, describe not only the "what" but also the "who", i.e., who were the people for whom each major barrier was most important. Attach any data tables, if available.	
Service-related	
A. Unreliable, inconvenient or unavailable services, including limited days and times when vaccination is available	
B. Poor treatment by health personnel (e.g., unfriendly manner, verbal or physical abuse, making illegal charges, allowing long waits in unpleasant conditions)	
C. Missed opportunities for immunization, including contraindications	
D. Difficult physical or geographical access	
E. Inadequate information provided by health staff about when/where to return	
F. Other	
Client-related	
A. Lack of knowledge of when and where to return for services	
B. Too busy – competing priorities	
C. Cultural or religious barriers (e.g. against religious or philosophical beliefs)	
D. Non-acceptability of immunization (routine) (e.g., fear of side effects, lack of confidence in immunization, don't feel susceptible, rumors about vaccine)	
E. Other (e.g., lack of trust in health workers or public health facilities; costs of transportation &/or illicit charges)	
Other or cross-cutting (describe), e.g.:	
A. Political instability	
B. Other (e.g., fear of being registered by official government services [among illegal immigrants or residents])	

ANNEX B

System and Client-Related Risk Factors for Non-Immunization in Three Countries

Factors Associated with Non-Immunization, Kenya (11 projects/programs)

System/Service Related

- Health staff's motivation, performance/competence and attitude/+ knowledge + behavior + ability to communicate with mothers (when to return, which vaccine and how many doses are needed) – 7 (projects/ programs)
- Appropriateness of time/limited day/hours when vaccination available; includes sessions that begin late and end early - 6
- Distance/travel conditions, access - 6
- Lack of resources/logistics (funding)/stock outs, which affects reliability, MOI, cold chain etc. – 5
- Waiting time - 4
- Reliability (no cancellation of sessions) (both fixed and outreach sessions) -- provider absent, lack of supplies, fuel; other priorities – 3
- Informal, illegal charges, indirect costs such as transportation - 2
- Use of all opportunities - contraindication, fear of giving multiple, for no clear reason - 2
- Availability of curative services/medicines - 1

Client Related

- False contraindications (particularly sick children, baby too old, and baby under-weight) as factor for health workers &/or parents – 8
- Conflicting priorities -- too busy earning money, with family or social obligations, caring for older children, mother is sick, summer travel (when women usually visit their parents house, etc) or mother sick – 6
- Religious/cultural/social beliefs/norms and rumor (sterilization, HIV), influences, e.g. problem accepting male vaccinators (mothers spend the initial period after the birth at parents home), misinformation about payment for immunization services – 6
- Lost/unavailable health card (affects both health workers' and mothers' willingness and requirement to keep and present a vaccination card) - 5
- Parental practical knowledge (not knowing child's age, when need to go, where, hours of operation, who, remembering) - 5
- Lack of interest/Level of motivation/lazy (mainly parents) – 5
- Perceived efficacy of vaccine – 5
- Perception of importance of vaccination for my child's health/attitude that better to treat illness (attitude towards curative and preventive aspects of health care) (Misconception about child growing well and the need for vaccination) – 4
- Fear of side effects - 4
- Previous positive or negative experience at health services (e.g., turned away, post-vaccination abscesses, verbally abused, publically humiliated - 2

- Fear of being embarrassed, harassed, humiliated, associating with male health - 2
- Income/socioeconomic status - 2
- Autonomy of women/father or mother-in-law pressuring against/husband refusal - 2
- Education (maternal and paternal) - 1
- Mistrust of health staff - 1
- Exposure to mass media - 1
- Feeling of not belonging to the majority social group (that don't fit it and may be unaccepted, embarrassed, physical appearance) - 1
- Perception that child is too sick, too "weak" for vaccination/fatalism - 1

Factors Associated with Non-Immunization, India (18 projects/programs)

System/Service Related

- Lack of resources/logistics funding)/stock outs, which affects reliability, MOI, cold chain etc. - 7
- Distance/travel conditions, access – 5
- Reliability (no cancellation of sessions) (both fixed and outreach sessions) -- provider absent, lack of supplies, fuel; other priorities – 4
- Health staff's motivation, performance/competence and attitude/+ knowledge + behavior + ability to communicate with mothers (when to return, which vaccine and how many doses are needed) - 4
- Lack of promotion/follow-up of routine immunization/health communication - 3
- Appropriateness of time/limited day/hours when vaccination available; includes sessions that begin late and end early - 3
- Waiting time - 3
- Informal, illegal charges, indirect costs such as transportation - 2
- Immunization refused because the child was sick - 1
- Security (health workers/parents) - 1
- Poor/ineffective communication regarding vaccines and benefits of vaccinations - 1
- Cost and costing policies/official fees (clinics/health centers depending on client for use of curative services and when there are less clients using these services the clinics are facing problems) - 1
- Use of all opportunities - 1
- Use of all opportunities - contraindication, fear of giving multiple, for no clear reason - 1
- Use of all opportunities - stock outs of essential vaccine or supplies - 1
- Community involvement in planning and managing services in social mobilization/channeling - 1

Client Related

- Parental practical knowledge (not knowing child's age, when need to go, where, hours of operation, who, remembering) – 9
- Conflicting priorities -- too busy earning money, with family or social obligations, caring for older children, mother is sick, summer travel (when women usually visit their parents house, etc) or mother sick - 6
- False contraindications (particularly sick children, baby too old, and baby under-weight) as factor for health workers &/or parents – 6
- Fear of side effects – 6
- Religious/cultural/social beliefs/norms and rumor (sterilization, HIV), influences, e.g. problem accepting male vaccinators (mothers spend the initial period after the birth at parents home), misinformation about payment for immunization services – 5
- Perception of importance of vaccination for my child's health/attitude that better to treat illness (attitude towards curative and preventive aspects of health care) (Misconception about child growing well and the need for vaccination) - 3
- Scientific knowledge - 3
- Income/socioeconomic status – 3
- Recent migrants/seasonal migration - 3
- Lack of interest/Level of motivation/lazy (mainly parents) - 3
- Residence - urban children more likely to be fully vaccinated - 2
- Gender - 2
- Perceived efficacy of vaccine - 2
- Mother's education - 1
- Birth Order - 1
- Fear of being embarrassed, harassed, humiliated, associating with male health worker - 1
- Familiarity and/or use of other health care services - 1
- Exposure to mass media - 1
- Households with female headship - 1
- Mother's employment - 1
- Religion - 1
- Mother's age - 1
- Antenatal care during pregnancy – 1
- Mistrust of health staff - 1
- Perception that child is too sick, too "weak" for vaccination/fatalism - 1
- Autonomy of women/father or mother-in-law pressuring against/husband refusal - 1
- Family size - 1
- Demand/acceptability of vaccination - 1
- Residence in un-recognized geographical location/slum - 1
- Perceived safety of vaccine/fear of multiple doses/vaccination - 1

Factors Associated with Non-Immunization, Bangladesh (10 projects/programs)

System/Service Related

- Informal, illegal charges, indirect costs such as transportation – 5
- Appropriateness of time/limited day/hours when vaccination available; includes sessions that begin late and end early - 5
- Health staff's motivation, performance/competence and attitude/+ knowledge + behavior + ability to communicate with mothers (when to return, which vaccine and how many doses are needed) – 4
- Distance/travel conditions, access – 3
- Lack of resources/logistics (funding)/stock outs, which affects reliability, MOI, cold chain etc. – 3
- Cost and costing policies/official fees (clinics/health centers depending on client for use of curative services and when there are less clients using these services the clinics are facing problems) - 2
- Waiting time - 2
- Use of all opportunities - 2
- Lack of promotion/follow-up of routine immunization/health communication - 1
- Quality of vaccination and other services (vaccination area not clean, equipments not clean, waiting are uncomfortable/ users' perceptions of quality are equally important - 1
- Use of all opportunities - not screening - 1
- False contraindications - 1
- Reliability (no cancellation of sessions) (both fixed and outreach sessions) -- provider absent, lack of supplies, fuel; other priorities - 1

Client Related

- Fear of side effects – 8
- Conflicting priorities -- too busy earning money, with family or social obligations, caring for older children, mother is sick, summer travel (when women usually visit their parents house, etc) or mother sick - 6
- Parental practical knowledge (not knowing child's age, when need to go, where, hours of operation, who, remembering) – 7
- Demand/acceptability of vaccination – 5
- Perception of importance of vaccination for my child's health/ attitude that better to treat illness (attitude towards curative and preventive aspects of health care) (Misconception about child growing well and the need for vaccination) – 5
- Lost/unavailable health cards (affects both health workers' and mothers' willingness and requirement to keep and present a vaccination card) - 4
- Perceived efficacy of vaccine – 3
- Autonomy of women/father or mother-in-law pressuring against/husband refusal – 3
- False contraindications (particularly sick children, baby too old, and

baby under-weight) as factor for health workers &/or parents - 3

- Perception that child is too sick, too "weak" for vaccination/ fatalism - 3
- Religious/cultural/social beliefs/norms and rumor (sterilization, HIV), influences, e.g. problem accepting male vaccinators (mothers spend the initial period after the birth at parents home), misinformation about payment for immunization services - 3
- Mistrust of health staff - 2
- Social status (bribes, favoritism) -2
- Previous positive or negative experience at health services (e.g., turned away, post vaccination abscesses, verbally abused, publically humiliated) - 2
- Gender - 1
- Income/socioeconomic status - 1
- Peer group pressure for or against vaccination - 1
- Perceived safety of vaccine/fear of multiple doses/vaccination procedure/vaccination materials - 1
- Recent migrants/seasonal migration - 1
- Reception of information on "where and when" of vaccination - 1
- Feeling of not belonging to the majority social group (that don't fit it and may be unaccepted, embarrassed, physical appearance) - 1

Documents Included in the Grey Literature Review

1. Abed A. *Perceptions of immunizable diseases in rural Bangladesh*. Research and Evaluation Division, Bangladesh Rural Advancement Committee, February 1988.

2. Abilla, WD, KK Munguti. *A National Qualitative Study of Factors which Promote and Hinder Immunization Activities in Kenya*. KEPI and REACH, January 1993.

3. *Addressing system wide barriers to immunization: Ghana*. No date (around 2004/5).

4. Africare – CIMCI NTUNGAMO. *Community-Based Integrated Management of Childhood Illness (CIMCI-PLUS) Project. Africare – Ntungamo. Factors Affecting Immunization Coverage among Children under Two Years in Ntungamo District*, October 2005. (Uganda)

5. Agarwal, S, A Bhanot, and G Goindi. Understanding and Addressing Childhood Immunization Coverage in Urban Slums. *Indian Pediatrics* 2005; 42/7: 653-663. (India)

6. AlConde S.A. *Reporte Final. Estudio de percepciones y expectativas a nivel poblacional sobre la prestación de servicios de inmunización, con énfasis en la vacuna Pentavalente*. For USAID's CHANGE Project. Santo Domingo, 2002.

7. Arokiasamy P, J Pradhan. *Gender bias against female children in India: Regional differences and their implications for MDGs.* Presented at the 2006 Annual Meeting of the Population Association of America, Los Angeles, California, March 30 - April 1, 2006. 22 pp.

8. Augustin A, E Holt, J Coreil, N Halsey. *Characteristics of Non-Users of Immunization Services*. Supported by the National Academy of Sciences and the U.S. Agency for International Development. No date (around late 1980s). (Haiti)

9. Babalola S and A Adequyi. *Factors Influencing Immunisation Uptake in Nigeria: Theory-Based Research in Six States*. PATHS, July 2005.

10. Bastien JW. *Cultural perceptions of neonatal tetanus and programming implications, Bolivia*. Arlington, Virginia: John Snow [JSI], Resources for Child Health [REACH], 1988. (USAID Contract No. DPE-5927-C-00-5068-00)

11. Bastien JW. *The Silver Bullet and the Hexing Thorn – vaccinations and neonatal tetanus in Bolivia*. Draft paper, March 1992. U. of Texas at Arlington.

12. Bender D, R Macauley. *Immunization Drop-outs and Maternal Behavior: Evaluation of Reasons Given and Strategies for Maintaining Gains Made in the National Vaccination Campaign in Liberia*. Presented at the 116th Annual Meeting of the American Public Health Association [APHA], Boston, Massachusetts, November 13-17, 1988.

13. Bhanot A, S Agarwal, K Srivastava. *Improving age appropriate immunization among urban poor infants. Possible Options and Approaches*. USAID/ Environmental Health Project, November 2004. (India)

14. Bjerregaard, P, SK Lwanga, DD Mutie. *Factors affecting immunization coverage. Availability of services, parental education and social situation*. 1991. (Kenya)

15. Blanchet T. *Perceptions of childhood diseases and attitudes towards immunization among slum dwellers, Dhaka, Bangladesh*. Arlington, Virginia: John Snow [JSI], Resources for Child Health [REACH], June 1989 (USAID Contract No. DPE-5927-C-00-5068-00)

16. Brown, J, P Djogdom, K Murphy, G Kesseng, D Heymann. *Identifying the Reasons for Low Immunization Coverage: A Case Study of Yaounde, United Republic of Cameroon*. Geneva: World Health Organization, 1980. EPI/GEN/80/4.

17. Bukenya GB. *KAP Study of Immunisation Services in Uganda. Study Report*. Health Management Consult Uganda: Kampala, 1998.

18. Cambodia National Immunization Program. Immunization services assessment report. 2000.

19. Centre International de L'Enfance, Groupe de Travail, Sobo Doulasso, 10-11 septembre 1990. Acceptabilite des Vaccinations. Synthese por Daniel Levy-Bruhl and Nicole Guerin. (Benin, Burkina Faso, Togo)

20. Chadambuka A, A Chimusoro, T Apollo, M Tshimanga. *Assessing the effectiveness of immunization strategies in a district with low immunization coverage in Zimbabwe. Phase 1 - A report on the situational analysis of factors that affect immunization coverage in Gokwe south*.

21. CHANGE Project *Barriers to immunization in Dominican Republic and Mozambique – CHANGE Project summary*. 2004. (changeproject.org)

22. Consultants Consortium SoSec KEMC. Third Party Evaluation of Expanded Programme on Immunization Punjab. UNICEF and Health Department Government of the Punjab, July 2000.

23. Datar A, A Mukherji, N Sood. *Health Infrastructure and Immunization Coverage in Rural India*. Rand Health Working Paper. August 2005.

24. Department of State for Health, The Gambia. *Draft report on the rapid assessment of system wide [barriers] to immunization*. September 2004.

25. Devivanayagam N, K Nedunchelian, TP Ashok, N Mala. *Reasons for partial/non immunization with oral polio vaccine/triple antigen among children under five years*. Madras: Advanced Centre for Clinical Epidemiological Research and Training, Institute of Child Health and Clinical Epidemiology Unit, Madras Medical College, May 1992. (India)

26. Elliott C, K Farmer. *Immunization status of children under 7 years in the Vikas Nagar area, North India*. Child: Care, Health and Development. July 2006; 32(4): 415-421.

27. Eng E, J Naimoli, G Naimoli, KA Parker, N Lowenthal. The Acceptability of Childhood Immunization to Togolese Mothers: A Socio-behavioral Perspective. *Health Ed Q* 1991; 28(1): 97-110.

28. Fairhead J, M Leach. *Childhood Vaccination Public Engagement with Science and Delivery. Research Report*. Brighton: Institute for Development Studies at the University of Sussex, 01-Jan-05. (Gambia)

29. Favin M. *Acceptability of Immunization*. Arlington, VA: The REACH Project, March 1991.

30. Fields R. Measles Initiative – summary of assessment findings. Arlington, VA: REACH, HealthCom, and Quality Assurance projects, 1993 (Burkina Faso, Kenya, Niger).

31. Fields R. Measles Initiative – trip report – June 8-30, 1992. Arlington, VA: REACH Project.

32. Fields R. *Overcoming obstacles to immunization in Africa*. Presented at the 121st Annual Meeting of the American Public Health Association [APHA], San Francisco, California, October 24-28, 1993.

33. *Focus group research (FGR) and knowledge attitudes and practices (KAP) surveys -- Syria*, no date (around 1990).

34. Foster SO. The Epidemiology of Non-Vaccination. *EPI Newsletter* (PAHO).October 1986: 5-6.

35. Gaturuku PK. Immunization coverage of Elgeyi Marakwet District. *KEPI Newsletter* August 1990; 1-3.

36. Gindler J, M Adewusi, D Fagbule, O Aderinto, D Mosanya, OJ Ayodele. Missed Opportunities in Urban Health Facilities, in *Immunization in 12 African Countries 1982-1993: 7-67-7-68,* S.O. Foster, ed. Atlanta: Centers for Disease Control and U.S. Department of Health and Human Services (Africa Child Survival Initiative, Combating Childhood Communicable Diseases) (Nigeria).

37. Grabowsky, M. *Missed Opportunities for Immunization*. Arlington, VA: The Resources for Child Health Project, March 1991.

38. Habimana P, A Bararwandika. Connaissances, opinions et comportements des parents en matiere de vaccination [Knowledge, attitudes and behavior of parents concerning immunization]. *FAMILLE, SANTE, DEVELOPPEMENT/ IMBONEZAMURYANGO* 1991 Apr; (20): 8-13.

39. Harvard Institute for International Development, Applied Research in Child Health, Polio Project. *Data analysis and dissemination workshop – Missed opportunities for polio immunization – Main findings from research in West Africa*.

40. Harvey, M. Measles Initiative: Kenya – immunization coverage surveys in Kisumu and Siaya districts, 1992. Arlington, VA: REACH Project, February 1992.

41. Health Access International. *Community demand for immunizations – A literature review of opportunities and obstacles in increasing community demand for immunizations*. Cambridge, 20th November 1999. (Prepared for Children's Vaccine Initiative)

42. Heggenhougen K, J Clements. *Acceptability of Childhood Immunization. Social science perspectives*. London: Evaluation and Planning Centre for Child Health, London School of Hygiene and Tropical Medicine, 1987.

43. Hirschhorn N. *Missed Opportunities for Immunization*. Arlington, VA: REACH Project, March 1990.

44. Holland, J, JI Donoso and JA Graeff. *Factors Affecting Completion of Childhood Immunizations in Rural Ecuador: An Observation Study*. Washington, D.C.: HealthCom, 1988.

45. Hutchins SS, HAFM Jansen, SE Robertson. Studies of missed opportunities for immunization in developing and industrialised countries. *Bulletin of the World Health Organization* 1993; 71(5): 549-560.

46. Hutchins SS, HAFM Jansen, SE Robertson, P Evans, RJ Kim-Farley. *Missed Opportunities for Immunization: Review of studies from developing and industrialized countries*. World Health Organization: Geneva, 1993. (WHO/EPI/92.8)

47. Ibnouf AH, HW Van den Borne, JA Maarse. Factors influencing immunisation coverage among children under five years of age in Khartoum State, Sudan. *SA Fam Pract* 2007; 49(8):14.

48. Indian Market Research Bureau. *Communization. Summary report on knowledge, attitudes and practices – Mothers*. November 1987. Prepared for UNICEF.

49. Jheta M, J Newell. Childhood vaccination in Africa and Asia: the effects of parent's knowledge and attitudes. *Bulletin of the World Health Organization* 2008; 86 (6): 419-420.

50. Kabir M. et al. *Beliefs about Childhood Immunization and Attitude Towards Uptake of Poliomyelitis Immunization in Nort*. Bayero University, Kano; Ahmadu Bello University, Zaria, National Program on Immunization, November 2006 (Nigeria)

51. Kagondu G, M Favin. *Role of Qualitative research in improving immunization coverage in Kenya*. Arlington, VA: REACH Project, 1993.

52. Kahn JG, AH Mokdad, MS Deming, JB Roungou, AM Boby, JL Excler, RJ Waldman. Avoiding missed opportunities for immunization in the Central African Republic: Potential impact on vaccination coverage. *Bulletin of World Health Organization* 1995; 73: 47-56.

53. Kaphle RS. *Communication Channels in Use in Somalia*. July-December 2000. Submitted to UNICEF-Somalia.

54. Keith N. *KAP related to vaccinations – Focus Group Research in the Tahoua and Maradi departments in Niger*, 1992. (for the Measles Initiative)

55. KEPI. *Immunization Coverage Survey South Nyanza District*. Nairobi, 1992.

56. Khan A. *Programmatic and non-programmatic determinants of low immunization coverage in Bangladesh*. Presentation made at Forum 9, Mumbai, India, 12-16 September 2005.

57. LaFond AK. *A study of immunization acceptability in Somalia*. Save the Children (UK), April 1990.

58. Laston S. AH Baqui, P Ngudup, D Silimperi. *Immunization beliefs and coverage in Dhaka slums*. ICDDR,B, May 1993. Urban FP/MCH Working Paper No. 5.

59. Leach M. Making Vaccine Technologies Work for the Poor. *IDS Policy Briefing* May 2006; 31.

60. Leach, M, J Fairhead. *Understandings of immunization: some West African perspectives*. Bulletin of the World Health Organization. June 2008; 86 (6): 418.

61. Leigh B, MS Kanu. *System wide barriers to immunization in Sierra Leone*. August 2004.

62. Loevinsohn BP and E Gareaballah. Missed opportunities for immunization during visits for curative care: a randomized cross-over trial in Sudan. *Bulletin of the World Health Organization* 1992; 70(3): 335-339.

63. Lwanga SK, A Burton, E Luman. *National report EPI coverage evaluation survey 2007/2008*. Jakarta: Directorate General Communicable Disease and Environmental Health, Ministry of Health, Republic of Indonesia, May 2008.

64. MacLeod W, E. Browne, MM Baldé, J Gyapong, DS Houinato, COA Jallow, AK Koumare, A N'Diaye, AG Hill. *Progress of polio immunization in seven peri-urban areas in West Africa*. Harvard Institute for International Development, ARCH Project, November 2, 2000 (draft).

65. Meche H, W Alemu W, M Woldeab. Achieving better immunization coverage in Ethiopia [letter] *World Health Forum* 191; 12(3): 339-40.

66. Millimouno D, AA Diallo, J Fairhead, M Leach. *The Social Dynamics of Infant Immunisation in Africa: Perspectives from the Republic of Guinea*. Brighton: Institute for Development Studies, University of Sussex, 2006. Working Paper 262.

67. Ministry of Health, Kenya. *1987 national coverage survey summary, Kenya*.

68. Ministry of Health, Directorate of Expanded Programme of Immunization and Division of Epidemiology, Department of Preventive Medicine, Ministry of Health, Sana'a. *A Study of the Reasons for Variations in Immunization Coverage in the Yemen Arab Republic*. August 1981.

69. Ministry of Health, UNICEF/Ethiopia. *National Immunization KABP Survey Report*. July 2001.

70. Ministry of Health and Family Welfare, State Government of Bihar. Universal Immunization Programme (UIP) Review – Bihar, 2004

71. Ministry of Health and PAHO/World Health Organization. *Rapid assessment of system wide barriers and good practices in the expanded programme on immunization: Guyana*. July 2004.

72. Ministry of Health Lusaka/Central Board of Health. *Rapid assessment and planning of country efforts to address system wide barriers to immunization*. Lusaka, June 2004.

73. Ministry of Health Socialist Republic of Viet Nam. *Rapid assessment of country efforts to address system wide barriers to immunization*. Hanoi, October 2004.

74. Ministry of Health, Republic of Rwanda, Expanded Programme on Immunization. *Report on the rapid evaluation and planning of Rwanda's efforts to eliminate the barriers to vaccination*. September 2004.

75. Ministry of Health & Family Welfare, Directorate of Health Services, Expanded Programme on Immunisation, Government of the People's Republic Bangladesh. EPI Programme Review 26 April 1998-May 15, 1998. May 1998.

76. Nath B, JV Singh, S Awasthi, V Bhushan, V Kumar. A study on determinants of immunization coverage among 12 - 23 months old children in urban slums of Lucknow district, India. *Indian Journal of Medical Sciences* 2007; 61(11):598-606.

77. Nichter M. Vaccinations in South Asia: False Expectations and Commanding Metaphors. In: Coreil J, Mull JD, eds. *Anthropology and Public Health*. Boulder, CO: Westview Press, 1990.

78. Obermeyer CM, R Cardenas. *Son preference and differential treatment in Morocco and Tunisia*. Studies in Family Planning. September 1997; 28(3): 235-44.

79. Oneyze A. *Preliminary findings - operation study on routine immunization Nairobi province - November-December 2008*. EPI Managers Meeting, Mombasa, Kenya..

80. PAHO/WHO. Missed Opportunities for Vaccination in the Americas: Diagnosis and Interventions, 1988-1990. *EPI Newsletter* June 1991:3-6.

81. PAHO. Study of Missed Vaccination Opportunities in Colombia. *EPI Newsletter* June 1990: 4-6.

82. PAHO. Missed Opportunities for Vaccination in Guatemala. *EPI Newsletter* October 1990: 6.

83. PAHO. Missed Opportunities Study: Honduras. *EPI Newsletter* December 1988: 8.

84. PAHO. Missed Opportunities to Vaccinate in Peru. *EPI Newsletter*. August 1996: 8.

85. Pal I, RN Chaudhuri. *Gender inequalities while rearing of children under 5 years in a rural area of West Bengal*. Indian Journal of Community Medicine 32(3) July 2007: 215-216.

86. Pande RP, AS Yazbeck. *Beyond National Averages for Immunization in India: Income, Gender, and Regional Inequalities*. Washington, DC: Health, Population and Nutrition, The World Bank, February 2002.

87. PATH and AIHI. Attitudes *Towards Immunization in Cambodia: A Qualitative Study of Health Worker and Community Knowledge, Attitudes and Practices in Kompong Chhnang*. 2002.

88. PATH Kenya. *Qualitative research for measles initiative/Kenya – Final report to Resources for child health project (REACH).*1992.

89. Patra N. *Universal Immunization Programme in India: The Determinants of Childhood Immunization*.

90. Perry H, S Nurani, MA Quaiyum, SA Jinnah, A Sharma. *Barriers to Immunization among Women and Children Living in Slums of Zone 3 of Dhaka City, Bangladesh: A Qualitative Assessment*. ICDDR,B, April 2007.

91. Perry, HB, S El Arifeen, I Hossein, R Weirbach. *The Quality of Urban EPI Services in Bangladesh: Findings from the Urban Initiatives' Needs Assessment Study in Zone 3 of Dhaka City*. ICDDR,B, 1996. Working Paper No. 24.

92. Pieris I, B Caldwell.*Gender and health in Sri Lanka*. Health Transition Review. October 1997; 7(2): 173-86.

93. Pillsbury B. *Immunization: The Behavioral Issues.* Monograph #3 of Behavioral Issues in Child Survival Programs, July 1990. Prepared for the Office of Health, USAID, by International Health and Development Associates.

94. Raharjo Y, L. Corner. Cultural attitudes to health and sickness in public health programs: a demand-creation approach using data from West Aceh, Indonesia. In What we know about Health Transition: The cultural, social and behavioural determinants of health. The Proceedings of an International Workshop, Canberra, May 1989, Volume II, edited by J Caldwell, S Findley, P Caldwell, G Santow, W Cosford, J Braid, D Broers-Freeman: 522-533.

95. Rao GR, S Unisa. *An investigation into low coverage of immunizations in the state of Jharkhand and Rajasthan*. International Institute of Population Studies, no date.

96. *Rapid assessment of health systems barriers to immunization – Outcomes from the pilot in Uganda*, August 2004.

97. Razum O. *Mothers voice their opinion on immunization services*. World Health Forum 1993; 14(3): 282-6.

98. REACH Nigeria. *Important Barriers to Better Coverage* (from qualitative research). 1992.

99. Shafritz L. *Burkina Faso – trip report*. Healthcom, for the Measles Initiative, 1992.

100. Sharma V, A Sharma. *Is the female child being neglected?* Immunization in India. Health Policy and Planning. September 1991; 6(3): 287-90.

101. Sheldon SJ, C Alons. *A Study to Describe Barriers to Childhood Vaccination in Mozambique. Final Report*. Maputo: Ministry of Health, Expanded Program on Immunization, Mozambique; The CHANGE Project, and Project HOPE, July 2003.

102. *Social-Cultural Context of Immunization in Benin*. *Evaluation Newsletter* January 1991; 12 (UNICEF).

103. Steinglass, R. *Missed Measles Immunization Opportunities: The Himalayas*. Presentation at the National Council for International Health Conference, May 19-22, 1988, Washington, D.C.

104. Steinglass, R, J Singay, J Norbu, AVKV De Silva, A Schnur. *Missed Opportunities for Measles Immunization. A Review of Methods and Findings in the Kingdom of Bhutan*. Arlington, VA: The Resources for Child Health Project, 1985.

105. Survey Research Indonesia. *Urban E.P.I. – Social Marketing Study (for the REACH Project) – Final Report*. Jakarta, June 1990. Prepared for Ministry of Health, Indonesia and USAID.

106. Synovate. Advocacy and communication formative study for immunization – presentation of findings – Indonesia – 12th September 2007. (PowerPoint presentation)

107. Talukdar LR. *Needs Assessment Study of Field Workers Involved in the EPI*. Dhaka: Ministry of Health and Family Welfare, Bangladesh, November 1991.

108. Timaeus I, K Harris K, F Fairbairn. *Can use of health care explain sex differentials in child mortality in the developing world? In: Too young to die: genes or gender?* [compiled by] United Nations. Department of Economic and Social Affairs. Population Division. New York, New York, United Nations, 1998: 154-78.

109. Tonglet R, M Soron'gane, M Lembo, MW Mukalay, M Dramaix, P Hennart. Evaluation of immunization coverage at local level. *World Health Forum* 1993; 14(3): 275-81.

110. Uddin MJ, CP Larson, E Oliveras, AI Khan, MA Quaiyum, NC Saha, F Ahmed, IA Khan, Shamsuzzaman. *Coverage of Child Immunization in Rural Hard-to-reach Haor Areas of Bangladesh: Acceptability of Alternative Strategies*. ICDDRB, August 2008. Working Paper #168.

111. Uddin MJ, CP Larson, E Oliveras, AI Khan, MA Quaiyum, NC Saha, IA Khan, Shamsuzzaman. *Effectiveness of Combined Strategies to Improve Low Coverage of Child Immunization in Urban Slums of Bangladesh*. ICDDR,B, October 2008. Working Paper #169.

112. UNICEF/Armenia, WHO/Armenia; and Ministry of Health. *Immunization coverage survey*. Republic of Armenia, July 2006.

113. Wansi E, D Metango, E Maganga, E Banda, T Msiska. *Community IMCI Baseline Survey – Malawi*. UNICEF, WHO, Government of Malawi, June 2001.

114. World Health Organization. *Behavioural Factors in Immunization*. Behavioural Science Learning Modules. Dept. of Mental Health and Substance Dependence, WHO, 2000. WHO/MSD/MDP/00.10.

115. World Health Organization. *Comprehensive EPI review (program review and immunization coverage survey)*. Conducted by external partners: AMP, IMMUNIZATIONbasics/USAID, WHO and UNICEF, October 2008. (Benin)

116. World Health Organization, Expanded Programme on Immunization. Missed opportunities for immunization (Comoros). *Weekly Epidemiological Record* November 1988; 45: 344-346.

117. World Health Organization, Expanded Programme on Immunization. Missed opportunities for immunization (Mozambique). *Weekly Epidemiological Record* February 1989; 5: 32-34.

118. World Health Organization, Expanded Programme on Immunization. *Missed Opportunities for Immunization*. EPI Global Advisory Group Meeting. Washington, D.C. – 9-13 November 1987. EPI/GAG/87/WP.12. (Cameroon, Gambia, India, Pakistan)

119. World Health Organization. Final Draft for Weekly Epidemiological Record. Expanded Programme on Immunization. Missed Opportunities for Immunization. *Weekly Epidemiological Record*. 1988. (Ethiopia)

120. World Health Organization. *Expanded Programme on Immunization.* Missed opportunities and acceptability of immunization. *Weekly Epidemiological* Record 1989; 64: 181-188. (Zimbabwe)

121. World Health Organization, Expanded Programme on Immunization. Missed opportunities for immunization *Weekly Epidemiological* Record October 1994; 41(14): 303-306. (Yemen)

122. World Health Organization, Expanded Programme on Immunization. Missed opportunities for immunization. *Weekly Epidemiological Record* June, 1990; 22: 167-170. (Ethiopia)

123. World Health Organization, Expanded Programme on Immunization. Attitudes of Somali parents to immunization. *Weekly Epidemiological Record* July 1989; 29: 224-5.

124. World Health Organization, Expanded Programme on Immunization. Global review of missed opportunities for immunization. *Weekly Epidemiological Record* 1993: 173-175.

125. World Health Organization, UNICEF, U.S. Centers for Diseases Control and Prevention, World Bank, Ministry of Health, State Hygiene and Anti-Epidemic Inspectorate, Centers for Diseases Control and Prevention. *Immunization Programme Management Review, Armenia*. October 2006.

126. Zambia, Government of, WHO, UNICEF, DANIDA, JICA, and USAID (BASICS). Sustaining the Benefits of Immunization within Zambian Health Reform – A Review. 1997.