This is an updated document to the one made available at the time of the SAGE meeting. The first 48 pages of this version were not in the original background document but a brief summary of their contents was made during the presentation by CDC.

Epidemiology of the Unimmunized Child

Findings from the Peer-Reviewed Published Literature, 1999 - 2009

Prepared for the World Health Organization

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Global Immunization Division

Centers for Disease Control and Prevention

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

Acronyms

CDC	U.S. Centers for Disease Control and Prevention
DHS	Demographic and Health Survey
EPI	Expanded Program on Immunization
GID	Global Immunization Division
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IMMbasics	IMMUNIZATIONbasics (global USAID-funded project, 2004-2009)
MOH	Ministry of Health
SAGE	Strategic Advisory Group of Experts (WHO)
STI	Swiss Tropical Institute
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

Background: In 2008, the Scientific Advisory Group of Experts on Immunization requested more information on 'the epidemiology of the unimmunized child'. In response to this request, the World Health Organization coordinated a three part review of current literature and available data to explore the reasons and factors linked to low vaccine uptake in low and middle income countries. The Global Immunization Division (GID) at the U.S. Centers for Disease Control and Prevention (CDC) conducted the review of the peer-reviewed literature. IMMUNIZATIONbasics (IMMbasics) and the Swiss Tropical Institute (STI) reviewed the grey literature and analyzed data from the Demographic and Health Survey (DHS), respectively.

Methods: For GID's review of the peer-reviewed literature, eight medical and behavioral and social science literature databases were searched for relevant articles. These included Medline, EMBASE, Sociological Abstracts, Soc Serv Abs, ERIC, Cochrane, Web of Science, and CINALH. The initial search filter was broad in order to encompass all aspects of immunization service delivery and acceptance of immunization in low and middle income countries. All titles and abstracts identified from the database search were reviewed by a single individual, and those including one or a combination of immunization-related terms were categorized as "highly relevant". The search on articles published between 1999 and 2009.

Highly relevant articles were reviewed by two independent reviewers using a standardized abstraction form. Articles were excluded if they did not present information or data on a low or middle income country, were not written in an official WHO language, did not discuss routine childhood vaccinations, were not published in a peer-reviewed journal, did not meet minimum study quality criteria, or did not present specific reasons/factors related to low vaccine uptake. For the remaining relevant articles, all reasons and factors associated with the under-vaccinated child (missing one ore more routine vaccinations) and the unvaccinated child (missing all routine vaccinations) were abstracted and entered into a qualitative software database. Abstracted reasons and factors were categorized into four major themes: Immunization systems, Communication and Information, Family Characteristics, and Parental Attitudes and Knowledge. Sub-categories were created within each of these major themes.

Findings: The initial database search identified16,097 possibly relevant articles. The review of each title and abstract resulted in 607 articles. Following full review of these articles, 145 from the Medline database and 53 from the non-Medline databases were assessed as highly relevant and included in the analysis. Additionally, 13 articles were received directly from the International Center for Development in Canada, prior to publication. Eleven of these articles were deemed highly relevant following full article review. Review findings were based on a total of 209 articles. Fifty-four countries were represented; however, 49 articles were based on studies conducted in India. A greater number of articles were identified during more recent years, except during 2009, which only represented articles published by March 2009.

A total of 901 reasons and factors associated with the under-vaccinated child were identified from these 209 articles. Of these reasons and factors, 393 (44%) were related to immunization systems, 255 (28%) to parental attitudes and knowledge, 199 (22%) to family characteristics, and 58 (6%) were associated with communication and information. Thrifty-three reasons and factors were abstracted from 12 articles describing the completely unvaccinated child. Of these, 4 (12%) were related to immunization systems, 18 (55%) to parental beliefs and knowledge, 9 (27%) to family characteristics, and 2 (6%) to communication and information. The distribution of reasons and factors associated with these four major themes were relatively constant over review period.

Discussion: Several common themes were identified in this review to describe the epidemiology of the under-vaccinated child in low and middle income countries. Access due to geographic barriers (e.g., living in remote/rural areas, clinic too far away) and missed opportunities to vaccinate (e.g., not having a vaccination card at time of visit), for example, were linked to low vaccine uptake in most countries from which articles were identified. Other reasons and factors, especially those linked to parental attitudes and knowledge, such as role of gender, regionally focused and more difficult to interpret. Many of the identified parental attitudes and regarding vaccinations may be 'proxies' for more complex health seeking behaviors and perceived barriers.

In the reviewed literature, the reasons and factors linked to under-vaccination (missing one or more routine vaccinations) were most likely related immunization systems. On the other hand, the reasons/factors associated with being unvaccinated (missing all routine vaccinations) were most likely related to parental attitude or knowledge. The Unvaccinated child may reflect cultural beliefs held by caregivers, regardless of opportunity and access. As stated above, this finding may involve in effect more complex health related behaviors not easily investigated or documented in the published literature.

The findings generated from this systematic literature review only reflect studies and projects from countries that have been published. For example, the reviewed identified the lack of peer-reviewed literature describing reasons and factors associated with low vaccine uptake among children living in Central Africa, certain countries in South East Asia as well as other locations in Eastern Europe. Similarly, this review only reports reasons and factors researched and published in peer-reviewed journals. Other reasons and factors may contribute to children being under or unvaccinated, but have not yet been researched and/or reported in a peer-reviewed journal. As a consequence, the findings from this review should be compared and contrasted with findings from a quantitative analysis of coverage data as well as with information from the grey literature.

Recommendations:

- Ongoing collection and review of newly published literature (along with grey literature) regarding the reasons and factors associated with low vaccine uptake is likely to provide additional insight into the findings identified from this systematic review.

- A more detailed investigation of the specific pathways through which certain family characteristics and parental attitudes are linked to the under-vaccinated child would be informative and helpful in improving coverage.

- Additional research on the reasons and factors linked to low vaccine uptake in countries from which no articles were identified, such as the Democratic Republic of Congo, may prove beneficial.

- Further investigation of gender, both of the child and caregiver as well as the health care worker, could provide insight into reasons for low vaccine uptake within certain high-risk areas.

- Findings from this review along with results from the analysis of the grey literature and DHS data could be used to develop pilot intervention projects designed to improve vaccine uptake in countries with known low routine vaccination coverage.

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1. Background and Objectives

In 2008, the Scientific Advisory Group of Experts on Immunization (SAGE) requested more information on 'the epidemiology of the unimmunized child'. In response to this request, the World Health Organization coordinated a three-part review of current data and literature to explore the reasons and factors associated with low vaccine uptake in low and middle income countries. The Global Immunization Division (GID) was asked to review the published literature regarding the research question. Global immunization partners, the Swiss Tropical Institute (STI) and IMMbasics, analyzed DHS data and the grey literature, respectively.

GID conducted the review and analysis of the peer-reviewed literature. The goal was to identify and review all relevant literature published since 1999 according to the following criteria:

1) Focuses on low and/or middle income countries
2) Examines routine immunization services
3) Describes reasons or factors linked to low vaccine uptake

Information regarding the unvaccinated or under-vaccinated child was systematically-collected from these articles. Due to time constraints and the number of articles identified, GID limited the review period to articles published between 1999 to mid-2009 and to those published in peer-reviewed journals in order to better ensure the quality of information reported.

2. Methodology

The project lead consulted with a reference librarian and qualitative analysis experts at the CDC to conduct this review. GID and external staff were recruited to assist with the full review of identified articles.

2.1a Database search – initial filter. During the initial filter, eight different medical and behavioral and social science literature databases were searched for relevant articles. These included Medline, EMBASE, Sociological Abstracts, Soc Serv Abs, ERIC, Cochrane, Web of Science, and CINALH. The initial search filter was kept broad to encompass all aspects of immunization service delivery and capture the acceptance of immunization in low and middle income countries (**Appendix A**). Low and middle income countries were defined according to United Nations criteria as of 2004. Articles in all five official WHO languages (English, French, Spanish, Portuguese, and Russian) were identified. Duplicate results were eliminated from the search findings when possible.

2.1b Review of titles/abstracts – second filter. All titles and abstracts were reviewed by one person (project lead). Each title/abstract was categorized into one of the three categories: 1) Highly relevant, 2) Possibly relevant, or 3) Not relevant. These categories are defined as follows:

1) *Highly relevant*: Titles included one or a combination of the following terms:
    - Routine immunization
    - Infant (or child) health service utilization
    - Immunization coverage (or survey)
    - Coverage of measles (or other specific EPI vaccination) *OR*

The abstract, if available, mentioned routine immunization and reasons/risk factors related to a child's vaccination status.

In some cases, an article title included the above specified terms, but was still excluded. These exceptions are outlined below in "Not relevant" section.

2) *Possibly relevant*: Titles did not include above, but included broader reference immunization strategies or immunization initiatives in either the title or abstract.

3) *Not relevant*: If neither the title nor abstract included reference to routine immunization, the articles were excluded as not relevant.

This included the following articles:

- Articles investigating immunogenicity of a EPI vaccine (and other serological, genetic investigations)
- Articles investigating non-EPI related immunization, such as HIV, Malaria, HPV, Influenza, etc.
- Articles describing adult vaccinations
- Articles describing global immunization policy (such as optimal schedules, etc.)
- Articles describing cancers, anti-smoking initiatives, etc.

Articles describing mass immunization campaign coverage or general articles describing the epidemiology of VPDs in a country or region were also categorized as not relevant.

2.1c Review of highly relevant articles – third (final) filter. Full articles were retrieved for titles and abstracts assessed as highly relevant during the second filter. These articles were obtained through internet searches, PubMed queries, and the CDC library article request service. If not obtained from one of these sources, the articles was categorized as 'Not found'. Retrieved articles were initially reviewed in full by one person to determine overall relevancy. If the article appeared relevant, the article was distributed to two persons for complete review. A standardized abstraction form was developed, piloted, and used for all article reviews (**Appendix B**). Due to work volume and timeline (for SAGE October 2009 meeting), several additional reviewers were recruited during the course of the review process. Completed abstraction forms were reviewed for any differences and reconciled, if necessary. Articles not written in a WHO language, not discussing an EPI vaccination, or not published in a peer-reviewed journal were excluded. Articles not describing a reason or factor related to a child being under or unvaccinated were excluded.

2.2 Management of articles and collected information. After reconciliation, data from all reviewed articles were entered into a project EZ text database (version 4, Atlanta, GA), a qualitative research software product developed by the CDC STD/HIV Division. The database included quantitative data including date of publication, study type, country in which study was conducted, study quality assessment as well as qualitative information of reasons/factors identified for the under- or unvaccinated child. If a review article was determined not to be relevant, the reasons for this determination were entered. Each step in the review process was tracked in an Excel spreadsheet to assess article status and review progress.

2.3 Study quality. Articles identified as highly relevant were assessed for study/project quality – according to ten criteria. Articles with a score of 70% (or meeting at least 7 of the 10 criteria below) were included in the final review analysis.

1) Study question/hypothesis/purpose of the project defined
2) Target population defined
3) Methods included

4) Recruitment/sampling scheme described
5) Analyses described
6) Source of vaccination information
7) Data/results presented
8) Findings compared to other studies
9) Limitations addressed
10) Major conclusion described

2.4 Definitions. The GID review identified reasons/factors linked to both under-vaccinated and unvaccinated children.

- An under-vaccinated child was defined as any child missing one or more of the recommended EPI vaccinations
- An unvaccinated child was defined as any child missing all EPI vaccinations

2.5 Framework used for classifying factors. Reasons and factors identified from the peer-reviewed literature were categorized according to the "Classification of Factors Affecting Receipt of Vaccines" from *Vaccines* (3rd edition). The major themes included the following:

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

Due to findings identified by the IMMbasics, additional reasons/factors were added to each major theme. **Appendix C** contains the original list of factors, as well as those added by IMMbasics (underlined). In order to facilitate aggregation and comparison, GID applied this same categorization to findings from the peer-reviewed literature. Each reason or factor was classified into one major theme and sub-category. All abstracted reasons/factors were counted equally in determining the frequency of reasons/factors in each of these major themes and sub-categories (i.e. reasons were not weighted according to study type or sample size).

3. Results

3.1 Description of articles. The number of articles identified through the first, second and final filter are presented in **Figure 1**. The initial Medline database search identified 9,480 potentially relevant articles, and the Non-Medline database search identified 6,617 potentially relevant articles. Through the second review (assessment of titles and abstracts), a total of 620 relevant articles were identified (includes 13 articles received directly from IDRC, Canada that were in press at the time of this review). Of these, 209 were determined to be both highly relevant and of good study quality and included in the analysis (**Table 1**). This consisted of 145 articles from the Medline database, 53 articles from the non-Medline database, and 11 articles received from IDRC, Canada. Of the remaining 411 articles, 102 were excluded as not as duplicates, 22 were not found, and 285 were excluded following full review. Roughly 38% of these reviewed articles were excluded based on reviewers' indication that no factor or reason regarding a child's vaccination status was described in the article (**Table 2**). Thirty-three articles (~10%) were excluded due to a low study quality score. Low scores were most frequently linked to failing to describe study limitations, not comparing findings to other studies, and not defining the source of vaccination information.

Roughly 75% of the 209 highly relevant articles were cross-sectional studies or based on a secondary analysis of cross-sectional surveys (such as analyses of DHS data); 11 % were

intervention studies (assessing impact of intervention on vaccination status); 5% were anthropological investigations or results from focus groups, and 4% of articles were categorized as systematic reviews and/or lessons learned. The remaining 5% included a combination of study types (e.g., cross-sectional survey with focus group interviews). No expert opinion or editorial articles were included in the review, as these articles did not meet the study quality criteria.

Fifty-four countries were represented among the 209 articles (**Figure 2**). Forty-nine of these articles (24%) were from India alone. Other countries including Columbia, Brazil, Bangladesh, Burkina Faso, Cambodia, China, Kenya, Pakistan, Nepal, Nigeria, South Africa, and Turkey were also well represented, with between 4 and 14 articles each. The remaining 41 countries were the focus of one to three articles each. Nine additional highly relevant articles focusing on findings from multiple-country or sub-WHO regional studies were included. (**Appendix D** contains country specific fact sheets containing identified reasons and factors related to low vaccine uptake in these countries). Articles discussing reasons and factors linked to the unvaccinated child were identified only from seven countries of the 54 identified above. These included Bangladesh, Benin, India, Nepal, Nigeria, Turkey, and Vietnam. Six of the12 total articles containing these reasons/factors were based on studies conducted in India.

During the review period, there were an increasing number of highly relevant articles identified during more recent years, with the exception of 2009, which only represented articles published (and listed in Medline or non-Medline databases) by March 2009 (**Figure 3**). There were no detectable temporal trends for any of the 12 articles describing reasons/factors related to the unvaccinated child.

3.2 Reasons/factors linked to the under-vaccinated child. A total of 901 reasons or factors linked to low EPI vaccine uptake were abstracted from the 209 relevant articles. Of these, 393 (44%) were Immunization Systems related reasons or factors, 251 (28%) were parental attitudes and knowledge related, 199 (22%) addressed family characteristics, and 58 (6%) were associated with limitations and/or weaknesses in immunization related communication and information.

3.2a Immunization systems. The 393 reasons or factors linked to immunization systems were grouped into 14 subcategories (**Table 3**). The four major sub-categories (based on frequency counts of individual reasons and factors) included 1) access and/or distance to services, 2) missed opportunities, 3) low health worker experience/knowledge, and 4) unavailable vaccines or supplies. Issues relating to access to services included perceived cost of services, cost of transportation, and lack of health insurance. Distance to services was most frequently identified as a reason for low vaccine uptake by caregivers living in rural and/or remote communities, often in locations without a health facility or where outreach services were not conducted on a regular basis. Nevertheless, in a few articles, duration of travel time in an urban setting was noted as a reason for low vaccine uptake. Many children remained under-vaccinated due to missed opportunities, which included not having vaccination card at the time of the clinic visit, vaccinator absent at the designated time of immunization services, and children receiving curative services only (i.e. the child's immunization status was not assessed). Additionally, contraindications to vaccinations were incorrectly interpreted; and children for whom vaccinations were otherwise appropriate were not vaccinated. Although less frequently reported, under-vaccinated children linked to mothers with a lack of or limited access to prenatal or antenatal care.

3.2b Communication and information. The 58 reasons or factors linked to communication and information were grouped into nine subcategories (**Table 4**). The four major sub-categories

included 1) lack of media/radio exposure, 2) poor communication due to perceived provider rudeness or a lack of trust in him/her, 3) the dissemination of inadequate or incorrect information by health care worker, and 4) a lack of community involvement in the expanded program on immunizations. Although communication and information-related reasons/factors were the least frequently linked to low vaccine uptake in the identified literature, these reasons/factors were reported by countries in all WHO regions.

3.2c Family characteristics. The 199 family characteristics-related reasons or factors were grouped into 12 subcategories (**Table 5**). The four major sub-categories included 1) low education level or illiterate caregivers, low socio-economic status, living in large family/having older siblings, and belonging to a minority group/low caste or migrant status. Although the education level of both parents was assessed, the educational level of mother or maternal caregiver was most frequently associated with a child's vaccination status.

3.2d Parental attitudes and knowledge. The 251 reasons or factors linked to parental attitudes and knowledge were grouped into 12 sub-categories (**Table 6**). The four major sub-categories included 1) caregivers' lack of knowledge about immunizations, 2) caregiver misconceptions or fear of vaccinations, 3) low motivation among caregivers, and 4) caregiver opposition to vaccination due to religious/traditional beliefs. Caregivers were frequently not aware of the need and to vaccinate their child or the threat of disease transmission if their child was not vaccinated. The misconceptions or fear of vaccinations ranged from the impression that vaccinations do not work to the concerns that vaccinations harm the child, or cause disease or other adverse event such as sterility. In certain countries, strong religious or traditional beliefs against vaccinations were reported, primarily from Pakistan, Nigeria, Benin, and in certain regions of India. Although less frequently reported, being a female child was also a reason/factor related to low vaccine. The role of a child's gender was primarily identified from studies/projects conducted in India, Pakistan, Bangladesh, Nigeria, and Turkey.

3.2e Other findings. The review identified a number of infrequently reported reasons and factors which could affect the vaccination status of a large number of children in low and middle income countries. The lack of physician referrals for vaccinations, the lack of female health care workers (reported from Pakistan), and limited family discussion regarding immunizations were identified as reasons for low vaccine uptake of childhood vaccinations. Children from families who migrated seasonally and those born during civil conflict and war were also more likely to be under-vaccinated. Weak and inadequate supervision at the local and district level were linked to low coverage. Finally, one article reported that children of HIV positive caregivers were at greater risk of low vaccine uptake compared to children on HIV negative caregivers. Given limited resources and health needs of the HIV positive caregiver, the child's vaccination status may be a lower priority.

3.3 Reasons/factors linked to the unvaccinated child. Thrifty-three reasons and factors were abstracted from 12 articles describing completely unvaccinated children. Of these, 4 (12%) were immunization systems-related reasons or factors, 18 (55%) concerned parental beliefs and/or knowledge reasons or factors, 9 (27%) were related to family characteristics, and 2 (6%) were associated with limitations and/or weaknesses in immunization related communications and Information.

Roughly 33% of the parental beliefs and knowledge reasons and factors were related to religious beliefs or the lack of knowledge and misconceptions regarding vaccinations (**Table 7**). In three of the six articles from India, gender preference (i.e. being a female child) was

associated with being unvaccinated. Living in rural/remote areas, and commuting distances to health facilities were also linked to children being unvaccinated, as was low SES.

3.4 Changes in reasons/factors over time. The distribution of reasons and factors for under-vaccination according to the four major themes were relatively constant over time (**Figure 4**). For example, the percent of all reasons and factors which were immunization systems related ranged from a high of 58% in 2000 a low of 35% in 2009. Communication and information-related reasons and factors remained the lowest frequently-reported category each year during the review period, ranging between 1% and 10% of reasons and factors reported each year.

4. Discussion

4.1 Interpretation of findings. A number of common themes were identified in this review to describe the epidemiology of the under-vaccinated child in low and middle income countries. Many of these themes, including limitations and/or weaknesses in the immunization system were similar across the review period (1999 to 2009) and region. Access due to geographic barriers (living in remote/rural areas, clinic too far away) and missed opportunities to vaccinate, for example, were linked to low vaccine uptake in most countries from which articles were identified, which underscores the robustness of these findings. Other reasons and factors, especially those linked to family characteristics and to some degree, parental attitudes and knowledge, may be more difficult to interpret. Low educational level and low socioeconomic status (often strongly correlated) were linked to low vaccine uptake in the majority of reviewed articles. The 'cause' of these observed associations, however, was rarely investigated. Similarly, a person's religious background was associated with low vaccine uptake. In many cases, it was unclear if this association was due to religious convictions or possibly related to more complex health seeking behaviors or perceived barriers, such as belonging to a minority ethnic or language group. A better understanding of the pathways between these reasons and factors as well as the relationship between the different reasons and factors and a child's immunization status would be informative and helpful in improving coverage. Finally, the link of prenatal or antenatal care with a child's vaccination status is noteworthy. Increasing access to the health care system during pregnancy could improve pre-natal care as well as provide opportunities for promotion of child preventive services, including vaccinations.

While just half of the reasons and factors linked to being under-vaccinated (missing one or more routine vaccinations) were immunization system related, the majority of reasons/factors associated with being unvaccinated (missing all routine vaccinations) were related to parental attitudes and knowledge, according to the reviewed literature. This suggests that caregivers will likely bring their partially vaccinated children to obtain vaccinations if there is adequate access and minimal opportunity costs. On the other hand, completely unvaccinated children may reflect beliefs on the part of the caregivers, regardless of opportunity and access.

There were a few infrequently reported findings that may merit additional investigation. For example, understanding whether under-vaccinated children of HIV positive caregivers was a unique finding in one study which could be potentially be a reason or factor in other locations, could have important implications for improving vaccination coverage in countries and regions with a high prevalence of HIV. Similarly, the gender of the health care worker was identified as a reason for low vaccine uptake among children in Pakistan, but not elsewhere. The absence of this finding elsewhere could constitute a research bias, an artifact of the peer-reviewed literature, or a country-specific reason or factor related to low vaccine uptake.

4.2 Limitations

4.2a Review methodology. Although efforts were made to identify all relevant articles, the review methodology may have not captured all pertinent articles during the specified time period. As a result, this methodology may have potentially introduced some bias into the presentation and interpretation of the results. The initial search of literature databases used a broad search filter to capture as many articles as possible. A few sources of information, primarily articles published in the CDC's MMWR and WHO's WER, were not included in review findings as these were non-peer reviewed articles. It is unclear whether the exclusion of these sources biased the results or not. Additionally, the second filter, the review of titles and abstracts, was conducted by one person and due to the number and variability of articles identified during the initial filter, some subjective judgment was required in identifying likely relevant articles. This subjectivity was minimized with a set of pre-defined inclusion criteria. Nevertheless, there were occasionally titles and abstracts that were not easily categorized. Due to time restrictions, articles were reviewed by different sets of primary and secondary reviewers. Standardized review instructions and abstraction forms were provided. However, the use of different reviewers for different articles may have introduced bias in the assessment of relevancy as well as in the documentation of reasons and factors linked to under- or unvaccinated children. The observed consistency of findings over time, however, suggests that overall the potential bias due to the described methodology is likely to be minimal.

4.2b Reliability of Findings. Despite different study designs and sample sizes, each reason/factor abstracted from articles meeting the minimum study quality criteria' was weighted equally. The magnitude of any association between the reason/factor abstracted and child's vaccination status was not abstracted. Therefore, reasons and factors from relatively small projects and low quality scores contributed equally to review findings as large quantitative studies. Assessment of the magnitude of associations is better done using standardized quantitative evaluations such the analysis of the DHS data conducted by STI.

Classification of reasons/factors into the four major themes was not always intuitive. Reasons and factors are often complex and cross-cut over several categories. For example, a caregiver who does not believe in vaccinations – a parental belief and knowledge findings – may not have had a good experience during a previous visit to the clinic. Findings reported here reflect the categorization of all reasons and factors in a standardized manner, according to the definitions provided. Overlap between the sub-categories and major themes likely occurred, but were not easily captured.

4.2c Research bias. The findings from this systematic literature review only reflect the reasons and factors researched and published in peer-reviewed journals. Other reasons and factors may strongly contribute to children being under or unvaccinated, but have not been researched and/or reported in the peer-reviewed journal. As a consequence, the findings from this review should be compared and contrasted with findings from quantitative analysis of coverage data, as well as with information in the grey literature and other sources that may not yet have been aggregated into an official report. Collectively, information from these varied sources can describe the major factors for low vaccine uptake and be used to develop effective strategies for improving vaccination coverage for all children.

5. Conclusions and recommendations

The review identified several general patterns regarding the reasons and factors associated with the under-vaccinated and unvaccinated child in low and middle income countries. Access and distance to immunization services as well as missed opportunities to vaccinate were universally linked to low vaccine uptake. The review also identified certain information gaps, including the

lack of peer-reviewed literature describing reasons and factors linked to the under-vaccinated child in Central Africa, certain countries in South East Asia as well as other locations in Eastern Europe. Additionally, certain factors, such as the role of gender, were identified only from certain countries. Further investigation of gender, both of the child and caregiver as well as the health care worker, could provide insight into reasons for low vaccine uptake within certain high-risk areas. Nevertheless, the consistency of findings (percent of reasons/factors in each major theme) over time suggests that the findings from this review along with results from the review of the grey literature and DHS data analysis can be used to develop appropriate intervention projects to improve routine vaccination coverage.

Recommendations:

- Ongoing collection and review of newly published literature (along with grey literature) regarding the reasons and factors associated with low vaccine uptake is likely to provide additional insight into the findings identified from this systematic review.

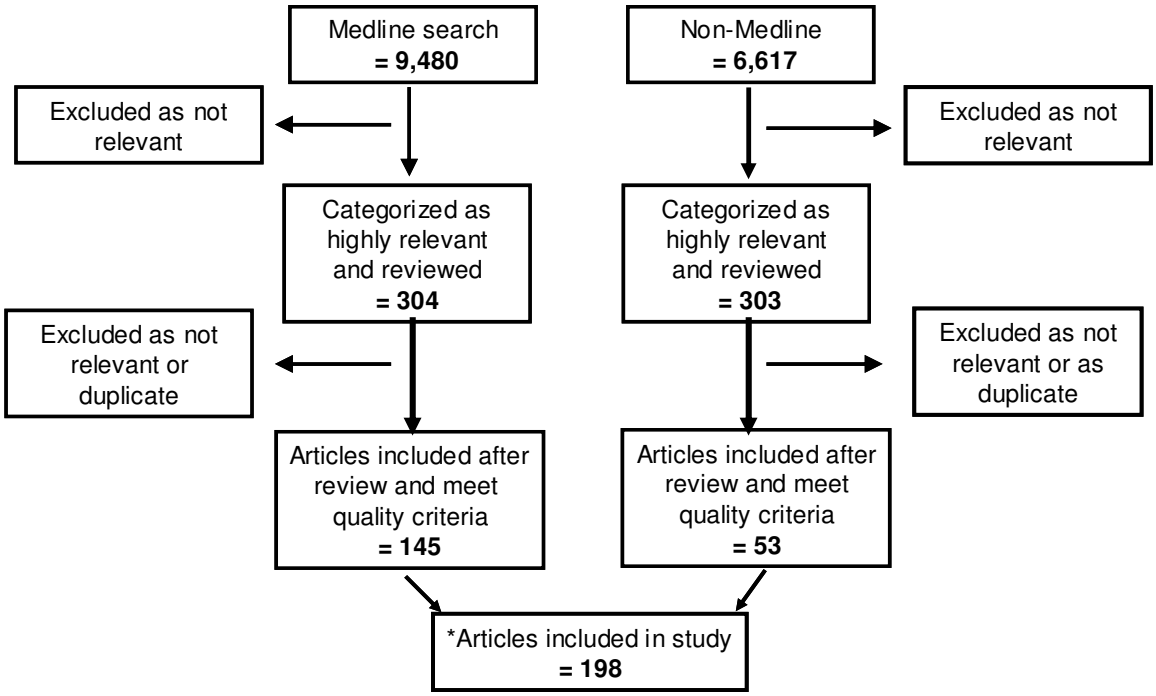
- A more detailed investigation of the specific pathways through which certain family characteristics and parental attitudes are linked to the under-vaccinated child would be informative and helpful in improving coverage.

- Additional research on the reasons and factors linked to low vaccine uptake in countries from which no articles were identified, such as the Democratic Republic of Congo, may prove beneficial.

- Further investigation of gender, both of the child and caregiver as well as the health care worker, could provide insight into reasons for low vaccine uptake within certain high-risk areas.

- Findings from this review along with results from the analysis of the grey literature and DHS data could be used to develop pilot intervention projects designed to improve vaccine uptake in countries with known low routine vaccination coverage.

Figure 1. Flowchart of database search and article review



*Does not include 13 articles received directly from IDRC (Canada)

Table 1. Relevant articles included in the review, by each inclusion filter

	First filter	Second filter	Final
Medline	9,480	304	145
Non-Medline	6,617	303	53
Other	---	13	11
Total	16,097	620	209

*Other includes 13 articles received directly from IDRC (Canada)
Final review indicates full article review and assessment of study quality

Table 2. Articles excluded during final filter (full review), from 304 Medline and 303 Non-Medline articles*

	Medline	Non-Medline	Other^	Total
Not in WHO Language	11	4	0	15
Not EPI Vaccine	18	16	0	34
Not Peer Reviewed	15	44	0	59
No Reason Described	63	46	2	111
Low Study Quality	19	14	0	33
Other article factors~	13	22	0	35
Total Excluded	139	146	2	287

*Does not include 102 duplicates and 22 articles not found which were excluded prior to full review
^Other includes 13 articles received directly from IDRC (Canada), 2 were excluded
~Other article factors include articles discussing campaign related activities, broad policy reasons/factors, etc.

Table 3. Frequency of immunization systems related reasons/factors from reviewed articles, 1999 – 2009

Sub-categories	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Access/Distance to services*	8	8	4	3	7	6	10	18	7	17	10	98
Living in rural area	3	2	2	2	6	1	6	4	3	3	3	35
Lack of supplies/vaccines	3	3	2	3	1	5	1	7	0	5	2	32
Poor health worker knowledge/training	2	0	4	1	3	0	3	4	5	9	7	38
Poor service quality and reliability^	0	2	4	4	2	1	0	2	1	5	4	25
Lack of antenatal/perinatal care	0	4	0	5	2	0	0	3	5	8	2	29
Missed opportunities~	10	8	7	4	7	3	3	14	5	9	3	73
Living in urban area	0	0	0	0	0	0	0	1	1	0	0	2
Living in settlement/slum area	0	0	0	0	2	3	0	0	1	0	0	6
Lack of physician referral to services	0	0	3	1	1	1	1	0	0	3	0	10
Cost of vaccinations**	2	1	3	0	4	2	5	3	2	2	1	25
Poor timing/availablity of vaccinators	3	2	4	0	1	1	2	2	1	0	0	16
Vaccination schedule	0	0	0	0	0	0	0	1	1	0	0	2
Migration patterns	0	0	1	0	0	1	0	0	0	0	0	2
Total	31	30	34	23	36	24	31	59	32	61	32	393

*Includes lack of outreach services in community, and poor access due to civil/armed conflict
~Includes both direct and indirect - transportation costs, etc.
^Includes no vaccination card, incorrect contraindications, lack of integrated services (e.g. curative only)

Table 4. Frequency of communication and Information related reasons/factors from reviewed articles, 1999-2009

Sub-categories	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Lack of health educators	0	0	0	0	0	0	0	0	1	2	2	5
Poor communication from health worker	0	0	4	1	1	1	0	0	1	1	1	10
Inadequate media messages	0	0	0	0	0	0	0	0	0	0	1	1
Lack of media exposure	2	0	1	1	1	0	0	4	2	2	3	16
Lack of community involvement	0	0	0	0	0	0	0	2	0	0	2	4
Incorrect information provided	1	1	1	0	0	0	0	3	0	6	0	12
Gender of health worker	0	0	0	0	0	0	0	0	1	1	0	2
Lack of trust or social connections	0	0	1	2	1	0	0	1	1	0	0	6
Lack of home visits by health worker	0	0	0	0	1	0	1	0	0	0	0	2
Total	3	1	7	4	4	1	1	10	6	12	9	58

Table 5. Frequency of family characteristics related reasons/factors from reviewed articles, 1999-2009

Sub-categories	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Illiterate caregivers	1	1	1	2	2	3	2	3	4	2	1	22
Low education level of caregivers	3	1	4	6	5	4	6	5	5	10	5	54
Low socioeconomic status	4	0	1	0	6	6	10	5	6	9	4	51
Large sibship/birth order	3	1	2	1	3	2	7	4	3	5	1	32
Belonging to minority group/low caste	0	1	0	2	3	0	2	1	2	2	1	14
Migrants	0	1	0	1	1	1	1	2	3	2	0	12
Blue collar worker/occupation	0	0	2	1	0	1	0	0	0	1	0	5
Marital status - mom unmarried	0	0	1	0	0	1	1	1	0	0	0	4
Male headed household	0	0	0	0	1	0	0	0	0	0	0	1
Mother's age	0	1	1	0	0	0	0	0	0	0	0	2
Other domestic issues (conflict/death)	0	0	1	1	0	0	0	0	0	0	0	2
Total	11	6	13	14	21	18	29	21	23	31	12	199

Table 6. Frequency of parental attitudes/knowledge related reasons/factor from reviewed articles, 1999-2009

Sub-categories	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Motivation	3	6	6	5	1	7	4	4	2	2	4	44
No understanding of vaccine importance	4	3	6	3	3	3	3	8	5	5	9	52
No information on when to vaccinated	1	2	2	0	1	1	7	6	1	4	2	27
Misconception of vaccinations	1	1	4	3	1	0	0	4	1	4	4	23
Fear of side effects	1	3	3	3	1	0	3	8	3	4	2	31
Being female child	2	0	0	1	4	1	3	2	3	2	4	22
Religious/cultural beliefs against vaccines	0	0	3	1	0	1	1	6	2	1	9	24
Lack of family discussions on vaccines	0	0	1	0	1	0	0	1	1	0	3	7
Reject vaccinations - no reason	1	0	0	0	0	0	1	0	0	0	1	3
Mother's autonomy	0	0	0	0	1	0	0	0	1	1	1	4
Previous bad experience with clinic*	1	0	2	0	0	0	1	4	1	2	0	11
Social pressure against vaccinations	0	0	1	0	1	0	0	1	0	0	0	3
Total	14	15	28	16	14	13	23	44	20	25	39	251

*Includes lack of trust due to previous experiences or due belonging to different ethnic/language group, etc.

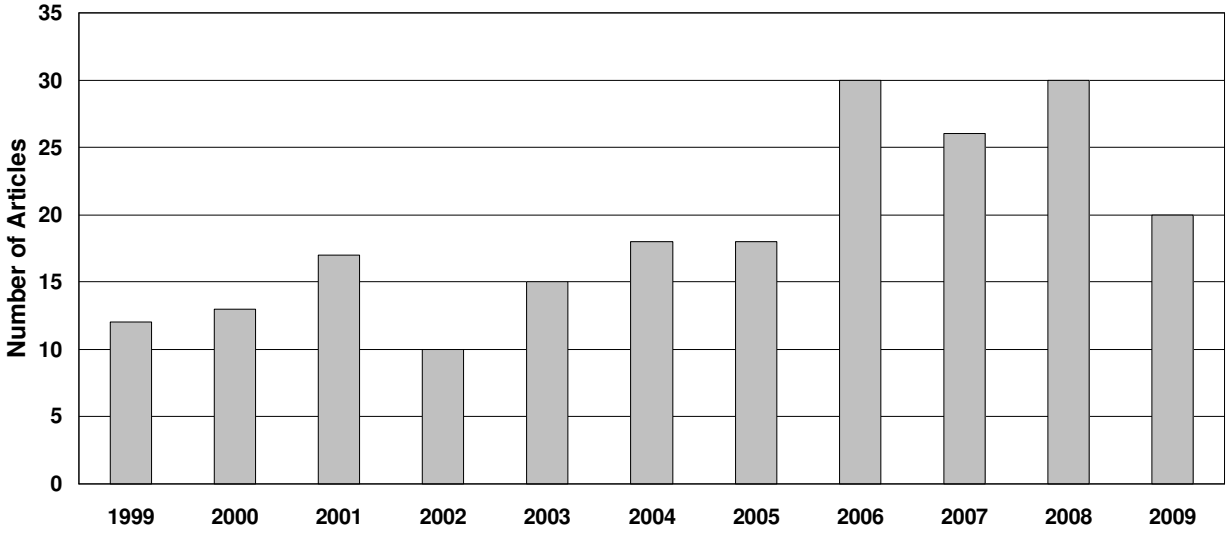
Table 7. Frequency of factors and reasons linked to the unvaccinated child, 1999 - 2009*

Themes and subcategories	Frequency
Immunization systems	
Living in rural area	3
Distance to health facility	1
Limited access to prenatal services	1
Communication and information	
Lack of information on schedule, location, and timing of vaccinations	2
Family characteristics	
Low SES	3
Low parental education level	3
Occupation as laborers	1
Large family size	1
Parental attitudes/knowledge	
Being a female child	2
Religious/traditional beliefs against vaccinations	7
Fear/concerns of vaccine safety	2
Lack of knowledge of vaccinations and VPDs	3
Lack of motivation	4
Total	33

*From 12 articles presenting reasons/factors associated with children completely unvaccinated (no previous EPI vaccination).

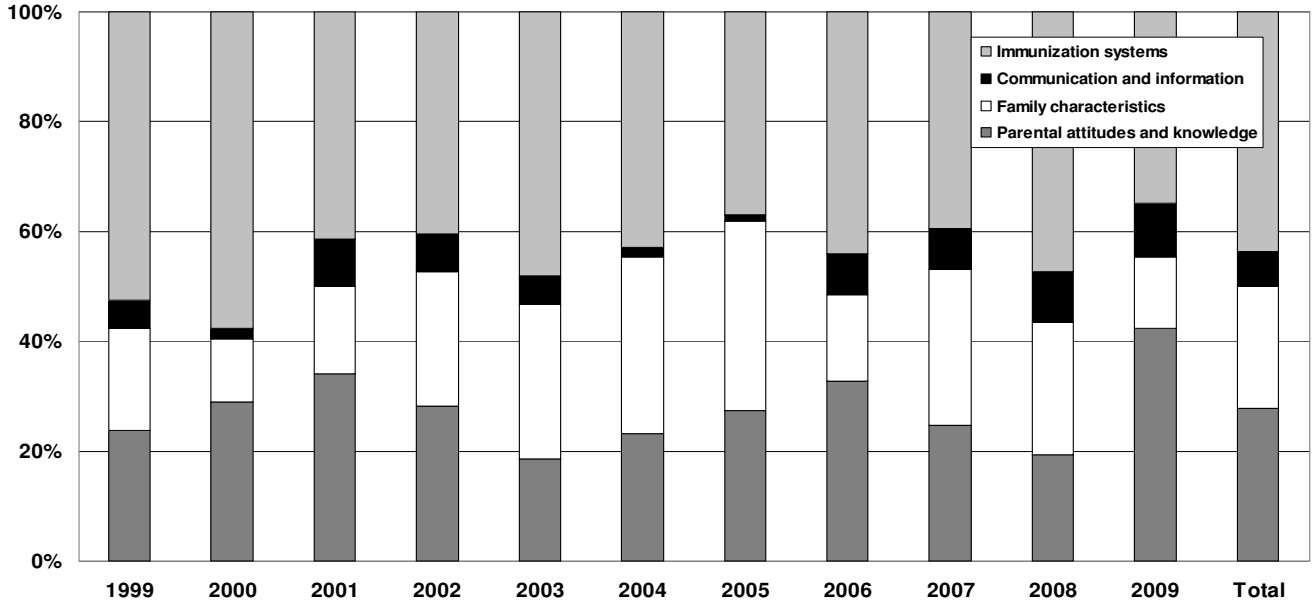
Figure 2. Relevant articles (n = 209) by country, 1999 – 2009 (excludes 9 global/regional articles)

Figure 3. Number of relevant articles (n = 209) by year published, 1999 – 2009*



*2009 only reflects articles published by March 2009 (exception are articles in press at the time of the review received directly from IDRC, Canada)

Figure 4. Reasons and factors identified from peer-reviewed published literature by year, 1999 – 2009.



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Appendix A: Search criteria coding used for initial filter

1) MEDLINE+ (17,751)
exp Immunization/ or **exp vaccines/** or vaccine* or vaccinat* or immuniz* or immunis*

AND

exp Developing Countries/ or ((develop* or low income or low-income or lower income or lower-income or middle income or middle-income) adj5 (country or countries)) or Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar* or Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina* or Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua* or Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica* or Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian or Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*

exclude:
animal studies
exp *Veterinary Medicine/ or exp *Rabies/ or exp *Rabies virus/ or exp *Influenza in Birds/ or exp *HIV/ or (immunolog* or serolog*).ti

2) EMBASE 1980-current (13,228)

exp Immunization/ or exp vaccine/ or (vaccine* or vaccinat* or immuniz* or immunis*)

AND

exp Developing Country/ or ((develop* or low income or low-income or lower income or lower-income or middle income or middle-income) adj5 (country or countries)) or (Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar* or Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina* or Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua* or Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or

Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica* or Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian or Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*).ti,ab

***NOTE: because EMBASE has journals more likely to have been published in other countries, I limited the "country" part of the search to title and abstract to avoid author affiliation, publisher, etc.*

exclude:
animal studies
exp *Veterinary Medicine/ or exp *Rabies/ or exp *Rabies virus/ or exp *Avian Influenza/ or exp *Human Immunodeficiency Virus/ or (immunolog* or serolog*).ti

3) Sociological Abstracts (CSA) (217)
4) Social Services Abstracts 1979-current (CSA) (126)
5) ERIC (CSA) (126)

DE="immunization programs" or DE="vaccination" or KW=(vaccine* or vaccinat* or immuniz* or immunis*)

AND

DE=("developing countries") or KW=((develop* or low income or low-income or lower income or lower-income or middle income or middle-income) within 5 (country or countries)) or KW=(Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar* or Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina* or Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua* or Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica* or Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian or Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*)

exclude:
TI=(immunolog* or serolog*)

6) COCHRANE (2039)

exp Immunization/ or exp vaccines/ or vaccine* or vaccinat* or immuniz* or immunis*

AND

exp Developing Countries/ or ((develop* or low income or low-income or lower income or lower-income or middle income or middle-income) near/5 (country or countries)) or Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar* or Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina* or Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua* or Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica* or Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian or Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*

exclude:
exp *Veterinary Medicine/ or exp *Rabies/ or exp *Rabies virus/ or exp *Influenza in Birds/ or exp *HIV/ or (immunolog* or serolog*):ti

7) Web of Science (11866)

TS=(vaccine* or vaccinat* or immuniz* or immunis*)

AND

TS=((develop* or low income or low-income or lower income or lower-income or middle income or middle-income) SAME (country or countries)) or *need to do in chunks*
TS=(
Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar*
or
Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina*
or
Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua*
or
Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or

Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica*
or
Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian
or
Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*
)

exclude:
Immunology, Veterinary Science and Zoology
TI=(immunolog* or serolog*)

7) CINAHL (4257)

(MH "Immunization+") or (MH "Vaccines+") or vaccine* or vaccinat* or immuniz* or immunis*

AND

(MH "Developing Countries") or (develop* or low income or low-income or lower income or lower-income or middle income or middle-income) or Afghan* or Bangladesh* or Benin or Burkina Faso or Burkinabe or Burundi* or Cambodia* or African or Chad or Chadian or Comoros or Cormoran or Congo* or Cote d'Ivoire or Ivorian or Eritrea* or Ethiopia* or Gambia or Ghana* or Guinea* or Guinea-Bissau* or Haiti* or Kenya* or Korea* or Kyrgyz or Kirghiz or Lao or Laotian or Liberia* or Madagascar or Malagasy or Malawi* or Mali or Malian or Mauritania* or Mozambi* or Burma or Burmese or Myanmar* or Nepal or Nepalese or Niger or Nigeri* or Pakistan* or Papua New Guinea* or Rwanda* or Sao Tome* or Principe or Senegal* or Sierra Leone* or Solomon Island* or Somali* or Tajik* or Tadzhik or Tanzania* or Togo or Togolese or Uganda* or Uzbek* or Vietnam* or Yemen* or Zambia* or Zimbabwe* or Albania* or Algeria* or Angola* or Armenia* or Azerbaijan* or Bhutan* or Bolivia* or Bosnia* or Herzegovina* or Cameroon* or Cape Verd* or China or Chinese or Colombia* or Congo* or Djibouti or Dominican or Ecuador* or Egypt* or El Salvador or Salvadoran or Georgia* or Guatemala* or Guyana or Hondura* or India or Indonesia* or Iran or Iranian or Iraq* or Jordan* or Kiribati or Lesotho or Mosotho or Basotho or Macedonia* or Maldives or Maldivan or Marshall Islands or Marshallese or Micronesia* or Moldova* or Mongolia* or Morocc* or Namibia* or Nicaragua* or Paraguay* or Peru or Peruvian or Philippines or Filipino or Samoa* or Sri Lanka* or Sudan or Sudanese or Swaziland or Swazi or Syria* or Thailand or Thai or Timor-Leste or Tonga* or Tunisia* or Turkmen* or Ukrain* or Vanuatu or Ni-Vanuatu or West Bank or Gaza or American Samoa or Argentin* or Belarus* or Belize* or Botswana or Motswana or Batswana or Brazil* or Bulgaria* or Chile or Chilean or Costa Rica* or Croatia or Croat or Cuba or Cuban or Dominica or Fiji* or Gabon or Gabonese or Grenada or Grenadian or Grenadan or Jamaica* or Kazakhstan* or Latvia* or Lebanon or Lebanese or Libya* or Lithuania* or Malaysia* or Mauritius or Mauritian or Mayotte or Mexic* or Montenegro or Palau* or Panama* or Poland or Pole or Polish or Romania* or Russian or Serbia* or Montenegrin or Seychell* or South Africa* or "Kitts and Nevis" or Kittian or Nevisian or "St. Lucia" or Saint Lucia* or "St. Vincent" or Saint Vincent or Grenadines or Suriname* or Turkey or Turk or Uruguay* or Venezuela*

exclude:
animal studies
(MM "Veterinary Medicine") or (MM "Rabies") or (MM "Influenza, Avian") **or** (MM "Human Immunodeficiency Virus+") or TI immunolog* or TI serolog*

Appendix B. Standardized abstraction form

Article Information	
Author:	
Title:	
Year published:	Year study conducted:
Abstraction Information	
Abstractor Name:	Abstraction Date:
☐ Not Relevant ☐ Potentially Relevant ☐ Highly Relevant	
If *not* relevant, why? ☐ Not in WHO Language ☐ No Reason/factor described ☐ Not EPI vaccination ☐ Not Peer-Reviewed Journal ☐ Other _____	
Type of Study	
Cross-sectional studies (including community surveys and other observational studies) ☐ Intervention studies (pre/post projects, case-control studies, community trials) ☐ Systematic reviews ☐ Lessons learned ☐ Focus group/anthropological investigations ☐ Expert opinion/editorial ☐ Other ☐ _____ (specify)	
Country:	Data available for meta-analysis ☐
Setting: Community: ☐ School: ☐ Institution: ☐ Secondary data analysis: ☐ Other: ☐ _____ (i.e. meeting)	

Quality of study (were following topics/issues addressed in article?)

Study question/hypothesis/purpose of project defined? □ No □ Yes (describe if unsure):

Target population presented? □ No □ Yes	Methods included? □ No □ Yes
Recruitment/sampling described? □ No □ Yes	Analyses described? □ No □ Yes
Source of vaccination information? □ No □ Yes If survey, check if verified (e.g. by card): □	Data/results presented? □ No □ Yes
Findings compared to other studies? □ No □ Yes	Limitations addresses? □ No □ Yes

Major conclusion described? □ No □ Yes (describe if unsure):

Findings from article

Vaccinations (specific antigens referenced in article):

1) Measles □ 4) BCG □ 7) Pneumo □
2) DPT □ 5) Yellow Fever □ 8) Hib □
3) Polio □ 6) Hep B □ 9) Rotavirus □
10) All EPI vaccinations □ 11) Vaccinations in general □

Reasons for not vaccinated

Were reasons for children not being vaccinated primary or secondary focus of paper? □ 1st □ 2nd

Reasons children were unvaccinated/not fully vaccinated according to paper (check all that apply):

Family characteristics □ Immunization systems □ Other □
Parental attitudes/knowledge □ Communication and information □

Gender Related Topics Included in Article

Gender topic covered in article? □ No □ Yes

If yes, check all that apply:

Gender of children □ Gender of health care worker □
Education level of mother vs. father □ Gender role in child care giving □
Women's empowerment □ Other □

List Reasons for not vaccinated

Reason #1: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #2: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #3: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #4: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #5: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #6: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #7: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #8: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #9: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #10: (related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #11(related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Reason #12(related to 'zero-dose' child □)
(qualitative only □, univariate analysis □, multivariate analysis □)

Other articles identified from references:

If other reasons are listed, document on the back of this page.

Appendix C. Categorization of factors/reasons

Immunization systems

- 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 (GID placed this in Communication and Information)
- Female headed household

Parental attitudes and 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

Appendix D. Country fact sheets

Description:
Following pages list reasons/factors associated with un- or under vaccinated children from peer-reviewed articles published between 1999 and 2009 identified from Medline and non-Medline databases by country. Listing order does not reflect importance or magnitude. A summary is provided to highlight most frequently cited reasons/factors.

Definitions:
Reason/factor categories from Vaccines, 3rd edition

Sources:
Population estimates from: U.S. Census Bureau, International Data Base, Population by age and sex for 2009, (http://www.census.gov/idb/country.php)

DTP3 Coverage estimates from: Institute of Health Metrics and Evaluation, DTP3 Coverage (Global), http://www.healthmetricsandevaluation.org/resources/datasets/dtp3/dtp3_data.php)

Afghanistan

Total population: 28,395,716
Population < 5 years of age: 4,319,222
Estimated Routine Coverage (2006 DPT3): 65% (95% CI 34%– 89%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Insecure areas with limited access/delivery of immunization services

Communication and information:
--None identified

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--None identified

Angola

Total population: 12,799,293
Population < 5 years of age: 2,134,188
Estimated Routine Coverage (2006 DPT3): 41% (95% CI 17%– 70%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Weak routine immunization program, primarily due to civil conflict, affecting certain ethnic groups

Immunization Systems:
--Civil conflict (war) linked to low vaccine coverage
--Proximity to conflict linked to low vaccine uptake
--Living in rural area linked to low vaccine uptake, especially during civil conflict

Communication and information:
--No radio ownership linked to low vaccine uptake

Family Characteristics:
--Belonging to minority ethnic group linked to access to health services and vaccine uptake
--Male headed household linked to low vaccine uptake (compared to female headed household)
--Low education level linked to vaccine uptake
--Low socio-economic factors linked to low vaccine uptake

Parental Attitudes and Knowledge:
--None identified

Argentina

Total population: 40,913,584
Population < 5 years of age: 3,619,567
Estimated Routine Coverage (2006 DPT3): 83% (95% CI 41%– 97%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Children in large families without insurance, with large sibship and low parental education level at highest risk

Immunization Systems:
--Lack of health insurance
--Living in certain zone in city
--Uninsured caregiver
--Children served by public health facilities (compared to private clinics)
--Children not attending day care linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Low socio-economic status of family
--Low educational level of head of household
--Children living in households without running more likely to be under vaccinated
--Birth order
--Low parental education
--Born later in the sibship linked to low vaccine uptake (not being born first)
--Lower education level of caregiver
--Having single parent family linked to lower vaccine uptake
--Shortage of money in the household

Parental Attitude and Knowledge:
--Illness of child

Bangladesh

Total population: 156,050,883
Population < 5 years of age: 18,276,825
Estimated Routine Coverage (2006 DPT3): 91% (95% CI 86% - 94%)
Number of relevant articles: 11

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization services in hard to reach/remote locations (including areas prone to seasonal flooding), poor knowledge level among caregivers regarding vaccinations linked to low vaccine uptake

Immunization Systems:
--Lack of intensive outreach services
--Residing in a rural settlement linked to low vaccine uptake
--Distant proximity (> 2 miles) to outreach clinic linked to low vaccine uptake
--Lack of health care worker in community
--Clinic staff providing only one service at a time (no integration)
--Missed opportunities among children living close to clinic (< 1 km) but in family with many siblings (> 2 children)
--Children living in rural areas less likely to be fully vaccinated - poor access to outreach clinics
--Children in urban slums less likely to be fully vaccinated
--Children living in areas prone to seasonal flooding linked to low vaccine uptake
--Low health care staff to population ratio linked to low vaccination coverage (a large number of unfilled field positions remain vacant for several years)
--Children of families living in locally owned tea estates less likely to be fully vaccinated (compared to children living on foreign born owned estates)
--Irregular or cancelled EPI sessions linked to lower coverage
--Inadequate time spent at EPI spots (due to travel time) linked to lower coverage, geographic barriers
-- Accessibility to health center, far distance
--Health promoter did not want to provide services to the poorest clients

Communication and Information:
--Lack of interaction between caregivers and health care workers
--Poor behavior of health care workers
--Families with no exposure to mass media were less likely to have immunized children
--Low coverage linked to limited awareness of EPI sessions
--Low coverage due to lack of community involvement in EPI program

Family Characteristics:
--If no outreach services, mothers' low education level linked to low vaccine uptake
--Less than primary school education level of mother linked to low vaccine uptake
--Poorer households linked to low vaccine uptake
--Lower maternal education level of mother linked to low vaccine uptake (less than secondary school)

--Children of fathers in unsalaried jobs less likely to be fully vaccinated
--Belonging to minority ethnicity or religious group (lower caste-Hindu)linked to lower vaccine uptake
--Low economic status linked to poor access to health services (e.g. transportation to clinic, etc.)
--Family issues
--Parents with less education were less likely to have immunized children
--Being poor linked to low vaccine uptake
--Illiterate mother

Parental Attitudes and Knowledge:
--If no outreach services, female gender linked to low vaccine uptake
--Lack of interaction between caregivers and health care workers
--Being female gender linked to low vaccine uptake
--Lack of awareness among mothers about availability of specific health services and health needs
--Limited emancipation of women linked to low vaccine uptake (conservative attitudes towards women)
--Parents lack of information
--Lack of motivation
--Mother's poor knowledge about benefits of complete vaccination
----Lack of parental awareness on importance of immunizations
--Lack of parental awareness regarding number of subsequent doses needed to be fully vaccinated
--Lack of awareness for timing of service delivery
--Lack of awareness regarding age at which vaccines should be received

Benin

Total population: 8,791,832
Population < 5 years of age: 1,522,774
Estimated Routine Coverage (2006 DPT3): 68% (95% CI 56% - 78%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
Poor knowledge and understanding of benefits of immunizations among caregivers, and role of anti-vaccination promotion among certain religious groups linked to low vaccine coverage

Immunization Systems:
--Missed opportunities to vaccinate
--Poor knowledge of health worker regarding immunization services
--Lack of household resources to travel to clinic/hospital (related to low utilization of general health services

Communication and Information:
--Caregivers being uncomfortable with hospitals/staff (related to low utilization of general health services)
--Behavior of health officials were tactless and negative
-- Poor communication between staff and caregivers (related to low utilization of general health services)

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--Traditional beliefs, culture, religious practices (related to low utilization of general health services)
--Religious followers (Christian) reject vaccinations due to only God protects children
--Religious followers (Christian) believe that vaccinations make children sick (misinformation)
--Religious followers (Christian) believe that vaccinations are made by 'white witch doctor'
--Religious followers (Christian) believe vaccinations are 'poison'
--Religious leaders promote non-vaccination beliefs
--Culturally against oral vaccines, if no scar, not beneficial
--Mothers hate bureaucratic hassles including expenses for travel
--Mothers' lack of information on vaccinations (vaccinations cause anemia)

Botswana

Total population: 1,990,876
Population < 5 years of age: 226,170
Estimated Routine Coverage (2006 DPT3): 97% (95% CI 90%– 99%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Poor access to services, missed opportunities to vaccinate, and limited communication from health care workers regarding benefits of immunizations

Immunization Systems:
--Distance to health care worker linked to low vaccine uptake
--Hard to reach children neglected due to competing demands of health system
--Clinic hours not convenient for caregivers
--Drops-out due to frequent movement or seasonal relocations
--Shortages of vaccines (stock-outs)
--Missed opportunity as health care workers not checking immunization status of children during curative visits
--Lack of human and material resources for immunization services (diverted by HIV)

Communication and information:
--Need for additional doses not communicated adequately to parents (do not understand)
--Negative attitudes of health care workers

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--Parents refuse vaccinations due to religious reasons

Brazil

Total population: 198,739,269
Population < 5 years of age: 17,974,073
Estimated Routine Coverage (2006 DPT3): 90% (95% CI 74% - 98%)
Number of relevant articles: 6

Summary of reasons/factors linked to un/under-vaccinated children:
A number of missed opportunities to vaccinate children and caregivers' (mothers') low knowledge level regarding benefits of vaccinations

Immunization Systems:
--Lack of vaccines
--Lack of integrated health services linked to missed opportunities for vaccination
--Poor/inefficient neonatal services linked to low vaccine uptake
--Missed opportunities by community pediatricians

Communication and Information:
--Lack of communication related to location and timing of vaccination services
--Limited exposure to media linked to low vaccine uptake

Family Characteristics:
--Low education level of mother linked to low vaccine uptake
--Larger number of siblings (> 3) linked to low vaccine uptake
--Parents with lower income less likely to have fully vaccinated children
--Occupation of caregiver influences vaccine uptake

Parental Attitudes and Knowledge:
--Immunizations are a low priority to parents
--Limited awareness among mothers regarding immunizations
--Mother's fear of subjecting their children to injections (feeling sorry for child)
--Empathy or feeling sorry for child linked to low vaccine uptake
--Lack of awareness/education about vaccinations

Burkina Faso

Total population: 15,746,233
Population < 5 years of age: 2,881,107
Estimated Routine Coverage (2006 DPT3): 78% (95% CI 58% – 92%)
Number of relevant articles: 6

Summary of reasons/factors linked to un/under-vaccinated children:
Mothers with low education and income levels most likely to not completely vaccinate their children, limited knowledge and many misconceptions about vaccinations

Immunization Systems:
--Limited provider's experience linked to low vaccine uptake (do not want to open new vial)
--Lack of vaccine supply linked to low vaccine uptake
--Lack of pre-natal care linked to low vaccine uptake
--Lack of resources at district level
--Having to pay for vaccination card
--Children without a vaccination card linked to low vaccine uptake (not being completely vaccinated)
--Lack of strong leadership at district level (i.e. in district health officer)

Communication and Information:
--Having the perception of communication problems with health workers linked to low coverage (not being completely vaccinated)

Family Characteristics:
--Mother's with low education level linked to low vaccine uptake
--Low education level of mother
--Low family income linked to low vaccine uptake
--Low income linked to low vaccine uptake
--Family's poor economic status linked to low vaccine uptake (not being fully vaccinated)

Parental Attitudes and Knowledge:
--'Parents don't care for their children's health'
--Vaccinations are too complex and constraining procedure (difficult to obtain and keep vaccination card)
--Parents reject vaccinations
--Parental misconception and lack of knowledge about immunizations, appropriate age to get child vaccinated
--Lack of information regarding immunizations
--Family is traveling or not at home when vaccinations are scheduled
--Child was sick and was not vaccinated

Cambodia

Total population: 14,494,293
Population < 5 years of age: 1,654,489
Estimated Routine Coverage (2006 DPT3): 78% (95% CI 62% - 89%)
Number of relevant articles: 4

Summary of reasons/factors linked to un/under-vaccinated children:
Children living in remote or rural areas linked to low vaccine uptake

Immunization Systems:
--Increased use of private health clinics where vaccinations are refused due to cost (still free at public clinics)
--Lack of knowledge among health workers regarding correct vaccination schedule and timing (intervals between vaccinations)
--Distance to health facility (living more than 1 hr away from facility)
--Weak or limited technical support/assistance to district health department
--Migration, population mobility linked to low vaccine uptake
--Geographic reasons, far distance to clinic/hospital for immunization services
--Economic reasons/constraints linked to low vaccine uptake
--Where the child lives
--How health care is managed, contractors or government health care linked to lower coverage

Communication and Information:
--None identified

Family Characteristics:
--Poverty of family

Parental Attitude and Knowledge:
--Low mothers' knowledge level regarding vaccinations linked to low vaccine uptake
--Fear of Adverse Events linked to low vaccine uptake

Cameroun

Total population: 18,879,301
Population < 5 years of age: 2,885,955
Estimated Routine Coverage (2006 DPT3): 75% (95% CI 63% - 84%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Caregivers with low education and socio-economic levels and children living in rural areas at risk of being under-vaccinated, fatalistic attitude linked to low vaccine uptake

Immunization Systems:
--Living in rural area linked to low vaccine uptake, especially if mother has low education level
--Caregivers in rural areas were less likely to have vaccinated children
--Less supervisory visits to health facilities and facility level planning

Communication and Information:
--None identified

Family Characteristics:
--Low education level of caregivers linked to low vaccine uptake
--Caregivers with a lower level of education were less likely to vaccinate their children
--Low maternal education level
--Low socio-economic status

Parental Attitude and Knowledge:
--Parents don't perceived benefit of immunizations
--Low efficacy among child's caregivers regarding getting child vaccinated
--High perceived susceptibility and severity of disease linked to low vaccine uptake (fatalism)
--Caregivers with a high perception of susceptibility and severity were less likely to vaccinate their children (fatalism)

Chad

Total population: 10,329,208
Population < 5 years of age: 1,808,388
Estimated Routine Coverage (2006 DPT3): 35% (95% CI 17%– 58%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--None identified

Communication and information:
--None identified

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--Lack of awareness among parents regarding benefits of vaccination

Chile

Total population: 16,601,707
Population < 5 years of age: 1,216,841
Estimated Routine Coverage (2006 DPT3): 86% (95% CI 46%– 98%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Economic reasons linked to low vaccine uptake
--Hospitalized or chronically ill children less likely to be vaccinated

Communication and information:
--None identified

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--Poor parental recall for vaccinations

China

Total population: 1,338,612,968
Population < 5 years of age: 86,270,550
Estimated Routine Coverage (2006 DPT3): 93% (95% CI 86% - 97%)
Number of relevant articles: 6

Summary of reasons/factors linked to un/under-vaccinated children:
Living in poor, rural areas linked to low vaccine coverage, price of immunization and general health services perceived as barriers to obtaining vaccinations, being born at home and low maternal education linked to low vaccine uptake

Immunization Systems:
--Few immunization service sessions per year
--Fee immunization service linked to low vaccine uptake
--Poor health insurance schemes for immunization services
--Living in remote mountain regions linked to low coverage
--Living in a rural and poor region linked to low vaccine uptake
--Being born at home linked to low vaccine uptake
--Being born in a township hospital (compared to county, provincial, or national hospital)
--Residing in rural location
--Live in poor rural areas, usually mountainous hard to reach areas by health services
--Parents living in hard to reach areas can not access health services
--Supply of vaccines linked to unvaccinated children
--Economic burden on poor families regarding use of health care services linked to children not being fully vaccinated
--Place of delivery, children born at home less likely to be vaccinated compared to children born in a hospital
--Price of health service had negative impact on immunization uptake
--Travel time in urban area had negative impact on immunization uptake
--In rural area, travel time to clinic/health center linked to low vaccine uptake
--Price of vaccine linked to low vaccine uptake

Communication and Information:
--Lack of notification from providers to parents regarding need for/timing of vaccinations
--Lack of TV/radio exposure linked to low vaccine uptake

Family Characteristics:
--Low SES level linked to low vaccine uptake
--Low education level of mother linked to low vaccine uptake
--Limited household wealth (socio-economic status, not having bicycle) linked to low coverage
--Mother's low education level linked to low vaccine uptake
--Migrant children linked to lower vaccine uptake compared to resident children
--Low mother's education had negative impact on immunization uptake
--Low income had negative impact on immunization uptake

Parental Attitude and Knowledge:
--Poor knowledge level of parents regarding immunizations linked to low vaccine uptake (e.g., danger of measles infection/disease)
--The risk of females having lower immunization uptake (decreasing over time)
--In rural area, being female linked to low vaccine uptake

Columbia

Total population: 43,677,372
Population < 5 years of age: 3,915,654
Estimated Routine Coverage (2006 DPT3): 86% (95% CI 75% - 93%)
Number of relevant articles: 5

Summary of reasons/factors linked to un/under-vaccinated children:
Limited accessibility to health services and belonging to a socially vulnerable group (poor, 'non-Indian', having a low education level), and missed opportunities linked to low vaccine uptake

Immunization Systems:
--Missed opportunities
--Changes in vaccination schedule
--Vaccine supply issues (due to limited storage)
--Limited time spent with child linked to low vaccine uptake
--Increased bureaucracy linked to low vaccination coverage
--Lack of clear role of local health authorities linked to low vaccination coverage
--Lack of training, supervision, and monitoring at local level
--Lack of resources to maintain hardware (cold chain and vehicles) linked to low vaccination coverage
--Lack of personnel (health care workers) linked to low vaccination coverage
--Displaced persons due to civil conflict
--Residents in the North/Southwest less likely to be vaccinated than children living in the Southeast
--Not having a regular health care provider linked to low vaccine uptake
--Children displaced by armed conflict
--Less experienced health workers in clinic (< 14 years)
--Health worker mentioned that children were rejected for vaccination due to lack of supplies
--Poor accessibility to health services
--Low insurance coverage
--Not being affiliated with social security
--Increased number of vaccine contra-indications mentioned

Communication and Information:
--None identified

Family Characteristics:
--Low education level of head of household linked to low vaccine uptake
--Larger family size linked to low vaccine uptake
--Low education level of parents linked to low vaccine uptake, especially for older children in family
--Poverty
--Social vulnerability
--Large household size
--Low level of education for head of household

--Being a 'non-Indian'
--Low socio-economic status

Parental Attitudes and Knowledge:
--Multiple injections
--Issues regarding vaccine safety
--Parents lack of trust in vaccination site staff and safety in conflict zones
--Parents with less knowledge regarding provider's schedules and requirements for accessing services less likely to have fully vaccinated children
--Health worker perceived that community was afraid of vaccine side effects linked with being fully vaccinated

Congo

Total population: 4,012,809
Population < 5 years of age: 710,103
Estimated Routine Coverage (2006 DPT3): NA
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Geographic distance to health facility and inadequate vaccine supply linked to low vaccine uptake, parents not knowledgeable about benefits of vaccinations

Immunization Systems:
--Children living in urban area (compared to peri-urban area) less likely to be vaccinated against measles
--Access to health facility, far distance linked to low vaccine uptake
--Lack of adequate supply of vaccine
--Child was sick and not vaccinated
--Vaccine was not available

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Parents lacked information regarding vaccinations
--Parents did not have time to take children to get vaccinated

Costa Rica

Total population: 4,253,877
Population < 5 years of age: 369,550
Estimated Routine Coverage (2006 DPT3): 86% (95% CI 64% - 98%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Distance of health facility and low education/socio-economic status of parents linked to low vaccine uptake

Immunization Systems:
--Migration patterns at border
--Distance to health care facility

Communication and Information:
--None identified

Family Characteristics:
--Education of parent/caregiver
--Socio-economic status of family
--Maternal employment status

Parental Attitude and Knowledge
--None identified

Ecuador

Total population: 14,573,101
Population < 5 years of age: 1,495,279
Estimated Routine Coverage (2006 DPT3): 94% (95% CI 86% - 98%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--High cost of immunization services linked to low vaccine uptake

Communication and Information:
--Lack of media communication regarding importance of vaccinations

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--None identified

Ethiopia

Total population: 85,237,338
Population < 5 years of age: 15,782,678
Estimated Routine Coverage (2006 DPT3): 38% (95% CI 21% - 56%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Living in rural area and distance to health clinic linked to low vaccine uptake, mothers with limited education and socio-economic capital placing children at-risk for vaccine preventable diseases

Immunization Systems:
--Distance to health care center/facility
--Residing in rural area linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Children born to rural-rural migrant woman
--Low level of mother's education
--Limited social/economic capital of mothers linked to low vaccine uptake

Parental Attitude and Knowledge:
--Low level of health care seeking behavior among mothers linked to low vaccine uptake
--Mother has limited role in family decision making linked to low vaccine uptake

Gambia

Total population: 1,778,081
Population < 5 years of age: 294,500
Estimated Routine Coverage (2006 DPT3): NA
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Low education and socio-economic level of caregivers linked to low vaccine uptake

Immunization Systems:
--None identified

Communication and Information:
--In urban areas, lack or prior social connections with clinic staff and strong interpretation with woman linked to low vaccine uptake

Family Characteristics:
--In urban areas, living in poor compound, rented home, and no phone linked to low vaccine uptake
--In urban areas, mothers with less than five years of education linked to low vaccine uptake
--Woman with many children, children with born later (birth order) were less likely be fully vaccinated

Parental Attitude and Knowledge:
--Confusion on whether all vaccinations were received linked to low vaccine uptake

Georgia

Total population: 4,615,807
Population < 5 years of age: 236,909
Estimated Routine Coverage (2006 DPT3): 80% (56% - 94%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Lack of supportive supervision is linked to lower coverage

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--None identified

Ghana

Total population: 23,887,812
Population < 5 years of age: 3,195,280
Estimated Routine Coverage (2006 DPT3): 85% (95% CI 79% - 91%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Poor or lack of prenatal care
--Residing in a rural area linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Father's occupation linked to low vaccine uptake (i.e. laborer or agriculturist)

Parental Attitude and Knowledge:
--None identified

Guinea-Bissau

Total population: 1,533,964
Population < 5 years of age: 235,586
Estimated Routine Coverage (2006 DPT3): 64% (95% CI 50%– 76%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Children with limited access and/or interaction with the health care system as well as belonging to certain ethnic groups less likely to be vaccinated

Immunization Systems:
--Greater traveling distance to clinic linked to low vaccine uptake
--Being away from home during the day linked to low vaccine uptake
--Child is ill or hospitalized
--Children with limited contact with health care system less likely to be fully vaccinated
--Children of mothers who did not receive the tetanus vaccine during pregnancy linked to low vaccine uptake
--Children born at home less likely to be fully vaccinated
--Malnourished children (small arm circumference < 125 mm) linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Low paternal education linked to low vaccine uptake
--Father's occupation, working in agriculture linked to low vaccine uptake
--Low socio-economic status linked to low vaccine uptake (e.g, roof type)
--Children born later in the sibship (> 4) linked to low vaccine uptake
--Children of older mothers linked to low vaccine uptake
--Children belonging to Balanta or Pepel ethnic groups linked to low vaccine uptake

Parental Attitude and Knowledge:
--None identified

Haiti

Total population: 9,035,536
Population < 5 years of age: 1,201,731
Estimated Routine Coverage (2006 DPT3): 56% (95% CI 42% - 69%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--None identified

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Use of traditional healers by mothers associated with lower child immunization uptake

Honduras

Total population: 7,833,696
Population < 5 years of age: 1,007,553
Estimated Routine Coverage (2006 DPT3): 94% (95% CI 89% - 96%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Monetary incentives increase immunization coverage, for first dose of DPT but not for measles

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--None identified

India

Total population: 1,156,897,766
Population < 5 years of age: 118,660,782
Estimated Routine Coverage (2006 DPT3): 56% (95% CI 43% – 69%)
Number of relevant articles: 49

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization programs in rural or remote areas (distance to health clinic, travel costs, missed opportunities at clinics (absent vaccinator), no access to pre/ante-natal care. Belonging to low socio-economic status with low education level and/or low caste/minority group, and having limited knowledge/understanding of vaccinations linked to low vaccine uptake, fear and misconceptions of vaccinations affecting motivation to seek vaccinations

Immunization Systems:
--Missed opportunity to vaccinate children when child is in clinic for illness
--Health care workers do not screen children for vaccination status (missed opportunity)
--Health care workers will not vaccinated if child does not have vaccination card
--Children are not vaccinated following reports of previous convulsions or other adverse reactions following previous vaccinations
--Long waiting time creates barrier to immunizations
--Increasing dislocation of routine services
--Inadequate resources to support routine programs (for personnel, transport, etc.)
--Missed opportunity - child's vaccination status not checked by health worker
--Health worker misinformed about vaccinations (contraindications)
--Inadequate vaccine supply to offer to patients
--Missed opportunity - health worker not available to provide vaccinations
--Long wait times
--Ill child (inaccurate contraindications)
--Costs associated with vaccination linked to low vaccine uptake
--Children born at home (outside and institution) more likely not to be vaccinated (no doses)
--Children residing in rural areas linked to low vaccine uptake
--High opportunity costs, including time to take children to clinic to get vaccinated (especially for girls)
--Missed opportunity - children visiting health clinic for curative purposes not offered vaccinations
--Health care workers incorrectly applied contraindications, resulting in missed opportunity for vaccination
--Child denied vaccination because health care worker refused to open vial to vaccine one child
--Health care worker not available to vaccinated child during health clinic visit
--Immunizations not considered priority during curative visits
--Poor access to healthcare services linked to low vaccine uptake
--Lack of adequate vaccine supply linked to low vaccine uptake
--Missed opportunity due to child's illness
--Refusal of health care worker to vaccinate child
--Residing in a rural area linked to low vaccine uptake

--Residing in poor state (northern region in India) linked to low vaccine uptake due to system failure
--Mother did not receive ANC services (and did not receive TT vaccine)
--Not being born in institution linked to low vaccine uptake
--Limited access to health clinic due to distance (> 5 km) linked to low vaccine uptake
--Parents cited 'obstacles' in getting children vaccination (no elaboration)
--Lack of antenatal care linked STRONGLY to low vaccine uptake
--Being born at home linked to low vaccine uptake
--Health worker refused
--Lack of available fixed health infrastructure
--Far distance to health facility linked to low vaccine uptake
--Living in poor district linked to low coverage
--Residing in rural area linked to low coverage
--Limited antenatal care by mothers linked to lower vaccine uptake
--Vaccination center too far away
--Missed opportunity, health care worker did not vaccinate children
--Rude health care workers
--Indirect costs associated with seeking vaccination create barriers to getting children vaccinated (travel costs, income lost, etc.)
--Public health system linked to inadequate services
--Residing in a rural environment linked to low vaccine uptake
--Living far away from primary health clinic linked to low vaccine uptake
--Limited access to public and private health services among poor
--Rural-urban differences in vaccination patterns
--Geographic differences between states
--Weak immunization performance/inadequate services in poor/rural areas
--Vaccinator not present
--Lack of immunization services in community
--Residing in a rural area
--Parents reported many obstacles to getting children vaccinated
--Residing in a rural area linked to low vaccine uptake
--Children living in slum area are linked to low vaccine uptake
--Location of facility creates obstacle, too far away (children in small and remote villages)
--Absent vaccinators
--Lack of immunization card
--Not being born in hospital
--Absence of vaccinator
--Immunization site too far away (in rural area)
--Missing vaccination card
--Absent health worker during polio campaign
--Unavailability of vaccine
--Missed opportunities to vaccinate children while at health care facility/clinic
--Immunization site too far away
--Vaccination time not convenient
--ANM (health worker) not available
--Children did not have vaccination card
--Parents facing obstacles linked to low vaccine uptake
--Mother not receiving prenatal care in rural area for a male child only

--For girls, if community does not have high availability of clinics and good roads
--Children residing in slum areas with poor health infrastructure
--Vaccinator is absent
--Missed opportunities

Communication and Information:
--"Ignorance of mothers", not receiving or understanding health messages
--Health workers do not emphasize importance of vaccinating for measles after 9 months of age (missed opportunity)
--Limited media exposure linked to lower vaccine uptake
--Lack of trust in the provider
--Few or no household visits for health care worker linked to low vaccine uptake
--Residing in rural area
--Residing in northern state (where other health and social indicators are the lowest in the country)
--Low exposure to media (TV, News, Radio)
--Lack of access to electronic media (radio or TV) linked to low vaccine uptake
--Poor rapport between immunization program and community
--No community involvement of immunization program
--Low community awareness regarding EPI

Family Characteristics:
--Having an illiterate mother linked to children not being vaccinated and being only partially vaccinated
--Poverty linked to low vaccine uptake
--Illiterate mother and father linked to low vaccine uptake
--Having an illiterate mother linked to low vaccine uptake
--Having many older siblings (born later in sibship) linked to low vaccine uptake
--Belonging to lower caste group (scheduled caste or tribe) linked to lower vaccine uptake
--Children in low socio-economic household more likely not to be vaccinated (no doses)
--Children born later with many siblings (later in sibship) more likely not to be vaccinated (no doses)
--Children living in a joint family more likely not to be vaccinated (no doses)
--Presence of same-sex older siblings linked to low vaccine uptake (especially for girls)
--Illiterate mothers linked to low vaccine uptake
--Belonging to poor urban family linked to being unvaccinated
--Poor household wealth linked to low vaccine uptake
--No or low maternal education linked to low vaccine uptake
--Belonging to a 'scheduled' tribe linked to low vaccine uptake
--No or low paternal education linked to low vaccine uptake
--Illiterate caregivers linked to low vaccine uptake
--In rural area, mother working outside of home linked to low vaccine uptake
--Birth order, being born later among a large sibship
--Having an illiterate mother linked to children not being vaccinated and being only partially vaccinated
--Low literacy level of parents, especially mothers linked to low vaccine uptake
--Illiterate mothers linked to low vaccine uptake
--Poor family linked to low vaccine uptake

--Illiterate mothers linked to low vaccine uptake
--Belonging to lower caste linked to low vaccine uptake
--Being born later in the sibship linked to low vaccine uptake
--Low maternal education level linked to low vaccine uptake
--Lower parental education linked to lower immunization coverage
--Belonging to lower castes
--Being a member of a household with a low standard of living linked to lower vaccine uptake
--Being born later in the sibship linked to lower vaccine uptake
--Living in rural area linked to lower coverage
--Child was sick
--Child returned to native village
--Domestic problems
--Low maternal education level linked to low vaccine uptake
--Poverty linked to low vaccine uptake
--Less than middle school education of mother linked to low vaccine uptake
--Belonging to certain castes linked to low vaccine uptake (minimal)
--Lower paternal education level linked to low vaccine uptake
--Illiterate parents linked to low vaccine uptake
--Belonging to a low caste linked to low vaccine uptake
--Illiterate mothers linked to low vaccine uptake
--Belonging to a lower caste/tribe linked to low vaccine uptake
--Children of illiterate mothers linked to low vaccine uptake
--Low level of mother's education
--Children of migrants less likely to be vaccinated
--Belonging to a lower caste linked to low vaccine uptake
--Literacy rates among parents
--Low household wealth linked to low vaccine uptake
--Large family size and large number of children under 5 years of age
--Low literacy among caregivers linked to low vaccine uptake
--Low socio-economic status linked to low vaccine uptake
--Low maternal literacy/female education
--Low level of mother's education
--Being in the lowest two wealth quartiles (poverty) linked to not being completely vaccinated

Parental Attitude and Knowledge:
--Mother is ignorant or not aware or has misconception regarding vaccinations
--Poor understanding/knowledge among health workers
--Increasing community fatigue regarding immunization (after so many polio campaigns)
--Limited maternal awareness/understanding of routine vaccinations
--Being Female linked to not being vaccinated
--Mothers belief that immunization was not beneficial
--Being female linked to not being immunized or being only partially vaccinated
--Low knowledge or awareness level regarding need/importance of vaccinations
--Mothers' lack of awareness regarding vaccinations
--Mother prefers to receive vaccinations from private provider (compared to public clinic)
--Muslim children less likely than Hindu children not to be fully vaccinated
--Children in Muslim households more likely not to be vaccinated (no doses)
--Belonging to a Muslim family linked to low vaccine uptake

--Lack of awareness among parents regarding schedule/timing of vaccinations
--Female gender of child linked to low vaccine uptake
--Social norms (related to household dynamics) linked to low vaccine uptake
--Mothers refuse to return for vaccination services in turned away the first time
--Parents lack information regarding availability of the measles vaccine
--Parents lack knowledge regarding vaccination schedule (timing for each vaccination)
--Parents' refusal to vaccinate due to belief that it is better to get the disease
--Female gender linked to low vaccine uptake
--Child is female
--Being Female linked to not being vaccinated
--Mothers belief that immunization was not beneficial
--Being female linked to not being immunized or being only partially vaccinated
--Low knowledge or awareness level regarding need/importance of vaccinations
--Lack of mothers' knowledge regarding HBV vaccine
--Parents lack sufficient information regarding vaccinations
--Lack of motivation among parents to get children vaccinated
--Being Muslim linked to low vaccine uptake
--Being female linked to low vaccine uptake
--Being a female child linked to lower vaccine uptake
--Lack of awareness among caregivers regarding need for vaccinations
--Caregivers fear side effects
--Caregivers did not observe disease in unimmunized children
--Parents observed adverse events in previous vaccinations
--Lack of knowledge about immunizations among caregivers
--Parents have low level of knowledge regarding usefulness of vaccinations in preventing illness, even after outbreak
--Girls less likely to be vaccinated (or more likely to be completely unvaccinated) especially in northern states, and in rural areas
--Lack of knowledge among poor in rural areas regarding benefits of immunization
--Lack of information among poor in rural areas as to where and when immunizations are offered
--Being Muslim linked to low vaccine uptake
--Lack of knowledge among parents regarding need for vaccinations
--Lack of knowledge among parents regarding place and time for vaccinations
--Lack of motivation among parents (no faith in immunizations, inconvenient)
--Fear of immunizations
--Child illness
--Lack of parental motivation to get children vaccinated
--Parents lack information regarding vaccinations
--Lack of family information regarding immunizations
--Lack of motivation among caregivers to take children to get vaccinations
--Mother is too busy to take children to get vaccinated
--Child was ill, and did not get vaccinations
--Lack of parents’ knowledge regarding immunizations (health education intervention increased vaccine uptake)
--Female gender linked to lower vaccine coverage
--Mother is busy
--Place and time of immunization not known
--Unaware of need to return for subsequent doses

--Being female linked to low vaccine uptake
--Religious affiliations
--Adverse events following immunizations
--Lack of awareness among parents regarding vaccinations
--Sickness prevented seeking or being vaccinated
--Being female
--Lack of motivation due to no faith in immunizations
--Lack of motivation due to fear of adverse effects and other misconceptions
--Lack of information regarding benefits of immunizations
--Lack of information regarding place of immunizations
--Child not well at time of vaccination
--Female child and other vulnerable children
--Lack of information
--Parents have misconceptions and beliefs about immunizations
--Having too many doses linked to low vaccine uptake
--Community elders believe that vaccinations are not needed
--Child had illness at the scheduled time
--Mother's lack information about immunization program
--Caregivers are lazy, forgot
--Child is female
--Mother is from household with a Muslim head of a specific caste/tribe
--Girls at higher birth orders and with older sisters are at greater risk of missing antigens compared to male siblings
--Girls receive less access to immunization than boys
--In three northern states, girls are the least likely to be vaccinated compared to boys
--Parent apathy linked to low vaccine uptake
--Lack of community motivation
--Parents not aware of the need for immunizations
--Ignorance about where immunization services are located in area
--Lack of information or parents are unaware of need for vaccinations (or need for multiple doses)
--Lack of motivation among caregivers (too busy, or vaccinations are inconvenient)
--Illness of mother or child or other family problems
--Parents fear potential side effects

Indonesia

Total population: 240,271,522
Population < 5 years of age: 22,293,426
Estimated Routine Coverage (2006 DPT3): 64% (95% CI 38% - 84%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Limited access as well as knowledge of health workers and limited involvement of community in immunization programs

Immunization Systems:
--Vaccination site too far
--Living in a rural area

Communication and Information:
--Limited knowledge/skills/community involvement of health care worker linked to low vaccine uptake (training program increased the follow-up of no shows, and working with village volunteers)

Family Characteristics:
--Higher levels of mother's education strongly associated with protective childhood behaviors including vaccination

Parental Attitudes and Knowledge:
--Parents fear side effects (e.g. vaccine makes child sick)
--Parents did not know that they had to vaccinate their children (lack of knowledge)
--Mother too busy or forgot

Iraq

Total population: 28,945,569
Population < 5 years of age: 4,068,460
Estimated Routine Coverage (2006 DPT3): 61% (95% CI 48% - 73%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Lack of vaccines at primary health centers
--Distance to clinics, especially in rural areas
--Residing in a rural environment

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Inadequate health education for mothers (ignorance and negligence)

Jamaica, Trinidad, Tobago

Total population:
Jamaica: 2,825,928
Trinidad, Tobago: 1,229,953
Population < 5 years of age:
Jamaica: 278,327
Trinidad, Tobago: 82,553
Estimated Routine Coverage (2006 DPT3):
Jamaica: 79% (95% CI 63% - 90%)
Trinidad, Tobago: 82% (95% CI 58% - 95%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Children living in large, extended families with limited income most likely not to be fully vaccinated

Immunization Systems:
--None identified

Communication and Information:
--None identified

Family Characteristics:
--Being a member of a poor household
--Belonging to a single parent household
--Having a high number of siblings in households
--Birth order impacts vaccine uptake
--Cohabiting households with limited income (in Jamaica)
--Lack of support from extended family support

Parental Attitude and Knowledge:
--None identified

Kazakhstan and Uzbekistan

Total population:
Kazakhstan: 15,399,437
Uzbekistan: 27,606,007
Population < 5 years of age:
Kazakhstan: 1,184,413
Uzbekistan: 2,400,868
Estimated Routine Coverage (2006 DPT3):
Kazakhstan: 91% (95% CI 85% - 95%)
Uzbekistan: 93% (95% CI 88% - 96%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
Limited access to health services and concerns regarding vaccinations linked to low vaccine uptake

Immunization Systems:
--Living in urban area, such as Almaty, was linked to low vaccine uptake
--Only visit to doctor because of sickness in past 12 months associated with lower vaccine uptake (proxy for access to medical care)
--Children without vaccination cards were at higher risk of not being vaccinated.

Communication and Information:
--Concerns regarding competence of health care workers

Family Characteristics:
--Children of unmarried mothers were more likely to be under-vaccinated

Parental Attitude and Knowledge:
--Concerns linked to adverse events linked to low vaccine coverage
--Gaps in knowledge regarding immunizations linked to low vaccine uptake
--Muslim religion was linked to low vaccine uptake
--Concerns regarding vaccine quality

Kenya

Total population: 39,002,772
Population < 5 years of age: 6,616,901
Estimated Routine Coverage (2006 DPT3): 87% (95% CI 73% - 95%)
Number of relevant articles: 4

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization program, including missed opportunities and inadequate vaccine supply, limited knowledge among caregivers regarding vaccinations, lack of motivation linked to low vaccine uptake

Immunization Systems:
--Cost of immunizations linked to low vaccine uptake
--Inconvenient clinic schedule
--Increased distance from vaccination clinics linked to low vaccine uptake
--Seasonal rainfall patterns, due to need to plant crops
--Increase cost of public transport fares which occurred in relation to rainfall patterns
--Missed opportunities due to vaccines are out of stock
--Vaccine schedule at clinic (not given on certain days)
--Syringes out of stock
--Vaccination card was lost
--Lack of finances to get vaccinations
--Child was sick or under weight
--Children were sick at time of vaccination
--Lack of finances to get vaccinations

Communication and Information:
--None identified

Family Characteristics:
--Older mothers less likely to have their children completely vaccinated compared to younger mothers
--Low education level of mothers linked to low vaccine uptake
--Divorced mothers less likely to have children completely vaccinated
--Children in large families with more siblings less likely to be fully Vaccinated
--Low level of education of mother
--Parents of with large families less likely to vaccinate their children

Parental Attitude and Knowledge:
--Very low (or very high) knowledge level regarding immunizations linked to low vaccine uptake
--Negligence and/or ignorance among caregivers regarding children's vaccinations linked to low uptake
--Caregivers too 'busy' to take children to get vaccinations
--Parental belief that is it wrong to vaccinate child when child is sick

--Lack of motivation of parents
--Lack of knowledge of disease

Malawi

Total population: 15,028,757
Population < 5 years of age: 2,635,309
Estimated Routine Coverage (2006 DPT3): 86% (95% CI 79% - 91%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Limited access to health and/or immunization services due to distance, low education level and socio-economic status linked to low vaccine uptake

Immunization Systems:
--Residing in areas with no mobile < 5 clinic
--Children born at traditional birth attendant camp linked to low vaccine uptake
--Living further from the nearest health clinic serving under 5 children

Communication and Information:
--None identified

Family Characteristics:
--Being born at home
--Being born between April and June
--Poorer housing standard and poorer socio-economic status
--Lower mother's education linked to low vaccine uptake

Parental Attitude and Knowledge:
--None identified

Malaysia

Total population: 25,715,819
Population < 5 years of age: 2,747,812
Estimated Routine Coverage (2006 DPT3): 87% (95% CI 49%– 98%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Missed opportunity - children with history of previous hospitalization less likely to be fully vaccinated

Communication and Information:
--None identified

Family Characteristics:

Parental Attitude and Knowledge:
--Incorrect/lack of knowledge among caregivers regarding vaccination schedule

Mali

Total population: 13,443,225
Population < 5 years of age: 2,513,923
Estimated Routine Coverage (2006 DPT3): 70% (95% CI 58%– 81%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Low skill and knowledge level among health workers linked to low coverage

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Lack of information regarding vaccinations among caregivers

Mexico

Total population: 111,211,789
Population < 5 years of age: 10,726,608
Estimated Routine Coverage (2006 DPT3): 81% (95% CI 59% - 93%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
Parents not motivated to seek EPI vaccinations and report poor customer service during previous interactions with health system

Immunization Systems:
--Health centers only offered part of services advertised during mass campaigns

Communication and Information:
--Poor 'beside manner' on part of personnel giving vaccinations
--Poor customer service upon arrival at health center
--Limited exposure to media (radio and television) linked to lower vaccine uptake

Family Characteristics:
--Lower socio-economic status linked to vaccination coverage

Parental Attitude and Knowledge:
--Pain associated with vaccination turns parents away
--Limited information about immunization campaign
--Low parental demand for services linked to low vaccine uptake

Mongolia

Total population: 3,041,142
Population < 5 years of age: 293,202
Estimated Routine Coverage (2006 DPT3): 89% (95% CI 79% - 96%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Living outside of metropolitan area

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitudes and Knowledge:
--None identified

Mozambique

Total population: 21,669,278
Population < 5 years of age: 3,502,534
Estimated Routine Coverage (2006 DPT3): 79% (95% CI 59% - 92%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization program, lack of knowledge among health care workers as well as distance to health clinic (families must seek transportation to obtain vaccinations), misconceptions about vaccination among caregivers

Immunization Systems:
--Location of home (living outside of the village less likely be vaccinated)
--Greater distance to health clinic
--Needing transportation to the clinic decreases likelihood of being vaccinated
--Home delivery linked to lower vaccine uptake
--Health care worker only sees vaccination target, not a health tool to protect children
--Health care workers do not understand benefits about vaccination
--Poor knowledge of immunization concepts by district directors
--Lack of outreach/health facilities

Communication and Information:
--None identified

Family Characteristics:
--Mother's education level (low level of education linked to low vaccine uptake)
-- Children born in another country linked to lower vaccine uptake

Parental Attitude and Knowledge:
--Mother's lack of information on EPI linked to low vaccine uptake
--Mother's lack of belief in immunizations linked to low vaccine uptake
--Problematic assumptions about vaccinations

Nepal

Total population: 28,563,377
Population < 5 years of age: 3,246,265
Estimated Routine Coverage (2006 DPT3): 88% (95% CI 81% - 93%)
Number of relevant articles: 4

Summary of reasons/factors linked to un/under-vaccinated children:
Limited access to immunization services and missed opportunities (not having vaccination card) linked to low vaccination coverage

Immunization Systems:
--Not having vaccination card related to high default rate
--Low quality health post (immunization services)
--Access to health post (limited impact)
--Minimal outreach activity (limited impact)
--Not having a vaccination card linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Lower education level of caregivers linked to low vaccine uptake
--Children of parents employed as laborers less likely to be vaccinated

Parental Attitude and Knowledge:
--None identified

Nicaragua

Total population: 5,891,199
Population < 5 years of age: 662,703
Estimated Routine Coverage (2006 DPT3): 84% (95% CI 67%– 95%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Urban living

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Low institutional trust

Nigeria

Total population: 149,229,090
Population < 5 years of age: 23,399,207
Estimated Routine Coverage (2006 DPT3): 55% (95% CI 43% - 67%)
Number of relevant articles: 9

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization program, inadequate knowledge of health workers, missed opportunities (not having vaccination card), and limited access among children living in remote rural areas (distance to services). Poor communication between health care workers to caregivers, lack of understanding of disease risk/vaccination benefits among parents, role of anti-vaccination promotion among religious groups, lack of trust in health system

Immunization Systems:
--Vaccines were not available
--Inadequate vaccine supply, especially at birth
--Missed opportunities to vaccinate
--Children not having vaccination cards were less likely to be fully vaccinated
--Poor attitude among health care workers
--Difficulty in training health care workers, low knowledge level
--No antenatal care reduces the likelihood of receiving BCG vaccine
--Place of birth, being born at home instead of clinic reduces likelihood of receiving BCG vaccine
--Not having a vaccination card reduces likelihood of receiving BCG vaccine
--Irregular supply of BCG vaccine linked to lower coverage
--Living in remote conditions linked to low vaccine uptake (in geographically hard to reach areas)
--Inconsistent supply of vaccines (cold chain, transport related)
--Poor commitment to vaccination services
--Inadequate knowledge level among health care workers regarding vaccinations
--Immunization histories not taken during clinic/hospital visits
--Lack of adequate vaccine supply
--Far distance to health facility linked to low vaccine uptake

Communication and Information:
--General distrust in health system, having to pay for drugs while immunizations were free
--Children of mothers without availability of newspapers and radio had higher risk of unvaccinated
--Lack of outreach efforts
--Mother is not exposed (lack of information) to information on child health in media or community
--No one in community to educate mothers on importance of vaccinations (lack of vaccination community workers), lack of awareness
--General distrust of the immunization program

Family Characteristics:
--Low literacy levels among mothers living in rural areas linked to low vaccine uptake
--Low parental education level linked to vaccine uptake
--Children with mothers and fathers with no education were more likely to be unvaccinated compared to children with mothers and fathers with more than two years of formal education
--Children of mothers in the poor and middle quartiles of wealth (poverty) were less likely to be fully vaccinated
--Rank of birth, higher the rank, lower the likelihood of receiving BCG vaccine
--Belonging to minority ethnic group (ethnic isolation)
--Low education level of mother
--Low socio-economic status of parents linked to low vaccine uptake
--Low maternal education level

Parental Attitude and Knowledge:
--Parents are not aware of measles vaccination
--Parents do not believe that vaccinations work
--Parents/families felt abused by while in hospital or sick
--Husband refuses permission or is not around to accompany mother to clinic
--Against vaccinations for religious reasons (illness caused by God or evil spirits)
--Limited knowledge of mother/caregiver regarding vaccinations
--In rural areas, caregivers do not understand importance of vaccinations in terms of disease prevention
--Local, religious, and traditional leaders in rural areas do not promote immunization awareness
--Immunizations viewed as dangerous or unnecessary
--Mothers reported disease in children that were vaccinated
--Belief that vaccines cause sterility
--Religious leaders communicate ill effects of vaccinations
--Vaccinations are being promoted by Western/Christian countries
--Religious beliefs that 'God' should be vaccinating/protecting children
--Limited to no focus on other serious diseases (attention only on polio)
--Children of Muslim mothers were more likely not to be vaccinated compared to Christian mothers
--Children of mothers with autonomy were more likely to be unvaccinated
--Mother not knowing timing or routine immunization visits (knowledge)
--Mother does not have someone to assist with taking child for vaccination (no time or resources)
--Father does not approve of immunization linked to low uptake of BCG vaccine
--Low awareness/misconceptions regarding vaccinations
--Limited maternal knowledge of immunizations
--Low knowledge level among parents regarding vaccinations
--Child was ill and not vaccinated
--Reported illness following previous vaccination (fear of adverse events)
--Political leaders arguing that OPV is not safe (could cause HIV, Cancer, and infertility)

Pakistan

Total population: 174,578,558
Population < 5 years of age: 21,270,828
Estimated Routine Coverage (2006 DPT3): 58% (95% CI 51% - 65%)
Number of relevant articles: 12

Summary of reasons/factors linked to un/under-vaccinated children:
Poor access to health/immunization services due to distance, primarily among children living in remote rural communities, limited knowledge regarding risk of disease/benefits of immunization among rural poor, infrequent family discussions regarding immunizations, limited mobility of women, fear and misconceptions concerning vaccinations

Immunization Systems:
--Mothers not receiving TT vaccination linked to low vaccine uptake among children
--Distance to facility (greater distance) linked to low vaccine uptake
--Absence of mobile teams linked to low vaccine uptake
--Inadequate vaccine supply at health clinics
--Children not vaccinated due to illness or weakness
--Physicians do not provide advice on vaccinations
--Many physicians consider vaccine has limited effectiveness and/or side effects
--Physicians have poor knowledge regarding immunizations
--Limited supply of syringe stock
--Limited health care worker training and knowledge
--Clinics or vaccination posts are too far away
--Limited mobility of vaccinators to reach remote (hard to reach) areas linked to low coverage
--No incentives for vaccinators linked to low coverage
--Pediatricians do not refer children for immunizations nor welcome EPI activity at sites
--Lack of involvement of private sector linked to low coverage
--Inadequate use of lady health workers (village health workers) in vaccination activity linked to low coverage linked to low coverage
--Limited power of district health officer to deal with absent vaccinators
--Poor design of vaccination card linked to low vaccine uptake
--Lack of center based education linked to low vaccine uptake
--Costs, financial and time (poverty) limited vaccination uptake
--Access to services limited vaccination uptake
--Living in rural area was risk for low vaccine uptake
--In rural areas, marginalized homes (distance) linked to low vaccine uptake
--Knowledge gap among health care workers
--Lower immunization uptake in rural areas
--In rural areas, greater distance to health facility related to lower coverage
--In rural areas, lack of immunization teams visiting community related to lower coverage
--Poor service quality, vaccinator absent, etc.
--Lack of vaccine at clinic

Communication and Information:
--Not owning a TV set was linked to low vaccine uptake
--Lack of visits by health care professionals discussing immunizations related to lower coverage

Family Characteristics:
--Illiterate father or mother or both parents linked to low vaccine uptake
--Low socio-economic status, housing type, linked to low vaccine uptake
--In rural areas, low SES (job type, roof type linked to low vaccine uptake)
--In urban areas, low maternal education linked to low vaccine uptake
--In rural areas, lower SES related to lower coverage
--Mothers with no formal education related to lower coverage
--Poverty

Parental Attitude and Knowledge:
--Parents lack information on need for as well as on location and place of immunizations
--Parents fear side effects
--Parents do not have any faith in vaccinations vaccinated
--Ill child or mother
--Mother lacks motivation (mother too busy)
--Caregivers have limited or incorrect knowledge regarding vaccination schedule
--Parents see vaccinations as unnecessary
--Parental belief that vaccines will make children sick
--Parents are too busy to take children to get vaccinated
--Parents are uninformed about immunizations
--Parents believe that vaccinations are not important
--Parents fear adverse reaction
--Limited knowledge about health care and immunizations linked to low vaccine uptake
--Limited information on prevalence of measles and complications associated with measles linked to low coverage
--Limited family discussions of vaccinations linked to low coverage
--Limited information/knowledge about the importance of vaccination
--Limited information on cost of vaccination in relation to treating case of measles
--Misconceptions about vaccinations limited vaccination uptake
--Lack of family discussion of vaccination limited vaccination uptake
--Mothers unable to identify (knowledge) vaccine preventable disease related to lower coverage
--In urban areas, mothers aware of bad effects of immunization related to lower coverage
--In rural areas, mothers unaware of bad effect of immunization related to lower coverage
--Lack of family discussions regarding immunization related to lower coverage
--Lack of mother's participation in family discussions of immunization related to lower coverage
--Parents do not understand risk, negative or fatalistic attitudes regarding immunizations
--Parents think that vaccinations are painful and fear side effects
--Limited mobility of women

Papua New Guinea

Total population: 5,940,775
Population < 5 years of age: 775,745
Estimated Routine Coverage (2006 DPT3): 61% (95% CI 30% - 87%)
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
Lack of access to immunization services due to distance and poor security, limited motivation among caregivers (have other activities/responsibilities) to get children vaccinated

Immunization Systems:
--Caregiver was sent away and asked to return the next day
--Irregular access to clinic
--Far distance to clinic
--Waiting too long at clinic
--Lack of money for transportation to clinic
--There is insecurity in area
--Lack of resources to repair of transport and good outreach sites (service outreach limited) linked to low vaccine uptake
--Poor security, many tribal battles ongoing linked to low vaccine uptake
--Lack of transport and/or staff linked to low vaccine uptake
--Lack of supervision linked to low vaccine uptake

Communication and Information:
--Health worker is not nice to parent
--Inadequate community involvement linked to low vaccine uptake

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Death of relative in village (time) keeps parents from taking child to clinic
--Parent not well informed about vaccine side effects
--Father does not consent to vaccination
--Household chores keep mother busy
--Too many injections are given

Philippines

Total population:
Population < 5 years of age:
Estimated Routine Coverage (2006 DPT3):
Number of relevant articles: 2

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Living in a rural area linked to low vaccine uptake
--Residing in a rural community associated with low coverage
--Not attending all antenatal visits linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--Certain ethnicities less likely to be fully vaccinated
--Low education level of parents linked to low vaccine uptake
--Lower socio-economic status linked to low vaccine uptake
--Having a number of children less than 5 years of age in household
--Born later in the sibship linked to low vaccine uptake

Parental Attitude and Knowledge:
--None identified

Sierra Leone

Total population: 5,132,138
Population < 5 years of age: 854,920
Estimated Routine Coverage (2006 DPT3): 75% (95% CI 59%– 87%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Children born during the war having lower vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--Mother too busy to take children to get vaccinated (postponed until mother has time)
--Fear of side effects linked to low vaccine uptake

South Africa

Total population: 49,052,489
Population < 5 years of age: 4,700,346
Estimated Routine Coverage (2006 DPT3): 91% (95% CI 76% - 98%)
Number of relevant articles: 4

Summary of reasons/factors linked to un/under-vaccinated children:
Clinic factors (missed opportunities, incorrect information, as well as distance and timing of services) linked to low vaccine uptake

Immunization Systems:
--Parents can not afford transport to the clinic
--Clinic is too far from home
--Stock-out of vaccines at the clinic
--Mother is pregnant and unable to walk child to clinic
--Elderly caretaker also unable to walk to clinic
--Many obstacles to immunization
--Lack of adequate vaccine supply linked to low coverage
--Place of immunization too far away
--Obstacle to immunization - child illness
--Concerns that measles campaign diverts resources away form routine measles program and results in lower coverage
--Clinic factors, reported missed opportunities, told to return another time
--Clinic factors, provided incorrect vaccination dates (communication)
--Clinic factors, immunizations provided at inconvenient times
--Clinic is too far away for some families
--Clinic factors, vaccines not being available
--Lack of information given by health workers, incorrect ideas about contraindications
--Lack of information given by health workers regarding need for repeat doses
--Caregiver being unable able to attend clinic
--Children not having a vaccination card more likely to have low vaccine uptake

Communication and Information:
--Rude of unhelpful nurses and/or clinic staff

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--No one is available to take the child to the clinic
--No one at home to look after the other children
--Parents lack information needed to get their children vaccinated
--Parents lack motivation to get their children vaccinated

--Caregiver not being in home area when child vaccine is due and not knowing that mother can take child to another clinic

Swaziland

Total population: 1,337,186
Population < 5 years of age: 179,166
Estimated Routine Coverage (2006 DPT3): 91% (95% CI 86 – 95%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
Missed opportunities, including not having a vaccination card, and vaccine supply linked to low vaccination coverage

Immunization Systems:
--Children without health card resulted in missed opportunities
--Limited availability of vaccines
--Facilities not providing integrated services
--Type of clinic linked to missed opportunities

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--None identified

Tanzania

Total population: 41,048,532
Population < 5 years of age: 6,388,230
Estimated Routine Coverage (DPT3): NA
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Greater distance to health clinic linked to low vaccine uptake
--Limited time spent on preventive services such as immunization in health facilities

Communication and Information:
--None identified

Family Characteristics:
--Low socio-economic status is linked to low vaccine uptake
--Low socio-economic status linked to low vaccine uptake

Parental Attitude and Knowledge:
--None identified

Thailand

Total population: 65,998,436
Population < 5 years of age: 4,374,097
Estimated Routine Coverage (2006 DPT3): 97% (95% CI 93% - 99%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--Residing in rural area linked to low vaccine uptake

Communication and Information:
--None identified

Family Characteristics:
--None identified

Parental Attitude and Knowledge:
--None identified

Turkey

Total population: 76,805,524
Population < 5 years of age: 7,023,630
Estimated Routine Coverage (2006 DPT3): 74% (95% CI 53% - 89%)
Number of relevant articles: 14

Summary of reasons/factors linked to un/under-vaccinated children:
Density/availability and experience/knowledge level of health care workers, access to immunization services including travel distance and living in remote communities as well as low educational attainment and misconceptions among caregivers regarding vaccinations associated with low coverage

Immunization Systems:
--Children of families living in sub-urban areas have lower coverage compared to children in urban areas
--Child was sick and therefore not vaccinated
--Low health worker density linked to low vaccine uptake
--Residing in a rural location linked to low vaccine uptake
--Type of health worker density linked to low vaccine uptake
--Living in a settlement area linked to low vaccine uptake
--Living in a rural area linked to low vaccine uptake (but better than in settlement areas)
--Low knowledge/training level of health care workers linked to low vaccine uptake
--Years of work experience impacts vaccination coverage
--Missed opportunities (health care worker did not want to open new vial)
--Economic reasons
--Limited follow-up visit of midwives
--Living in rural area
--Wrong contraindications
--Lack of money for transportation
--Lack of training/knowledge of health care workers (training increased vaccination coverage)
--Low health care staff density associated with low coverage (different categories of health staff have different influence on coverage)
--Missed opportunities (health care worker did not want to open new vial)
--Economic reasons

Communication and Information:
--Gender of health worker impacts vaccination coverage
--Lack of effective communication between health staff and mothers

Family Characteristics:
--Families with fewer than 2 kids had lower rates of being fully vaccinated
--Low socio-economic status
--Large sibship size
--Low literacy level of mothers linked to low vaccine uptake
--Illiterate mothers linked to low vaccine uptake

--Low level of maternal education (but no link to father's education level)
--Immigration
--Education level of mother
--Migration from one area to another (from rural to semi-urban areas)
--More siblings in the family linked to low vaccine uptake
--Socio-economic status of the family
--Birth interval
--Lower education level of parents linked to low vaccine uptake
--Illiterate mothers more likely to have unvaccinated or partially vaccinated children
--Illiterate fathers more likely to have unvaccinated or partially vaccinated children
--Lower socio-economic status linked to low vaccine uptake
--Large sibship linked to low vaccine uptake
--Immigration

Parental Attitude and Knowledge:
--Lack of parental knowledge regarding importance and timing of vaccinations
--Poor knowledge among parents regarding reasons to vaccinate
--Parents confused on timing/schedule for vaccinations (due to different schedules used by private vs. public providers)
--False beliefs among parents regarding vaccination linked to low vaccine uptake
--Parents have fear about potential side effects of vaccines
--Being in a village and having no knowledge of vaccination
--The father did not allow vaccination
--Illness of child and misinformation about side effects of vaccines
--Immunizations not perceived as important
--Gender roles
--Being in a village and having no knowledge of vaccination
--The father did not allow vaccination
--Illness of child and misinformation about side effects of vaccines

Uganda

Total population: 32,369,558
Population < 5 years of age: 6,545,273
Estimated Routine Coverage (2006 DPT3): 66% (95% CI 53% - 77%)
Number of relevant articles: 6

Summary of reasons/factors linked to un/under-vaccinated children:
Limited access to immunization services and missed opportunities (including knowledge of health workers) linked to low vaccine uptake, many misconceptions and limited understanding of vaccinations among caregivers

Immunization Systems:
--Gaps in service delivery
--Not having a vaccination card linked to low vaccine uptake
--Poor access and quality of services
--High staff turnover
--Multi-dose schedules difficult to complete compared to single dose
--Children were refused vaccinations by health worker due to illness (contraindication)
--Missing child health card linked to low vaccine uptake
--Being born at home linked to low vaccine uptake
--Lack of knowledge regarding immunizations among health care workers
--HIV status of mother (being infected linked to lower vaccine uptake)
--Access to immunizations (to location where vaccinations are given)
--Few or no antenatal visits linked to lower vaccine uptake among children

Communication and Information:
--Parents have poor access to information regarding immunizations
--Caregivers are uncomfortable with health care workers

Family Characteristics:
--Born later in the sibship (having a large number of older brothers/sisters)
--Mother's education level

Parental Attitude and Knowledge:
--Caregiver belief that vaccines are dangerous (laced with HIV)
--Illness of caregiver linked to low vaccine uptake
--Low motivation of caregiver, lack of concern for child
--Unconvinced of need for immunizations due to traditional beliefs and practices
--Lack of knowledge regarding immunizations among parents
--Limited maternal knowledge about immunizations
--Negative maternal beliefs about immunizations

Vietnam

Total population: 88,576,758
Population < 5 years of age: 7,773,616
Estimated Routine Coverage (2006 DPT3): 82% (95% CI 72% - 89%)
Number of relevant articles: 3

Summary of reasons/factors linked to un/under-vaccinated children:
Lack of access (living in rural area) to immunization services and maternal health care services) as well as low maternal education and belonging to minority group linked to low vaccine uptake

Immunization Systems:
--Residing in a poor, rural area linked to low vaccine uptake
--Lack of community health center in area (geographic isolation)
--Living in a rural area
--Low availability of community health centers
--Location of vaccine storage site
--Limited pregnancy tracking in community
--Location and relation to rural or urban hospital
--Poor interpretation of contraindications for Heb B birth dose
--Limited access to maternal services

Communication and Information:
--Mother not watching TV on regular basis
--Minimal access to television (media)

Family Characteristics:
--Low literacy and education levels of mother linked to low vaccine uptake
--Low SES linked to low vaccine uptake
--Belonging to a minority group linked to low vaccine uptake
--Low literacy level of mothers linked to low vaccine uptake
--Low socio-economic status
--Being a minority

Parental Attitude and Knowledge:
--Family perceptions of benefits of birth dose
--Traditional practices of keeping newborns at home

Zambia

Total population: 11,048,532
Population < 5 years of age: 2,005,423
Estimated Routine Coverage (2006 DPT3): 90% (95% CI 78% - 97%)
Number of relevant articles: 1

Summary of reasons/factors linked to un/under-vaccinated children:
See below

Immunization Systems:
--HIV infected children unlikely to be vaccinated

Communication and Information:
--None identified

Family Characteristics:
--Low maternal education level linked to low vaccine uptake
--Large family size linked to low vaccine uptake

Parental Attitude and Knowledge:
--None identified

General: Regional/Global

Number of relevant articles: 9

Summary of reasons/factors linked to un/under-vaccinated children:
Weak immunization programs, low concentration of skilled health care workers, environmental barriers (distance, civil conflict), and poor understanding and many misconceptions (fears) about vaccinations among caregivers

Immunization Systems:
--Residing in rural area linked to low vaccine uptake
--Limited or no incentives to vaccinate children linked to low coverage
--Low concentration of doctors per 1000 population linked to low measles vaccine coverage
--Low concentration of all health workers per 1000 population linked to low measles vaccine coverage
--Poor management of immunization programs
--Non-robust implementation of immunization programs resulting in poor service delivery
--Lack of political pressure to improve immunization systems
--Low concentration of doctors and nurses linked to low vaccine uptake
--Low concentration of doctors alone linked to low vaccine uptake
--Parents are not using vaccination services because of poor management
--Parents are not using vaccination services because of logistical problems
--Many missed opportunities to vaccination children
--Lack of outreach facilities or vaccination posts
--Conflict linked to low vaccine uptake
--Environmental barriers to vaccination (distance is far, limited transportation, and civil conflict) linked to low vaccine uptake
--Limited vaccine supply linked to low vaccine uptake
--Missed opportunities due to scheduling linked to low vaccine uptake
--Low health worker density linked to low vaccination coverage
--Low nurse density linked to low vaccination coverage
--Poor service quality (management, funding, and delivery)

Communication and Information:
--Poor media communication schemes linked to low vaccine coverage
--Lack of social mobilization linked to low coverage
--Poor communication exchange between provider and parents

Family Characteristics:
--Illiterate mothers linked to low vaccine uptake
--Children in low SES households less likely to be fully vaccinated compared to higher SES households
--Low social class or low socio-economic status linked to low vaccine uptake
--Low parents' education level linked to low vaccine uptake
--Low female literacy linked to low vaccination coverage

Parental Attitude and Knowledge:
--Girls less likely to be fully vaccinated compared to boys
--Low knowledge levels regarding vaccination services
--Lack of incentives for families to vaccinate their children (e.g. free-credit, etc.)
--Poor public demand for immunization services
--Parents have negative beliefs about measles and vaccination (measles is not a problem, vaccine makes children sick, not negative consequences if children do not receive vaccine)
--Mother's do no request vaccinations (only passive acceptance)
--Religious conviction - against vaccinations
--Coercive pressure or political association with campaigns
-Anti-vaccination lobby (regarding vaccine safety, etc.)
--Lack of trust or acceptance of western medical system