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GENDER AND IMMUNISATION

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Swiss Centre for International Health
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Disclaimer

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1 Introduction

Immunization and gender

Child immunisation status is determined by a myriad of factors at the individual, family, and community level, as well as by health system or service delivery level issues. Barriers, for example, may affect the demand for services (e.g. whether a caretaker takes the child for vaccination), as well as the supply of services (e.g. how vaccination is made available and under what conditions). These factors were the subject of the previous WHO mandated project that investigated the Epidemiology of the Unvaccinated Child. This study builds on the results of that project and attempts to focus specifically on gender related barriers that may lie behind some of the well documented constraints to immunization coverage

Gender refers to socially constructed roles, behaviours, activities and attributes that a given society considers appropriate for men and women[1]. Sex refers to the biological and physiological characteristics that define men and women, boys and girls.[1] The role of gender and sex disparities in immunization coverage has been subject to much debate in recent years with terminology often used interchangeably. The GAVI Alliance (GAVI) has recently entered into this discussion and set a gender policy to focus attention on gender related barriers to immunization.

The Global Alliance for Vaccine and Immunisation (GAVI) requested the Initiative for Vaccine Research (IVR) at WHO to commission a project to explore the evidence around sex disparities and gender related barriers to children's immunisation status. The project was financed by GAVI to support their gender policy implementation plan.

The Swiss Centre for International Health (SCIH) at the Swiss Tropical and Public Health Institute (Swiss TPH) with the guidance of an ad-hoc Technical Advisory Group (TAG) on Gender and Immunization constituted by WHO and WHO's IVR Department planned the research with three components: an analysis of Demographic and Health Surveys (DHS) to explore sex disparities in vaccination status, and to look specifically at selected gender related variables as predictor of vaccination status; a qualitative systematic review to synthesize qualitative information that could provide insight on how gender specific constraints may affect immunisation coverage; and a series of case studies in selected locations to investigate specific national or sub-national data for evidence of gender related barriers in specific contexts. Additionally, the Programme for Appropriate Technology in Health's (PATH) Vaccine Access and Delivery Program carried out qualitative data collection through focus group discussions in field studies in Rajasthan[2] to assess sex disparities in immunisation coverage and gender related barriers to coverage. Their report on Rajasthan, however, has been reviewed and included in the case study.

[1] WHO. What do we mean by "sex" and "gender"? In: WHO, editor. Geneva, 2010.

[2] Shankar S, Dutta T. Understanding the Role and Impact of Gender In the Use of Immunization Services; Report of a study conducted in Jaipur, Rajasthan, India: PATH India, 2010.

2 Approach and Methods

2.1 Conceptual Framework

To analyse specific gender related barriers, we adapted a gender framework[3] to help us conduct a gender analysis of the barriers identified in the previous project looking at generic predictors of unvaccinated children. Based on this analysis, and supported by a gender analysis of DHS data[4], certain variables were selected that could provide information on gender related barriers (see Annex 1).

2.2 Methods

The project entailed a statistical analysis of the DHS data, a qualitative systematic review, and case studies to assess whether the global results reflect local or regional circumstances. The DHS analysis and the qualitative systematic review followed protocols developed for the studies that were reviewed and approved by WHO/IVR and the TAG. Case studies were selected based on pronounced in-country differences to study gender issues around immunization that contribute to that difference. Results of these studies were then triangulated[5] to build an internally consistent line of argument through validation or refutational analysis.[6]

2.2.1 Analyses of Demographic Health Surveys (DHS) and national indicators

Data sources

DHS have been conducted in six different phases since 1984 up to 2008. For this study 166 surveys were analysed in 67 countries. The full list all of all datasets is shown in Annex 2. For these analyses, only the unique or most recent survey of each country with data available was included.

Data on the national indicators were available from UNDP's website except data on infant mortality which were obtained from the UN data website.

Variables

Survey, children, outcomes and predictor variables were identified in the datasets. **Outcome variables** included only subjects with known vaccination status in at least one of the six antigens defined in the scope of this study. The 'Access' outcome variable had two possible values: 0 (child having received not a single dose of vaccine); and 1 (child having received at least one dose of vaccine). The 'Utilisation' outcome variable had two possible values: 0 (child having received at least one dose of vaccine), and 1 (child being fully vaccinated for the six antigens). **Predictor variables** were classified in two main groups: core variables and gender-related variables. Predictor variables are listed in the Annex 3.

[3] Sen G, Iyer A, Mukherjee C. A Methodology to Analyse the Intersections of Social Inequalities in Health. *Journal of Human Development and Capabilities* 2009;10(3):397 - 415.

[4] Kishor S, Subaiya L. Understanding Women's Empowerment: A Comparative Analysis of Demographic and Health Surveys (DHS) Data. In: Inc. MI, editor. *DHS Comparative Reports* No. 20, 2008.

[5] Humble Á.M. Technique Triangulation for Validation in Directed Content Analysis. *International Journal of Qualitative Methods* 2009;8(3).

[6] Denzin, N. *The research act*. Chicago: Aldine Publishing,1970.

Analysis

To assess associations between the outcomes (not having received any dose of vaccine and having received at least one dose of vaccine) and the predictor variables, we used generalised estimating equations for binary data with a logit link function, adjusting for the cluster design. Logistic regression results are expressed as odds ratios. All models were multivariable using the core predictors listed above. Effect modification by sex of the child was examined for all predictor variables. To obtain separate effect estimates for boys and girls for a given binary factor, we introduced sex-specific versions of the respective factor. Effect modification by factors other than sex was also examined. Random effect meta-analysis was used to obtain summary estimates for the odds ratios of different factors.

Additional analyses were conducted to estimate benefits that might be achieved by improving certain highly predictive factors using simple logistic regression models but also involved variables defined at the regional level. We then estimated the benefit of intervening on the most predictive factor assuming that this intervention would succeed in raising all regional prevalence rates of this factor to its present maximal level of the respective country. All other factors were kept constant. This benefit was defined by the rise in vaccination rate associated with the respective intervention.

Finally, correlations between immunization coverage rates and socio-economic, developmental and gender empowerment indicators[7] across countries were analysed. Since associations between vaccination rates and national indicators were not expected to be linear, Spearman's rank correlation coefficient was used for their description.

2.2.2 Qualitative Systematic Review

A systematic review of qualitative studies using meta-ethnography[8] and qualitative synthesis[9] methods was conducted. Meta ethnography methods were selected as they: 1) permit cross-study comparison by analyzing how the different studies are related to each other; 2) provide a systematic approach while maintaining the interpretive properties of the original data; and 3) render more powerful results and greater generalisibility[10].

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[7] http://hdrstats.undp.org/en/indicators; http://data.un.org/Data.aspx?d=MDG&f=seriesRowID%3a562. [infant mortality only] (last checked on 01/10/2010)

[8] Noblit GW, Hare RD. *Meta-ethnography: Synthesizing qualitative studies*. Newbury Park, California: Sage., 1988.

Wallace A, Croucher K, Quilagars D, Baldwin S. Meeting the challenge: developing systematic reviewing in social policy. *Policy and Politics* 2004;32(4):455-70.

[9] Barroso J, Powell-Cope GM. Metasynthesis of Qualitative Research on Living with HIV Infection. *Qualitative Health Research* 2000;10(3):340-53.

Pound P, Britten N, Morgan M, Yardley L, Pope C, Dakar-White G, et al. Resisting medicines: a synthesis of qualitative studies of medicine taking. *Social Science and Medicine* 2005;61:133-55.

Walsh D, Downe S. Meta-synthesis method for qualitative research: a literature review. *Journal of Advanced Nursing* 2005;50(2):204-11.

[10] Smith L, Pope C, Botha J. Patients' help-seeking experiences and delay in cancer presentation: a qualitative synthesis. *The Lancet* 2005;366:825-31.

Roberts KA, Dixon-Woods M, Fitzpatrick R, Abrams KR, Jones DR. Factors affecting uptake of childhood immunisation: a Bayesian synthesis of qualitative and quantitative evidence. *Lancet* 2002;360(9345):1596-99.

Search and selection strategy

A literature search was conducted to identify papers published in peer reviewed journals that contained an analysis of the selected barriers. The search was conducted using electronic social sciences and medical literature databases with key words drawn from the UNVAC project and using the gender framework. No date restrictions were applied. We restricted the electronic search to English, French, Spanish, Italian, German, and Portuguese language publications. The flowchart (see Annex 4) documents the process of selection and the number of articles included and excluded at each stage. Of the initial number of hits (N=4,303), 173 studies that met the inclusion criteria (i.e. correct topic, region, study design and analysis method) continued to full manuscript review (N=173) and quality appraisal[11]. Twenty three studies were retained for analysis.

2.2.3 Case Studies

The objectives of the case studies were 1) to provide a multi-disciplinary view of trends and patterns in children immunization and 2) to assess the internal validity of our findings using different methods. Case studies were selected based on an analysis of key national indicators related to gender, and child health. Countries with poor results on at least five of the major indicators were considered along with the demonstrative capacity of the case study. Three case studies (Lao, India (Rajasthan/ Kerala) and Uganda/Kenya) were initially proposed but due to time constraints only India (Rajasthan and Kerala) and Lao were done. The selection of the countries was done in consultation with WHO and TAG. Lao was selected as an example of a country with low coverage rate and high percentage of ethnic groups with low utilisation of services. Within India, Kerala and Rajasthan were selected representing two states with different vaccination rates.

For each case study, qualitative and quantitative information was drawn from the database of articles retrieved, and from additional hand and web-based searches. Literature that met the inclusion criteria was retained for the case study. For each case study, an analysis was done of the quantitative survey data using methods employed in the UNVAC project's quantitative review on barriers to immunisation[12]. For the qualitative literature, qualitative synthesis methods were used (see above). The review of the literature was complimented by an analysis of surveys from India (DHS) and Lao (MICS). For the case studies, we analysed the attributable benefit of modifying factors that were shown to play a statistically significant role in childhood immunisation status in the country. Results of the findings from the various methods were then triangulated to systematically compare, refute or validate the findings in order to achieve a consistent line of argument.

For study specific methods, see the complete study reports.

[11] Rolfe G. Validity, trustworthiness and rigour: quality and the idea of qualitative research. *Journal of Advanced Nursing* 2006;53(3):304-10.

[12] CDC, *Epidemiology of the unvaccinated child: findings from the peer-reviewed published literature*, 1999-2009: USA: 2009, 114 p.

3 Results

3.1 Demographic and Health Surveys analyses

Results of the DHS analysis conducted are divided into the following parts: sex discrepancies between boys and girls and subgroups of core variables; core predictors in general and in subgroups of core variables; gender-related predictors in general and in subgroups of core variables; and relation between vaccination status rates and national indicators from other sources. Analyses of attributable benefits conducted for the case studies are reported in the 3.1.4 section.

3.1.1 Sex discrepancies

Sex discrepancies show the likelihood of presenting the outcome of interest comparing girls and boys (for the outcome of having received no dose of vaccine and for the outcome of having received at least one dose of vaccine). Differences (or lack of differences) between girls and boys may not hold in certain subgroups of individuals or households (e.g. in girls and boys belonging to the subgroup of poor households). Sex discrepancies are presented taking into account subgroups of other variables (core variables and additional gender-related variables). For example, the likelihood of having received no dose of vaccine (outcome) comparing boys and girls belonging to poor households (subgroup).

The OR for sex (female versus males) was 1.00 (CI 0.96 to 1.04) indicating the males and females had the same likelihood of not being vaccinated (see Annex 5). Some countries showed OR greater than 1 (females being more likely of not being vaccinated) with CI not including 1: India 2006 (1.13, 1.01 to 1.27), Yemen 1991 (1.24, 1.10 to 1.40), Bolivia 2003 (1.59, 1.04 to 2.23) and Namibia 2007 (2.09, 1.04 to 4.21). The OR for Honduras was very imprecise with extremely wide CI (8.12, 1.02 to 64.47). The lower limit of the CI was very close to 1 except in Yemen 1991. Surveys with extreme values in the OR showed much larger CI, suggesting the estimated in these cases were very imprecise.

The pooled OR and confidence intervals across all surveys for the variable sex in the subgroups of other variables is shown in Annex 6. Similarly, in most of the subgroups there were no differences between girls and boys. However, some OR below 1, suggesting that boys were more likely of not being vaccinated, could be found in the following subgroups: least educated mothers, poorest households, when the child was not the fist born, sex of the head of the household male, caregiver being in couple, caregiver did not receive cash for work, women did not decide on how to use money, women decides on large purchases, women has no concerns about asking permission to obtain health care. Most of the upper limits of the CI were very close to 1. None of the subgroups favoured boys.

The same analyses reported above were repeated using another outcome: having received at least one dose of vaccine as opposed to being fully immunized. The OR for sex showed similar results: the pooled OR for sex was 1.00 (0.98 to 1.03) suggesting that girls and boys have the same likelihood of having received at least one dose of vaccine, as compared to being fully vaccinated. In Madagascar 2004, Haiti 2006 and Tanzania 2004 girls were more likely of being fully vaccinated; and in Nicaragua 2001 and in Malawi 2004 and Nepal 2005 that was the case for boys, with lower CI very close to 1.

- **Pooled OR for sex did not show significant differences between girls and boys in either of the two vaccination outcomes.**
- **In certain subgroups of children (e.g. children from the poorest households), boys were more likely to not being vaccinated than girls.**
- **In certain countries and years, outcomes favoured girls, and in others outcomes favoured boys.**
- **There are no substantial differences between the outcome 'not having received any dose of vaccines' (as opposed to 'having received at least one dose') and the outcome of 'having received at least one dose of vaccine' (as opposed to 'being fully vaccinated').**

3.1.2 Core variables

The likelihood of presenting the outcome (i.e. not having received any dose of vaccine or having received at least one dose of vaccine) according to other variables core and gender-related variables (e.g. education level of the caregiver or wealth status of the household) is reported below. The differences (or lack of differences) in the likelihood of presenting the outcome of interest for each variable is also presented in subgroups of the core variable.

The pooled OR for the core variables consistently showed that children from disadvantaged groups were more like of not being vaccinated: children of mothers with the least educational level, of mothers with partners with the least educational level, of mothers not vaccinated against TT and of poor households (all factors found to be statistically significant, with CI not containing the value 1).

In the subgroups of those variables, similar results were obtained, with the following exceptions showing the same likelihood (OR with CI containing the value 1) in:

- children of the least and most educated women in the subgroup women not being vaccinated against TT;
- children of mothers with partners of the least and most educated in the subgroup of women not being vaccinated against TT;
- children of poor and rich households in the subgroup of children of least educated women.

See Annex 7 for the OR and CI described above.

- **Pooled OR for core variables showed consistent statistically significant differences in all variables favouring the most disadvantaged groups (e.g. children from poor households).**
- **Exceptionally, in the subgroups of women not vaccinated against TT and of the least educated women some variables showed no statistically significant differences.**
- **There were no substantial differences between the outcome 'not having received any dose of vaccines' (as opposed to 'having received at least one dose') and the outcome 'having received at least one dose of vaccine' (as opposed to 'being fully vaccinated').**

3.1.3 Gender related variables

Other genders related were examined looking at the Odds Ratio of 'not being vaccinated' depending on the values of those variables. Table 1 summarized the results of the analysis on gender related variables in Annex 8.

Table 1. Associated factors with children having received no dose of vaccine

Factors associated with children not having received any dose of vaccine include children:

- of least educated women;
- of women with least educated partners;
- of women without TT vaccination;
- of poor households;
- who are younger;
- of household with male heads;
- living in rural areas;
- of households not having radio;
- of households were radio is seldom listened to;
- of households without television;
- of households were television is seldom watched;
- of women who state that arguing with the partner, neglecting children and going out justifies beating them;
- of women who do not receive cash for work;
- of women who decide for health care, how to spend money, or the daily purchases;
- of women who have concerns about the distance of health services, who go alone for health care, who state that know where to get health care, who have concerns about asking for permission to get health care or about the gender of the health care provider;
- of women who think that their partners having other women justifies refusing to have sex.

In most of the cases, these differences hold for the subgroups of the core variables. Some exceptions existed where certain statistically significant OR loose significance, or where non statistically significant OR become significant. For a complete list of factors, see Annex 8.

- **Gender related variables that indicate decision capacity of women and stating that beating is justified under certain circumstances are associated with not being vaccinated.**
- **Gender related variables that express women concerns on health care (e.g. distance, gender of provider) are associated with not being vaccinated.**
- **Gender related variables show the same OR considering subgroups of core variables, except in a few subgroups.**
- **There are no substantial differences between the outcome 'not having received any dose of vaccines' (as opposed 'to having received at least one dose') and the outcome of 'having received at least one dose of vaccine' (as opposed to 'being fully vaccinated'); data not shown.**

3.1.4 Vaccination status rates in relation to national indicators

Vaccination coverage rates vary greatly across countries, thus the question is how these differences might be explained by economic or other country characteristics. In a preliminary approach towards addressing this question, we performed correlation analyses linking vaccination coverage rates with a range of national development indicator variables: a) economic strength (GDP per capita); b) economic disparities (GINI, poverty rate); c) level of education (illiteracy rate); d) health and health care (infant mortality, government health expenditures); e) empowerment of women (Gender development index GDI, female combined gross enrolment ratio, gender empowerment measure GEM, female earned income, income ratio between women and men, Percentage of women in ministerial positions); and f) the human development index HDI. The results of these correlation analyses are presented in Annex 9.

Associations of these national indicators with children's immunization was depending on the outcome, i.e. association was weaker when considering the rate of full vaccination coverage than when considering the rates of coverage by at least one dose of vaccine or by DTP3. Moreover, most general economic indicators show almost no association with vaccination coverage rates. However, infant mortality rates, poverty rates and adult illiteracy rates showed a strong negative association with vaccination coverage by at least one dose and by DTP3, respectively. Conversely, government health expenditures, the gender development index and female combined gross enrolment ratio showed a strong positive association with the same measures of vaccination coverage. A closer look at the scatter plots (see Annex 10) shows that even countries in the lower range of the human development index may attain high rates of vaccination coverage. Interestingly, some indicators of female empowerment as Gender Development Index or Female combined gross enrolment ratio showed a significant positive association with vaccination coverage meaning that when women empowerment increased, vaccination coverage was higher. Nevertheless, this association was not systematic; the association between vaccination coverage and other gender indicators such as Gender Empowerment Measure being not significant and/or negative.

- **High adult literacy and less infant mortality were positively associated with being vaccinated.**
- **National economic indicators showed no association.**
- **Gender related indicators showed a mixed picture.**
- **Gender related variables show the same OR considering subgroups of core variables, except in a few subgroups**.

3.2 Qualitative Systematic Review

3.2.1 Study characteristics

Twenty-three studies conducted between 1982 and 2010 were included in the review; 16 were published between 2000 and 2010, 5 in the 1990s and 2 in the 1980s. The studies represent a wide range of developing countries including some that have well known coverage challenges such as Bolivia (1), China (1), Ethiopia (2), Haiti (1), India (4), Nigeria (3), and Mozambique (2). Other countries include Bangladesh, Cameroon, Gabon, Kenya, South Africa, Senegal, Togo, and Turkey.

3.2.2 Gender related barriers to immunisation

Barriers identified in the articles cluster around the following main themes: health systems, power and politics, knowledge and health beliefs, education, information and communication, poverty and livelihoods, women's agency and decision-making, and gender and social norms. The gender related issues underlying these themes that emerged from the review are summarized below in Table 2 but are presented more in detail in Annex 11.

Table 2. Gender Related Barriers to Immunisation

Theme	Gender related dimension
Health systems	▪ Women have limited access to household financial resources can not access care ▪ Provider attitudes and skills: Disrespect of mother's time, effort, specific circumstances, social status; poor skills ▪ Dependency on clinic for ANC, pregnancy and child health care; fear of reprisal for not following the recommendation/"law" ▪ Service organisation: Unpredictability and hours of service; lack of privacy exposes women to shame/humiliation at facility; ▪ Time and distance affect women with multiple roles more acutely ▪ Social and cultural accommodation for women limited and constraining
Power and politics	▪ Politicization of immunisation by local leaders manipulates women through rumours and fear; resistance to immunisation demanded by men but carried out by women ▪ Government priorities, policies and methods pressure women through authoritarian family planning and immunisation strategies; rather than through constructive engagement ▪ Colonial administration of Immunisation treats women as passive agents ▪ Western and traditional medical system, and social norms make woman responsible for child's health status, not the husband or family ▪ Health programmes perpetuate this gender norm
Knowledge / Health Beliefs	▪ Health decision-making is based on experience and knowledge; women are responsible for the consequences of their decisions as measured by child's health ▪ Mother's behaviour (or misbehaviour) blamed for child health ▪ Mother's accept blame/shame related to child health as sign of their "neglect" ▪ Mother's lack knowledge yet have awareness of the importance of vaccines ▪ Information not provided in a way that can be understood by women with alternative world view
Education, Information, Communication	▪ Women's lower educational level (versus men) cited as reason for non or under vaccination ▪ "Lack of knowledge" or alternative knowledge claims dismissed and equated with illiteracy and lack of education ▪ Knowledge is built on experience by women of immunisation service ▪ Low literacy is linked to "types of belief" held about vaccines ▪ Father's education also an issue ▪ Health education targets women only; Men do not get information ▪ Health message are transferred but inaccessible way

Agency / Decision -making	▪ Mother's choices depends on other family members ▪ Limited degree of access to and control over household resources limits women's capacity to act on her own and her child's behalf
Gender /social norms	▪ Disempowering gender roles limit mothers' access to services ▪ Women divide their time between maternal tasks (childbearing/rearing responsibilities), domestic tasks, livelihoods activities (productive tasks) and social tasks (attending sick family members, unexpected guests, etc) ▪ Blame on mothers for "negligence" or "insufficiency" in case of a sick child may limit their motivation to attend public health services ▪ Marital discord and domestic violence contribute to psychic overload
Poverty and Livelihoods	▪ In contexts where poverty leads to social exclusion, social networks may be be too weak to assist mothers to take children to immunization, both financially and by allowing them to take some time off work ▪ Women from less well-integrated families often lack social connections that encourage clinic attendance ▪ Specific groups like migrant women are even more marginalized ▪ Mothers don't attend health services to avoid poverty induced shame

3.2.3 Synthesis of qualitative findings

A synthesis and interpretation of the results of the review are presented below, and where available, supported by additional references. For a complete presentation of the discussion see the full report of the Qualitative Systematic Review.

- The health status of the child is inextricably linked to the mother's perceived capacity to care for and nurture her child[13]. Despite the father's and extended families' say how the mother should care for her child, they are rarely implicated in the health status of the child. This gendered aspect of child health is sustained and perpetuated by both the biomedical and traditional health beliefs discourses.
- Immunisation services are gendered in how they are understood, presented, and managed. In resource poor setting, primary health care and maternal and child health (MCH) often prioritise MCH over curative care. As immunisation services target mothers as the primary caretakers of children, they are themselves feminized or gendered in their organisation, the kind of information they provide and the way they deliver services. This can result in a gendered bias against men in their access to and utilisation of health services[14] and therefore reinforces gender and social dynamics found in the communities.
- Immunisation programmes that fail to recognize the constraints that women or mothers face in accessing and utilising services may be inadvertently contributing to gender inequities. Provider attitudes, public exposure to criticism, and missed opportunities can reinforce gender stereotypes and divisions in the society and contribute to maintaining the perception that child health is only the woman's responsibility. Her "failure" to immunise her children, in this context, becomes normative to the extent that even she accepts her child's health status as caused by her own "neglect". In such circumstances, the system itself perpetuates the low status of women and her subordinate position within it.

[13] State of the World's Children, UNICEF 2008
[14] Hill K, Upchurch DM. Gender Differences in Child Health: Evidence from the Demographic and Health Surveys. *Population and Development Review* 1995;21(1):127-51.

- Service factors continue to pose a significant barrier to completing child vaccination schedules. Mother's experience in the health centre are often compromised by power differentials, both socioeconomic (e.g. poverty) and gendered (e.g. low status of women). It is therefore critical to understand gendered socio-relational experiences of immunisation services as potential obstacles to accessing vaccination interventions and to improving the responsiveness of services to all, regardless of sex or socioeconomic status.
- Vaccination has been used as a political tool in some regions for political gain. Politicians and various opinion leaders, including religious leaders, have used vaccination programmes and campaigns to gain or maintain their power base. Commonplace is the use of sterility rumours to sow fear in the communities. Women, as caretakers of children having to decide whether or not to vaccinate their child, are on the frontlines of resistance with pressure from all sides. In this circumstance of high politicization of vaccination, gender disparities existing in societies can easily be exploited. Poor, rural, ethnically or socially marginalized women suffer these political challenges most acutely.
- Women may also use immunisation services as a platform for covert resistance to demonstrate their disapproval of government policies (past and present), lack of services, or the disrespect they may feel at the clinic when they face a rude or patronizing provider. However, even though enacted by women, this resistance is often dictated by men and communities while the woman, as the caretaker of child, is blamed by authorities and the community as the negligent one when the child falls ill.
- Men or fathers are rarely implicated in vaccination programmes. Information often does not reach them. By targeting only women, vaccination interventions moreover neglect the critical influence men have over women's decision-making power. In many developing countries, even if women have the primary daily responsibility for child health care, it is the men who control women's access to information, finances, transportation, and other necessary resources to access health services[15]. Programmes that have reached out, have positive results[16]. Research on barriers rarely records the views of men and families related to vaccination even though the importance of women social and familial resources has been found to facilitate vaccination utilisation[17].

[15] Green EC. *AIDS and STDs in Africa: bridging the gap between traditional healing and modern medicine.* Boulder, Colorado Oxford, England: Westview Press, 1994.
[16] Peacock D, Redpath J, Weston M, Evans K, Daub A, Greig A. Literature Review on Men, Gender, Health and HIV and AIDS in South Africa August 2008 for In: *Network*. SGJ, editor, 2008
[17] Coreil J, Losikoff P, Pincu R, Mayard G, Ruff AJ, Hausler HP, et al. Cultural feasibility studies in preparation for clinical trials to reduce maternal-infant HIV transmission in Haiti. *AIDS Educ Prev* 1998;10(1):46-62.
Schwarz NG, Gysels M, Pell C, Gabor J, Schlie M, Issifou S, et al. Reasons for non-adherence to vaccination at mother and child care clinics (MCCs) in Lambarene, Gabon. *Vaccine* 2009;27(39):5371-75.
Oluwadare C. The Social Determinants of Routine Immunisation in Ekiti State of Nigeria. *Stud. Ethno-Med.* 2009;3(1):49-56.
Bisht S, Coutinho L. When Cure Is Better than Prevention: Immunity and Preventive Care of Measles. *Economic and Political Weekly* 2000;35(8/9):697-708.

3.3 Case Studies [India; Lao]

3.3.1 India

According to the DHS, in 22 of the 29 Indian states, at least of 80% of children had received at least one dose of vaccine with a national average of 85.6%. Among these states which include Kerala, several reached more than 90% of children with at least one dose of vaccine. Rajasthan remains below the national average. In Rajasthan, a poorer Indian state, the analysis of the DHS-survey revealed a low percentage of children with at least one dose of vaccine (78.4%). Sex discrepancies were not significant. TT-immunization of the mother was the most important predictor variable of infant vaccination while the partner's education had no effect. Wealth played a particularly important role in the vaccination status of children whose mothers were less empowered. In Kerala the DHS-survey showed a vaccination rate of 97% (at least one dose of vaccine). TT-immunization of the mother is the strongest predictor variable of infant vaccination. Mother's education was the predominant variable affecting children's vaccination status.

Data from other state level surveys however paints a more divergent picture from the DHS results, showing high vaccination coverage for Kerala (75% of children in Kerala were fully vaccinated at the age of 6 months) but very low coverage for Rajasthan (only 25% of children were fully vaccinated).

Quantitative studies concur reporting a series of common factors affecting vaccination practices in both states: socio-economic factors such as parents' education and occupation, households' income; accessibility factors such as distance and transport; health service aspects such as availability of staff, vaccine and overall management of the service, and finally factors related to knowledge and information. Cultural factors and societal norms, such as caste, boy preference, birth order and sibling composition play out across both states but had higher impact in Rajasthan in terms of sex inequalities facing vaccination. Issues of service quality and geographical accessibility also tend to be more prominent in Rajasthan. Possible explanations given for these variations between the two States include a higher geographical accessibility in Kerala than in Rajasthan due to specific settlement patterns, variations in regional/local health system performance, differentials in development interventions and the particularities of Kerala's development model.

The qualitative literature from the States corroborated the findings from local surveys. Most qualitative studies report immunization barriers pertaining to local or regional patterns of vaccination acceptance and local vaccination culture. Both factors refer to community-level understanding and interpretation of diseases and vaccines. Dynamics of passive acceptance or even resistance versus active demand for vaccinations are other explanations of regional variations in vaccination compliance. They are perpetuated by aspects of poor quality of immunization service, such as a lack of respect towards mothers and caretaker which perpetuates confrontational relationships between community members and health staff. While confrontation or acceptance underline various power relationships between communities and states representative, these various attitudes are also shaped by past experience of immunization and their reinterpretation. In these studies, gender-specific barriers to immunization

reflect those power confrontations as women's autonomy to decide on children's vaccination may be influenced by the community's position on vaccination.

All methods were consistent in showing variations in coverage rates between the two states as well as on the importance of a number of factors affecting women's autonomy and position in society such as wealth, ANC attendance, education and control over resources and mobility. Where the DHS analysis showed no sex discrepancies in vaccination coverage in Rajasthan and sex discrepancies favouring girls in Kerala, quantitative and qualitative studies detail a high level of gender inequality and systematic discrimination against girls (exemplified in some surveys by sex differences in vaccination rates) in Rajasthan in various configurations (e.g. son preference, birth order, in urban or rural setting). On the contrary, Kerala is cited as an example of a state with rather high level of gender equality in child care and parenting practices. In these two states, the attributable benefit analysis of DHS showed that in Rajasthan particularly improvements in women TT status vaccination, a predictor strongly related to the vaccination status of children, may be associated with a significant improvement in children vaccination as an example of how deeper analysis of barriers in specific settings could yield policy and practice recommendations for improving coverage in local settings.

3.3.2 Lao

In Lao there was a lack of quantitative and qualitative data, particularly at the sub-national level. No DHS was available and thus no attributable benefit analysis was possible in this case. In the absence of DHS, the latest MICS was analyzed. Analysis of MICS data revealed a high percentage of unvaccinated children with great disparities within the country and possible sex discrepancies favourable to girls. Mother's education and mother's TT status were strongly connected with children's immunization. Studies with qualitative survey data reported a series of socio-demographic factors such as mother's education, or occupation, but also accessibility obstacles as well as issues pertaining to community awareness on immunization and quality of service. The qualitative literature review revealed that immunization obstacles are rather linked to culture and ethnicity, with predominance of ethno medical beliefs and a health system tailored to the culture to the dominant group in Lao. Quality issues in the way immunization service is delivered to hard-to-reach ethnic groups show a certain lack of concern for the cultural specificities of these populations. And yet communities express their wish to be empowered with their own health but in a way that respect their cultural specificities. In this case studies, the available data when triangulated and analysed for gender disparities present comparable findings related to mother's education and TT status. While the MICS analysis pinpoints sex discrepancy in vaccination status that favours girls, surveys and qualitative studies do not report sex discrepancies in vaccination. According to these studies, low immunization trends in Lao affect indifferently boys and girls. While gender constraints exist in Lao relative to mother's autonomy and position in society, the ethnic factor seems to weigh more than gender inequality to account for low immunization rate in Lao.

4 Conclusions of the DHS quantitative data analysis, the systematic review of qualitative data on gender and immunization and the case studies

Main findings	Implications
Understanding Vaccination Coverage	
1) There is a significant proportion of children who have not received a single dose of vaccine (+).	'Unvaccinated children' assessed through nation-wide representative surveys has proven to be a significant indicator of inequities in vaccination which cannot be captured only looking at DTP3 coverage. Use of both survey and qualitative methodologies are needed to better understand and contextualised barriers to vaccination.
Sex discrepancies in vaccination	
2) Girls and boys have the same likelihood of being vaccinated in most of the countries and in the pooled estimate of data from all countries. A few moderate exceptions exist. DHS data and sub-national level data do not always correspond. Sex discrepancies favouring boys were found in a few countries with known gender inequity and son preference.	Sex discrepancies do not seem to be a widespread problem related to vaccination globally. Where sex discrepancies exist, sex disaggregated data should be used to better investigate the problem. Qualitative research methods can compliment and help to explain gender based discrimination, and potential areas for intervention locally.
Education and Poverty	
3) Core variables (e.g. education and poverty) are associated with the vaccination status. While significant, literacy alone does not always determine vaccination status. Knowledge of the importance of vaccination is key. Poverty is experienced as a lack of both financial and social resources; such constraints are compounded by gender related discrimination to negatively impact vaccination utilisation.	Despite strong associations, key development measures such as education, gender inequality and poverty alleviation are longer term goals. In the short term, emphasis should also be put on increasing knowledge of caretakers, and facilitating socially and culturally appropriate access to services to rural and marginalised populations. Solutions to mitigating the negative effects of low education status and poverty on vaccination coverage must be found locally. Data from other variables and explanations from qualitative studies should be looked at to explore entry points for interventions.

Main findings	Implications
Experience with the Health System **4) Having been vaccinated for tetanus during pregnancy is associated with children vaccination status. Women's choice of health system and health seeking more generally is shaped by their experiences with the health system. Attributable benefit analysis of key variables suggest that increasing the coverage of TT vaccination of mothers would have a dramatic effect on the immunisation rates of children in selected countries.**	Attributable benefits suggest that interventions targeting TT vaccination status may impact substantially on children vaccination rates. Likewise, improving first experience with the services could facilitate uptake in vaccination. Vaccination programmes need to give greater attention to gender based barriers at the point of service such as provider attitudes, indirect social and material costs, or inconsistent and inconvenient availability of service that contribute to low uptake of vaccination services.
Access to information and communication **5) Access to information (measured by access and use of radio and television) was associated with vaccination coverage. Information giving and communication messages that are not "cross-culturally" appropriate and understandable (recognising alternative health beliefs) are less effective. Programmes that target only mothers (rather than also fathers and families) may reinforce gender biases in vaccination and child health care**.	Use of appropriate information and communication strategies through radio and television can increase vaccination coverage. Information and messages must, however be adapted to acknowledge local health beliefs and views so that the messages are understandable and acceptable to the people. To begin to change gender bias in child caretaking, and the gendered repercussions documented in exclusively women targeted approaches, information and communication campaigns should try implicating mothers, fathers, families and communities in improving child health.

Main findings	Implications
Decision-making over financial resources **6) Gender related variables related to women's capacity to take decision about personal and family finances are associated with the vaccination status positively (qualitative and local survey data) and negatively (DHS analysis.) While autonomy in decision-making over resources is considered to be an important measure of women's autonomy in health seeking, working mothers with few social resources (e.g. single mothers) face considerable challenges in accessing services. More research is needed to explore these differences, particularly in countries where decision making by women runs counter to the best interest of the child.**	The role of women's autonomy and decision-making over resources and child vaccination status provides a mixed picture. In some settings more decision-making power yields lower vaccination utilisation. Where this is the case, further exploration is needed on the barriers these women face particularly in getting their children vaccinated. There is documentation that working urban women face considerable constraints in accessing services due to time and social resource limitations. Changes in service organisation (e.g. extending service hours, providing childcare) can facilitate utilisation. Working with fathers and families through support and extension services has also shown effectiveness. Programmes must explore reasons for gender based barriers and define with communities appropriate solutions to increase access to vaccination coverage.
Empowerment **7) Gender variables related to women's concern about accessing health care are associated with vaccination status. Measures of women's empowerment are correlated with the low status of women in many societies where women have little power to decide the health care needs of their child. Men and extended families often control women's mobility and decision-making in these contexts related to child vaccination.**	Improving the status of women in the couple and family is critical to improving child vaccination status. Interventions that have targeted families through counselling and social support groups have proven effective in some settings. While attention needs to be given to involving men and in the care of their children so that gender barriers to immunisation can be slowly transformed, more research is needed to establish a gender differential (i.e. whether the determinant factors are due to household relationships or to wider socio-economic factors) in vaccination status.

Main findings	Implications
Politicization of immunization	
8) Vaccination has been used as a tool in some regions by political and religious leaders for political gains. Political actors often use fear and negative experience with past fertility control policies to heighten resistance. Women, in these settings, face considerable pressure not to vaccinate their children. In such context, gender disparities existing in societies can easily be exploited. Poor, rural, ethnically or socially marginalized women suffer these political challenges most acutely.	Rumours and misinformation campaigns have had devastating affects on vaccination coverage in some settings. Historic and current policies restricting fertility plays have fuelled rumours and resistance in some settings. Programme managers must be attentive to the predicament many mothers may find themselves in as they try to negotiate social pressures, fear, and health care for their children.

WHO

Project gender and immunisation

Statistical component

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The statistical component is reported in two documents:

- **the report itself (this document) and**
- **an annexed document with all graphics where odds ratios for individual countries and pooled odds ratios are presented for each predictor, and all combinations of predictors.**

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Disclaimer

Abbreviations

CMC	Century Month Code
DHS	Demographic and Health Survey
DTP	Diphtheria, Tetanus and Pertussis vaccinae
EPI	Expanded Programme on Immunisation
GAVI	The GAVI Alliance
GDI	Gender Development Index
GDP	Gross Domestic Product
GEM	Gender Empowerment Measures
HB	Hepatitis B
HDI	Human Development Index
ISO	International Standards Organisation
IVB	Immunisation, Vaccines and Biologicals
IVR	Initiative for Vaccines Research
MICS	Multi-Indicator Cluster Survey
OR	Odds Ratio
SAGE	Strategic Advisory Group of Experts
Swiss TPH	Swiss Tropical and Public Health Institute
TAG	Technical Advisory Group
TT	Tetanus Toxoid vaccine
UN	United Nations
UNDP	United Nations Development Programme
WHO	World Health Organisation

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1 Executive summary

Routine childhood vaccination is one of the most cost-effective health interventions and has proven to save millions of lives. Despite increased coverage since the launch of the Expanded Programme of Immunisation (EPI) in the 70s, inequities between and within countries still exist. The Strategic Advisory Group of Experts on Immunisation of the World Health Organisation (WHO/SAGE) requested the World Heath Organisation to undertake a study of the epidemiology of the unvaccinated child (2009) and subsequently a study of the gender-related factors associated with the vaccination status, to inform the GAVI Alliance gender policy. The general objective of this study was to provide evidence on sex differences in vaccination status and on the relative importance of their predictors.

In the statistical component of this study, Demographic and Health Surveys (DHS) were analysed to ascertain the vaccination status of children from 12 to 59 months old and its association with selected predictor variables. A total of 166 surveys in 67 countries were included.

Two outcome variables were defined: 'access' (with two values: having received no dose of vaccine and having received at least one dose of vaccine) and 'utilisation' (having received at least one dose of vaccine and being fully vaccinated).

Several predictor variables were used, based on the findings of a previous literature review and of the study of the unvaccinated child. A full analyses related to the sex of the child was conducted. Core variables included: education status of the caregiver, education status of caregiver's partner, caregiver's tetanus toxoid (TT) vaccination status and household wealth index. Additionally, a series of variables related to women empowerment were also included (e.g. decision capacity before certain circumstances).

Data was downloaded from the DHS website and processed to homogenise variables names and codes. Exceptions were properly handled and predictor variables were dichotomised. To assess associations between the outcomes and the predictor variables we used generalised estimating equations for binary data with a logit link function, adjusted for clustering. Effect modification by sex of the child was examined for all predictor variables. These results are presented with odds ratios (OR) and 95% confidence intervals.
Additional analyses were conducted in a small subset of surveys to estimate benefits that might be achieved by improving certain highly predictive factors. We estimated the benefit of intervening on the most predictive factor and assumed that this intervention would succeed in raising all regional prevalence rates of this factor to its present maximal level of the respective country. Finally, correlations between immunization coverage rates and socio-economic, developmental and gender empowerment indicators across countries were analysed.

The main findings were:

1. Pooled OR for sex comparing girls and boys did not show differences in any of the two vaccination outcomes.
2. In certain subgroups of children (e.g. children from the poorest households), boys were more likely of not being vaccinated than girls.
3. In certain countries and years, outcomes favoured girls, and in others outcomes favoured boys.
4. There are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated).

5. Pooled OR for core variables showed consistent statistically significant differences in all variables, making the most disadvantaged groups to be more likely of not being vaccinated (e.g. children from poor households).
6. Exceptionally, in the subgroups of women not vaccinated against TT and of least educated women some variables showed no statistically significant differences.
7. There are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated).
8. Gender related variables that indicate decision capacity of women and stating that beating is justified under certain circumstances are associated with the children not being vaccinated.
9. Gender related variables that express women's concerns on health care (e.g. distance, gender of provider) are associated with the child not being vaccinated. These associations vary greatly between countries.
10. Gender related variables show the same OR across subgroups defined by core variables, except in a few subgroups.
11. There are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated); data not shown.
12. Attributable benefits analyses are useful to model the sensitivity of the vaccination outcomes to changes on predictor variables.
13. In the examples examined, improvements in women's TT status vaccination, a predictor strongly related to the vaccination status of children, may be associated with a significant improvement in children's vaccination.
14. High adult literacy and less infant mortality were positively associated with being vaccinated at the country level.
15. National economic indicators showed no association with vaccination coverage at the country level.
16. Gender related indicators showed a mixed picture at the country level.

An annexed reports shows all graphics containing individual surveys OR for all predictors with the estimates of the pooled OR.

In conclusion:

1. 'Unvaccinated children' assessed through nation-wide representative surveys uncovers inequities in vaccination access which cannot be captured only looking at DTP3 coverage.
2. There is no evidence to support a global policy to gather sex disaggregated data on vaccination.
3. Although associations with core variables are strong, most of these factors are hardly addressable in the short or mid term (e.g. poverty), except for the TT vaccination status of mothers.
4. Women partnership relations can be an entry point for interventions to improve access to vaccination. However, male gender related variables have not been explored to establish a gender differential.
5. Gender factors vary greatly country by country, and a global policy can only be general in nature.
6. The relation between antenatal care and childhood routine immunisation needs to be further explored as an entry point for interventions to improve vaccination access.
7. National indicators are of limited use in identifying countries with low vaccination rates.

2 Background

Routine childhood vaccination is one of the most cost-effective health interventions and has proven to save millions of lives. The Expanded Programme of Immunisation (EPI), created in 70s, introduced routine systematic vaccination against six diseases in the health services worldwide. While some countries had effective and extensive coverage for some vaccines prior to 1980, international efforts to make immunization against major childhood diseases available to all infants began in the late 1970s and early 1980s culminating with the 1990 Universal Childhood Immunization imitative. Between 1990 and 2000 global immunization coverage remained stable at between 75% and 80% and, since 2000, increased commitment to immunization at both national and international levels has led to a gradual increase in both availability of new vaccines and in the proportion of protected children[1].

These global achievements, however, mask significant differences both within as well as between countries. Furthermore, global vaccination monitoring, greatly albeit not exclusively based on DTP3[2] (Diphtheria, Tetanus and Pertussis) and measles[3] coverage, cannot provide insights on those children that have no contact with the health system who remain unvaccinated.

In 2008 the World Health Organization's Strategic Advisory Group of Experts on Immunisation of the World Health Organisation (WHO/SAGE) requested that WHO's Department of Immunization, Vaccines and Biologicals (IVB) undertake a "more detailed analysis of children who have not been reached by immunization services", which resulted in the study of the "Epidemiology of the unvaccinated child". This study explored generic predictors associated with children not having received any dose of vaccine[4], included 241 Demographic and Health Surveys (DHS) and Mulit-Indicator Cluster Surveys (MICS) from 1986 up to 2007 and showed that 9.9 % of children did not receive any dose of routine vaccine, across all surveys and years analysed. It also served to identify key predictors of unvaccination which have been used as the basis of this analysis.

Furthermore, in May 2009 the Initiative for Vaccine Research (IVR) launched responded to the SAGE request issued in April 2010 to generate evidence on gender related issues affecting vaccination of children. The project was financed by the GAVI Allinace (GAVI) to support their gender policy implementation plan[5]. The project aim was to collect and analyze evidence related to the role and impact of sex and gender in immunization coverage. This analysis is to be reported back to SAGE at the end of 2010. The project was monitoring by WHO and the Technical Advisory Group (TAG) specially set up to this end.

The general objective of this analysis is:

> To provide evidence on sex differences in vaccination status and on the relative importance of their predictors, form a selection of surveys, to inform WHO gender strategy and GAVI gender policy.

The specific objectives are:

1. Review and document existence of sex disparities in vaccination coverage of EPI vaccines
2. Define predictors of sex disparities in vaccination coverage, if any.
3. Assess gender related predictors in the uptake and delivery of vaccination services
4. Discuss the utility of sex disaggregated data in health information systems and surveys

3 Methods

The following table summarises the scope of the analyses:

Table 1. Scope of the analyses

Data sources	Individual subjects datasets – DHS
Subjects	Children alive* at the time of interview, aged 12 to 59 months
Outcome variables	Children having received not a single dose of vaccine versus children having received at least one dose of vaccine ('access'). Children having received at least one dose of vaccine versus fully vaccinated children ('utilisation'). Outcome variables are based on routine immunisation of infants according to national immunisation schedules.
Predictor variables (examples)	Sex of the child, place of residence, educational level of caregiver and father, wealth index, marital status, among others.
Year of the estimates	Calendar year when the majority of the subjects where interviewed minus one year.

3.1 Data sources

DHSs are the best available multi-purpose nation-wide representative surveys. Previous analyses of DHS datasets suggested that their methods and way of implementation are robust. DHSs have large sample sizes and are typically conducted every five years in the certain counties. DHS have been conducted in six different phases up to 2008:

- Phase 1 (1984 to 1989)
- Phase 2 (1988 to 1993)
- Phase 3 (1992 to 1997)
- Phase 4 (1997 to 2003)
- Phase 5 (2003 to 2008)

183 DHS were listed in the DHS-MEASURE website[6]. Three could be excluded right away for not having relevant data for this study; another six had restricted access. Of the remaining 174 surveys, three sub-national surveys were excluded and another five had no vaccination variables. The final number of DHS was 166 in 67 countries. The full list all of all datasets, showing the included and excluded ones, is shown in Annex 1, together with a map with the countries where DHS were conducted.

* Dead children do not have vaccination status information in DHS.

For the analyses, only the unique or most recent survey of each country with data available was included.

Data on the national indicators were available from United Nations Development Programme (UNDP) website[7] except data on infant mortality which were obtained from the United Nations (UN) data website[8].

3.2 Variables

Variables of interest to this study followed under the following types:

- Survey information (e.g. country, year, dataset filename)
- Survey design information (e.g. primary sampling unit, cluster weights)
- Merging information: cluster identification, household identification, child identification, secondary datasets subjects information (wealth index identification)
- Children characteristics (age at interview, sex)
- Vaccination variables (e.g. DTP3)
- Outcome variables ('access' and 'utilisation')
- Predictor variables (e.g. mother's tetanus toxoid status)

Age at interview of included children had to ensure that every subject in the analysis had had time to receive all doses of all antigens: children had to be at least 12 months of age. On the other hand, the upper limit of the age range should be the smallest one to minimise recall bias, usually 23 months to have a one year cohort of children. However, data requirements for the analyses in this study advised to include a bigger number of children; hence, the upper age limit was set at 59 months. For each child, the age at interview was estimated subtracting the date of birth from the date of the interview. All age and date variables were previously codified in Century Month Codes (CMC).

Datasets contained two main types of vaccination variables: the day, month and year when a certain vaccination was given, and a summary codified variable classifying the child as vaccinated yes/no, or as not vaccinated, vaccinated documented with a date in the health card, with a mark in the health card or reported by the caregiver. Where possible, priority was given to the vaccination date variables to estimate the summary variables and where both types existed they were combined to minimise missing values in the final summary variable.

Summary variables are usually codified after the 'day' of vaccination variables. The 'day' of vaccination can have values from 1 to 31 for the days of the month, 44 indicating that there was a mark in the card for that vaccine, and 66 indicating that the caregiver reported that the child was vaccinated. In many surveys it was possible to verify the summary variables (e.g. DTP3) by looking at their consistency with the 'day' of vaccination variables.

In most of the DHS I all children with known vaccination status had health cards; and it was expected that a child who had a card had had at least one contact with the vaccination services. This reduced the proportion of unvaccinated children, since coverage among card-holders tends to be higher than coverage among non-card-holders. Therefore, estimates may be less robust in these surveys.

Certain surveys had DTP vaccinations (both dates and summary variables) in two different sets of variables: in the proper DTP variables and in a combined variable labelled as 'DTP - hepatitis B vaccine (HB)'. However, this DTP-HB variable was ambiguously labelled in some surveys as 'DTP or HB' (for each of the DTP doses, 1 to 3). Calculating DTP3 coverage assuming that 'DTP or HB' was actually 'DTP and HB' gave DTP3 coverage results that were more consistent with the coverage

figures found in surveys reports. Hence, a child having received any dose of 'DTP or HB' was considered as being vaccinated with DTP, although an unknown number of children may have been vaccinated only with HB.

No consideration was given to the validity of doses because both methods to document a vaccination (health card and recall) were taken into account. Considering only valid doses would have reduced the sample size too much to make analyses feasible. Therefore, a vaccine was considered as given if it was documented either by card or by caretaker recall.

Vaccination variables explicitly indicating that vaccines were delivered in vaccination campaigns were excluded.

Definition of outcome variables
In the outcomes variables only subjects with known vaccination status in at least one of the six antigens defined in the scope of this study were included.

'Access' variable (named 'C01') had two possible values:
- 0: child having received not a single dose of vaccine;
- 1: child having received at least one dose of vaccine.

'Utilisation' variable (named 'C1F') had two possible values:
- 0: child having received at least one dose of vaccine;
- 1: child being fully vaccinated, i.e. child received the six antigens.

In those cases where a vaccine variable was absent from a survey (e.g. BCG in some surveys), this vaccine was excluded from the analyses.

Predictor variables
Several determinants of unvaccinated children have been described in the literature, such as wealth, place of residence, educational level of the care-taker, age of the mother at first birth or the child's birth order[9]. A recent analysis of DHS and MICS surveys also showed similar and consistent patterns of differences in DTP3 coverage among certain groups[10]. A recent literature review examining studies reporting routine vaccination coverage identified the same predictors as well[11].

Drawing on those sources and in discussions with WHO and the TAG, predictors were classified in two main groups:

- Core variables: these variables have already shown significant effects on children access to immunization in former analyses. They have also been widely found in a previously conducted systematic literature review looking at articles reporting vaccination coverage. As one of the key issue to investigate, the sex of the child was included in this category. The other core variables were the mother level of education, the partner level education, the mother tetanus toxoid (TT) status and the wealth index of the household.

- Gender variables: they were related to autonomy, empowerment, emancipation and social status of women. These variables could only be addressed with DHS surveys which estimate women's empowerment through their participation in making household decisions, i.e. it reflects the degree of decision-making control that women are able to exercise in areas that affect their own lives and environments (e.g. through their attitudes toward women's ability to refuse sexual intercourse with their partners).

Predictors were dichotomised into two categories. For example, 'marital status' contained more than two categories in most of the surveys where this variable was present: 'married', 'living with someone', 'separated', 'divorced', 'widowed', 'never married'; the re-codification process defined two categories: 'in couple' and 'alone'.

Each category in all variables was assigned a default value for the logistic regression analysis. All along this study, Odds Ratios (OR) are consistently interpreted as the likelihood of the occurrence of an outcome (e.g. not having received any dose of vaccine) of the default group in relation to the other group(s). The full list of predictor variables and their values is in Table 2.

It has to be noted that the timing of the occurrence of the outcome events (vaccinations) and the timing of the occurrence of the events described in the predictors, do not necessarily match. For example, a child may been vaccinated in a given year but the marital status of the caregiver changed in a following year which was captured by the survey; or deaths in the household may have occurred before or after the year when the child was vaccinated. This points at the need to have some caution when interpreting the association between predictors and outcomes. Table 2 summaries the predictor variables and their values:

Table 2. Predictor variables and values

Variable description	Default value labels	Other value labels
Sex of the child	Female	Male
Birth order of the child.	Oldest	Younger
Level of education of the mother	Least educated (The least level of education, whether no education, or primary…)	Most educated (The other levels of education combined)
Level of education of the partner	Least educated (The least level of education)	Most educated (The other levels of education combined)
Marital status of the mother	Alone	In couple (All marital status implying being together with a partner)
TT vaccination status of the mother	Less than 2 TT doses (in any pregnancy; some surveys distinguish between last and previous pregnancy; here was combined)	2 or more TT doses (in any pregnancy)
Urbanisation	Rural (Combined with other codes that suggest rural)	Urban
Radio ownership	No radio in the household	Radio in the household (if more than one radio, like in some surveys, the actual number of radios not considered)
Television ownership	No TV in the household	TV in the household (if more than one TV, like in some surveys, the actual number of radios not considered)
Frequency of listening to radio	Woman never listens to the radio	Woman listens to the radio at least once a week
Frequency of watching TV	Woman never watches TV	Woman watches TV at least once a week
Wealth index	Poorest quintiles	Each one of the other quintiles

Variable description	Default value labels	Other value labels
Age difference in the couple	Large (more than 10 years)	Small (10 years or less)
Sex of the head of the household	Female	Male
Earns cash for work	No	Yes
Concerns about male health provider	Yes	No
Concerns about getting permission for care	Yes	No
Concerns about distance to health facility	Yes	No
Concerns about going alone for health care	Yes	No
Concerns about knowing where to get health care	Yes	No
Agrees going out justifies beating	Yes	No
Agrees neglecting children justifies beating	Yes	No
Agrees arguing with partner justifies beating	Yes	No
Agrees on refusing to have sex if partner has another woman	Yes	No
Decision making on large purchase	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on daily purchase	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on health care for herself	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on visits to relatives	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on money use	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone

3.3 Data management

Permissions to download DHS datasets were granted at the beginning of the study. Original datasets were downloaded from the DHS website and stored in a server marked as ‘read only’. Each survey may have several types of datasets relevant to this study: a ‘child’ dataset and a ‘wealth index’ dataset. These datasets needed to be merged prior to the analyses. Some DHS had the wealth index information already incorporated into the child datasets and there was no ‘wealth index’ file to merge.

Original datasets were copied and renamed according to predefined conventions. Dataset names included the country code or country name, the year, type and version of the survey and the type of file. Renaming of files was automated.

Datasets were copied again to the subfolder used for the analyses and kept as a read only repository. In this way, originally downloaded datasets remained untouched unless accidental deletion of the repository files.

Names of the datasets contained either full country names or country codes. These were respected to easily identify datasets being analysed with the original ones. However, country codes within the data were standardised using two digit International Standards Organisation (ISO) codes[12].

Original variables consist of a name (e.g. h7), a format (e.g. string), a length (number of characters or figures), a label (e.g. 'DTP3'), a value label (usually sharing the name of the variable) and labels for each of the values (e.g. 0: not vaccinated; 1: vaccinated).

A list of variables of interest to this study was prepared using significant short names without spaces, preceded by the letter 'x' to allow batch handling later on in the code written to manage data and to conduct the analyses. Variables of interest were contained in the child, woman and wealth index datasets. In each survey, the appropriate original variables relevant to this study were identified and matched with the significant variable names. In general, surveys had the same names for the same variables across all datasets.

Original variables were renamed to the significant names, following the consistent original variables names. The renaming involved the child and wealth index datasets. Exceptions to the main renaming process were identified and code written accordingly to handle those exceptions. In the renaming process labels of variables and labels of values were not modified. The value labels attached to each variable was also renamed to have the same name for a variable and for the value labels.

Once renamed, datasets were merged where necessary: child and wealth index datasets. The merging process was done based on three parameters: cluster identification, household identification and the secondary dataset individual identification (wealth index identification).

Once variables were correctly and consistently renamed across all surveys, their contents were re-codified to ensure consistency of the meaning of the values of the codified variables, across all surveys. Surveys were consistent in the values and the value labels. When a variable of interest was missing in a given dataset, a new variable was created and left with missing values in all observations. Labels of values were edited to reflect the meaning of the values of variables, after having been re-codified.

At this stage, all datasets had the same variables, with the same names, the same codes for the values of codified variables and the same labels. Exceptions due to inconsistencies in the original datasets have been documented in detail elsewhere[4].

3.4 Analyses

To assess associations between the outcomes (not having received any dose of vaccine and having received at least one dose of vaccine, 'access' and 'utilisation' respectively) and the predictor variables we used generalised estimating equations for binary data with a logit link function. To adjust for clustering of data within geographic regions unexplained by the model, an exchangeable correlation structure was assumed for data from the same geographic region. In some ways, this mimics the gold standard of a mixed logistic regression model with region-specific random effects and provides a valid and computationally much less expensive alternative if the number of clusters is sufficiently large. Like for ordinary logistic regression, results of these analyses are expressed as odds ratios. All models were multivariable using the core predictors listed above. All these variables

were binary. Educational status was dichotomized into “lowest level of education” vs. “higher level of education”, wealth status into “poor” versus “rich” and the TT vaccination status of the mother was categorized into “vaccinated” versus “non-vaccinated”.

In keeping with the main objective of the present project, effect modification by sex of the child was examined for all predictor variables to see whether some of them were manifestly more predictive of a positive or negative outcome in one of the two sexes. A logically equivalent but semantically different way of phrasing this question is whether the odds ratio of being vaccinated between girls and boys shows manifest variation across different categories of a given predictor variable. These analyses involved interaction terms which were defined as the product of the binary variable sex with the respective binary factor variable. To obtain separate effect estimates for boys and girls for a given binary factor, we introduced sex-specific versions of the respective factor (i.e. having the same value as the original variable in children of the respective sex but a value of 0 in children of the opposite sex). In addition to the original project plan, effect modification by factors other than sex was also examined. The results of these analyses were summarized in tables and graphically represented by forest plots. Random effect meta-analysis was used to obtain summary estimates for the odds ratios of different factors.

Additional analyses were conducted to estimate benefits that might be achieved by improving certain highly predictive factors. These analyses were done using simple logistic regression models but involved variables defined at the regional level as well. These regional variables were derived from the individual level ones by computing the regional means of the latter. In this way, every individual level variable was assigned its regional counterpart. It is noteworthy to mention that the regional counterpart of a binary factor is exactly the regional prevalence rate of this factor. For simplicity, these analyses only involved four core variables: educational status of the mother, educational status of her partner, wealth index and TT-immunization of the mother alongside with their regional counterparts.

We then estimated the benefit of intervening on the most predictive factor and assumed that this intervention would succeed in raising all regional prevalence rates of this factor to its present maximal level of the respective country. For these calculations, all other factors were kept constant. This benefit was defined by the rise in vaccination coverage rate associated with the respective intervention. Of course, such estimates must be interpreted with caution since the underlying model describes cross-sectional and not longitudinal associations and because the real causal factors may be hidden behind the ones observed.

Finally, correlations between immunization coverage rates and socio-economic, developmental and gender empowerment indicators across countries were analysed. Since associations between vaccination rates and national indicators were not expected to be linear, Spearman’s rank correlation coefficient was used for their description. Vaccination rates were related to national indicator values only if the underlying survey was conducted within five years of the validity range of the respective indicator value. This explains the varying sample sizes underlying the different correlations and scatter plots. As regards to infant mortality, only the most recent survey of each country and the indicator data closest in time to this survey were used.

All confidence intervals are at the level of 95%. Data management and statistical analyses were undertaken using Stata/IC 10.1, StataCorp LP (USA) in Windows XP SP3 (2002). The final pagination of logistic regression graphics was undertaken with MS Access.

3.5 Limitations

Several limitations in the data management processes and analyses have to be taken into account when interpreting results; namely:

- the vaccination status of children did not take into account valid or invalid doses (e.g. doses beyond the appropriate vaccination age for a given dose);
- the vaccination status was ascertained as documented in the health cards of the children and by caregivers recall, which may introduce some bias (over-estimating vaccination in some cases and under-estimating vaccination in others);
- inconsistencies in the original datasets (e.g. ambiguous naming of variables) have been resolved looking at patterns in other datasets, which may introduce small errors in a small number of variables and surveys;
- analyses are based on available data which corresponds to a substantial but limited number of countries in different years; therefore, pooled estimates do not reflect the situation for countries or years where there is no data available;
- a great number of variables and models have been analysed which may increase the number of occasions where, in spite of no true underlying relations, observed odd ratios became statistically significant
- children who have died did not have vaccination status data in the datasets.

4 Findings

The findings section is divided into the following parts:

1. sex discrepancies between boys and girls and subgroups defined by core variables;
2. core predictors in general and in subgroups defined by (other) core variables;
3. gender-related predictors in general and in subgroups defined by core variables;
4. attributable benefits;
5. relation between vaccination status rates and national indicators from other sources.

Multivariable logistic regression findings and meta-analyses are presented in a series of graphics in an annexed document. There is one graphic for each predictor, sub-group (if any) and outcome. Graphics show the OR for the most recent or unique survey with data available in each country, reason why graphics may have a different number of data points. At the bottom of the graphic there is the pooled estimate of the OR.

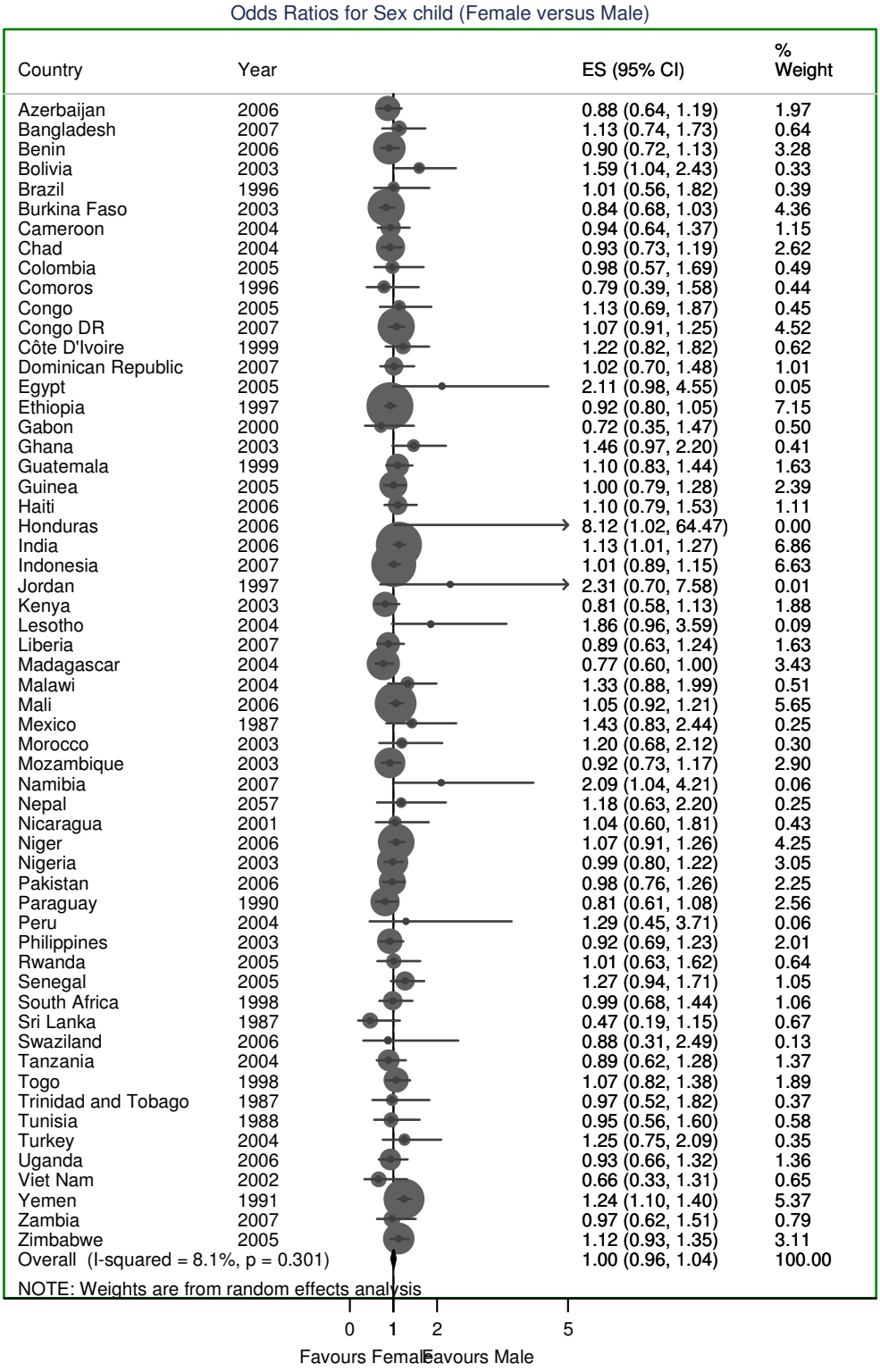
4.1 Sex discrepancies

Sex discrepancies show the likelihood of presenting the outcome of interest comparing girls and boys (for the outcome of having received no dose of vaccine and for the outcome of having received at least one dose of vaccine). Differences (or lack of differences) between girls and boys may not hold in certain subgroups of individuals or households (e.g. in girls and boys belonging to the subgroup of poor households). Sex discrepancies are presented in the full group of children in each survey and taking into account subgroups of other variables (core variables and additional gender-related variables). For example, the likelihood of having received no dose of vaccine (outcome) comparing boys and girls belonging to poor households (subgroup).

The OR for sex (female versus males) was 1.00 (CI 0.96 to 1.04) indicating the males and females had the same likelihood of not being vaccinated (see Figure 1). Some countries showed OR greater than 1 (females being more likely of not being vaccinated) with CI not including 1: India 2006 (1.13, 1.01 to 1.27), Yemen 1991 (1.24, 1.10 to 1.40), Bolivia 2003 (1.59, 1.04 to 2.23) and Namibia 2007 (2.09, 1.04 to 4.21). The OR for Honduras was very imprecise with extremely wide CI (8.12, 1.02 to 64.47). The lower limit of the CI was very close to 1 except in Yemen 1991. Surveys with extreme values in the OR showed much larger CI, showing that estimates were very imprecise in these cases .

Table 3 shows the pooled OR and confidence intervals across all surveys for boys compared to girls in the subgroups defined by other variables. Iin most of the subgroups there were no differences between boys and girls. However, some OR below 1 (with CI not containing 1), suggesting that boys were more likely of not being vaccinated, could be found in the following subgroups: least educated mothers, poorest households, when the child was not the fist born, sex of the head of the household male, caregiver being in couple, caregiver did not receive cash for work, women did not decide on how to use money, women decides on large purchases, women has no concerns about asking permission to obtain health care. Most of the upper limits of the CI were very close to 1. None of the subgroups favoured boys.

Figure 1. Likelihood of outcome 'access' (not being vaccinated) between girls and boys.



Meta-analysis, by survey, sorted by OR. Outcome: Access

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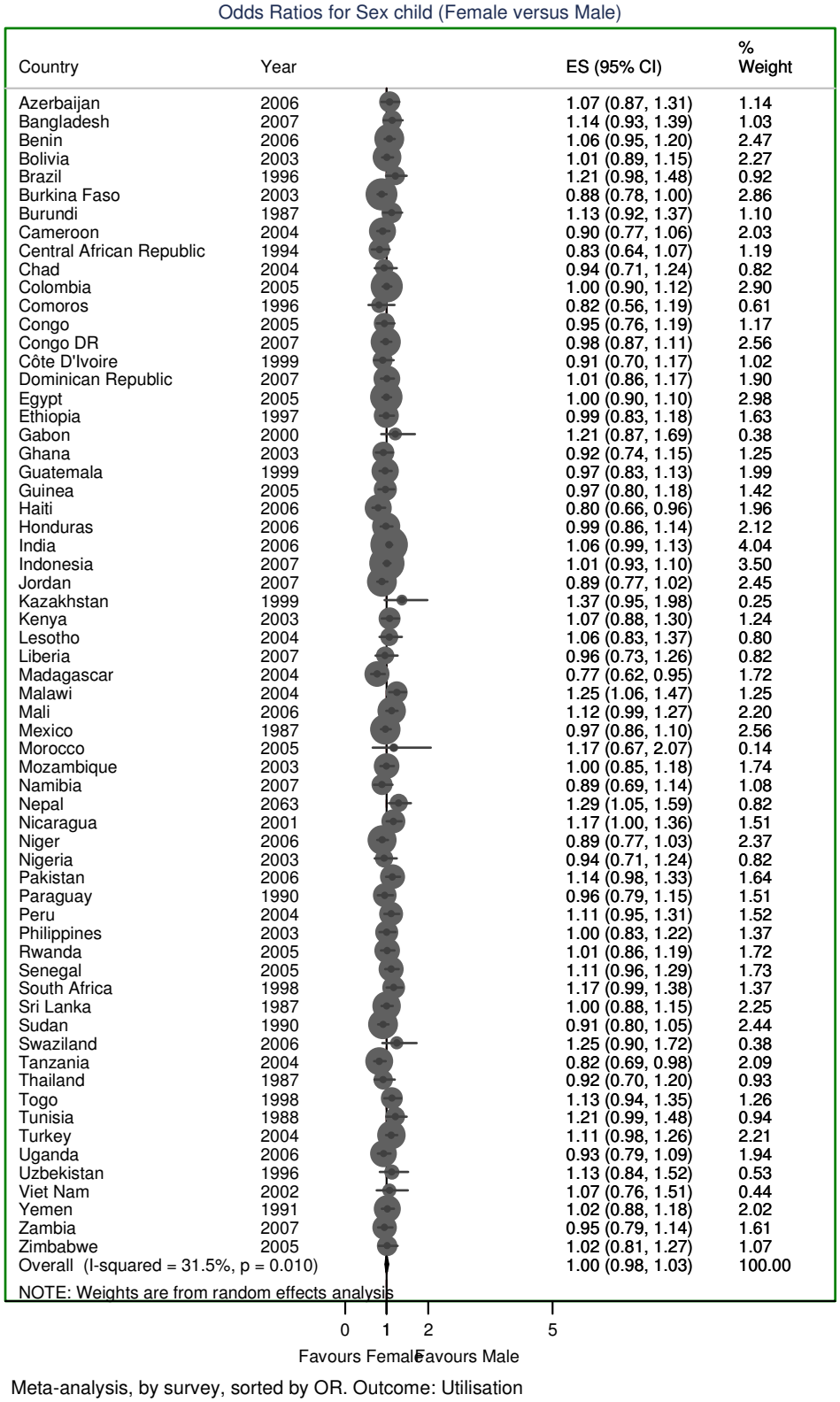
Table 3. OR for sex (females versus males) in different groups of other variables. Outcome: 'access' (not being vaccinated).

	Core predictors:	Sex		
	Values:	Female versus Male		
		OR	lower	upper
All	**Subgroups**	**1.00**	**0.96**	**1.04**
Sex	**Female**			
	Male			
Education	**Least educated**	0.91*	0.83	0.99
	Most educated	1.01	0.96	1.05
Education partner	**Least educated**	0.90	0.80	1.00
	Most educated	0.99	0.95	1.03
Tetanus before birth	**No**	0.96	0.88	1.03
	Yes	0.99	0.94	1.04
Wealth index	**Poorest**	0.92*	0.87	0.98
	Richest	0.99	0.94	1.04
Birth order	**1st born**	1.00	0.95	1.05
	Younger	0.81*	0.72	0.89
Sex head household	**Female**	1.01	0.96	1.06
	Male	0.79*	0.70	0.88
Marital	**Alone**	1.02	0.98	1.06
	In couple	0.66*	0.54	0.78
Age difference couple	**Large**	1.00	0.95	1.04
	Small	0.91*	0.83	1.00
Residence	**Rural**	0.96	0.88	1.05
	Urban	0.99	0.95	1.03
Radio	**No**	0.96	0.89	1.04
	Yes	0.96	0.91	1.01
Radio how often	**Never**	1.01	0.95	1.07
	At least once a	0.95	0.89	1.00
Television	**No**	0.98	0.90	1.06
	Yes	0.98	0.94	1.02
TV how often	**Never**	0.96	0.89	1.04
	At least once a	0.98	0.93	1.03
Arguing with partner justifies beating	**No**	0.96	0.89	1.02
	Yes	1.00	0.95	1.06
Neglecting children justifies beating	**No**	0.95	0.89	1.01
	Yes	1.02	0.96	1.08
Going out justifies beating	**No**	0.96	0.90	1.01
	Yes	1.01	0.95	1.07
Cash for work	**No**	0.92*	0.86	0.98
	Yes	0.94	0.86	1.02
Woman decides health care	**No**	1.01	0.96	1.06
	Yes	0.92	0.74	1.09
Woman decides money	**No**	0.83*	0.73	0.93
	Yes	0.95	0.85	1.04
Woman decides large purchase	**No**	1.01	0.96	1.05
	Yes	0.87*	0.76	0.97
Woman decides daily purchase	**No**	1.00	0.95	1.05
	Yes	0.96	0.81	1.11
Woman decides visit	**No**	1.00	0.95	1.04
	Yes	0.88	0.72	1.04
Distance to health facility	**Yes**	0.94	0.84	1.04
	No	0.98	0.87	1.09
Going alone for health care	**Yes**	1.00	0.92	1.08
	No	0.90	0.78	1.01
Knowing where health care	**Yes**	0.97	0.88	1.05
	No	0.90	0.76	1.04
Concerns permission for care	**Yes**	1.03	0.96	1.10
	No	0.78*	0.64	0.92
Concerns not female provider	**Yes**	0.96	0.88	1.04
	No	0.98	0.77	1.18
Partner's women reason not to have sex	**Yes**	0.96	0.91	1.02
	No	1.03	0.95	1.11

The same analyses reported above were repeated using another outcome: having received at least one dose of vaccine as opposed to being fully immunized. The OR for sex showed similar results: the pooled OR for sex was 1.00 (0.98 to 1.03) suggesting that girls and boys have the same likelihood of having received at least one dose of vaccine as compared to being fully vaccinated. In Madagascar 2004, Haiti 2006 and Tanzania 2004 girls were more likely of being fully vaccinated; and in Nicaragua 2001 and in Malawi 2004 and Nepal 2005 that was the case for boys, with the lower CI very close to 1 (see Figure 2).

Figure 2. Likelihood of outcome 'utilisation' (having received at least one dose of vaccine) between girls and boys.



Meta-analysis, by survey, sorted by OR. Outcome: Utilisation

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- **Pooled OR for sex did not show significant differences between girls and boys in neither of the two vaccination outcomes.**
- **In certain subgroups of children (e.g. children from the poorest households), boys were more likely of not being vaccinated than girls.**
- **In certain countries and years, outcomes favoured girls, and in others outcomes favoured boys.**
- **In terms of relations to the different predictor variables considered, there are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated).**

4.2 Core variables

In this section we report the likelihood of presenting the outcome (i.e. not having received any dose of vaccine or having received at least one dose of vaccine) according to other variables, core and gender-related variables (e.g. education level of the caregiver or wealth status of the household). The differences (or lack of differences) in the likelihood of presenting the outcome of interest for each variable will also be presented in subgroups defined by the core variable.

The pooled OR for the core variables consistently showed that children from disadvantaged groups were more like of not being vaccinated: children of mothers with the least education level, of mothers with partners with the least education level, of mothers not vaccinated against TT and of poor households (all of them statistically significant, with CI not containing the value 1).

Looking at the subgroups of those variables, similar results were obtained, with the following exceptions showing the same likelihood (OR with CI containing the value 1) in:

- children of least and most educated women in the subgroup women not being vaccinated against TT;
- children of mothers with partners least and most educated in the subgroup of women not being vaccinated against TT;
- children of poor and rich households in the subgroup of children of least educated women.

See Table 4 for the OR and CI described above.

Table 4. OR for core variables in different groups. Outcome: 'access' (not being vaccinated).

	Core predictors:	Sex			Education			Education partner			Tetanus before birth			Wealth index		
	Values:	Female versus Male			Least educated versus Most educated			Least educated versus Most educated			No versus Yes			Poorest versus Richest		
		OR	lower	upper	OR	lower	upper	OR	lower	upper	OR	lower	upper	OR	lower	upper
All	**No subgroups**	**1.00**	**0.96**	**1.04**	**1.65***	**1.49**	**1.81**	**1.36***	**1.23**	**1.50**	**2.42***	**2.11**	**2.73**	**1.52***	**1.37**	**1.66**
Sex	**Female**				1.52*	1.35	1.69	1.30*	1.14	1.45	2.30*	1.98	2.61	1.41*	1.27	1.55
	Male				1.47*	1.32	1.61	1.23*	1.10	1.37	2.36*	2.01	2.72	1.51*	1.34	1.67
Education	**Least educated**	0.91*	0.83	0.99				1.13*	1.01	1.24	1.34*	1.05	1.63	1.35	0.98	1.73
	Most educated	1.01	0.96	1.05				1.37*	1.24	1.50	2.55*	2.22	2.88	1.48*	1.34	1.63
Education partner	**Least educated**	0.90	0.80	1.00	1.45*	1.24	1.67				1.69*	1.42	1.97	1.41*	1.17	1.66
	Most educated	0.99	0.95	1.03	1.51*	1.34	1.68				2.63*	2.31	2.94	1.45*	1.31	1.60
Tetanus before birth	**No**	0.96	0.88	1.03	1.13	0.96	1.31	1.00	0.87	1.13				1.22*	1.07	1.36
	Yes	0.99	0.94	1.04	1.67*	1.45	1.89	1.42*	1.27	1.57				1.57*	1.40	1.73
Wealth index	**Poorest**	0.92*	0.87	0.98	1.59*	1.43	1.75	1.43*	1.23	1.63	2.08*	1.74	2.42			
	Richest	0.99	0.94	1.04	1.86*	1.46	2.26	1.17*	1.05	1.29	2.59*	2.21	2.98			

*: OR statistically significant (CI do not contain the value 1).

- **Pooled OR for core variables showed consistent statistically significant differences in all variables, making disadvantaged groups more likely of not being vaccinated (e.g. children from poor households).**
- **Exceptionally, in the subgroups of women not vaccinated against TT and of least educated women some variables showed no statistically significant differences.**
- **There are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated).**

4.3 Gender related variables

A number of other variables defined as gender related were examined, looking at the OR of not being vaccinated depending on the values of those variables, as shown in the first column of Table 5. The following columns show the likelihood of not being vaccinated for the same variables in the subgroups defined by the core variables. For easy reading, the values of the OR have been substituted with symbols: '=' means that there are no differences (the CI of the OR contains 1); 'v' means that the OR is statistically significantly below 1; and '^' means that the OR is statistically significantly above 1 (in practical terms, '^' favours the first terms of the 'versus' statement –more likely of NOT being vaccinated-, while 'v' favours the second term of the 'versus' statement –more likely of NOT being vaccinated).

Table 5. Likelihood of outcome 'access' (not being vaccinated) for gender related variables.

	Subgroups:	All	Sex		Education		Education partner		Tetanus before birth		Wealth index	
			Female	Male	Least educated	Most educated	Least educated	Most educated	No	Yes	Poorest	Richest
Sex	Female versus Male	=			v	=	=	=	=	=	v	=
Education	Least educated versus Most educated	^	^	^			^	^	=	^	^	^
Education partner	Least educated versus Most educated	^	^	^	^	^			=	^	^	^
Tetanus before birth	No versus Yes	^	^	^	^	^	^	^			^	^
Wealth index	Poorest versus Richest	^	^	^	=	^	^	^	^	^		
Birth order	1st born versus Younger	v	v	v	v	v	v	v	=	v	v	v
Sex head household	Female versus Male	v	=	v	v	v	=	v	=	v	v	v
Marital	Alone versus In couple	=	=	=	v	=	=	=	v	=	=	v
Age difference couple	Large versus Small	=	=	=	=	=	=	=	=	=	=	=
Residence	Rural versus Urban	^	^	=	=	^	=	=	v	^	=	=
Radio	No versus Yes	^	^	^	=	^	=	^	=	^	^	^
Radio how often	Never versus At least once a week	^	^	^	=	^	=	^	=	^	^	^
Television	No versus Yes	^	^	^	=	^	=	^	=	^	=	^
TV how often	Never versus At least once a week	^	^	^	=	^	=	^	=	^	^	^
Arguing with partner justifies beating	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Neglecting children justifies beating	No versus Yes	v	v	=	v	=	v	v	=	v	=	v
Going out justifies beating	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Cash for work	No versus Yes	^	^	^	v	=	=	^	=	^	=	=
Woman decides health care	No versus Yes	v	v	=	=	v	v	v	=	v	=	v
Woman decides money	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Woman decides large purchase	No versus Yes	=	=	=	=	=	=	=	v	=	=	=
Woman decides daily purchase	No versus Yes	v	v	v	=	v	v	v	v	v	v	v
Woman decides visit	No versus Yes	=	=	=	=	=	=	=	=	=	=	=
Distance to health facility	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Going alone for health care	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Knowing where health care	Yes versus No	^	^	^	v	^	=	^	^	^	^	^
Concerns permission for care	Yes versus No	^	^	^	=	^	=	^	=	^	^	^
Concerns not female provider	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Partner's women reason not to have sex	Yes versus No	^	=	=	=	^	=	^	=	^	=	=

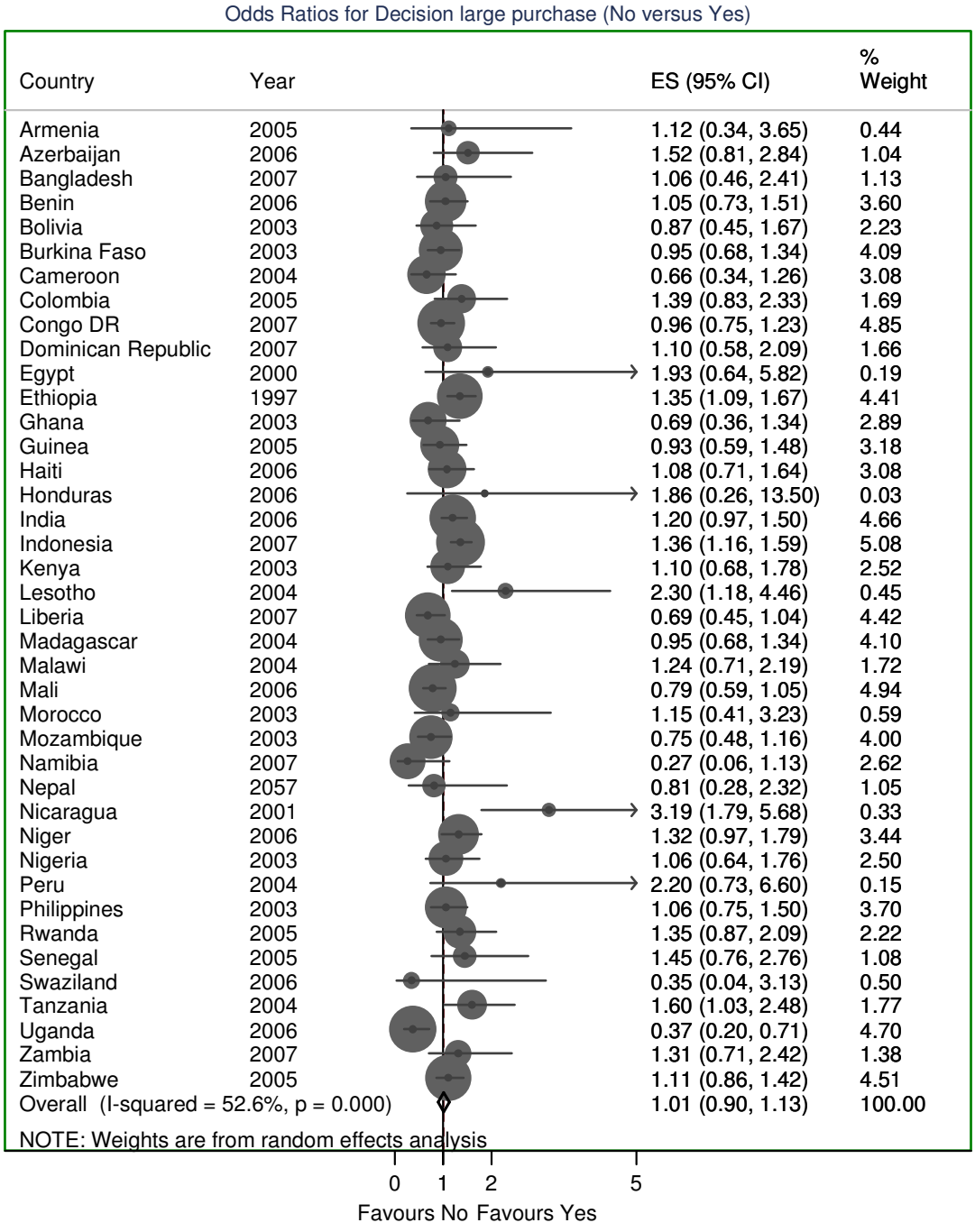
As shown in the table, factors associated with children not having received any dose of vaccine include children:

- of least educated women;
- of women with least educated partners;
- of women without TT vaccination;
- of poor households;
- who are younger;
- of household with male heads;
- living in rural areas;
- of households not having radio;
- of households were radio is seldom listened to;
- of households without television;
- of households were television is seldom watched;
- of women who state that arguing with the partner, neglecting children and going out justifies beating them;
- of women who do not receive cash for work;
- of women who decide for health care, how to spend money, or the daily purchases;
- of women who have concerns about the distance of health services, who go alone for health care, who state that know where to get health care, who have concerns about asking for permission to get health care or about the gender of the health care provider;
- of women who think that the fact of their partners having other women justifies refusing to have sex.

In most of the cases, these differences hold for all subgroups defined by the core variables. Some exceptions exist where certain statistically significant OR loose significance, or where non-statistically significant OR become significant (see Table 5 for details).

In general, however, OR show mild to moderate associations, being very close to 1. There is also great heterogeneity among countries in many of the gender-related predictors, as shown in the figure below, as an example.

Figure 3. Likelihood of outcome 'access' (not being vaccinated) between women able and not able to decide to engage in large purchases.



Meta-analysis, by survey, sorted by OR. Outcome: Access

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- **Gender related variables that indicate decision capacity of women and stating that beating is justified under certain circumstances are associated with the child not being vaccinated.**

- **Gender related variables that express women's concerns on health care (e.g. distance, gender of provider) are associated with the child not being vaccinated. These associations vary greatly between countries.**

- **With few exceptions, gender related variables show the same associations with non-vaccination of the child across all subgroups defined by the core variables,.**

- **In terms of relations to the different predictor variables considered, there are no substantial differences between the outcome of not having received any dose of vaccines (as opposed to having received at least one dose) and the outcome of having received at least one dose of vaccine (as opposed to being fully vaccinated); data not shown.**

4.4 Attributable benefits

While logistic regression provides a tool to evaluate potential "attributable benefits", such analyses will only be undertaken in a selection of countries and presented with small increments of the predictors. This should be understood as a demonstrative example that countries can use at the local level to obtain a better understanding of their local situation. Doing such an exercise at the global level for countries may have limited benefits.

Rajastan (India 2006)
In Rajastan, the DHS-survey provided a coverage rate (at least one dose received) of 85% with rates in primary sampling units ranging from 15% to 100%, the maximum rate occurring in the largest sampling unit. Among the main predictor variables of infant vaccination considered (i.e. educational status of the mother, of her partner, wealth status and TT-immunization of the mother) TT-immunization of the mother was by far the strongest one. According to the logistic regression model, a rise in maternal TT-immunization rate to 100% across the entire state, without changing any of the other variables, would result in an increase of infant vaccination rates to at least 92% across all sampling units. Given that the maternal TT-immunization rate in the largest sampling unit already attained 100%, this scenario does not appear to be entirely out of scope.

Kerala (India 2006)
In Kerala, the DHS-survey provided a coverage rate (at least one dose of vaccine) of 97% with rates in primary sampling units ranging from 50% to 100. Here, too, TT-immunization of the mother was by far the strongest predictor variable of infant vaccination. According to the logistic regression model, a rise in maternal TT-immunization rate to 100% across the entire state, without changing any of the other variables, would result in an increase of infant vaccination rates to at least 97% across all sampling units.

Kenya (2003)
In Kenya, the DHS-survey provided a vaccination coverage rate of 89% (at least one dose of vaccine) with regional rates ranging from 50% (in the north eastern region) to 96% (in the central region). Also

in Kenya, TT-immunization of the mother was the strongest predictor of infant vaccination. However, TT-immunization rates were lower in Kenya than in the two Indian states, reaching a maximum of 58% in the central region. According to the logistic regression model, a rise in maternal TT-immunization rate to 58% across the entire country, without changing any of the other variables, would result in an increase of infant vaccination rates to at least 92% in all regions.

Uganda (2006)

According to the DHS-survey, infant vaccination rate in Uganda was quite high (at least one dose of vaccines). Its regional rates varied from 81% in central region to 96% in the north region. However, in this data set, the regional TT-immunization rate was not a significant predictor of infant vaccination. On the other hand, higher maternal education showed a strong positive association with infant vaccination, while the association with the factor wealth was significantly negative. Thus, an intervention focused on improving education of mothers might be an option in this country. However, paradoxically, the highest vaccination coverage was achieved in the region with the lowest rate of higher maternal education, i.e. in the north region. But vaccination coverage is also high in the area of Kampala where levels of education reach their national maximum. One might suspect that the high coverage rate in the poorest region is the result of a specific intervention and that an extension of this intervention to other regions might bring similar benefits.

Figure 4. Relation between vaccination coverage among children and poverty rate across regions (Uganda).

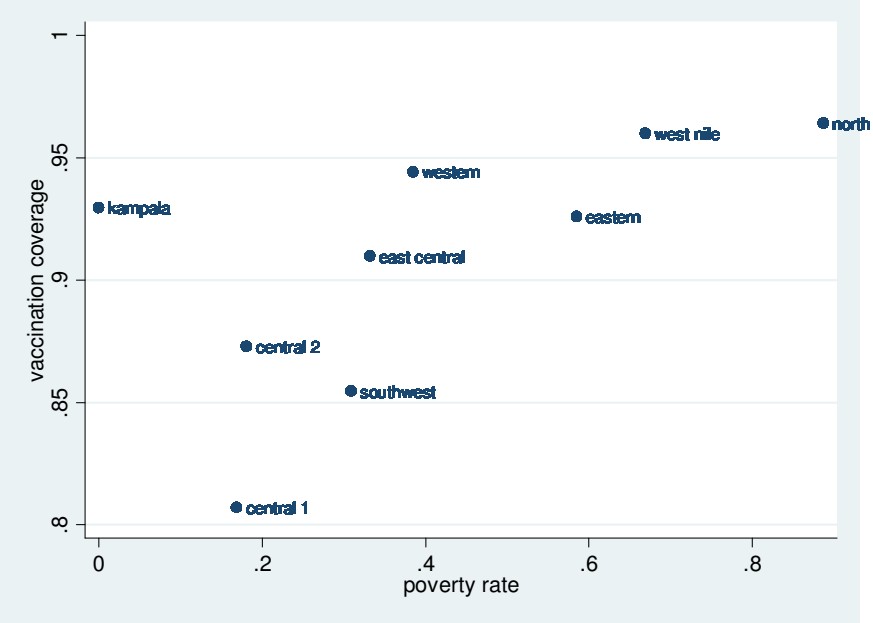


Figure 5. Relation between vaccination coverage among children and rate of low maternal education across regions (Uganda 2006).

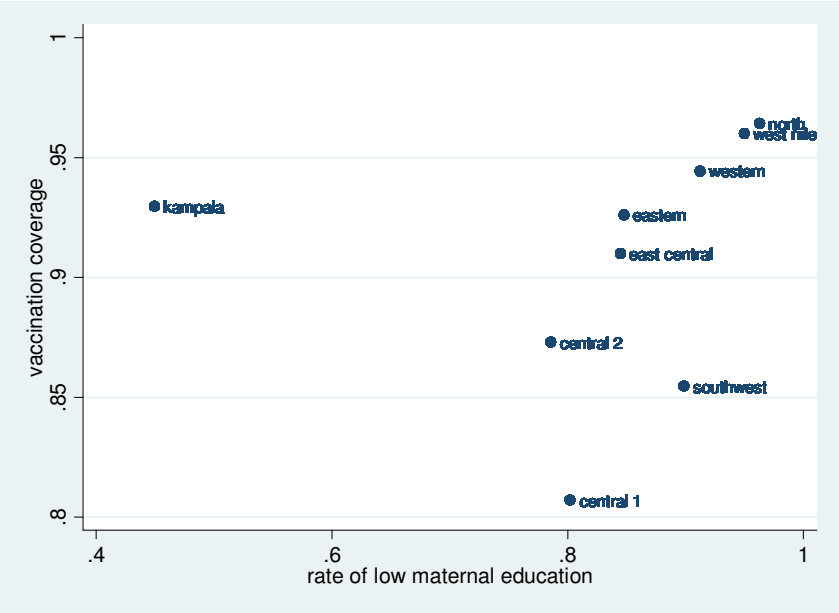
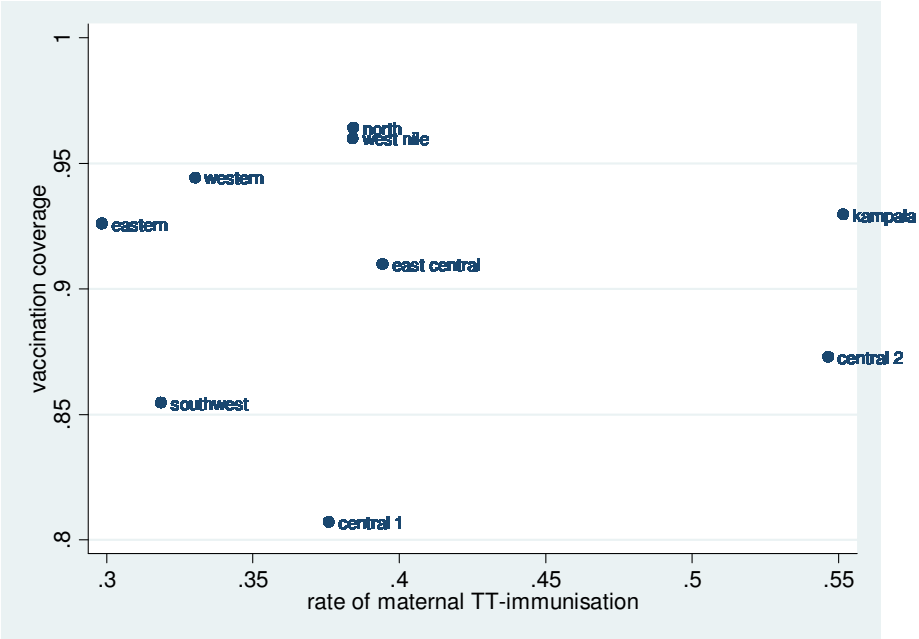


Figure 6. Relation between vaccination coverage among children and maternal TT-immunization rate across regions (Uganda 2006).



- **Attributable benefits analyses are useful to model the sensitivity of the vaccination outcomes to interventions on predictor variables.**

- **In the examples examined, improvements in women TT status vaccination, a predictor strongly related to the vaccination status of children, may be associated with a significant improvement in children vaccination.**

4.5 Vaccination status rates in relation to national indicators

Vaccination coverage rates vary greatly across countries. Therefore, the question of how these differences might be explained by economic or other country characteristics arises. In a preliminary approach towards addressing this question, we performed correlation analyses linking vaccination coverage rates with a range of national indicator variables. We considered the following indicators:

a. economic strength (Gross Domestic Product (GDP) per capita);
b. economic disparities (GINI, poverty rate);
c. level of education (illiteracy rate);
d. health and health care (infant mortality, government health expenditures);
e. empowerment of women (Gender development index (GDI), female combined gross enrolment ratio, Gender Empowerment Measure (GEM), female earned income, income ratio between women and men, percentage of women in ministerial positions);
f. the Human Development Index (HDI).

The results of these correlation analyses are presented in Table 6.

Interestingly, associations between these indicators and the full vaccination rates were weaker than the associations with coverage with at least one dose or DTP3 coverage. Moreover, most general economic indicators show almost no association with vaccination coverage rates. However, infant mortality rates, poverty rates and adult illiteracy rates showed a strong negative association with vaccination coverage by at least one dose and by DTP3, respectively. Conversely, government health expenditures, the gender development index and female combined gross enrolment ratio showed a strong positive association with the same measures of vaccination coverage. A closer look at the scatter plots (see Annex 10) shows that even countries in the lower range of the human development index may attain high rates of vaccination coverage. Looking at the association between female empowerment indicators (see Annex 10) and coverage, some of those indicators were associated with coverage rates but others were not.

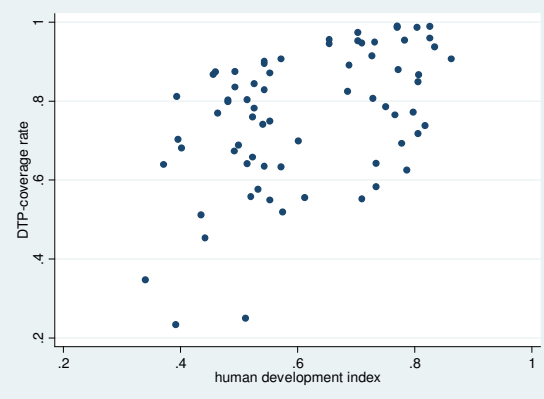
Table 6. Rank correlations between national rates of different types of vaccination coverage and various national indicators.

	At least one dose of vaccine		Full vaccination		DTP3	
	R	**p-value[1]**	**R**	**p-value[1]**	**R**	**p-value[1]**
General indicators						
HDI (N=66)	0.46	<0.0001	0.10	n.s.	0.44	0.0001
GDP per capita (n=66)	-0.14	n.s.	-0.07	n.s.	-0.16	n.s.
GINI (n=173)	0.08	n.s.	-0.08	n.s.	-0.03	n.s.
Poverty rate (N = 117)	-0.25	0.007	-0.08	n.s.	-0.19	0.04
Adult illiteracy rate (N = 140)	-0.44	<0.0001	-0.19	0.03	-0.43	<0.0001
Infant mortality (N = 85)	-0.52	<0.0001	-0.24	n.s.	-0.59	<0.0001
Government health expenditures per capita (N=74)	0.53	<0.0001	0.35	0.002	0.60	<0.0001
Gender specific indicators						
Gender development index GDI (N = 58)	0.48	<0.0001	0.15	n.s.	0.40	<0.0001
Female combined gross enrolment ratio (N = 61)	0.52	<0.0001	0.25	0.053	0.53	<0.0001
Gender empowerment measure (n=34)	0.12	n.s.	-0.17	n.s.	0.01	n.s.
Female earned income (n=66)	-0.14	n.s.	0.13	n.s.	-0.06	n.s.
Income ratio between women and men (n=66)	0.07	n.s.	0.10	n.s.	0.09	n.s.
Percentage of women in ministerial positions (n=63)	-0.13	n.s.	0.005	n.s.	-0.10	n.s.

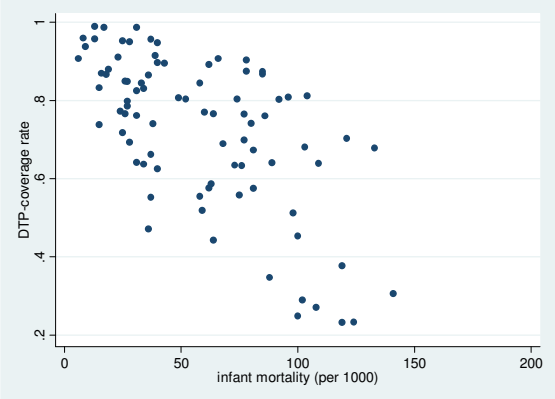
[1] n.s. = non-significant at the level of 0.05, i.e. $p > 0.05$

Figure 3.1 (A to D). DTP3-coverage rates in relation to different national indicators.

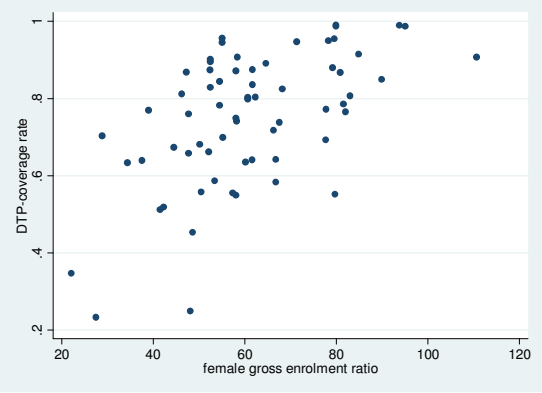
A



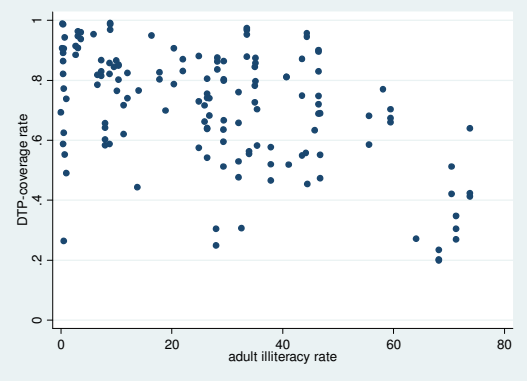
B



C



D



A) association between DTP3-coverage rate and human development index
B) association between DTP3-coverage rate and infant mortality rate
C) association between DTP3-coverage rate and female gross enrolment ratio
D) association between DTP3-coverage rate and adult illiteracy rate

- **High adult literacy and less infant mortality were positively associated with being vaccinated.**
- **National economic indicators showed no association.**
- **Gender related indicators showed a mixed picture.**

5 Conclusions and implications

	Conclusions	Implications
1)	**There is a significant proportion of children who have not received a single dose of vaccine(+).**	'Unvaccinated children' assessed through nation-wide representative surveys uncovers inequities in vaccination access which cannot be captured only looking at DTP3 coverage.
2)	**Girls and boys have the same likelihood of being vaccinated in most of the countries and in the pooled estimates from all countries. A few moderate exceptions exist.**	Sex discrepancies do not seem to be a widespread problem related to vaccination. There is no evidence to support a global policy to gather sex disaggregated data on vaccination.
3)	**Core variables (e.g. wealth) are associated with the vaccination status.**	Although associations are strong, most of those factors are hardly addressable in the short or mid term (e.g. poverty). Data from other variables and explanations from qualitative studies should be looked at to explore entry points for interventions.
4)	**Female gender related variables are associated with the vaccination status; these are variables relating to 'decision' capacity' and 'concern about health care'.**	Women partnership relations can be an entry point for interventions to improve access to vaccination. However, male gender related variables have not been explored to establish a gender differential (i.e. whether the determinant factors are due to household relationships or to wider socio-economic factors). These factors vary greatly country by country, and a global policy can only be general of nature.
5)	**There is a strong association between children's vaccination and mothers (TT) vaccination status. Attributable benefit analyses showed that changes in TT vaccination status may lead to substantial increases in children's vaccination.**	The relation between antenatal care and childhood routine immunisation needs to be further explored. Antenatal care can be an entry point for interventions to improve vaccination access (e.g. integration in the continuum of care).
6)	National indicators show different levels of association or lack of association with several indicators of vaccination coverage.	Despite that the outcome 'access' (unvaccinated children) is more sensibly associated National indicators, these are of limited use in identifying countries with low vaccination rates..

(+) Data not shown in this report[4].

ANNEXES

Annex 1. Included and excluded DHS datasets (list and map)

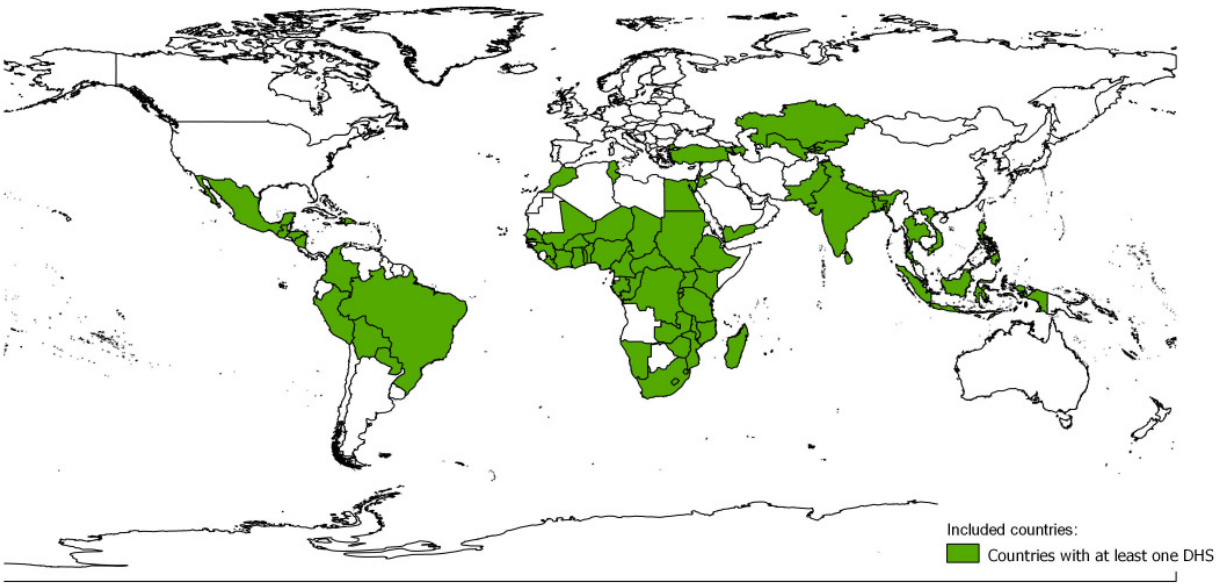
Table 7. List of included and excluded DHS.

	Country	Year		Country	Year
	Included				
1	Armenia	2000	41	Dominican Republic	1999
2	Armenia	2005	42	Dominican Republic	2002
3	Azerbaijan	2006	43	Dominican Republic	2007
4	Bangladesh	1994	44	Egypt	1988
5	Bangladesh	1996	45	Egypt	1992
6	Bangladesh	2000	46	Egypt	1995
7	Bangladesh	2004	47	Egypt	2000
8	Bangladesh	2007	48	Egypt	2003
9	Benin	1996	49	Egypt	2005
10	Benin	2001	50	Ethiopia	1992
11	Benin	2006	51	Ethiopia	1997
12	Bolivia	1989	52	Gabon	2000
13	Bolivia	1994	53	Ghana	1988
14	Bolivia	1998	54	Ghana	1993
15	Bolivia	2003	55	Ghana	1998
16	Brazil	1986	56	Ghana	2003
17	Brazil	1996	57	Guatemala	1987
18	Burkina Faso	1993	58	Guatemala	1995
19	Burkina Faso	1999	59	Guatemala	1999
20	Burkina Faso	2003	60	Guinea	1999
21	Burundi	1987	61	Guinea	2005
22	Cameroon	1991	62	Haiti	1994
23	Cameroon	1998	63	Haiti	2000
24	Cameroon	2004	64	Haiti	2006
25	Central African Republic	1994	65	Honduras	2006
26	Chad	1997	66	India	1993
27	Chad	2004	67	India	1999
28	Colombia	1986	68	India	2006
29	Colombia	1990	69	Indonesia	1991
30	Colombia	1995	70	Indonesia	1994
31	Colombia	2000	71	Indonesia	1997
32	Colombia	2005	72	Indonesia	2002
33	Comoros	1996	73	Indonesia	2007
34	Congo	2005	74	Jordan	1990
35	Congo DR	2007	75	Jordan	1997
36	Côte D'Ivoire	1994	76	Jordan	2002
37	Côte D'Ivoire	1999	77	Jordan	2007
38	Dominican Republic	1986	78	Kazakhstan	1995
39	Dominican Republic	1991	79	Kazakhstan	1999
40	Dominican Republic	1996	80	Kenya	1989

	Country	Year		Country	Year
81	Kenya	1993	121	Paraguay	1990
82	Kenya	1998	122	Peru	1986
83	Kenya	2003	123	Peru	1991
84	Kyrgyzstan	1997	124	Peru	1996
85	Lesotho	2004	125	Peru	2000
86	Liberia	1986	126	Peru	2004
87	Liberia	2007	127	Philippines	1993
88	Madagascar	1992	128	Philippines	1998
89	Madagascar	1997	129	Philippines	2003
90	Madagascar	2004	130	Rwanda	1992
91	Malawi	1992	131	Rwanda	2000
92	Malawi	2000	132	Rwanda	2005
93	Malawi	2004	133	Senegal	1986
94	Mali	1987	134	Senegal	1993
95	Mali	1996	135	Senegal	2005
96	Mali	2001	136	South Africa	1998
97	Mali	2006	137	Sri Lanka	1987
98	Mexico	1987	138	Sudan	1990
99	Morocco	1987	139	Swaziland	2006
100	Morocco	1992	140	Tanzania	1991
101	Morocco	2003	141	Tanzania	1996
102	Morocco	2005	142	Tanzania	1999
103	Mozambique	1997	143	Tanzania	2004
104	Mozambique	2003	144	Thailand	1987
105	Namibia	1992	145	Togo	1998
106	Namibia	2000	146	Trinidad and Tobago	1987
107	Namibia	2007	147	Tunisia	1988
108	Nepal	2052	148	Turkey	1993
109	Nepal	2057	149	Turkey	1998
110	Nepal	2063	150	Turkey	2004
111	Nicaragua	1998	151	Uganda	1988
112	Nicaragua	2001	152	Uganda	1995
113	Niger	1992	153	Uganda	2001
114	Niger	1998	154	Uganda	2006
115	Niger	2006	155	Uzbekistan	1996
116	Nigeria	1990	156	Viet Nam	1997
117	Nigeria	1999	157	Viet Nam	2002
118	Nigeria	2003	158	Yemen	1991
119	Pakistan	1991	159	Zambia	1992
120	Pakistan	2006	160	Zambia	1996

	Country	Year		Country	Year
161	Zambia	2002	164	Zimbabwe	1994
162	Zambia	2007	165	Zimbabwe	1999
163	Zimbabwe	1988	166	Zimbabwe	2005
	Excluded				
167	Brazil	1991	171	Nigeria (Ondo State)	1986
168	Dominican Republic	2007	172	Senegal	1997
169	Ecuador	1987	173	Togo	1988
170	Indonesia	1987	174	Ukraine	2007

Figure 7. Map showing the countries with DHS.



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Disclaimer

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Executive Summary

Study characteristics

Twenty-three studies conducted between 1982 and 2010 were included in the systematic review; 16 were published between 2000 and 2010, 5 in the 1990s and 2 in the 1980s. The studies represent a wide range of developing countries including some that have well known coverage challenges such as Bolivia (1), China (1), Ethiopia (2), Haiti (1), India (4), Nigeria (3), and Mozambique (2). Other countries include Bangladesh, Cameroon, Gabon, Kenya, South Africa, Senegal, Togo, and Turkey.

Barriers to immunisation

Barriers identified in the articles cluster around the following main themes: health system constraints and quality of care; poverty and livelihoods; education and health literacy; culture and worldview; power and politics; women's agency and decision-making; and gender and social norms.

Synthesis of qualitative findings: Gender aspects

- The health status of the child is inextricably linked to the mother's capacity to care for and nurture her child(UNICEF 2008). However, women are often not in control of intra-household resources but depend on a husband or extended family members. But despite the father's and extended families' decision-making power and control of resources, they are rarely implicated in practical aspects of health care regarding the child. This gendered aspect of childcare and health is sustained and perpetuated by both the traditional and biomedical health beliefs discourses who both consider mothers as primarily responsible for child health.
- Immunisation programmes that fail to recognize the constraints that women or mothers face in accessing and utilising services may be inadvertently contributing to gender inequities. Provider attitudes, public exposure to criticism, and missed opportunities can reinforce gender stereotypes and divisions in the society and contribute to maintaining the perception that child health is only the woman's responsibility. Her "failure" to immunise her children, in this context, becomes normative to the extent that even she accepts her child's health status as caused by her own "neglect". In such circumstances, the system itself perpetuates the low status of women and her subordinate position within it.
- Immunisation services are gendered in how they are understood, presented, and managed. As immunisation services target mothers as the primary caretakers of children, they are themselves feminized or gendered in their organisation, the kind of information they provide and the way they deliver services. Moreover, in resource poor setting,

primary health care and maternal and child health (MCH) often prioritise MCH over curative care. This can result in a gendered bias against men in their access to and utilisation of health services(Hill and Upchurch 1995) and therefore reinforces gender and social dynamics found in the communities.

- Service factors continue to pose a significant barrier to completing child vaccination schedules. Mother's experience in the health centre are often compromised by power differentials, both socioeconomic (e.g. poverty) and gendered (e.g. low status of women). It is therefore critical to understand gendered socio-relational experiences of immunisation services as potential obstacles to accessing vaccination interventions and to improving the responsiveness of services to all, regardless of sex or socioeconomic status.
- Vaccination has been used as a political tool in some regions for political gain. Politicians and various opinion leaders, including religious leaders, have used vaccination programmes and campaigns to gain or maintain their power base. Commonplace is the use of sterility rumours to sow fear in the communities. Women, as caretakers of children having to decide whether or not to vaccinate their child, are on the frontlines of resistance with pressure from all sides. In this circumstance of high politicization of vaccination, gender disparities existing in societies can easily be exploited. Poor, rural, ethnically or socially marginalized women suffer these political challenges most acutely.
- Women may also use immunisation services as a platform for covert resistance to demonstrate their disapproval of government policies (past and present), lack of services, or the disrespect they may feel at the clinic when they face a rude or patronizing provider. However, even though enacted by women, this resistance is often dictated by men and communities while the woman, as the caretaker of child, is blamed by authorities and the community as the negligent one when the child falls ill.
- Local health beliefs posed a problem for the utilization of preventive services. The persistence of these beliefs cannot be fully understood as a lack of adequate information only. They are embedded in the local social context, where blame and guilt linked to the responsibility for an illness is used to establish and maintain social hierarchies. Often, traditional medicine concepts link the cause of illness to a mother's transgression of social norms and expectations, or link it to the danger of female powers, and traditional practitioners served to control the negative female forces. This gendered blame is perpetuated by the biomedical health systems: mothers are blamed for not preventing disease due to poor caretaking, low hygiene, or not immunising their child.
- Men or fathers are rarely implicated in vaccination programmes. Information often does not reach them. By targeting only women, vaccination interventions moreover neglect the critical influence men have over women's decision-making power. In many developing countries, even if women have the primary daily responsibility for child health care, it is

the men who control women's access to information, finances, transportation, and other necessary resources to access health services(Green, Symonds et al. 1999). Programmes that have reached out, have positive results(Peacock, Redpath et al. 2008). Research on barriers rarely records the views of men and families related to vaccination even though the importance of women social and familial resources has been found to facilitate vaccination utilisation(Coreil, Losikoff et al. 1998).

1 Introduction

Childhood routine immunization continues to challenge many governments despite international, and national efforts. Since 1974 when the World Health Organization launched the expanded programme on immunization (EPI) focusing on developing countries the global coverage of the 6 preventable childhood disease — polio, diphtheria, tuberculosis, pertussis (whooping cough), measles and tetanus - rose from 5% in 1974 to 80% in 1998. In 2003, global DTP3 (three doses of the diphtheria-tetanus-pertussis combination vaccine) coverage was 78% — up from 20% in 1980. However, 27 million children worldwide still were not reached by DTP3 in 2003, including 9.9 million in South Asia and 9.6 million in sub-Saharan Africa. Since 2003 some progress has been made in some countries but the global goal of ensuring routine immunization of children less than one year of age reaches 90 per cent nationally and at least 80 per cent coverage in every district or equivalent administrative unit remains. Why progress has stalled has been investigated(UNICEF 2010).

Studies on barriers to routine immunisation have become standard. They tell us that those who miss out on routine vaccination programme tend to be people living in remote locations, urban slums and border areas. They also include indigenous groups, displaced populations, those lacking access to vaccination because of various social barriers, those lacking awareness or motivation to be vaccinated and those who refuse. Reasons for low uptake of immunization services in different countries have identified a combination of cultural, social, economic, education and logistical factors. In 2008-2009, a series of studies were commission by GAVI and WHO entitled: “The Epidemiology of the Unvaccinated Child” or UNVAC study on factors associated with the unvaccinated and under vaccinated child identified four primary categories of barriers – limitations of the immunization system (e.g. distance, health staff’s motivation and attitude, lack of resources/logistics and false contraindications, etc); communication and information (e.g. lack of promotion or follow up); family characteristics (e.g. economic stats, migration, parental education) and parental attitudes and knowledge (e.g. lack of practice knowledge, fear of side effects, conflicting priorities, religious/cultural or social beliefs and rumours, health beliefs, etc). Concurrently, studies were beginning to document sex disparities in immunisation coverage in some countries in a range of contexts (against both boys and girls) – a finding consistent with the major sex differentials found in the burden of disease across vaccine-amenable illnesses(Hill and Upchurch 1995; Jatrana 2004).

Barrier studies however were largely quantitative in nature (e.g. review of demographic health survey and other survey data) and generally produced a common list of barriers. Qualitative studies have also been done primarily in places that have experienced the most profound

challenges to increasing coverage such as northern Nigeria, Ethiopia, and India. Given the well recorded list of barriers, and the exploration of those barriers using qualitative methods, and assuming programmatic efforts over the past 15 years have attempted to address some of the most important challenges that have been identified to increasing immunization coverage, it remains difficult to understand why more progress has not been made among specific populations. Attempts to explain the reasons for low immunization uptake in different settings using qualitative, ethnographic and anthropological methods have identified some of the same factors yet often with a larger explanatory model. Issues such as poverty, family size, and educational level of the mother, social isolation, distance, migrant status and cultural beliefs, as well as organizational factors have all been identified using qualitative methods. Some studies focused on maternal perception and knowledge of immunizations to be particularly important determinant(Nichter and Nichter 1994). How factors interact, and how perceptions impact of behaviours, possibly compounded by gender factors such as autonomy and decision-making by female caretakers has received much less attention.

Gender refers to the economic, social and cultural attributes and opportunities associated with being male or female in a particular setting at a particular point in time(WHO 2010). Recognizing that gender equality, and its underlying power relations, is a powerful determinant of health outcomes, and that gender and sex related differentials in outcomes are often exacerbated in the hardest to reach populations(Sen, Iyer et al. 2009), the Scientific Advisory Group (SAGE) for the Initiative for Vaccine Research (IVR) at WHO recommended the commissioning of a study to explore the role of gender in barriers to immunisation. The GAVI Alliance has also recently set a gender policy to focus attention on gender related barriers to immunization. This Qualitative Systematic Review, as part of a larger multi-method investigation under the auspices of the Immunisation and Gender Project has been carried out by the Swiss Centre for International Health of the Swiss Tropical and Public Health Institute, attempts to identify and explore gender related barriers that may be affecting poor child immunization status in some countries or regions.

2 Methods

2.1 Overview

A systematic review of qualitative data (using meta ethnography and qualitative synthesis methodology) was conducted between October 2009 and June 2010. The aim of the review was to synthesize high quality, qualitative research data by using meta-ethnography methodology to assess gender related factors that maybe affecting child immunisation status. The specific research questions were:

A) What is the role of gender on individual, family and community barriers to accessing immunisation coverage for children?
B) What is the role of health system related barriers on caretakers' access to immunisation coverage?
C) What is the role of gender on barriers caretakers face in the supply of immunisation services?
D) What is the role of gender on barriers the health system faces in their supply of immunisation services?

The result of this review was to provide an explanatory framework for barriers previously identified as well as offering a contextual understanding of the gender related factors underpinning many barriers to immunization, and to inform, and provide evidence for the interpretation of the results of a DHS analysis and Case Studies also being conducted under the auspices of this project.

2.2 Conceptual Framework

Several existing frameworks and gender analysis tools have been reviewed to inform the development of a Gender Analysis Framework for investigating factors influencing immunisation coverage. The framework developed by Gita Sen and Piroska Östlin for the role of gender as a social determinant of health finally served as a basis for the development of the Framework adapted for investigating the factors influencing the demand and supply of child immunisation (Sen and Ostlin 2007).

The framework has three levels. At the top there is the immunisation coverage disaggregated by sex. One level below there is the immunisation demand and supply that determines immunisation coverage. Immunisation demand and supply itself is influenced by different factors. These factors are listed in the two boxes at the bottom of the framework. The demand side factors refer to the caretaker and/or the child and the supply side factors to the health care provider and the health system respectively. The arrows between the different levels represent the directions of influence, determination and possible feedback effects. The factors listed in the demand side and the supply side are also interlinked with each other, as for example access to resources is strongly linked with empowerment. However, these linkages are numerous and complex and, to simplify matters, are therefore not shown in the framework.

The findings from the UNVAC study's "Review of Grey Literature on the Epidemiology of the Un Immunised Child"(ImmunisationBasics 2010) conducted by Immunisation Basics, as well as the results from the Centers for Disease Control (CDC) quantitative "Assessment of Determinants of Unreached Children in Immunisation"(CDC 2009), informed the development of the list of supply

side and demand side factors influencing immunisation coverage. These factors act at three different levels represented in the framework and are defined as follows:

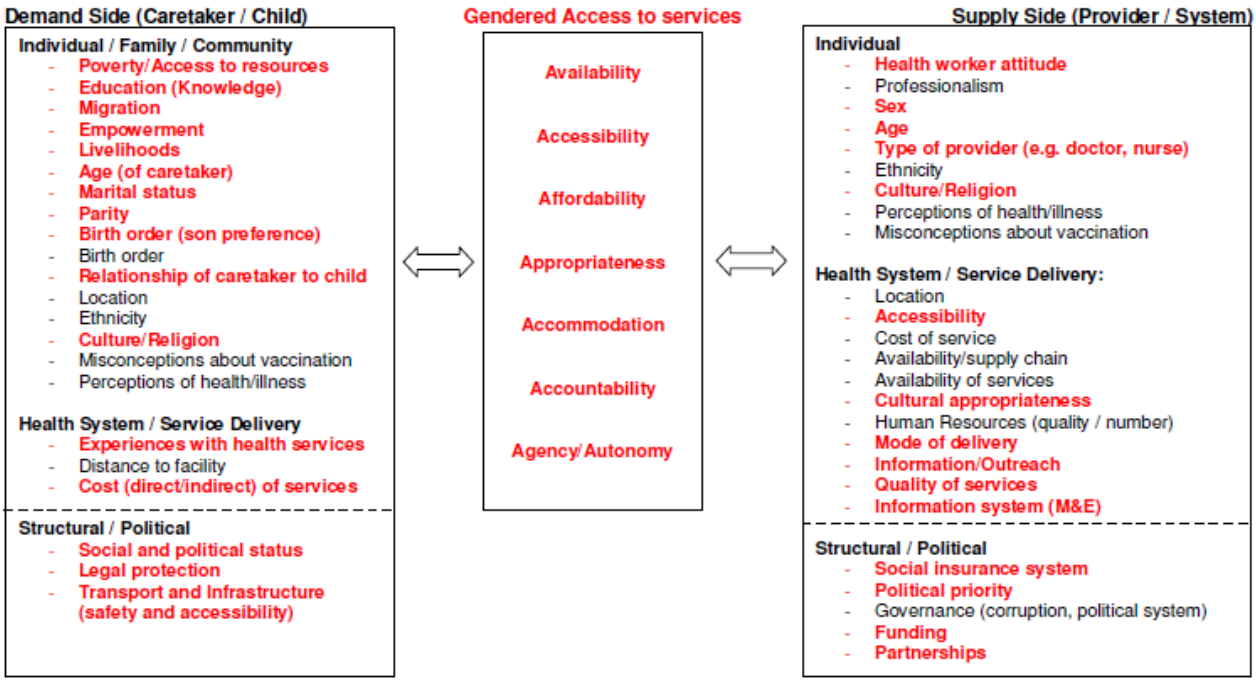
- Individual / Family / Community
- Health system / Service delivery
- Structural / Political

Some of the factors listed are self-explanatory; others are broader and encompass different aspects. For example education does not only refer to the level of education of the caretaker, but also to knowledge. For example, the ability to read and speak certain languages and to understand information (e.g. the information provided in a vaccination campaign). In the same way, the factor livelihoods is more than just the economic sector in which the family earns its living. It also involves the division of labour between different members of the household and the question of who bears responsibilities for income generation and use of that income. Similarly, migration has different aspects. It includes a situation where the primary care taker is living away from home and left the children in the care of someone else, but also seasonal migration and displaced people due to conflict or natural disasters.

The influencing factors are either coloured in red or black. Those factors in red we assume may have a gender dimension, i.e. they do mean different things for women/girls and men/boys. The list of gendered factors (red) and other factors (black) influencing immunisation demand and supply is generic in the sense that context is not taken into account. The gendered nature of a factor in one culture may have no or a less of a gender dimension than in another context. For example the factor birth order in the sense of son preference is very much gendered in countries such as India and Nepal, but birth order has relatively no gender dimension in countries of Western Europe or parts of Africa.

Table 1 - Gender Analysis Framework

A Gender Analysis Framework to Investigate Factors Influencing Immunisation Coverage



The final aim of the process is to not merely identify gender related barriers but to be able to offer a contextualized understanding and explanation as to which specific aspects of a barrier such as transportation truly contributes to low or under immunisation of children. These explanations can contribute to how programme planners and managers understand and address well known barriers in future.

2.3 Design

This qualitative systematic review employing meta-ethnography methodology was conducted from October 2009 to June 2010. Meta-ethnography, since first offered by Noblit and Hare(Noblit and Hare 1988), has proven to be a useful tool to synthesize the evidence from qualitative studies. The method of meta-ethnography is an effective tool to synthesize qualitative studies in order to attain a deeper understanding of complex health-related topics (Noblit and Hare 1988) (Barroso and Powell-Cope 2000) (Pound, Britten et al. 2005) (Garside, Britten et al. 2008). Meta ethnography allows for synthesis and presentation of qualitative evidence that is concise and even directive, thus facilitating use of results across methodological disciplines. Meta-ethnography uses the process of “translation” to synthesis findings, whereby the findings of a study are examined in the terms of other studies to see whether they are referring to the same concepts (“reciprocal translation”), refer to opposite concepts (“refutational translation”) or can be ordered so that they create a “Line of argument”. Translation involves an interpretive ‘reading’ of

meaning (al) in order to discern whether studies' authors conceptually describe phenomena differently that can, in effect, be factually interpreted in the same manner. It permits cross-study comparison by analyzing how the different studies are related (Smith, Pope et al. 2005); provides a systematic approach while maintaining the interpretive properties of the original data (Dixon-Woods, Agarwal et al. 2005); and renders more powerful results and greater generalisibility than one research on the same theme (Smith, Pope et al. 2005) (Britten 1989) (Campbell, Pound et al. 2003). Meta ethnography, as opposed to a literature review, provides a systematic approach to the analysis and synthesis of findings across multiple studies, and "involves the juxtaposition of studies and the connections between them, in order to develop a more sophisticated understanding" (Harvey 2007) of the topic. The focus is on interpretation instead of accumulation of information (Walsh and Downe 2005).

In the field of immunization, information has largely been gathered from studies focusing on prevention and promotion interventions and studying barriers to access to immunization services. Qualitative evidence from ethnographic or anthropological works, published in peer reviewed journals, has been largely overlooked. In this meta-ethnography, we attempt review all relevant qualitative studies from an interdisciplinary perspective.

2.4 Search strategy, inclusion and exclusion criteria

The search was conducted using electronic social sciences and medical databases: Medline, Embase, CINAHL, Cochrane Library, ERIC, Anthropological Lit, CSA databases, IBSS, ISI Web of Knowledge, JSTOR, Soc Index and Sociological Abstracts. Key words were drawn from the reviews conducted for the unvaccinated child project and expanded to include the gender related determinants of immunization coverage. They were built around the following themes: immunization, vaccines, health services, health behaviour, developing countries. There were no date restrictions and initially no regional distinction in order to assess the scope and variety of the literature. (This was later amended to exclude articles from developed countries). We restricted the electronic search to English, French, Spanish, Italian, German, and Portuguese language publications. The search was done on February 17, 2010. Publications after that date were included only if they had been found in hand searching of bibliographical references found in the search. All studies published in peer-reviewed journals from the earliest date of each database up to the cut-off date of the search (23 March 2010) containing qualitative methods of data collection and analysis were considered. Thesis and unpublished works were reviewed but not included. Other methods of data collection and analysis were excluded.

2.4.1 Selection of Studies

Retrieved citations were reviewed in duplicate by four researcher (AMH & CS) and (OMK&SG). Sifting was done in three phases; title, abstract and full text. At each stage of the review process

four researchers (AMH & CS) and (OMK & SG) assessed and coded independently. Differences were resolved by consensus. All bibliographies of studies and books that corresponded with the inclusion criteria were scanned to not overlook potentially important works. Quantitative reviews on immunization interventions were also checked and studies (surveys, cross sectional studies, cohorts, RCTs, reviews) without significant qualitative data were excluded (N=293). All studies using a qualitative design and analysis method or those for which no abstract was available continued to full text review (N=173). Twenty three studies conducted in resource limited settings then passed quality appraisal (Campbell, Pound et al. 2003) (Wallace, Croucher et al. 2004) (Walsh and Downe 2006) (Rolfe 2006) and were retained. Figure 1 shows the flowchart with the initial number of hits through database, hand and bibliography search after exclusion of duplicates (N=4303), the number and reason of articles excluded at each sifting phase, the number of reviewed full manuscripts (N=173), and the final number of studies included in the meta-ethnography after the several quality appraisals phases (N=23).

2.5 Quality appraisal

Quality assessment of qualitative literature is much contested both because of the tensions between inclusiveness and quality (Smith, Pope and Botha 2005; Dixon-Woods 2006, Rolfe 2004) and contested notions of quality within and between different qualitative research communities and disciplines. Initially we drew up a detailed assessment sheet combining the work of Walsh and Downe (2005) and Campbell et al. (2002). However, as well as being very time consuming, we found the types of studies and publication dates too varied to be judged in this manner with methodologically weak, but conceptually strong papers (typically older, ethnographic texts) scoring poorly. We concluded that it was more important to prioritize papers based on their relevance to the synthesis than on their methodological standards, as previous authors have also noted (Noblit and Hare (1988); Dixon-Woods et al (2006); Garside, Britten and Stein (2008)). Instead, we used the concise assessment criteria of Wallace et al. (2004) and at the same time assessing its potential contribution to the synthesis. Papers that did not contain (sufficient) qualitative data alongside prevalence data were considered "fatally flawed" and excluded (Dixon-Woods et al 2006). We appraised the 173 publication we extracted by first classifying then as topical surveys, thematic surveys, conceptual thematic descriptions and interpretive explanatory studies following Sandalowski and Barroso's categories of qualitative analysis (2007). Studies falling under the first two categories were excluded as they repeated what was already known from the studies in the last two categories. The 23 studies that were eventually included are listed in Table 1 together with the study characteristics.

2.6 Data extraction and synthesis method

Twenty three studies were included in the synthesis. They were read and re-read by four authors (AMH & CS) and (OMK & SG) independently who identified and extracted study and sample characteristics together with key findings or in the form of quotes, themes and concepts. A division was made between 1st, 2nd and 3rd order constructs according to Malpass et al. (2009) as is showed in Figure 2.

First order constructs are those expressed by research participants themselves and are usually expressed as direct quotes or respondents voices summarized by the author. Second order constructs are the interpretation study authors give to the experiences of the study participants (1st order constructs) in their discussion of findings in their papers, and third order constructs are our interpretation as reviewers based on a synthesis process of the 1st and 2nd order constructs found in the selected papers.

During the initial coding process, key themes and concepts were extracted (Noblit and Hare 1988) and peer reviewed for inclusiveness. A distinction was made between first-order (original quotes) and second-order (author's analysis) findings, and they were coded in duplicate. Discrepancy between codes was resolved by a consensus discussion between the researchers. Second-order constructs pertinent to gender based determinants to immunization were identified and cross-compared (Smith et al. 2005).

Atlas.ti software was used in order to assist the researchers to identify themes emerging from the included studies. All themes emerging from the papers were then consolidated, grouped and given labels. As groups of themes were compared with each other, their relation -- either as reciprocal, refutational, or as a common line of argument (Noblit and Hare 1988) -- became clear. Through this process, 1st and 2nd order constructs were 'translated' into each other and were summarized on translation sheets. This in turn informed our 3rd order constructs or our broader interpretation of the synthesized results (see synthesis / discussion section). Studies that were conceptually better developed (interpretive explanatory studies) provided the lens through which other less well developed studies (conceptual thematic descriptions) were interpreted.

In this report, first order constructs (direct quotes from respondents in the studies) are provided as italised, indented quotes. Second order constructs or author's summaries or interpretation of their respondent's views are stated as the view of the authors or given in single, non italicized quote (e.g. Bastien (1994) reports that 'culture plays an important role in Bolivia'). These two levels of findings on barriers to immunisations are presented in the results section. Third level constructs or our qualitative synthesis and interpretation of the results as presented in the Discussion section.

Figure 1 - Meta ethnography flowchart

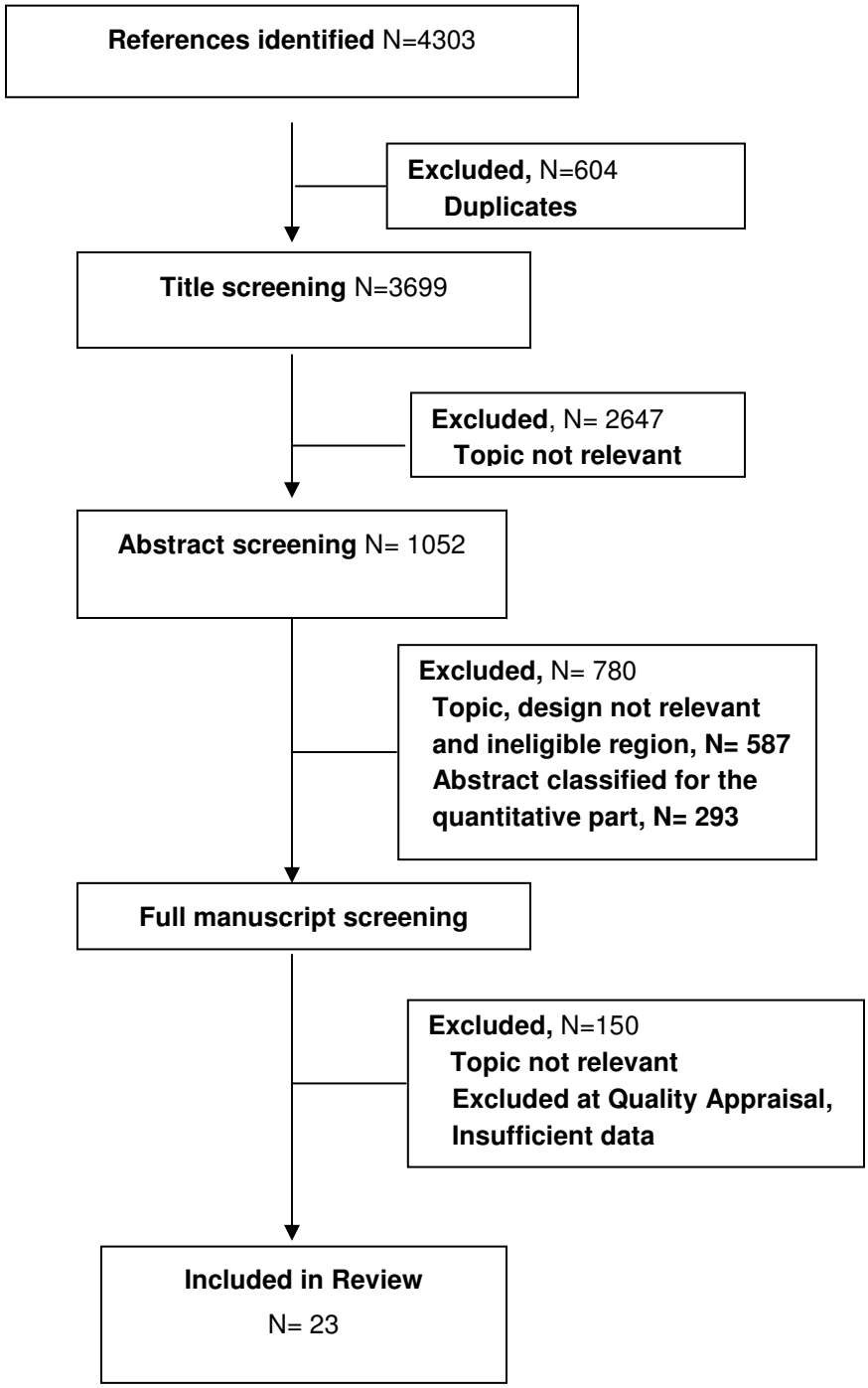


Figure 2 - Definition of 1st, 2nd and 3rd order constructs (adapted from Malpass et al. 2009)

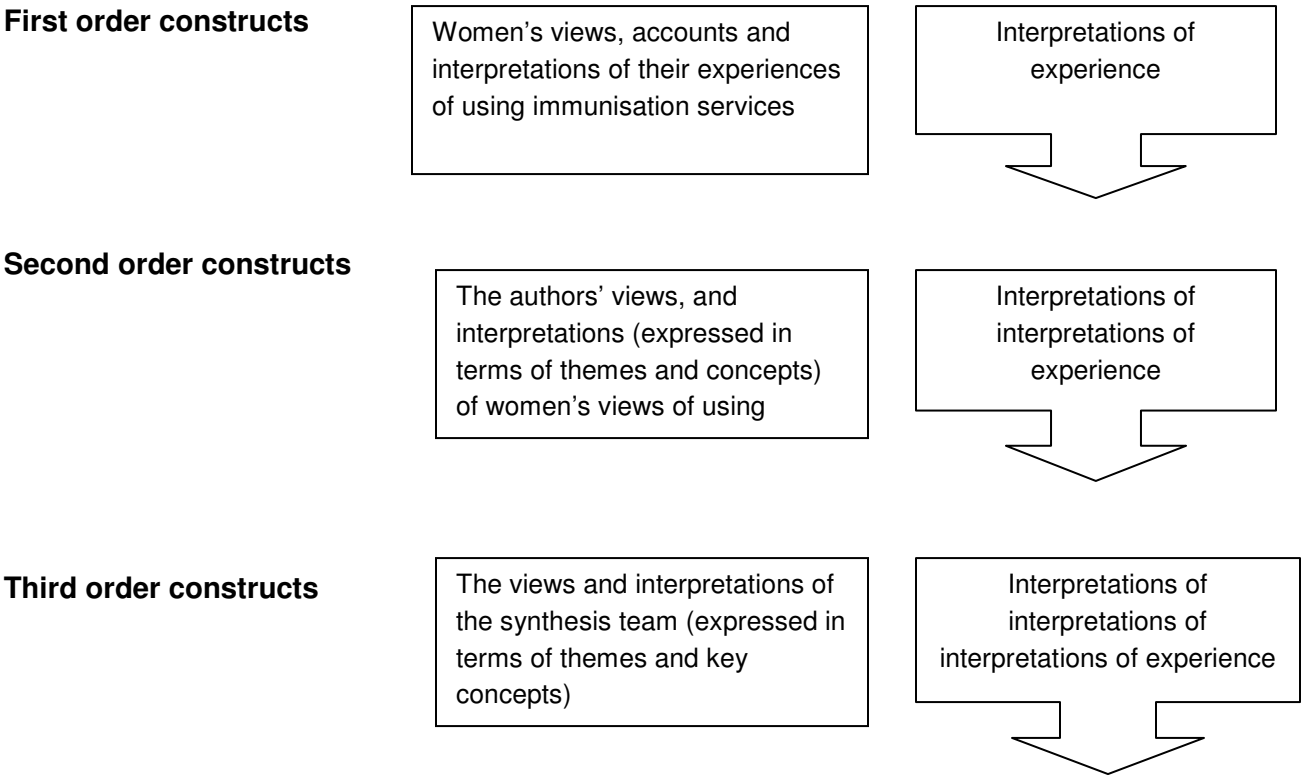


Table 2 - Study characteristics table

#	Author(s)	Year	Country	Urban /rural	Sample subgroup	Method of data collection	IDIs	FGDs	Study objective
1	Azevedo	1991	Cameroon	rural	Opinion leaders and individuals of the community	FGDs		29	To ascertain the attitudes, beliefs, and practices associated with child mortality and usage of modern health care centres
2	Bastien	1995	Bolivia	rural	Community members	Open ended interviews and participant observation	n.a.	n.a.	To analyze cultural beliefs and practices in order to understand how people in three cultural areas in Bolivia (Aymara, Quechua and Tupi-Guarani) think about NNT and tetanus toxoid
3	Berhanel	2000	Ethiopia	rural	Health workers and community members; Mothers of children <5 years	In depth interviews (IDIs); KI interviews, FGDs; Document review; Observations	n.a.	96	To understand social, cultural. political and economic factors that influence the efficiency and effectiveness of immunization Programs
4	Bisht	2000	India		Mothers of children between the ages of 0 to 2 years	IDIs	205		To understand the various perceptions of the causation of measles and the quest for therapy in different socio-cultural contexts
5	Chaturvedi	2009	India	rural	Mothers of children <5 years; Community leaders	IDIs; FGDs; Non-formal interactions (n=156); Observations.	43	12	To gain an insight into the phenomenon of social resistance and rumours against pulse polio campaign.

Table 2: Study characteristics table (continued)

#	Author(s)	Year	Country	Urban /rural	Sample subgroup	Method of data collection	IDIs	FGDs	Study objective
6	Coreil	1994	Haiti	urban	Mothers of preschool children and health care providers	FGDs; Natural groups interviews	4	26	To understand the social context of immunization seeking behaviour and to help develop a culturally valid survey instrument for use in a subsequent case-control study
7	Dasgupta	2008	India	urban/rural	Mothers of children <5 years; Community leaders	Qualitative. Rapid appraisal procedures (RAP)	43		To understand the perceptions and likely determinants that facilitate or act as barriers in implementing additional strategies for polio eradication
8	Eng	1991	Togo	rural	Mothers	FGDs		110	To investigate the lack of acceptance of childhood immunisation from a social science perspective
9	Fassin	1986	Senegal	urban/rural	Mothers of children <5 years	Semi structured interviews	100		To investigate the relation between social groups in rural and urban areas
10	Helman	2004	Transkei	rural	Caretakers of children <5 years	Semi-structured Interviews; FGD	60	17	To examine perceptions of childhood illnesses, and the role of immunisation in preventing them, among caretakers of young children

Table 2: Study characteristics table (continued)

#	Author(s)	Year	Country	Urban /rural	Sample subgroup	Method of data collection	IDIs	FGDs	Study objective
11	Li	2004	China	rural	Mothers of children born in the 3 years prior to the study	FGDs			To test the general hypothesis that gender inequality and the state's family planning policy have a significant influence on Maternal and childcare utilization
12	Mavimbe	2006	Mozambi-que	urban	Official district Directors	Semi-structured interviews; Participant observation; Secondary data collection	14		To ascertain the construction of immunization coverage and how they implement the desired program strategies in order to improve the health status of the region
13	Odebiyi	1982	Nigeria		Older mothers	IDIs	200		To assess the mothers' awareness of the seriousness of the disease and their knowledge of its prevention
14	Odebiyi	1993	Kenya	rural	Mothers attending the clinic	IDIs	184		To examine the role of the women in the expanded program of immunization (EPI)
15	Oluwadare	2009	Nigeria	urban/rural	Mothers; Health workers; Community leaders	FGDs; KI interviews	n.a.	n.a.	To explain the intractable plummeting trend of immunisation in Nigeria and in Ekiti State as a case study

Table 2: Study characteristics table (continued)

#	Author(s)	Year	Country	Urban /rural	Sample subgroup	Method of data collection	IDIs	FGDs	Study objective
16	Pool	2006	Mozambi-que	urban/rural	Mothers/caretakers of infants	IDIs and semi-structured interviews, Participant observation	308		To describe attitudes to the expanded programme on immunization (EPI) and intermittent preventive treatment in infants and perceptions of the relationships between them
17	Renne	2006	Nigeria	urban/rural	Parents; students (without children) who had polio; immunization workers and local government health officials members	IDIs; Participant observation	32		To examine the reasons for the difficulties in eradicating polio from the perspective of community members
18	Schwarz	2009	Gabon		Mothers of children <5 years	IDIs; informal conversations; observations	40		To explore attitudes of mothers towards childhood vaccinations and reasons for non-attendance and non-adherence to mother–child clinics (MCCs)
19	Suresh	2000	India	urban/rural	Children between 0-59 months	Semi-structured interviews	20		To validate the reported coverage for 1999-2000
20	Tadesse	2009	Ethiopia	rural	Community representatives in Wonago district	FGDs; IDIs	22	6 x ?	To explore factors associated with child immunization

Table 2: Study characteristics table (continued)

#	Author(s)	Year	Country	Urban /rural	Sample subgroup	Method of data collection	IDIs	FGDs	Study objective
21	Topuzoglu	2007	Turkey	suburban	Mothers of children <5 years	FGDs; IDIs	2	8 x ?	To understand the behaviours of mothers concerning the immunization of their children, the decision-making process, the perceived barriers, and the enabling factors to access the services
22	Uddin	2010	Bangladesh	urban	Mothers of children aged 12–23 months and service providers	FGDs; IDIs; Participant observations	16	8 x ?	To assess the impact of an EPI intervention package
23	Unisa	2006	Jharkhand / Rajasthan		Programme officials and community members	FGDs; IDIs	704	30	To explore the problems fro supply side of the immunisation services and to examine the demand for immunisation services, knowledge and utilization of the different typed of vaccines by the community

3 Results

3.1 Study Characteristics

All of twenty-three studies included in the review are based on field work done in countries that were experiencing specific barriers to routine immunisation. The studies were conducted between 1982 and 2010; 16 were published between 2000 and 2010, 5 in the 1990s and 2 in the 1980s. The studies represent a wide range of developing countries including some that have well known coverage challenges such as Bolivia (1), Ethiopia (2), India (4), and Nigeria (3). Other countries include Bangladesh, Cameroon, China, Gabon, Haiti, Kenya, Mozambique (2), South Africa, Senegal, Togo, and Turkey.

3.2 Health System Barriers to Immunization Services

3.2.1 Denial of the right to privacy and poor quality of care

Poor treatment by providers are important elements that influence many mothers to stay away from health centres after they have had a negative experience, resulting in missed opportunity for vaccination.

Immunization is organized in such a way that mothers and their children are very exposed to both compliment and criticism. Little or no privacy results in the provider-mother interactions to be shared publicly, which may generate feelings of shame in cases of blaming of the mothers. Public counselling for a child in bad physical condition, for example, causes great embarrassment and shame for the mother who is held responsible for the health of the child (Bernahel 2000, Coreil 1994, Helman 2004, Oluwadare 2009, Schwarz 2009, Tadesse 2009, Topuzoglu 2007).

> *"If you come to the MCC, they will not talk to you in private, they will talk to you in front of everybody, to make sure that next time you will not bring it [the baby] like that, you will change…. They [other mothers] see that the child does not thrive, they prefer to stay at home, instead of going to the vaccination. Others do that, they prefer to abandon, now if you see that the child has become severely sick, that is when one discovers in the vaccination booklet, that she has not well followed the vaccinations of the child and that is not good."*
>
> [20-year-old mother of 1 child, Lambaréné, Gabon] (Schwarz 2009)

While health personnel often do not recognize the effect provider attitudes and criticism can have on mothers, mothers themselves described it as a major barrier to immunisation attendance. Patronizing and disrespectful treatment is reported as endemic in vaccination sites in many countries (Bastien 1995, Schwarz 2009, Coreil 1994, Helman 2004, Topuzoglu 2007).

> "*If you are late, they won't take you and you have to come back another time. Sometimes you arrive and they have already finished vaccinating. You will be obliged to come back".*
>
> [23-year-old mother of 2 children, Lambaréné, Gabon] (Schwarz 2009)

As Topuzoglu (2007) states, speaking about Istanbul, Turkey, "the need to protect one's pride and dignity is also affected by criticism from neighbours for seeking free services and by the type of reception clients

are given at a health care facility. The long waits, the impersonal and sometimes disrespectful treatment from insensitive staff, the patronizing attitude conveyed in many health education messages, can all lead clients to feel they have to pay an emotional price for health care." Providers administer vaccination roughly, without adequately explaining which vaccines are being received, or why they are important. There is a prevailing attitude among some providers that mothers are not able to understand or appreciate details related to vaccination.

> *"You can not understand it (which vaccine was administered) from the card; also they (the health personnel) do not say anything. You just take the child and they give the vaccine."*
>
> [Mothers from FGDs, Istanbul, Turkey] (Topuzoglu 2007)

This patronizing approach to caretakers is seen by some respondents as a reminiscent of the colonial era approach of dealing with the "natives" (Bastien 1995, Helman 2004, Topuzoglu 2007). As one health planner from India said, "The beauty of vaccination programs is that they require little from the community beyond lining up and holding out their arm at the proper time" (Bastien 1995).

Mother sometimes understood the way they were poorly treated by providers as a consequence of a transgression from their part (Bernahel 2000, Topuzoglu 2007). Topuzoglu (2007), for example, noticed that in Istanbul, Turkey, "mothers equated poor treatment as evidence that the vaccination was important. They [mothers] generally did not question why they were being treated badly by the provider. They rather blamed themselves as inadequately taking care of the child, or having transgressed in some way."

3.2.2 Missed opportunities

Missed opportunities were also often due to wrong contraindications that were put forward by healthcare providers. Poorly trained health professionals have sometimes wrong assumptions about when a child should or should not be vaccinated. For example, if a child has a fever or is sick, the health providers may refuse to give the vaccination (Topuzoglu 2007). The health personnel also sometimes refuse to give more than one shot at a time for premature or small gestational age babies, thus postponing some of the shots for these babies and requesting that the caretaker comes back another day. Mothers who have travelled long distances to bring their children for immunization can be discouraged and may not come back to fulfil their vaccination schedules (Bernahel 2000).

> "*Of course when the child is sick they [the health personnel] tell you to go and come back the next week, it was like that. My child was sick then, he had measles so I could not take him [to the immunization session], the last two shots were left out, I do not know which ones they were, I could not take him [to the PHC] afterwards."*
>
> [In-depth interview with Mothers, Soddo, Ethiopia] (Bernahel 2000)

3.2.3 Supply and infrastructure constraints

Lack of adequate vaccines, issues around the cold chain capacity – especially due to electricity shortages – and limitations of basic immunization supplies such as syringes, vaccination cards, and sterilization capacity is reported to be a significant barrier to immunization program effectiveness. It was also reported as reason for mothers to stay away from the services as they could not be sure that their efforts to get to the health facility would yield fruitful results. Interviewed mothers also complained about inadequate availability of properly functioning health centres, particularly for those living in more remote regions (Azevedo 1991, Bernahel 2000, Fassin 1986, Helman 2004, Odebiyi 1993, Oluwadare 2009, Schwarz 2009, Tadesse 2009, Unisa 2006). Fassin (1986), for example, notes about the Haalpulaaren of Senegal that "often 'cultural obstacles' are invoked by public health officials as the reason for weak vaccination coverage, but rather it is the failure of the immunization program logistics, in the end, that destroys the good will of the people [to go for vaccination]." Vaccination cards were also often mentioned as not available or, when available, not adequately used for record keeping (Azevedo 1991, Bernahel 2000, Eng 1991, Tadesse 2009, Unisa 2006).

3.2.4 Human resources

Poorly trained personnel and/or carelessness on the part of the providers in the administration of the vaccination, sometimes using dull needles and inappropriately sterilized equipment, was perceived by mothers as a important reason not to go for or complete the immunization of their children (Bastien 1995). The lack of qualified personnel also worsens the issue of availability of services in rural areas. In addition, when the personnel are available in remote areas they are often under motivated for example due to low salaries, and often paid late (Bernahel 2000, Odebiyi 1993, Oluwadare 2009¸ Suresh 2000, Tadesse 2009, Unisa 2006). It was also noted that more female providers would help uptake in the sense that they are perceived as more able to understand the needs of mothers.

> *"Women should be engaged to administrate immunization services because of their familiarity with children based on their mothering and mentoring roles."*
> [Nursing superintendent of the clinic in Saradidi, Kenya] (Odebiyi 1993)

3.2.5 Cost barriers

While immunization services are usually free of charge, indirect costs related to attending immunization service often represent a major constraint, particularly for single women, poor families and those living in rural areas (see section on livelihoods below). Almost all formal health services entail indirect economic costs related to transportation, travel, waiting time, and missed opportunities for income generation. The cost of additional medication prescribed during the visit is also a major obstacle. Sometimes, program administrators did not perceive economic factors to be significant system barriers since the immunization services themselves were provided without charge. Here, as elsewhere, the indirect `hidden' costs of service utilization are not accorded serious consideration in planning and evaluation of health programs (Azevedo1991, Bernahel 2000, Coreil 1994, Fassin 1986, Helman 2004, Oluwadare 2009, Schwarz 2009, Tadesse 2009, Topuzoglu 2007). As Oluwadare (2009) points out about Ekiti in Nigeria, "although

immunizations services were technically free, costs associated with medication, and under the table payment to providers for access to supplies, "fees" levied on patients, or other costs was commonly reported by caretakers seeking immunization services."

3.2.6 Accessibility

Transportation barriers remain a problem and are directly linked to coverage rates. Areas with the lowest coverage are often those inaccessible by car, which therefore rely on rally posts in neighbouring villages. The arrival of the health team is also contingent upon good weather (Bernahel 2000, Coreil 1994, Fassin 1986, Helman 2004, Odebiyi 1993, Oluwadare 2009, Schwarz 2009, Tadesse 2009, Topuzoglu 2007, Unisa 2006).

While many countries have national guidelines that mention the use of mobile units for hard to reach areas, in reality their use is minimal or non-existent. Indeed, many respondents complained that the government had stopped or scaled down the use of mobile units (Azevedo 1991, Helman 2004, Oluwadare 2009). Oluwadare (2009), writing about Ekiti State in Nigeria, mentions that "despite nation-wide guidelines, some settlements are designated as 'hard-to-reach' due to bad topography, impassable rivers, long distances to service point, and political unrest. These areas if found should be served by a mobile immunisation team. But, in all identified 'hard-to-reach' areas in the State, routine immunisation by itinerant health workers is not consistently in operation."

Unpredictability has a greater negative influence on utilization than absolute distance. Distance alone, thus, does not appear to explain utilization at the household level. Along with the unpredictability of posts in areas with difficult access, unreliable system of notification about an upcoming post by word of mouth also contributes to limiting accessibility. Pure and simple lack of health posts in remote region also continues to be a problem (Bernahel 2000, Coreil 1994, Helman 2004, Odebiyi 1993, Oluwadare 2009, Schwarz 2009, Tadesse 2009, Uddin 2010, Unisa 2006).

On the side, home visits by extension workers and community support groups are mentioned as creating trust and generating support mechanisms that may facilitate utilization of immunization services by rural women. In some cases, the trust relationship with the community health workers or between support group members may even help the woman to negotiate with her husband and within her household use of services (Bernahel 2000, Tadesse 2009, Uddin 2010).

> "*We do not have to pay for the health extension workers for vaccination services. They visit our households often. They convinced our husband who refused to vaccinate our children. They do not perform tasks easily – they lack transport facilities for example – but they figured out different problems and supported us to vaccinate our children fully."*
>
> [FGD discussant from rural Kebebe, Ethiopia] (Tadesse 2009)

Bernahel (2000) also observed in Ethiopia that the "use of community outreach workers and support groups was also highlighted as an important strategy to overcome cultural, and information barriers. They

are respected by the community and seen as better able to keep reliable records of the children in the communities where they work. When these outreach workers are unavailable, this can have a negative impact on the programme."

Extended service hours are also mentioned as increasing accessibility. This was particularly important for women working in urban areas (Bernahel 2000, Uddin 2010).

Uddin (2010) reports from Dhaka, Bangladesh, that "mothers, support group members, and service providers highly appreciated the extended EPI service schedules. The Assistant Health Officer commented that the extended timing was a great opportunity for working women to vaccinate their children. She said that working mothers, such as garment workers, could immunize their children at a time convenient to them, i.e. during their free time. Four mothers who completed all the doses said, 'it would not have been possible for us to complete all the doses for our children if this system was not introduced'."

3.2.7 Accommodation

Long waiting time and the discomfort of crowded waiting areas often lacking enough seats, as well as the feeling to be rushed when one's turn finally arrived were all mentioned as barriers to utilization (Coreil 1994, Suresh 2000). Ethnicity of the providers was also reported to be an important factor, influencing the selection of health practitioners. Clients may prefer to be attended by someone of their own tribe or caste while aspiring to reduce cultural and language barriers: "ethnicity is a major consideration of Quechua women in selecting whether the medical practitioner be either a hispanicized priest, a traditional Quechua curanderos, or a westernized mestizo doctor or nurse" (Bastien 1995).

3.2.8 Organization of services: the suspicion over vertical programs

Some respondents reported that they questioned government's real intentions hidden behind the focus on immunisation, particularly in the case of campaigns. When other basic primary health care services were neither available, nor free of charge, explanations that the authorities were simply interested in the health of the children is sometimes not taken seriously (Bernahel 2000, Chaturvedi 2009, Helman 2004, Mavimbe 2006, Oluwadare 2009, Schwarz 2009).

Chaturvedi (2009) for example observed in Northern India that in a context where many respondents express their dissatisfaction at the lack of primary health care services, "immunisation can appear to be externally driven and ignoring of the health priorities of the community. It raises a fundamental concern of the felt needs versus epidemiological needs, and it demonstrates that the top-down vertical approach is ill-equipped to address the plethora of local political, social and economic conditions… Such contradictions provide fertile ground for social resistance to repetitive activities like immunization."

Vertical and repeated focus on immunisation therefore leads to suspicion in the community about the motivations of the government or those seen as pushing for vaccination efforts. The question "why only polio?" was uppermost in the minds of the community (Bernahel 2000, Dasgupta 2008, Renne 2006).

> *"No, I don't allow my children to have the vaccine because I don't trust the vaccine. Because they said they are going to do it free of charge. And if we go to the hospital, we have to buy medicine and it is costly there. But this one is free of charge. In the hospital, your child can die or your brother can die if you don't have money. My children have had measles vaccine, but this polio vaccine, I won't allow it. I took them to the hospital to do the measles vaccine, they didn't come to my house. And I never took my children for any immunization except this measles vaccine."*
>
> [Farmer, Samaru, Northern Nigeria; September 2005] (Renne 2006)

Renne (2006) reports that in Northern Nigeria "what many people seemed to be questioning was the wisdom of an eradication program that appeared to them to reduce the resources and personnel available for PHC. Targets established in vertical programmes may in addition de-motivate providers and managers when they are not involved in setting priorities and goals. This might contribute to create an environment where falsification of data to meet targets becomes the norm (Bernahel 2000, Mavimbe 2006, Oluwadare 2009, Schwarz 2009, Unisa 2006).

As Mavimbe (2006) notes for Mozambique, "at the end, the rather remarkable coverage rates are not reflected by explicit reduction on disease incidence… District health directors have been assigned targets without their involvement… Such an approach will not help to build local ownership of immunization targets as the meetings held at the provincial level focus on criticism and are of no help in stimulating good reporting practices. The province and the districts should work as a steering force to place an understanding of immunization coverage within the broader context of preventive medicine and public health, not just as a meaningless program statistic."

3.2.9 Trust in health systems

Immunization services are often perceived by the communities as obligatory, as the "rule" of the law (Pool 2006). Women can experience the anger of the providers as evidence that it is very important to attend. They are also acutely aware that if they displease the provider they may compromise future care whether for ANC, delivery care or other health care needs, underscoring their sense of dependence on the local health services (Bernahel 2000, Pool 2006). This unequal relationship also affects mother's willingness to ask questions during immunisation sessions as they may fear reprisal (Bernahel 2000).

Health seeking is to a great extent defined by one's experience with the services (Bisht 2000, Bernahel 2000, Tadesse 2009). The quest for therapy is a process in which the patient creates social meaning through her/his interactions with a series of health care agents. In every community, a considerable repertoire of medical resources exists, repertoire that people exploit critically and situationally for various illnesses. Experience with providers thus dictates future utilization (Bisht 2000).

In most contexts people were reported to seek traditional medicine side by side with western medicine (Azevedo 1991, Bastien 1995, Bernahel 2000; see below), so communities also rationalized the use of

traditional medicine in the light of their experience at the health centres (Bisht 2000). In India, for example, Bisht (2000) found that while some respondents explained that they didn't use the health centres because "the PHC is too far off, others complained that they do not get proper treatment from the PHC doctors." Children are often taken to the closest and most accessible facility. The first encounter with the health system thus often determines where they will seek care in the future. Many mothers' first interaction with the health services is when she brings a sick child in for curative services and is offered immunisation (Oluwadare 2009, Bernahel 2000, Unisa 2006).

Oluwadare (2009) noted that in Nigeria, there "are a number of entry-points to the government health system. The first entry-point is the strongest and accounts for the continuous patronage of routine immunisation. Except in a few local government areas, like Ekiti West, and Moba, there is a critical rift between faith-based homes and public health workers, which hinder the desired complementary relationship." Concerning the difference between private and public providers, Unisa (2006) observed that in Jharkhand and Rajasthan, India, "public vs. private providers quality is determined by organisational set up at sub national level. It often depends on where funds are administered and distributed, and how. NGOs can play a positive role to make up for shortfalls of the government." Preference of public over private facilities is often more related to where they have had a positive experience in terms of quality of care, accessibility, and where the structural barriers to attend have been minimized (Nair 2007). Nair (2007) also noted that in Kerala, India, "there was little difference in preferences between private and government hospitals… [which] may reflect the prevailing community perception of high-quality cold chain networks operating in government hospitals."

3.3 Poverty and Livelihoods

3.3.1 Material resources and financial constraints

Although the fact that immunization services are offered free of charge minimises direct economic constraints, the level of poverty still indirectly influences utilization (Coreil 1994). Indirect costs such as transport still need to be financed by clients and in some cases material resources may not be sufficient to take a child to the clinic (Coreil 1994, Oluwadare 2009, Schwarz 2009).

The need to use the available resources for subsistence needs rather than health services affects the economically disadvantaged more directly because poorer families, "at the edge of survival", tend to depend more on a day-to-day acquisition of food (Coreil 1994). In these cases, subsistence takes priority over health related services in general and immunization in particular (Chaturvedi 2009, Coreil 1994, Topuzoglu 2007).

> *"When there are problems at home I can not think of anything, I even forget about the children. My husband had closed his business, he was not employed for a couple of months, this had a reflection on the children, on our house. I forgot the children, I neglected the children, otherwise it (the shots) would not have been incomplete"*
>
> (Topuzoglu 2007).

3.3.2 Competing priorities

In addition to immediate needs such as food, other basic needs such as employment also tend to take priority (Chaturvedi 2009). In order to assure the survival of the family, caretakers might be forced to assume multiple livelihood activities that impede clinic attendance (Coreil 1994, Schwarz 2009). These competing priorities have been reported by respondents to be a significant barrier to immunization (Coreil 1994).

Everyday life priorities include acquiring and preparing food, agricultural production in one's gardens and fields, market work, wage-earning jobs which do not provide paid leave, household chores, attending to children's or other relatives' needs. These priorities are considered more compelling than attending immunizations sessions and represent time away from home and family on a daily basis (Chaturvedi 2009, Coreil 1994).

3.3.3 Social Resources and exclusion

In addition, poverty can lead to social exclusion. In these cases, the social network of a mother might be too weak to assist her financially or by taking over some of her chores which would allow her to leave home or workplace for some time (Coreil 1994). Women from families that are less well-integrated also often lack the social connections that could encourage clinic attendance such as social relationship with health staff or socially organized groups of women who attend the clinics together (Coreil 1994, Oluwadare 2009, Fassin 1986, Chaturvedi 2009, Odebiyi 1993). Women who lack social support are therefore at risk of not being able to attend health services, which particularly impacts specific groups such as migrants and other marginalised groups who do not have assistance from friends, family or community (Coreil 1994).

Poverty also influences immunization by compounding other barriers families may experience in trying to access services. The poor are usually dependent on free public services, which can be of poor quality, while the rich can access private services if needed (Chaturvedi 2009). The advent of health problems for other members of the family may also render children immunization of secondary priority, the mothers facing "a kind of `psychic overload' that discouraged the women from thinking about non-essential things" (Coreil 1994).

Living in rural, remote areas makes immunization access more challenging. Where one lives can therefore be a considerable constraint in both one's capacity to get to the services as well as the health system ability and willingness to get to 'hard to reach' locations, with additional problems of climate of low staff motivation and compensation, particularly in the rainy season. For instance, Oluwadare reports that "a community of less than a thousand people and less than four kilometres to a comprehensive health centre in Gbonyin local government was tagged hard to reach and was not visited by the immunisation team except during polio rounds" (Oluwadare 2009).

Poverty also often invokes shame. Poor mothers avoid health services as they fear to be humiliated when their poverty becomes evident to the public. Especially when they cannot dress themselves and their

babies in good clothes and/or when children are too thin because of shortage of food. Mothers fear to be blamed as careless and avoid health services out of shame (Schwarz 2009, Coreil 1994, Fassin 1986). As one author explicitly mentions, “some women avoid completing the full vaccine series because they become discouraged after their infant fails to show adequate growth, despite their best efforts. Rather than face another disappointment, sometimes accompanied by embarrassment and mild criticism, they avoid returning to the post” (Coreil 1994).

3.4 Education, information and communication

3.4.1 General education and literacy

Education is presented as positively correlated to higher coverage rates (Azevedo 1991, Bastien 1995, Li 2004, Odebiyi 1982, Oluwadare 2009, Renne 2006), and illiteracy as a major barrier to immunization (Azevedo 1991, Eng 1991, Odebiyi 1982, Renne 2006, Topuzoglu 2007), sometimes linked to the “type of beliefs held about the vaccine” (Azevedo 1991). Mother’s education is reported as particularly important (Azevedo 1991, Li 2004, Odebiyi 1982), although father’s education is also mentioned as an indicator (Li 2004).

However, these affirmations seem to be based more on the literature referred to by the authors, in particular quantitative surveys, than on the actual results of their qualitative inquiry. Among those who investigated this link a bit more in depth, one study found that in fact half of the literate mothers that were interviewed “did not believe in the vaccine” (Odebiyi 1982) and that education had no impact on the beliefs in supernatural causes of diseases (Azevedo 1991). Similarly, education level had no impact on the awareness of the existence of immunization programmes (Azevedo 1991).

Whatever the correlation, the authors noted that education is often unequally available to communities in many countries. Different regions of a same country can face unequal access to education (Bastien 1995), and when different religious coexist, as in Nigeria, some education systems linked to specific religious identity can yield lower coverage (Oluwadare 2009, Renne 2006). Yet, as noted by Oluwadare, “the greater explanatory factor is not religion itself, but religiously fuelled social tendencies of poor education” (Oluwadare 2009). Finally, one of the major inequalities regarding education remains gender inequality, with women receiving less education than man in many settings across continents (Bastien 1995, Li 2004).

3.4.2 Health education and information

Several authors stress the need for more health education (Azevedo 1991, Helman 2004, Odebiyi 1982, Tadesse 2009), proposing for example to include elementary and essential health instruction as an integral part of a universal education (Azevedo 1991).

The main source of health education mentioned in the studies is the health personnel, in particular during vaccination sessions for education about immunization. Health personnel should therefore enhance the information they provide about immunization in general, but also about vaccines and childhood illnesses during vaccination sessions (Bastien 1995, Bisht 2000, Fassin 1986, Topuzoglu 2007). They should also

provide more information about symptoms so that communities can better recognise the diseases (Bastien 1995). Consequently, the lack of information provided by the health personnel during vaccination is a major missed opportunity (Bastien 1995, Coreil 1994, Schwarz 2009, Topuzoglu 2007), which sometimes reminds past colonial experience to communities (Bastien 1995).

Other sources of information and health education mentioned are older women who can play an important role in providing information to younger mothers (Bisht 2000), and different kinds of opinion leaders like local leaders (Suresh 2000), celebrities (Chaturvedi 2009), chiefs (Eng 1991), town criers, churches and mosques (Oluwadare 2009), the media (Renne 2006, Suresh 2000), and teachers (Suresh 2000). One author notes that the cause of lack of health education is a problem of lack of access to information, rather than an inability to learn (Eng 1991).

3.4.3 Communication and campaigns: too much information?

Therefore, intensification of health awareness campaigns is presented as “the best solution” to increase demand for vaccines (Azevedo 1991, Fassin 1986). However, the fact that these campaigns often focus on some specific diseases or populations can reveal itself problematic. The focus on women, for example, can appear suspicious (Bastian 1995), as can the focus on one single disease like polio, which can also tend to overwhelm information and communication about other antigens (Oluwadare 2009). Campaigns focus is also associated to a top-down approach that may generate resistance (Renne 2006). Campaigns to promote vaccination are also problematic when other basic health services are not available, with communities wondering why medication (vaccine) is suddenly given free of charge at their doorstep when they generally can’t access the basic health services they need (Renne 2006).

Cross-cultural communication appears to be critical to success of any type of communication about immunization. Doctors and nurses should therefore adapt the information model of immunization to people's conceptions, etiologies and treatment of immunifacient diseases if they intend to change the communities’ behaviours (Bastien 1995). Unfortunately health providers are generally unaware of local syndromes and of the social, magical, etc. significations of illnesses (Bastien 1995), which sends back to the well known issue of poor training of health personnel (Bastien 1995, Topuzoglu 2007, Uddin 2010).

3.5 Beliefs and Knowledge

Whether implicitly or explicitly, most authors imply that higher levels of knowledge are positively correlated with higher immunization coverage rates. “Knowledge”, opposed to “beliefs”, together with everything that helps increasing it (education, information campaign, etc.), emerges in the papers as one of the important domain to be taken into account when defining and implementing policies.

Although most (if not all) of the included studies mention the words “knowledge” and “beliefs” in their discussions of barriers and facilitators, none of them really propose a definition of the concepts. In most cases, then, the implied definition is that “knowledge” is awareness, understanding and acceptance of the

biomedical discourse on illness causation and treatment options, and "beliefs" refers to all alternative etiologies.

A few authors, however, discuss these themes more in depth and propose a subtler and more complex understanding of knowledge and beliefs. They remind that medical systems are also cultural systems (Azevedo 1991), and show how the coexistence of "ethno-medical" and biomedical systems deeply influences health seeking behaviours (in particular Bastien 1995, Bisht 2000). Furthermore, Bisht underlines the similarities between the properties of "beliefs" and those of "biomedical knowledge" by using the term "folk knowledge". Knowledge is then just a kind of discourse on illness, and competing discourses not only can coexist, but no strict boundaries can really be drawn between them (Bisht 2000).

3.5.1 Coexisting belief systems and knowledge claims

Empirical knowledge is influenced by the weight of the illness experience. If the main source of knowledge on vaccines and immunization is the health centre (Bastien 1995, Oluwadare 2009, Suresh 2000), several authors point to the fact that, at community level, what finally counts in shaping health seeking behaviours is more an "empirical knowledge" derived not so much from the information given by the biomedical community but from the communities' "long-term experience of the disease itself" (Bernahel 2000, Bisht 2000, Coreil 1994, Fassin 1986, Odebiyi 1982, Tadesse 2009, Topuzoglu 2007).

When an individual takes a decision about immunization, the health information received at the health centre is understood in the framework of the community's experience with both the diseases and the health services. A positive experience, for example the perception that a generation of children who were immunized suffered less from some diseases than others who were not, may lead to increased acceptance.

> "*a child will still get measles... but the child will not suffer much. Earlier children used to suffer a lot. Many of them even died due to measles*"
>
> [mother, Pauri Garhw, India] (Bisht 2000).

A negative experience, on the other hand, due to side effects or to misunderstandings of the aim and scope of vaccine (see below), may deter participation. Nonetheless, the relation between experience with vaccination and demand for vaccine is complex and not always straight forward. If in most reported cases the occurrence of a mild version of the disease after vaccination tended to generate distrust in the vaccine, it can also do just the opposite and increase trust in the efficacy because of the experience that the disease can provide life-long immunity from the disease, and the understanding that this is precisely the way vaccine work (Bisht 2000).

Knowledge claims that hold the idea that knowledge diffused through the health centre will be accepted and appropriated *as is* by the community "ignores the possibility that this knowledge may come into conflict with the existing knowledge of the community" (Bisht 2000). As for other domain, like religion or education, aspects imported from Western discourses don't force people to "abandon completely their

deep-seated values" (Azevedo 1991). New health related ideas and practices can be incorporated in traditional cures (Bernahel 2000, Bisht 2000, Pool 2006), and the biomedical knowledge, "once reinterpreted", "will become part of the local belief system and view" (Bernahel 2000). Traditional or folk knowledge itself, far from reflecting some pure tribal worldview, includes elements imported throughout the colonial experience, as evidenced by the existence of traces of the medieval European humoral theory in traditional ethiology, or the reconfiguration of witchcraft discourses under the influence of Christian missionarism (Bastien 1995). In the case of immunization, even when communities come to accept vaccination, "they do not necessarily do so with the biomedical understanding of the nature of immunity provided by vaccines" (Bisht 2000, Pool 2006).

The resilience of traditional understandings in health related issues is also obvious in the fact that a new religion (Christianity and Islam in this case) doesn't really change the individual's attitudes (Azevedo 1991). Religion doesn't change the understanding of traditional syndrome, even though the magical causes may be interpreted differently and some traditional practices may be changed due to religion (e.g. rubbing the child with a bible instead of sprinkling the blood of a sacrificial animal). These practices are usually still found in another form (Bastian 1995, Bisht 2000). Only one author mentions the opposite example of traditional practises completely abandoned due to religion (Renne 2006).

Concerning the impact of religion on coverage, although in Nigeria for example some Muslim regions may suffer from lower coverage, the cause "is not religion itself, but religiously fuelled social tendencies of poor education" (Oluwadare 2009). Concerning the competing health discourses, religion also has an ambiguous impact. Church affiliated hospitals, for example, send complex message by mixing biomedical assumptions with theories of divine intervention. On the one hand they "claim a scientific basis for their treatment of disease, while, on the other, they reinforce the African's belief in the role of the supernatural in the explanation of disease and death" (Azevedo 1991).

3.5.2 Illness vs. disease: the understanding of medical conditions

Bernahel (2000) reminds that discussions of impaired health can concern both *illness*, defined as the "individual psychological experiences of not being well", and *disease*, defined as "conditions constructed in the biomedical discourse." The way different communities experience "not being well" and create specific health belief systems to give meaning to that experience obviously vary (Bastien 1995), which is one of the reasons why a specific discourse (e.g. the biomedical discourse on immunization) cannot simply be mechanically adopted *as is* in replacement of a traditional one by a community.

Language itself poses a problem, be it only in the issue of naming of illness, disease and treatment options. In a same region, the name of a disease can point to different conditions for different groups, or the same word can be used by both biomedical providers and traditional healers when referring to two completely different things and thus creating confusion in the community (Bastien 1995, Bernahel 2000). The name used for a vaccine sometimes doesn't correspond to the same disease in all the dialects of a region, or difficulties to understand the message comes from the use of another language than the vernaculars, like Spanish or English (Bastian 1995, Bisht 2000). In some context, naming evil is to call it

upon the family, and therefore people won't use the name of a disease even if it exists and they know it (Fassin 1986). This aspect of language can seem trivial, but the terms used to designate diseases can also reflect in themselves deep traditional ideas about supernatural causations (Renne 2006), and therefore have an impact on treatment seeking behaviour.

3.6 Culture, world view, and medical systems

Biomedical illness explanations and treatment as preventive options thus do not always remain unquestioned, and this may not always be overcome by providing more accurate science-based information. It is therefore important to explore alternative belief systems more closely to elicit where common misunderstandings may be found both on the side of the healthcare providers and of the users.

As Bisht (2000) reminds, Young (1982) observed that in every culture, 'worrisome behavioural and biological signs, particularly those originating in disease, are given socially recognizable meanings', i e, they are made into symptoms and socially significant outcomes. In his paper, Young further argued that 'every culture has rules of translating signs into symptoms for linking symptomatologies to etiologies and interventions, and for using the evidence provided by interventions to confirm translations and legitimize outcomes' (Young 1982) A culture-specific worldview will thus always inform the way how illness is experienced and how meaning is created around it. It will also provide the ground to reinterpret scientific explanations.

3.6.1 Local taxonomies and biomedical discourse

To some extent, 'traditional' health beliefs might persist due to the absence of science-based health information that could clarify the 'true' pathophysiological cause of a disease, which would facilitate the explanation of biomedical prevention and treatment approaches (Bastien 1995, Bisht 2000, Eng 1991, Fassin 1986, Helman 2004, Odebiyi 1982, Oluwadare 2009, Renne 2006). Nonetheless, depending on pre-existing medical beliefs informed by 'indigenous' or 'traditional' worldviews, biomedical information will be accommodated differently. Hence, a particular pathology might not be 'correctly' represented in a corresponding local illness definition, and a disease that is to be prevented with a vaccine might not be recognized as a single entity. The local taxonomy might follow different principles and possibly know multiple explanations for one symptomatology (Bastien 1995, Bernahel 2000). In the reviewed papers, one example illustrates the complex local taxonomy of neonatal tetanus in a Bolivian indigenous society. Bastien (1995) explains how "Quechua women frequently refer to tetanus with words that also designate other diseases, such as tisi onqoy, which is a combination of tieso (rigidity) and tisis (tuberculosis) with onqoy (sickness); kharisirisqa, which refers to acute respiratory infections and diarrhea, attributed to a kharisiri, the legendary figure who steals a person's fat; chujchu (malaria); wayra (Bell's palsy or paralysis) and arrebato (fright, or susto). No specific name was found for tetanus."

As in this case, local illnesses concepts are often not directly transposable into biomedical symptom-diagnosis-schemes. If a disease is not recognized as such but attributed to a multitude of causes, the idea of a preventive measure for this specific disease can be difficult to introduce.

Although in some settings the symptoms described by the mothers coincide with the biomedical symptomatology (Bisht 2000, Fassin 1986), others found that the local illness conceptions made it difficult for health practitioners to isolate one particular disease by describing its symptoms (Bastien 1995). Some ethno-medical systems are structured around a matrix clustering of symptoms associated with different pathologies, often symptom complexes that are embedded in magical and supernatural symbols (Bastien 1995, Bernahel 2000). Among other reasons for not being able to recognise a defined biomedical pathology are some traditional practices, like especially warm clothing to increase the body temperature, or the fact that the severity of symptoms is differently interpreted in specific cultures (Bastien 1995, Bisht 2000). Treatment might therefore be sought for such a symptom complex (e.g. fever, cough), but not for the biomedically defined disease, which is not recognized as such (Bisht 2000).

Even if biomedical information is available, this information will still be appropriated in a culture-specific way. As seen above (see section on Knowledge), any new health information will be reinterpreted based on the pre-existing local explanatory illness concepts, as pointed out by Bisht: "Ghosh and Coutinho (1998) (Gosh and Coutinho 1998) have in the context of cholera argued that "fragmented items of bio-medical knowledge move into the knowledge of the community and the family... The communities' knowledge of the disease is not just a duplication of that of the experts... The disease holds different meaning in different spaces, and its verbalisation occurs within the boundaries of a particular system of knowledge*"* (Bisht 2000). Because new information is always integrated in an already existing medical explanatory system, even if new taxonomies are adopted, it is important to closely elicit local illness perceptions and taxonomies in order to identify and address possible misunderstandings.

One of the main conflicting aspects between the biomedical discourse behind immunization programmes and local belief systems concerns the understanding of illness causation. It emerges clearly from the included papers that the most commonly perceived primary causes of illness are what the author have regrouped under the umbrella "supernatural causes". God, witchcraft, spirit, werewolf, deceased child, consequence of misbehaviour, hereditary "washable" cause, etc. (Azevedo 1991, Bastien 1995, Bernahel 2000, Bisht 2000, Eng 1991, Fassin 1986, Renne 2006, Odebiyi 1982, Tadesse 2009). Other causes often mentioned by respondents are Hippocratic/Galenic humoral theory of the balance between the hot and cold, release of excess heat from the body, miasma theory, smells and vapours, wind both as physical wind(s) and as spirit blowing diseases (Bastien 1995, Bernahel 2000, Bisht 2000, Coreil 1994, Fassin 1986). Natural causes such as impure water, environment, uncleanliness, germs, and others are only rarely named (Azevedo 1991). Some authors found no sign of germ theory; although a `dirty' environment was sometimes blamed, no mention were made of bacteria or other micro-organisms as a cause of childhood infections (Helman 2004, Odebiyi 1982).
Prioritization among the different treatments options follows the perceived efficacy of available treatments based on individual and collective experiences. In cases where biomedical treatment options are considered ineffective, traditional treatments might be preferred:

> "*going to an allopathic doctor does not help since they have no cure for measles… Even our ancestors did the same (i.e. prayed to the goddess Ma Kusuvanda Devi). They never went to a doctor. They only prayed in this temple and the disease got cured*"
>
> [Mother of a five-year old boy in Surat, India] (Bisht 2000).

Especially when biomedical treatment options are non-existing or unreliable, this might be interpreted as a proof of an underlying supernatural cause, and traditional and/or spiritual healing practices might be preferred. In some cases like sterility, mental illnesses, epilepsy, convulsions, etc., supernatural causes are usually assumed to be primarily responsible, and traditional practitioners will still be consulted to address believed primary causes even when biomedical treatment is perceived as efficient to treat symptoms (Azevedo 1991, Bastian1995, Bernahel 2000, Bisht 2000, Renne 2006, Tadesse 2009). In many cases, biomedical treatment, by posing diagnosis only on the physical health of individuals, can be perceived as too simplistic to be trusted (Azevedo 1991).

But biomedical and traditional treatments don't usually exclude each other and, often, prioritization follows only to some extent the believed causes of the illness. For the diseases that are targeted by vaccinations, most papers report simultaneous use of both (Azevedo 1991, Bastian1995, Bernahel 2000, Bisht 2000, Renne 2006, Tadesse 2009). Common non-biomedical practices that have been reported include also spiritual healing through praying, fasting, pilgrimage to temples, use of Holy water, etc. (Azevedo 1991, Bastien 1995, Bisht 2000, Odebiyi 1982, Oluwadare 2009). Note that only one of the included study reported negative comments from the respondents concerning traditional medicine (Helman 2004), thus echoing the concerns voiced by several authors concerning the dangers of traditional practices, for example due to the lack of hygiene of some practitioners, in particular traditional birth attendants, or particular prescriptions related to alimentation, bathing, or clothing, that might further weaken the sick person or child (Azevedo 1991, Bastien 1995, Bernahel 2000, Fassin 1986).

3.6.2 Social causes of illness

A range of different illness explanations such as curses, sorcery, or other supernatural influences are described in several of the reviewed papers from different parts of the world (Bastien 1995, Bernahel 2000, Bisht 2000, Fassin 1986, Helman 2004, Renne 2006, Tadesse 2009). In most cases, there is a social conflict linked to the emergence of a disease. For example witchcraft, understood as a cause of illness through the use of "deadly forces by sorcerers and enemies" (Bastien 1995), implies a context of malfunctioning social relations, tensions, conflicts, and/or jealousy. Local etiology of disease, when referring to witchcraft, can thus be strategically used to reinforce social control. Bastien's account of a family who lost a child through NNT, but suspected witchcraft, shows how this family finally was forced to move out of their community:

> "*Late that evening, the parents called me, but I told them that I was unable to cure the infant and that they should baptize him… [After the child had died] I was told a priest refused to baptize the dead infant, adding to the family's shame and regret. … Several days later, the mother became paralyzed, and I cured her with medicinal plants. Because she*

showed the same symptoms as her baby, I was certain that she was bewitched and recommended that she move from the community. She moved to Oruro and subsequently had six children"

[Quechua curanderos], Bolivia] (Bastien 1995)

Unsurprisingly, most behavioural causes mentioned concerned the behaviour of mothers. The illness could have been caused if the mother was nervous, if she lost her temper or shouted at somebody, was physically abused, walked past putrid matter, had an unhappy pregnancy, or didn't breast feed correctly (Bastien 1995, Bisht 2000, Fassin 1986). Sexual misbehaviour, mother's unfaithfulness in particular, is also often perceived as dangerous for children (Azevedo 1991, Bastien 1995). Azevedo (1991) reports that "the Baya…, who lead in the frequency of utilization of the centres when they, as adults, fall sick… strongly believe in the consequences of the pregnant woman's infidelity, in the uselessness of immunization, and in the curse associated with a spontaneous abortion." Bastien (1995) noted that "Quechua women are sometimes implicated as the cause of NNT in that the sorcery attributed to tetanus is directed at them via the infant. One example is a case of NNT attributed to the fact that the mother refused amorous relations with a certain man, who then had sorcery applied to her. NNT becomes a power discourse of political and social control through sorcery that is dynamically manipulated for certain gains of individuals and families against each other."

Traditional practitioners, who act on more than just the physical health by including spiritual and social dimensions in the diagnosis and treatment, are therefore often considered important for the treatment of diseases believed to be caused through transgressions of social norms, or by witchcraft, where biomedical treatments are considered ineffective (Azevedo 1991, Bastien 1995, Bernahel 2000).

3.6.3 Prevention and risk perception

It is assumed that the perceived danger of an illness directly influences the acceptability of a vaccine. Renne (2006) states that "Immunization [among the Hausa] has had a mixed reception. When there is an imminent danger—such as a CSM epidemic, immunization is viewed as beneficial." But even a high perceived danger alone does not always mean that vaccination is seen as a solution. The perceived causes and the means available to prevent illnesses from such causes – such as prevention to protect oneself from witchcraft – shape the local understanding of prevention. Anthropological literature has described a wide range of practices to deal with a variety of threats and danger, which include the use of traditional medicines, magic, or prayers and other religious activities (Bisht 2000). These means are usually aimed at preventing any type of misfortune. The prevention of only a single disease may undermine beliefs in the effectiveness of a vaccine (Bisht 2000, Pool 2006, Oluwadare 2009):

Contradictions between local and biomedical illness explanations will be a challenge for the communication of preventative messages. For example, the anticipated outcome attributed to the different treatment options might influence the acceptance of a vaccine, as in the case of humoral medical concepts, where injections are perceived as dangerous in some periods of a child's life, such as during teething or when having a fever, suggesting that vaccinations are more dangerous than the disease itself

(Coreil 1994, Topuzoglu 2007). Experiences with the course of an illness might also vary within a population, and an illness might not be perceived as dangerous in general. For example, it is believed in some parts of India that measles normally appear in a defined way and, in this case, the affliction is not perceived as dangerous (Bisht 2000). This affects the overall risk perception of measles, which in turn affects the acceptability of a vaccine against this particular disease.

In some cases, the perceived cause of illness can be incommensurable with the idea to prevent a disease with a vaccination. This is especially the case if an illness is thought to be caused by a disturbance of social norms and hierarchies. Such explanations depend on the socio-cultural organization of a society and might vary even within a geographical region. Bastien (1995) for example points out that "Quechua women in the Department of Cochabamba, Bolivia, infrequently referred to NNT (neonatal tetanus) not as a disease but rather as curse inflicted upon them by vengeful enemies. Diseased babies were treated by curanderos to remove the curse, and died before being taken to a doctor… many cases of NNT never arrive at the health posts (postas sanitarias) since the affliction is perceived as a bewitchment or castigo (punishment) that must be dealt with by ritualists. Because of the stigma and fear attached to this interpretation, peasants do not report NNT."

Generally, diseases which are perceived to be caused by "supernatural and traumatic events with psychological, supernatural and social interpretations" are often not understood as preventable, (Bastien 1995, Bernahel 2000, Bisht 2000, Fassin 1986, Tadesse 2009).

> "*No preventive measure can be taken for this disease. What can we do? We do not have any facilities. The only thing we can do is bathe the child, give them food when they want any and leave the rest to god*"
>
> [Mother in Surat, India] (Bisht 2000).

Some respondents also thought that some vaccine preventable disease (VPD)s are only preventable by "natural immunity" gained through experiencing the disease (Bisht 2000, Odebiyi 1982).

Nonetheless, authors found the respondents generally able to understand the concept of prevention because of the existence of traditional preventive practices (e.g. herbs to protect babies) or other practises such as the use of mosquito nets for malaria (Bernahel 2000, Bastien 1995, Bisht 2000, Eng 1991, Fassin, 1986, Odebiyi 1982, Pool 2006). Even when witchcraft is believed to be the cause, or rather because it is, the idea that something can and therefore must be done to prevent illnesses still exist as illustrated by the use of amulets and rituals. Protecting the child from the evil eye and other dangers can even constitute an essential part of child care, for example in India (Bisht 2000).

Such a local understanding of prevention will influence the way how vaccines are looked at. Often, vaccines were just considered as "something good for health" in general, with beliefs that it could help build strength and improve a child's health, or that disease would develop only mildly and stay limited for the child who have been vaccinated (Bisht 2000, Eng 1991, Helman 2004, Odebiyi 1982, Pool 2006, Tadesse 2009, Topuzoglu 2007). However, if the idea that vaccines can prevent only a specific disease was missing, mothers tended to be discouraged to continue immunization schemes if their infant fails to

show “adequate growth” or good health after the first injections (Coreil 1994). Confusion has been found between cure and prevention, with respondents stating that they seek vaccination as a treatment for “weak” children (Bernahel 2000, Helman 2004, Pool 2006, Schwarz 2009); or between prevention and protection, where vaccine is seen as able to influence the intensity of the disease only, not its advent (Bernahel 2000, Bisht 2000, Fassin 1986, Helman 2004).

> “*Vaccines build up the strength, like Ravita' s (her daughter) cough was cured after she was given the infection (vaccine)...*”
>
> [Mother in Surat, India] (Bisht 2000).

> “*I just know that the child will not fall ill...I don't know anything about the number of vaccines that should be given to the child or for what they are given...*”
>
> [Mother in Pauri Garhwa, India] (Bisht 2000).

> “*Vaccinated children are more resistant (to diseases). If the child is vaccinated he/she develops the diseases only mildly, but if the child is not vaccinated the consequences would be more severe*”
>
> [Mother respondents, Istanbul, Turkey] (Topuzoglu 2007).

3.7 Power and politics as barriers to immunisation

3.7.1 When immunization programs are politicized

The data from the included papers show that immunization is used locally by political actors for political, financial and social gains. The do so through the spreading of rumours, misinformation, and by putting one group against a rival one using immunization as a discourse to problematise social or political divisions. Through these manipulations, power is gained or lost through one party’s capacity to control whether people go for immunization or not (Bastien 1995, Chaturvedi 2009).

In Uttar Pradesh, for example, Chaturvedi (2009) observed how resistance to polio vaccination could be perceived as resistance towards the dominant culture:

> *"Each time, you will hear newer and more and more weird things about the vaccine .... They can stretch the limits of imagination.... Last time there was a strong rumour that the polio vaccine is prepared by the Jews and America is using them to finish Muslims."*
>
> [Provider, Sambhal, India] (Chaturvedi 2009)

Chaturvedi then moves on to discuss immunisation as “a politicized issue with tutored stakeholders” (Chaturvedi 2009). In fact, in many places, especially where there have been historically low rates of coverage, an intense grassroots politicization of the issue is found.

In several regions, power struggles can negatively influence immunisation coverage (Chaturvedi 2009, Oluwadare 2009, Pool 2006, Renne 2006). In these cases, one party usually uses the immunisation programme to discredit the other. For example, Pool (2006) observed in Mozambique that "in some areas that are strongholds of the opposition party, political activists associated IPTi with the ruling party because it was being implemented through a government clinic." Such misuse of immunisation or of specific vaccines in search of political gains can also sometimes build on distrust of western biomedicine discourse and pharmaceutical companies which have a historic reputation in the region as being self interested (Oluwadare 2009, Pool 2006, Renne 2006).

3.7.2 The role of religious leaders

"God let the illnesses occur and brings the cure by himself so how can we prevent them?"

[Traditional Healer, Ethiopia] (Tadesse 2009)

In Christian (Bernahel 2000, Fassin 1986, Oluwadare 2009, Tadesse 2009) as well as Islamic contexts (Renne 2006) religious leaders have also been found to use rumors and edicts to build social and political resistance to immunisation, thus demonstrating their capacity to control and influence the population – a demonstration of their power. Among poorer, marginalized and socially disempowered populations, fear and a sense that they may be taken advantage of was not difficult to manipulate (Chaturvedi 2009, Oluwadare 2009). In Nigeria and India, rumors that public vaccination campaigns are organized by anti-Muslim groups spread among communities, carrying the idea that the promoted vaccines were dangerous (Chaturvedi 2009, Dasgupta 2008, Oluwadare 2009, Renne 2006, Suresh 2000).

"Every time there is a polio day, news start spreading that the polio programme is against Muslims. This makes me feel scared."

[Mother-Muslim, Sarai Pukhta, India] (Chaturvedi 2009)

"Our men keep talking about polio drops, and every time there is something new about it. Sometimes it's about sterility sometimes about pig's blood sometimes about conspiracy against Muslims. If the drops are good, why so much of bad news?"

[Mother-Muslim, Dingarpur, India] (Chaturvedi 2009)

Vaccination campaigns were abused by some local actors generating fear of the outreach of western ideology amidst the Muslim community (Chaturvedi 2009, see also section above on Power). In India, according to Chaturvedi (2009), rumours were circulated for political purposes mainly among already marginalized groups; while the sources of the rumours denied the responsibility for the spread of this rumours. Ultimately, a spillover of these rumours could be observed to other groups who did not share the underlying political/religious concerns.

Through the "construction of an otherness as the space of contagion" (Bisht 2000), illness can play an important role in the definition of social boundaries within a society and between socially distinct groups, sometimes associated with attributes of inferiority. In a similar way, Bastien (1995) argues that in a similar way in traditionally governed societies the use of witchcraft discourses to explain disease can turn the

discussion of illness into a politicized power discourse which participates to the reinforcement of social control: *"NNT becomes a power discourse of political and social control through sorcery that is dynamically manipulated for certain gains of individuals and families against each other."*

3.7.3 History, policy and fertility

Distrust in immunization must also be understood in view of the history of public health systems in many developing countries. The legacy of past colonial and later post-colonial government campaigns to control population through forced sterility or family planning underpins people's fear and imagination, creating fertile grounds for conspiracy theories. Using health policy to control women's fertility was resented in many countries, and perceived as an abuse of (patriarchal) state power over women that still resonate today in some places (Li 2004, Topuzoglu 2007). In China, Li (2004) notes how son preference, for example, interacts with family planning policy and impacts negatively on pregnant women and their families. In India, Dasgupta (2008) also reports how "incentives and coercion co-existed in the Family Planning Program (FPP)".

Many people found the tactics manipulative, suspicious, and even, at their worst, coercive (Dasgupta 2008, Fassin 1986). In settings where rumours playing with the population's fears of attacks on fertility or fecundity as a mean of population control by outsiders circulate, they easily spill over to immunization programs.

> "*No, I don't allow the people to do polio vaccination for my children in the house because there is a problem in it, such as that European people want us to reduce our numbers, to stop us from giving birth. And we are looking for medicine in the hospital to give to our children and we can't get it but this one, they are following us to our houses to give it. I don't trust this polio vaccine."*
>
> [Farmer, Samaru, Nigeria; September 2005] (Renne 2006)

Topuzoglu (2007) observed in his study in Turkey that "all the women had heard the rumour that polio vaccine administered in the national immunization days could cause sterilization." Questions arose whether "its roots [were] in the reaction to family planning activities that had been promoted by the governments since the last 30 years… The power relationship between the state and the individual might have given a rise to such complot theories."

The fear of attacks through the use of sterility is grounded in many local belief systems and reaches beyond colonial and post-colonial experiences with coercive family planning policies. Threats to induce sterility are also a common strategy to control others through sorcery or witchcraft (Bastien 1995, Dasgupta 2008, Renne 2006, Topuzoglu 2007). Among traditional communities in Bolivia, Bastien (1995) explained that "attacks on fertility and fecundity are frequently attributed to sorcery among peasants living in closed corporate communities as a mechanism to either get even or to level off prosperity. NNT is a way of keeping balance. Thinking in terms of gains and losses that balance each other is common…

Sorcerers strike at the act of reproduction, annihilate sexual life and increase their own strength and wealth by taking from someone else."

Bastien (1995) continues by reporting that "among the Tupi-Guarani women are told by men to avoid vaccinations because they cause sterility", and reminding that political and religious factions in Bolivia (e.g. sub-groups within the Catholic Church and previously Marxist groups fighting the "imperialistic nations") have also "used immunization as a political mechanism by circulating pamphlets that contend that vaccination shots sterilize women or by spreading rumours that birth control is a mechanism to keep the poor, poor."

3.7.4 Lack of trust and susceptibility to rumour among vulnerable populations

In many settings, the Government was found not to be trusted and populations were in general distrustful of "expert systems". In Uttar Pradesh, for example, Chaturvedi (2009) reports that some respondents claimed that immunization was being "used as a political tool by government that said they would withhold development until people participate." He then analyses than "children [were] held hostage between parents and state in some extremely marginalized pockets… These issues ranged from supply of essential goods in public distribution shops to construction of roads and bridges, and were raised by both Hindus and Muslims."

> "*As a rural Muslim mother put it, "Polio is your concern, not mine"- the program was thus perceived as the "government's need". The acceptance of the vaccine was being used to negotiate with the state machinery for developmental issues including road construction, basic sanitation, donations, loans, and even licences. "Some people think that this is a government program.....and if it is opposed, the state will do something for us.*"
>
> [District Level Provider, Moradabad] (Chaturvedi 2009)

Distrust obviously has historical roots. Patronizing organisation and implementation of immunisation services are reminiscent of the colonial era health services which are the historical roots of many of the current programmes (Bastien 1995, Dasgupta 2008, Pool 2006). As Bastien (1995) explains, "one unfortunate practice has been that doctors and nurses in Bolivia, and other parts of the world, frequently administer vaccinations without explanation. In the style of a past colonial epoch, they order the 'natives' to line up and get shot by the 'silver bullet'."

Lack of trust and susceptibility to rumour is most extreme among vulnerable populations and marginalised groups. Populations often dependent on the political or social support of particular leaders for their livelihoods, security, or even capacity to resist perceived oppressive forces, whether these leaders are tribal, religious or political. The international and national emphasis on immunisation programmes make the weak and vulnerable a target for use and abuse by those that would like to build up their power base (Oluwadare 2009, Pool 2006, Chaturvedi 2009). As Pool (2006) notes: "Although the factors that led to suspicion or rejection in this study were largely local and trial related, they did resonate with much wider cultural themes that span many countries across Sub-Saharan Africa (e.g. rumours about research and

health interventions, and more general ethical concerns about global inequality and the unequal distribution of resources on which these rumours are based)."

3.7.5 Social resistance, State control

In highly politicized sites, use of outsiders to influence the utilization of services can have a negative impact by fuelling passive and active social resistance (Chaturvedi 2009, Pool 2006).

> *"If you really want to do something, you will have to involve volunteers from Qureshis and Ansaris. See, there is no middle class ... Ordinary Musalman says that well-to-do people in their community have a double face. You keep on depending on Jamia-Shabana etc. ... nothing will happen. They don't even listen to me."*
>
> [Artisans' Union Leader, Moradabad] (Chaturvedi 2009)

> *"Celebrities don't mean anything in this place. Poor people don't have any faith in the educated section of their own community. Educated and rich people are seen as westernized and untrustworthy."*
>
> [Urdu Journalist, Sarai Pukhta] (Chaturvedi 2009)

Endemic resistance as seen in some regions can not be explained solely by socioeconomic, cultural or religious difference, but more likely by a constellation of factors that fuel each other to create deep resistance to externally promoted programmes (Chaturvedi 2009, Fassin 1986, Odebiyi 1982, Pool 2006, Coreil 1994). As Chaturvedi (2009) explains "endemic resistance against polio eradication program…refused to be totally explained by socioeconomic marginalization alone. Contents of some of the rumours indicated that the phenomenon had a distinct share of cultural resistance as well.''

As Schwarz (2009) notes in Gabon, there was a "widespread belief that EPI was `the law of the hospital'…" and that even if there were risks and rumours, compliance was not really a matter of choice anyway: Prevailing social perceptions/norms about state authority are often not questioned by the population. Caretakers, usually mothers, dare not contradict perceived legal or normative authority prescribing immunisation as mandatory (Schwarz 2009).

> "*People say that they want to kill our children, and whenever I arrived there to measure they used to say that it was a coffin. And many other people were also saying that they did not accept that their child could be given that treatment because it provokes diseases. There were many things being said, but we follow the law."*
>
> [25-year-old mother, Lambaréné, Gabon) (Schwarz 2009)

3.7.6 Government emphasis on status of women can contribute to better health outcomes

In locations where government has recognized the importance of improving the status of women and girls, positive outcomes have been registered on vaccination coverage. In Kerala State in India, this emphasis

on social wellbeing of families has contributed to increased immunisation rates. Nair (2007) points out that in addition to socially minded government programme focused on health and development based on principles of equality and equity. emphasis on female literacy and education, women's empowerment programmes through promotion of self-income-generation; and health awareness and hygienic practices more generally all contributed to better vaccination outcomes in that State.

3.7.7 Gender power relations

If illness is a politicized power discourse, as a consequence it also plays an important role in the construction of gender and gender power relations. Bastien (1995) describes sorcery as "a frequent means of revenge and retaliation," and therefore notes its importance in the maintenance of gender hierarchies: "blame is imputed on the mother for having done something to inflict sorcery upon her child: it is thought that because the sorcerers cannot get at the mother they attack her indirectly through her child.

Witchcraft as a power discourse is thus highly gendered. Blame is imputed on the mother, and in case of death of the child she is not only victimized by her child's death but also as a cause of this death. This specific blame on women can also be linked to conceptions of women imported through colonization, beliefs regarding women as passing on evil to the human kind (dangers of female sexuality, the corrupting influence on children and men, Eve seducing Adam and positing the Original Sin, etc.), and the historical Christian conception of the female witch inherited from the European witch-hunts (Bastien 1995).

Women thus represent a danger, a harbour of evil forces, and therefore need to be controlled. Perceptions of female danger are aligned with perceptions of female inferiority and insufficiency, both legitimizing the subjection of females. Two overlapping concepts are here at play: the need to control female powers (indigenous view), and the assumption imported from Christianity (in particular the Catholic church) that women are less able to control themselves and therefore need to be subjected to men. Accusing women of being responsible for a disease is therefore a means to control dangerous female forces, a "way that… men can use to castigate and control women" (Bastien 1995). Similarly, also in African or Asian contexts, mothers may be blamed for not taking proper care of their children if these get sick (Fassin 1996), or women may be considered to use sorcery to try to harm other women's children out of jealousy (Bisht 2000).

Bastien (1995) further shows how the socially weaker (and in particular the women) are accused of bringing a disease or allowing it to happen because they want to disturb the social order through acts of jealousy or negligence. While this notion of blame and guilt might be interpreted as a means to control the socially weaker, it also bears an element of power in favour of the weak - their power to manipulate evil forces or to disturb social hierarchies with unacceptable behaviour. While this power to disturb is of a symbolic nature, 'real' power is needed to maintain the social hierarchy, which is expressed in the control of particular healing procedures and the control of potential sources of evil. In analogy, vaccines may be understood as representation of political power, as the examples in Africa, India and Pakistan show (Chaturvedi 2009, Dasgupta 2008, Oluwadare 2009, Renne 2006, Suresh 2000).

3.8 Women, agency, gender roles and decision making

3.8.1 Gender roles and time allocation

Women in their everyday contexts usually carry out fragmented tasks and have to divide their time between maternal tasks (childbearing/rearing responsibilities), domestic tasks, diversified livelihoods activities (productive tasks) and social tasks such as attending sick family members, unexpected guests, etc. (Coreil 1994, Bastien 1995, Li 2004, Topuzoglu 2007, Schwarz 2009, Oluwadare 2009). Maintaining this balance has consequences in terms of time management and the burden of work may affect on the person's mental and physical health impede a mother's ability to take the child to the immunization session (Coreil 1994, Topuzoglu 2007).

Women who have an important productive role in the household – often both paid and unpaid – face time constraints to access services for their child (Li 2004, Schwarz 2009, Uddin 2010). The responsibility of child health care is usually left to the mother while on the other hand the socially subordinate role of women does not provide the decision-making power and means to go to the immunization services (Bastien 1995, Topuzoglu 2007, Li 2004, Coreil 1994). While women may gain status from healthy children, motherhood, being a "good" wife, and from her productive capacity, these competing demands can also create compounded barriers. For example, women's dual roles as farm labourer and housewife leave them exhausted and with little time.

> Interviewer: "*That also means, that there are women who work and who cannot go for vaccinations of their children?"*
> Mother: "*Yes there are a lot of mothers, who work and who do not have enough time to bring their children to the hospital."*
>
> [20-year-old mother of 3, Lambaréné, Gabon] (Schwarz 2009)

When women's domestic and social roles entail all responsibilities and work to represent the family physically by maintaining the family's home and keeping it ready for potential visitors at any time, her absence from home might not be acceptable. Women are thus responsible for carrying out all domestic and "social" work which is associated with social status of the whole family, while men are more likely to represent themselves as "leaders" and decision-makers (Eng 1991, Bastien 1995, Pool 2006, Topuzoglu 2007, Oluwadare 2009).

> *"The guests had come unexpectedly; you can not say to the guest to stay at home so that I could take the child to the session, we can not do such things....'*
>
> [Mother, Istabul, Turkey] (Topuzoglu 2007)

3.8.2 Control over resources and decision-making

In addition to time allocation, the allocation of intra-household resources is crucial for women's ability to access health services. Decision making power is often conditioned by unequal distribution of the family resources and intra-family power relations triggered by gendered socio-cultural norms. It often translates into women having little ability to access resources and/or to make autonomous decisions about how to

use them. The mother's ability to bring a child to the immunisation services thus often depends on other members of the family, primarily the husband but also other relatives such as the mother-in-law (Coreil 1994, Pool 2006, Renne 2006, Topuzoglu 2007, Li 2004, Schwarz 2009, Oluwadare 2009, Bastien 1995, Eng 1991). In some cases, the father, as breadwinner, did not provide any money for transportation (Topuzoglu 2007). When the cost of obtaining healthcare services is relatively high, the input of husbands in decision-making and payment is especially needed. Women tend to be more involved in decision making when their levels of income or education are appreciable (Oluwadare 2009).

Pool (2006), reporting from rural Mozambique, contrast the studies in other parts of rural Africa showing how many mothers seemed to be able to make decisions about health care for their children relatively independently of husbands and in-laws. Most participants indeed said that they did not need permission from the husband or other relatives. Most said that if they thought their child needed to be taken to the clinic, they would inform their husband, but would take the child anyway, even if he refused.

Overall, it was nonetheless commonly reported that women needed to get permission from their husband to take a child for immunization. Oluwardare (2009) noted that in Nigeria both men and women participating in group discussion agreed on the fact that a woman should inform/ask permission of her husband before taking children for immunisation. However it was stressed that it is unlikely that fathers would object to children being immunized.

> *"I can not leave the house with my children because my spouse does not let me. Problems raise when I do so, I only go to the market alone because it is very near."*
>
> (Topuzoglu 2007)

> *"I had asked my husband, to my neighbours (to take me to the session), they said that they were busy and they could not take me. Then I could not say anything, I could not raise my voice."*
>
> (Topuzoglu 2007)

Apart from gendered decision-making, age also plays an important role. In Turkey the mothers stated that, particularly in the rural villages, mothers-in-law did not let the newborns or the small aged babies to go for vaccination. In case they did, they sometimes would not let the baby get more than one shot at a time.

> *`For example I took my baby for vaccination in the village, she had two shots at a time, one was DPT, and I do not know the name of the other one. I came home and I told my mother in law, ooooo that day she said `what will I do with you, how could you let two vaccines to be administered at a time for such a young baby', that day I cried so much, I stayed awake by my child until the morning because I thought something bad would happen to her."*
>
> (Topuzoglu 2007)

3.8.3 Women's status and identity

Child health status is perceived as a reflection of the capacity of a mother to maintain and nurture her child (Bastien 1995, Fassin 1986). A child's condition can thus represent a mother's social status and, as such, contributes to the construction of female identity. Ill health of a child is then associated with female failure and blame.

Fassin (1986), writing about mothers in Senegal ten years earlier, also noted the "direct responsibility of the mother" for her child's health, and Topuzoglu (2007), more recently, from still another setting, in Turkey, finds the same beliefs evident among migrant women and families in Istanbul.

Making use of immunization services implies being exposed in public, which signifies exposure of a mother and child's condition, reflecting her family's social position. Coreil (1994) points out that "in order to obtain clinic-based services, mothers must enter an arena of public visibility where their performance as caretakers is open to scrutiny. In order to obtain a vaccination for a child, a mother risks being judged in other areas of caretaker competence, such as child nutritional status."

On the other hand, the wish to keep their children healthy may as much motivate women to comply with immunization recommendations. Indeed, in settings where immunization campaigns were politicized and generated resistance, it has been reported that mothers nonetheless took their children for immunization if they believed that vaccinations were beneficial for their children (Chaturvedi 2009).

Apart from fears to enter the public space social control may also affects women in another way. In cultural settings where gender norms restrict female mobility in public, women constrained themselves to leave their homes in order to maintain their reputation and status, or out of fear to expose themselves:

> *"I am a person who had never left the house. I do not have the courage to go from here to there because I am constantly at home. I was also grown up in a village, and also in the village you are always at home, we had come here (to Istanbul) and I am constantly at home here too. If you ask my husband he knows everywhere in Istanbul.... If you tell me to go from here to there, truly I will become terrified. I also tell my husband that if I get lost I probably will cry just like a child."*
>
> [Mother respondent, Istanbul, Turkey] (Topuzoglu 2007)

Topuzoglu (2007) notes that "The social status of women was recognized to play an important role in accessing the immunization services… The patriarchal structure of the community made their acts to be closely monitored by other members of the family and women were mostly isolated in their neighbourhoods."

In Haiti, Coreil (1994) also reports that some mothers *"are just plain shy about being in public and may put off going to a post because of timidity. Others have been put on the defensive by neighbours' teasing remarks about seeking handouts from the post."*

3.8.4 Son preference

In some contexts, the ability to give birth to a son determines the mother's status in the family and society. Boy preference was reported to generate discrimination of girls in general care, nutrition and immunisation status. This discriminatory situation is related to both the gendered cultural preference for boys or, in China, to the government one child policy: "son preference was another determinant of prenatal and obstetric care utilization. In the predominantly patrilineal setting of rural China, sons are ascribed a higher value and thus are given a higher priority in resource allocation than girls. Having already achieved a male child in the family reduced the chances of a woman stopping heavy physical work before birth. Furthermore, female children who had older sisters were the least likely to receive necessary immunizations, and thus were placed at the highest health risk. This gender inequality in health was attributable to the interaction between son preference and the birth control policy. Son preference itself is indicative of women's position in the larger society and within the home." (Li 2004).

As a consequence, mothers hid children that were not legitimate according to the one child policy, as well as themselves, from health services. While the one child policy is not a priori gendered, it becomes gendered through the preference of sons, leading to more 'legitimate' male children who are more likely profit from government health services such as immunization.

4 Discussion

Most qualitative studies included in this review were conducted in areas where vaccination campaigns had faced considerable resistance and non-uptake, and information was needed to address these problems. Only a few studies report findings from indigenous populations where information was required in advance to plan culturally adapted vaccination campaigns.
None of the studies were conducted to investigate gender-specific barriers in particular. However, immunization emerged to be a deeply gendered issue due to the fact that child health is generally considered as within mothers' responsibility. Out of this reason, even general barriers to immunization bear a gender dimension.

General barriers to immunization include health service delivery aspects, poverty issues, low health literacy, but also socio-cultural dimensions where immunization does not fit into the local worldview. These barriers have been described for health seeking in general, too (Gilson 2003, Hausmann 2000, McKian 2004, Obrist 2007). An additional theme emerged as prominent barrier more specific to vaccinations: the politicization of immunization campaigns in some regions of the world (see also Kaler 2009).

Specifically gender driven barriers to immunization can mainly be linked to women's lower social status and lack of economic and decision-making power. While women are usually the primary responsible persons to deal with health related issues, their decision-making power and their autonomy is often constrained, limiting their access to health services in general (Tanner 1998; Tolhurst 2008).

In the reviewed papers, two themes which emerged as prominent barriers to vaccinations, were at first sight void of a gender dimension: The politicization of public health campaigns, and persisting local health beliefs, such as sorcery. Both themes are however closely linked to social order, power, and gender hierarchies. When negotiating access to healthcare services, political arguments and strategies to deal with supernatural illness causation proved to be highly gendered as well.

4.1 Child health is feminized/gendered

The review confirmed that in the study locations the health status of the child is perceived as inextricably linked to the mother's capacity to care and nurture the child. Despite the father and often extended families' say in how the mother can and should care for her child, they are rarely implicated in the health status of the child, and child health remains the responsibility of the mother.
A mother's ability to care for a child is however jeopardized by her lower status in society: Women's autonomy and their ability to mobilize resources inside and outside her household might be constrained, restricting a mother's ability to follow health related recommendations (see also Tanner 1998; Tolhurst 2008; State of the World's Children, UNICEF 2008). Barriers linked to women's role in their families and in society, such as their subordination to the needs of others who control much of their time, restrict their ability to decide freely over how to set priorities. Intra-household power relations often restrict women's

access to and decision-making over household resources. In addition, due to their lower income, women are generally more likely to be affected by poverty even if they don't depend on the decisions of others. All these aspects are not specific barriers to vaccinations but to health seeking in general.

Likewise an ill child is commonly blamed on mother's insufficiency or negligence. Here, traditional illness concepts can play an important role, offering explanations that both refute or confirm maternal responsibility for a child's condition, but in any case offer space to negotiate social responsibilities (see also Castle 1994, Einarsdottir 2000, Kamat 2006). Several papers reported persisting local health beliefs, such as sorcery as the cause for health afflictions, coupled with a lack of science-based health knowledge. These beliefs posed a problem for timely and adequate treatment seeking and for the utilization of preventive services alike. The persistence of these beliefs cannot be fully understood as a lack of adequate information only. The literature shows that local belief systems are not necessarily completely replaced even when biomedical knowledge is appropriated (see e.g. Janzen 1978, Kalusa 2007). Scientific explanations are integrated in existing explanatory models, and supra-natural causes might still be used to explain the ultimate cause of an illness even when the pathways of infection are recognized. Perceived causes of illness and treatment seeking strategies are embedded in the local social context, where blame and guilt linked to the responsibility for an illness is used to establish and maintain social hierarchies. Often however, traditional medicine concepts link the cause of illness to a mother's transgression of social norms and expectations, or link it to the danger of female powers. In several examples women alone were blamed for their children's impaired health status, and traditional practitioners served to control the negative female forces. Questioning local notions of manmade illness through magic, sorcery, or bad behaviour invoking divine action, always means questioning social order in an indirect way as well.

This gendered blame is perpetuated by the biomedical health systems: Mothers are blamed for not preventing disease due to poor caretaking, low hygiene, or not immunising their child. Within both models, the woman is held responsible for child's health status and the blame is hers alone. There is however a difference in the possibility to raise material and emotional support within a mother's social network: as western medicine targets individual responsibility, obtaining support may be more difficult when the reason for a child's illness is seen as the consequence of maternal negligence. In contrast, when a cause is seen in a disruption of social relations, e.g. when sorcery or a curse is suspected as an act of jealousy, the case might become an issue of a larger group. Such 'attacks' are usually perceived as dangerous for a whole family or community, and joint efforts will be considered necessary to appease the forces and offset a potential "transgression." In short, biomedical and 'traditional' medical system often offer a different set of options to women, whose responsibility for a child's condition is a priori gendered, and in some cases traditional healing options are more favourable to women (and are thus gendered, too) (see also e.g. Mabilia 2000).

4.2 Immunisation Services are feminized/gendered

Immunisation services target mothers as the primary caretakers of children and as a result are feminized or gendered in their organisation, information and service delivery. Moreover maternal and child health

and immunisation are a foundation of primary health care. In resource poor settings, PHC may prioritise MCH over curative care which can result in a gendered bias against men in their access to and utilisation of services. As a service that targets women (rather than men or families) it can reflect and therefore reinforce gender and social dynamics found in the communities where they operate. Where gender disparities, and discrimination are present, the service may also reflect those inequalities and even contribute to perpetuating them through the ways in which they are established and operate. Immunisation services that solely target women may indirectly contribute to, and perpetuate gender roles and norms that impede accesses to child immunisation services. In the end, the design of a vaccination programmes may contribute to maintaining the perception that child health is the woman's responsibility. Her "failure" to immunise her children is seen in this context as a reflection of her "incapacity" whether due to low literacy or because she maintains "archaic" traditional beliefs that limit her use of western medical services, or because she can not manage the multiple and competing demands on her time and obligations. Her "insufficiency" in this context become normative to the extent to which even she accepts her child's health status as her caused by her own "neglect". In such circumstances, the system itself perpetuates the low status of women and their dependent relationship to the system, their husbands and extended families.

It is neglected that mainly women face the social costs, time costs, and miss opportunities, since women play multiple roles in theirs families and communities; they spend many more hours per day gathering water or fuel (productive role), preparing food or taking care of children (caregiver role) and/or visiting family or helping neighbours (social role). There is a predisposition to consider that women have free time, thus the multiple roles of women (productive, maternal and social role) are not taken into account in the design of the vaccinations programmes. These factors may be a significant hindrance to the access of women (and children under their care) to health services. In order to facilitate utilisation of the immunisation services it is essential to recognize and accept the multiple roles that women play in their families and communities and to explore how to make programmes more respectful with women's multi-tasks and needs.

By targeting only women, immunisation interventions clearly neglect the critical influence that men have over women's decision-making power. In many developing countries, women have the primary responsibility for child health care but it is men who control over women's access to health information and services, finances, transportation, and other resources (Green et al., 1995). Attending the immunisation services requires access and control over social resources (network to take care of things while away), personal resources (capacity to take decisions), and household resources (money, time) and women often lack control over them. For example, in 70% out of the 23 studies included in our systematic review, women stated that their husbands had exclusive control over their spending, including health care decisions, similar results has been obtained all over the world (Unicef 2006, 2007). But it has been shown that the inclusion of fathers in an immunisation campaign subsequently led to fathers taking greater responsibility for children's health, and led to greater rates of immunisation (Östlin et al, 2007). It is therefore critical to understand gendered socio-relational experiences of immunisation services as

potential obstacles to accessing vaccination interventions and to improving the responsiveness of services to all, regardless of sex or socioeconomic status (WHO, 1998).

4.3 Immunisation as a political tool: gendered implications

Immunisation may be used as a political tool through which gender disparities existing in societies as social and cultural norms are exacerbated.

Rumours about malevolent intentions of those introducing (e.g. the Government) or of those producing (e.g. 'the West') vaccines served certain interest groups to spread fear in the population, a tactic that was found on all continents (see also Kaler 2009). These rumours jeopardized vaccination coverage considerably as they often coincided with a general distrust in the Western medical system. Distrust could be based on collective experiences with coercive Colonial or Government health interventions, or mirror experiences with a poor quality of health services. Although the politicization of health interventions does not show a direct gender dimension, it may be argued that in the case of vaccinations mainly women and their children are affected negatively by the use of public health interventions for political purposes.

Especially poor, rural and ethnically or socially marginalized women are doubly discriminated against. Some politicians (formal and informal) and opinion leaders (including religious leaders) misuse immunisation programmes and campaigns in some regions to gain or maintain their power base or to preserve social order and control, and ultimately to build their bargaining power vis a vis perceived rivals. Commonplace is the use of sterility rumours to sow fear in the communities. Opposition is also created between biomedical and traditional belief systems requiring women to decide which belief model she should align herself with in a climate of extreme social and familial pressure. Resistance to immunisation, in this context is summoned by male leader (in most cases) but enacted by women when they refuse to immunise their children. If the child should fall sick however, the blame for the child's status lies with the mother.

The focus of the rumours on fertility is reminiscent of coercive family planning policies in some countries that brings back the fear and anger women experienced in the past under these oppressive policies (Li, Renne, Chaturvedi). In this climate, women may use immunisation services as a platform for covert resistance to demonstrate their disapproval of government policies (past and present), lack of services, or the disrespect they may feel at the clinic when they face a rude or patronizing provider. However this resistance is often dictated by men and communities yet the woman (caretaker of child) is blamed by authorities as the negligent one.

4.4 Limitation to the Study

In our review, the totality of the studies (n=23) focus on the role that women play in the children immunisation uptake largely ignoring the role of fathers in child health care decision making. Ten out of 23 studies attempted to assess the father's role, however only one obtained the information from fathers themselves; the rest relied on responses given by the children's mothers. Similar findings have been found in studies which explored the role of the father in vaccination coverage (Brugha, 1996).

5 Conclusions

The qualitative studies reviewed imply that child health and immunisation services are gendered in how they are understood, presented, and managed.

General gender inequality restricts women's ability to access healthcare services all over the world. While women are usually not the main decision-makers within households, they are the primary targets for child immunization services. To address this division in responsibility and decision-making power also fathers must be addressed by health promotion campaigns. Addressing family and fathers in vaccination initiatives is critical to improving the support for women's and children's health needs as well as to addressing the power-based gender inequalities in decision making. It is crucial to involve men in health initiatives in a positive light, emphasising the transformative power of men's involvement through innovative programming addressing the power inequalities resulting from gender bias (Sen and Östlin, 2007). By targeting communities and families in programme strategies, and not women alone, we can shift responsibilities for child health from the mother to the broader community for better health outcomes for the child.

On a wider level the power politics of immunisation is played in some regions by political and religious leaders for political gains. Also here the cost is borne by women as caretakers and their un-immunised children on the frontlines of resistance. Increasing coverage requires acknowledgement of the unequal power dynamic that exists within the service setting, the politicization of health care services, and of the marginalized position of women in these settings.

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7 Annexes

7.1 Annex 1: Translation Table

Translation Table

3rd order labels	3rd order constructs	2nd order constructs	Summary definition (translation) of 2nd order constructs	Source papers
Health systems				
Poor quality of care, basic rights compromised	**Privacy and confidentiality not respected**	Lack of privacy at health posts further embarrass mothers	Poor treatment, blaming and shaming by providers of caretakers/mothers who bring their children for immunization makes many mothers stay away after they have had a negative or compromising experience. Immunization is organized so that mothers and their children are extremely exposed to both compliment and criticism. Little or no privacy results in the provider-mother interaction to be shared publicly. Counselling for a malnourished child, for example, causes great embarrassment and shame on the mother who is held responsible for the health of the child.	Coreil 1994; Helman 2004; Oluwadare 2009; Tadesse 2009; Topuzoglu 2007; Bernahel 2000; Schwarz 2009
	Missed opportunities to provide vaccination	Providers give incorrect information and send mothers and children away; wrong contraindications	Health providers do not know contraindication well and have their own beliefs about when a child should and should not be vaccinated. If a child has a fever or is considered sick, they are often turned away. The health personnel also did not want to give more than one shot at a time for premature or small gestational aged babies and postponed some of the shots for these babies.	Bernahel 2000; Topuzoglu 2007
		Providers have poor technical skills, are poorly trained	Poorly trained and careless providers administer the vaccination, sometimes with dull needles, and inappropriately sterilized equipment.	Bastien 1995
Supply and infrastructure constraints	**Supply failures limit effectiveness of immunization programmes**	Shortage in supply of vaccines, cold chain capacity, and electricity	Lack of adequate vaccines, cold chain capacity, especially due to electricity shortages, and basic immunization supplies such as syringes, vaccination cards, and sterilization capacity was a significant barrier to immunization service effectiveness, and a reason for mothers to stay away as they could not be sure their efforts to get to the service would be fruitful. Such supply shortages as lack of drugs in the health post, and lack of advanced health institutions such as health centres, as well as basic supplies made services often less effective or non-functioning, particularly in more remote areas.	Azevedo 1991; Odebiyi 1993; Oluwadare 2009¸ Tadesse 2009, Unisa 2006, Schwarz 2009, Bernahel, 2000, Fassin 1986; Helman 2004
		Health cards	No vaccination cards were available, or they were inconsistently used so record keeping was very poor.	Azevedo 1991; Eng 1991; Tadesse 2009; Unisa 2006; Bernahel 2000
Human resources	**Lack of human resources, and working condition limit motivation**	Human resource shortages due to lack of qualified personnel, financial constraints, organisation	Availability of services in rural areas is a problem because of lack of qualified personnel; when there are staff, they are often under motivated because their salaries are often paid late, and are low; more women providers could help uptake as they are seen to understand the needs of mother's better	Oluwadare 2009¸ Tadesse 2009; Unisa 2006, Bernahel, 2000, Suresh 2000, Odebiyi 1993
Disrespect of caretakers as the social norm	**Poor treatment of caretakers demonstrates low status of women perpetuated by the**	Providers treat caretakers, particularly mothers, rudely demonstrating disrespect for their time, effort or	While health personnel often do not recognize the effect provider attitudes and criticism in public has on mothers, mothers themselves described it as a major barrier to immunisation attendance. Patronizing and disrespectful treatment is endemic in vaccination sites in many countries.	Bastien 1995; Schwarz 2009; Coreil 1994; Helman 2004; Topuzoglu 2007

	health system	interests.		
		Providers do not explain the vaccinations adequately	Providers administer vaccination without adequately explaining which vaccines are being received, or why they are important. There is a prevailing attitude among some providers that the local caretakers are not able to understand or appreciate details related to vaccination. This patronizing approach to caretakers is seen by some as a reminiscent of the colonial era approach of dealing with the "natives". (Bastien 1995) Partially at fault were technicians who did not educate them about vaccinations and reactions, poorly administered the vaccines, and treated them roughly.	Bastien 1995; Helman 2004; Topuzoglu 2007
	Women accept mistreatment due to low self esteem, social norms	Maltreatment by providers gives mothers sense of importance of vaccination; they also blame themselves	Mothers equated poor treatment as evidence that the vaccination was important. They generally did not question why they were being treated badly by the provider. They rather blamed themselves as inadequately taking care of the child, or having transgressed in some way.	Bernahel 2000; Topuzoglu 2007
Cost barriers	**Direct and indirect costs limits utilization**	Costs-indirect	While immunisation services are usually free of charge, indirect costs related to attending immunization service are a major constraint, particularly for poor families and those living in rural areas. Almost all formal health services entail indirect economic costs related to transportation, travel and waiting time, and missed opportunities for income generation. The cost of additional medication prescribed during the visit is also a major obstacle. Sometimes, program administrators did not perceive economic factors to be significant system barriers since the immunization services themselves were provided without charge. Here, as elsewhere, the indirect, `hidden' costs of service utilization are not accorded serious consideration in planning and evaluation of health programs. In addition, "fees" are sometime levied on poor migrant families for use of service in a new location despite the fact that this was not legally required.	Azevedo1991; Coreil 1994; Helman 2004; Oluwadare 2009; Tadesse 2009; Topuzoglu 2007; Bernahel 2000; Schwarz 2009; Fassin 1986
		Under the table payments and other costs	'While services National Guideline prescribes free immunizations which cover the free provision of dispensable syringes, there is consensus that payment is made for all antigens to cover the cost of syringes. A few of the health workers denied ever collecting money for immunization. The latter case was a product of misconception among the poor settlers annual development levy fees are mandatory for use of the service but most of the poor cannot afford this and so they desert public facilities, especially children's education and health services; when women delivery in public facilities and leave without paying the bill, they fear to return to the health facility where they have a past debt.'	Oluwadare 2009
Accessibility	**Reaching rural and poor communities**	Importance of minimizing transportation barriers	Transportation barriers remain a problem and are directly linked to coverage rates. Often areas with the lowest coverage are inaccessible by car and must therefore rally posts must be held at a neighbouring village, or the arrival of the health team is contingent upon good weather.	Coreil 1994; Fassin 1986; Helman 2004; Odebiyi 1993; Oluwadare 2009; Schwarz 2009; Tadesse 2009; Topuzoglu 2007; Unisa 2006; Bernahel 2000
		Mobile units	Many complain that the government has stopped or scaled down the use of mobile units it used to deploy in earlier inoculation campaigns.	Azevedo 1991; Helman 2004;

				Oluwadare 2009
		Home visits and community support groups	Home visits by extension workers and community support groups create trust and a support mechanism for women that facilitate rural women in utilizing immunization services. In some cases, the trust relationship between the community health worker or between support group members may even help the woman negotiate with her husband and within her household use of services. Use of community outreach workers and support groups was also highlighted as an important strategy to overcome cultural, and information barriers. They are respected by the community and seen as better able to keep reliable records of the children in the communities where they work. When these outreach workers are unavailable, this can have a negative impact on the programme.	Bernahel 2000; Tadesse 2009; Uddin 2010
		Unpredictability and location of post; lack of health posts	Unpredictability and location of post in another sector have a greater negative influence on utilization than absolute distance, thus distance alone does not appear to explain utilization at the household level. Along with the unpredictability of posts in areas with difficult access, availability factors include the sometimes unreliable system of notification about an upcoming post by word of mouth. Lack of health posts in remote region also continues to be a problem.	Coreil 1994; Helman 2004; Odebiyi 1993; Oluwadare 2009; Tadesse 2009; Uddin 2010; Unisa 2006; Bernahel 2000; Schwarz 2009
		Extension of service hours positive	In service sites where hours were extended, particularly into the afternoon, many women found accessing immunisation easier. This was particularly important for working women in urban areas.	Bernahel, 2000; Uddin 2010
Accomodation	**Responsiveness of services to the actual needs of clients rather than provider or manager perceived needs of clients**	Provider views on accommodation barriers differ from clients	Providers reported that the conflict between peak market hours and post operation, the long waiting time, the discomfort of a crowded waiting area often lacking enough seats, and feeling rushed when one's turn arrived were barriers to utilization but analysis failed to support overcrowding as a significant deterrent to utilization.	Coreil 1994; Suresh 2000
	Programme design can accommodate cultural and ethnic beliefs	Ethnicity	Ethnicity is a factor in selecting health practitioner. Traditional people may prefer to be attended by someone of their own tribe, or caste to reduce cultural and language barriers.	Bastien 1995
Organisation of services: Priority setting in programme design	**Priority setting in immunisation related to vertical vs primary health care**	Priorities of vertical programmes questioned when PHC is dysfunctional	People questioned government focus on immunisation, particularly campaigns, when basic primary health care services were not available, or not free of charge. Explanations that the authorities were interested in the health of the children was not taken seriously as sick children brought to the health care centre are turned away if the family can not pay, or when there is a lack of supplies, providers, or drugs.	Chaturvedi 2009; Helman 2004; Mavimbe 2006; Oluwadare 2009, Bernahel 2000; Schwarz 2009
		Vertical programme focus can lead to suspicion	Vertical and repeated focus on immunisation also leads to suspicion in the community about the motivations of the government or those seen as pushing vaccination efforts. The question "why only polio?" while delivery of routine health services remained dismal, was uppermost in the minds of the community	Renne 2006; Dasgupta 2008; Bernahel 2000

		Health providers should be involved in setting priorities and goals	Health information is unreliable when health providers and managers are not involved in setting priorities and goals and when they are not linked to primary health care. In addition, targets established in vertical programmes may de-motivate providers and managers, and create an environment where falsification of data to meet targets becomes the norm.	Mavimbe 2006; Bernahel 2000; Oluwadare 2009; Unisa 2006; Schwarz 2009
	Targets lead to low quality management and poor reporting practices	Financial incentives for repeat rounds add to suspicion	Targets and financial incentives created more suspicion of immunization services. People question why the government is so keen to get their children immunized. This questioning fuels fears of conspiracy and rumour. It also reminds people of past campaigns such as family planning programmes that used targeted and promoted serialisation.	Dasgupta 2008
Health system authority	**Health system authority maintained through unequal power dynamic between providers and clients; disempowering**	Dependency on clinic and fear of reprisal	The relationship between mothers and the clinic was ambivalent. While generally trusting the clinic and attending voluntarily, they were also acutely aware of being dependent, for vaccination, for antenatal care, and for illness, and there was a real worry among some of them that if they did not comply they may be treated differently if they needed help at some future date; providers use fear of sanctions to get people to come; This finding highlights a dependent relationship between the mother and the health care worker, which does not provide a ground for an effective information transfer.	Pool 2006, Bernahel, 2000
Trust and choice of health system	**Choice of health system and health seeking linked to experience and trust**	Health seeking as a process that builds meaning through experience	Health seeking, or the quest for therapy, is then a process in which the patient interacts with a series of health care agents who continuously create for her/him social meaning. This approach also recognizes that in every community there is a considerable repertoire of medical resources which people exploit critically and situationally for various illnesses. Late arrival and injections blamed for death of child; positive experiences with health extension workers, for example, build trust; experience dictates future utilization.	Bisht 2000; Bernahel 2000; Tadesse 2009
		Availability of medical assistance defines experience and sense of danger	Accessibility of services when people are ready to utilize them can also define whether the disease to be treated is considered life threatening or dangerous.	Bisht 2000; Fassin 1985; Suresh 2000
		Preference for traditional medicine over western medicine	People seek traditional medicine side by side with western medicine as traditional medicine is seen to address the cause of an illness while western medicine can provide treatment for the symptoms.	Azevedo 1991; Bastien 1995; Bernahel 2000
		Preference for traditional medicine linked to poor treatment by western providers	People also rationalized the use of traditional medicine when they had a bad experience at the health centres or felt they were poorly treated. (Bisht 2000)	Bisht 2000
		Private vs. public facilities as reference point for immunisation depends on first experiences	Children are often taken to the closest and most accessible facility whether they be public or private. The first encounter with the health system often determines where they will seek care in the future. Many mothers first interaction with the health services is when she brings a sick child in for curative services and is offered immunisation.	Oluwadare 2009; Bernahel, 2000; Unisa 2006
		Perception that cold chain operates better in government facilities	Preference of public over private facilities is often more related to where they have had a positive experience in terms of quality of care, accessibility, and where their structural barriers to attend are minimized.	Nair 2007
Power and Politics				
Immunisation as an instrument of power	**Immunisation used to gain power over others**	Immunisation programmes are politicized and can be	Immunisation is used by political actors for political, financial and social gains locally through the spreading of rumour, misinformation, and by pitting one groups against a rival using the immunisation discourse to problematize the social or political divisions. Through these	Bastien 1995; Chaturvedi 2009

		manipulated by political and religious actors	manipulations, power is gained or lost by one party as they demonstrate their capacity to control, in this context, whether people go for immunisation or not.	
		Political rifts between government and religious groups, both among and between themselves plays a role	Power struggles between government support programmes and faith-based programmes exist and can negatively influence immunisation coverage. In some case, one party uses the immunisation programme to discredit the other. An immunisation programme or vaccine itself can even be associated with one or another party thereby dividing support for its uptake. Use of immunisation or of specific vaccines for political gain sometimes builds on distrust of western biomedicine and pharmaceutical companies which have a historic reputation in the region as being self interested	Oluwadare 2009; Pool 2006; Renne 2006
		Use of rumour and suspicion by religious leaders to create resistance/ power shift	Immunisation has been used by religious factions or groups to demonstrate their local support as demonstrated by social resistance to what is labelled as an external priority to vaccinate children. Religious leaders have used rumour and edicts to build social and political resistance to immunisation, thus demonstrating their capacity to control and influence the population – a demonstration of their own power. Among poorer, marginalised populations, sowing seeds discontent, fear and a sense that they may be taken advantage of was not difficult	Chaturvedi 2009; Oluwadare 2009
		Fertility/fecundity as subject and used as tool to control populations	In regions where there have been problems with immunisation coverage due to rumours and misinformation, suspicion among the population can be high. Usually rather poor and marginalised, the targeted communities feel underserved and under siege by the repeated government efforts to get them to immunise their children. The repeated rounds, and almost exclusive emphasis on immunisation in these regions make people suspicion about possible ulterior motives. In this climate, rumours circulate. Many rumours include attacks on fertility or fecundity for population control by outsiders that people fear want to limit their population. Attacks through the use of sterility inducing forces or drugs are also a common strategy to control others in traditional medicine, sorcery and witchcraft.	Bastien 1995; Dasgupta 2008; Renne 2006; Topuzoglu 2007
		Lack of trust and susceptibility to rumour is most extreme among vulnerable populations and marginalised groups	Lack of trust and susceptibility to rumour is most extreme among vulnerable populations and marginalised groups. Populations dependent on the political or social support of particular leaders, whether they be tribal, religious or political, for their livelihoods, security, or even capacity to resist perceived oppressive forces that threaten them are far more vulnerable to exploitation by those vying for power and control in a particular location or region. The international and national emphasis on immunisation programmes make them a target for use and abuse against the weak and vulnerable in a society by those that would like to build up their power base	Oluwadare 2009; Pool 2006; Chaturvedi 2009
		Self interest to promote biomedicine	Another suspicious people raised was the potential for western powers to be promoting biomedicine and vaccines out of self interest, presumably for economic or political gains	Renne 2006
		Social resistance to outsiders	In highly politicized sites, use of outsiders to influence use of services can have a negative impact by fuelling passive or active social resistance.	Chaturvedi 2009; Pool 2006
		Social resistance by caste/class	Endemic resistance as seen in some regions can not be explained by socioeconomic, cultural or religious difference alone but more likely a constellation of factors that fuel each other to create deep resistance to externally promoted programmes.	Fassin 1986; Odebiyi 1982; Pool 2006
Power struggle between belief systems	**Tension between traditional beliefs and western aetiology and those that stand to win or lose with the**	Traditional beliefs, alternative health seeking and immunisation coexist at all levels	Traditional beliefs about disease causation rather than religion per se was an important underlying factor in health seeking behaviour of people. Traditional and western medicine coexist and are utilised side by side despite western biomedicines rejection of traditional aetiologies. The tension between these two poles that people navigate based on their experiences is heighten by the juxtapositioning of the two systems against each other – a	Azevedo 1991; Bastien 1995; Odebiyi 1982

	primacy of one or the other		situation which is used effectively by some to increase their own position and power vis a vis the other within the community.	
		Lack of trust in expert systems	People were in general distrustful of "expert systems". Trust is rather based on experience with individually perceived risks and danger. (Bisht 2000) Distrust coupled inflamed by rumour creates an environment ripe for conspiracy theory that combines both traditional and modern threats, usually related to fertility or sterility. (Pool 2006	Bisht 2000; Pool 2006
		African physicians distance themselves from traditional practitioners so as not to "share power"	The divide between traditional and western ethno-medical belief systems could be best understood and surmounted by African physicians. However, African doctors are often the most resistant to publicly affirm or even acknowledge traditional health beliefs as an important determinant in people's health seeking strategy, despite calls for collaboration and even integration between the two systems given their dominance in African rural health seeking preferences.	Azevedo 1991
Government priorities reinforce gender norms	**Government priorities and methods foster resistance and play on unequal gender norms**	Government not trusted because they promote immunisation and don't provide PHC for children - suspicious	Vertical immunisation programmes were hard to understand and accept in many communities. In some settings, governmental focus on immunisation instead of primary health care left many suspicious of governmental intent. Some asked "Why Polio?" when the major threats to children may be other disease such as diarrhoeal disease or malaria for which the government clinic did not provide free of charge. People openly questioned the government's motivation, and those of the international community behind the immunisation programme Mothers and women place blame for shortages and lack of quality services on the government.	Azevedo 1991; Renne 2006
		Colonial style administration of immunisation	Top down, patronizing organisation and implementation of immunisation services reminiscent of the colonial era health services are the historical roots of many of the current programmes.	Bastien 1995; Dasgupta 2008; Pool 2006
		Government coercive practices to increase coverage of immunisation	Vaccination was reported to be used as a political tool by government that said they would withhold development until people participate. (Chaturvedi 2009) people were aware that the priorities were of the government not the people and they resented it.	Chaturvedi 2009
		Use of incentives distorting the system and is ripe for bargaining by the people	Other "incentives" used included targets for providers as was done in the past with family planning programmes, and financial and gift incentives for caretakers and or providers to increase utilisation. Many people found the tactics manipulative, suspicious, and even, at their worst, coercive.	Dasgupta 2008; Fassin 1986
		Historical policy context that emphasises gender roles and social control	The legacy of past government campaigns to control population through forced sterility or family planning underpins people's fear and imagination creating fertile ground for conspiracy theory. Using health policy to control women's fertility was resented in many countries and seen as an abuse of state (patriarch cal) power over women that still resonates today in some places. The result of these policies was to create an artificial situation of scarcity in which people revert back to traditional gender roles and preference for boy children.	Li 2004; Topuzoglu 2007
		Fear of acting counter to the rules or governmental authority	Caretakers, usually mothers, dare not contradict perceived legal or normative authority prescribing immunisation as mandatory. Poor treatment by health providers when they have missed appointments, for example, further convinces mothers of the importance of immunisation, and more generally, a sense that they are acting in correctly in some way. Mother fear services could be withheld if they do not comply.	Pool 2006; Schwarz 2009
		Reduction in donors funds impacts on services	EPI programmes are often highly dependent on external support particularly in countries with large underserved populations where there is very low immunisation coverage. As a result, cuts in funding levels by donors can have immediate effect on the efficacy of the EPI programme.	Bernahel 2000
Child health as	**Feminization of**	Mother responsible for	The health of the child is the primary responsibility of the mother, not father or extended family	Bastien 1995;

gendered	**infant's health is rooted in both traditional belief systems and in western views of the maternal role and responsibility**	infant's health	and community. In this context, child health is a reflection of the capacity of the mother to maintain and nurture her child	Fassin 1986
		Son preference linked to mother's status in society; determinant of immunization status	The ability to birth a son determines mother's status in the family/society. Boy preference was seen in discrimination of girls in general care, nutrition and immunisation status. This discriminatory situation is related to both the gendered cultural preference for boys, and to the government one child policy	Li 2004
		Government emphasis on status of women created support for healthy families	In locations where government has recognized the importance of improving the status of women and girls, positive outcomes have been registered on vaccination coverage. In Kerala State in India, this emphasis on social wellbeing of families has contributed to increased immunisation rates	Nair 2007
Knowledge and Beliefs				
Beliefs and Knowledge systems	**Coexisting knowledge and belief systems**	Folk vs. Biomedical knowledge	No strict boundaries exist between folk and biomedical knowledge, they co-exist as is proved by the continuing use of both traditional and biomedical treatments	Bisht 2000
	Knowledge transfers between systems	Traditional knowledge itself includes imported elements (historical aspect, inheritance of colonialism)	Traditional knowledge includes imported elements, often linked to colonial experience (e.g. miasma theory and European humoral theory, reconfiguration of witchcraft discourse following Christianisation, etc.); Imported conception of women: "beliefs regarding women as passing on evil, such as witches, and as the corrupting influence on children and men, Eve seducing Adam and positing the Original Sin"	Bastien 1995
		Incorporation of different knowledge systems; reinterpretation of knowledge when imported	Fragmented items of biomedical knowledge move into the knowledge of the community; diseases holds different meanings in different spaces and its verbalisation occurs within the boundaries of a particular system of knowledge; incorporated elements of biomedical knowledge incorporated into traditional cures; new ideas and practices are reinterpreted and become part of local belief system and view; immunizations accepted as a present day addition to, and not as a replacement for, traditional disease prevention programme	Bernahel 2000, Bisht 2000, Eng 1991; Pool 2006
	Source of knowledge	Source of health knowledge (*a priori* knowledge)	The main source of information/knowledge regarding immunisation is the health centre	Bastien 1995, Oluwadare 2009, Suresh 2000
		A posteriori knowledge: empirical health knowledge	The source is not the bio-medical community but the communities' long-term experience of the disease itself. Empirical knowledge derived from personal experience of children with vaccine, or what friends and relatives said about their experience. Experience with health system (including access) also participate in building empirical knowledge; Positive experience creates acceptance and negative experience distrust, but contra example can exist: sometimes the fact that measles occurred even after vaccination had a positive effect on the mothers with respect to the vaccine, because only the experience of the disease can provide life-long immunity from the disease. Occurrence of mild measles after vaccination has led to a demand for the vaccine	Bernahel 2000, Bisht 2000, Coreil 1994, Fassin 1986, Odebiyi 1982, Tadesse 2009, Topuzoglu 2007
	Knowledge claims	Knowledge claims	"There is an assumption here that the knowledge popularised by the health workers about vaccines will be willingly accepted by the community". "It also ignores the possibility that this knowledge may come into conflict with the existing knowledge of the community".	Bisht 2000

		Accepting a new knowledge: with what rational?	Even when new tenets are imported from the west (e.g. Christianism, education) and adopted by population it doesn't imply abandonment of "deep-seated values"; communities who have come to accept vaccinations do not necessarily do so with the biomedical understanding of the nature of immunity provided by vaccines	Azevedo 1991; Bisht 2000
	Religion and knowledge	Impact of religion on traditional attitudes and values	religion (Christianity or Islam) does very little to change people's deep-seated attitudes and values; religion doesn't change the understanding of traditional syndrome, even though the magical causes are interpreted differently; some traditional practices are changed due to religion but still practiced (e.g. rubbing the child with a bible instead of sprinkling blood of a sacrificial animal)	Azevedo 1991; Bastien 1995; Bisht 2000
			On the contrary, traditional beliefs/practices can be abandoned if seen as in contradiction with new faith	Renne 2006
			When religion seems to impact coverage (Muslim = lower), it is not religion itself but more the lower education defined by religious geographical distribution	Oluwadare 2009
			Church affiliated hospitals mix the biomedical assumptions with theories of divine intervention; "claim a scientific basis for their treatment of disease, while, on the other, they reinforce the African's belief in the role of the supernatural in the explanation of disease and death"	Azevedo 1991
Illness vs. disease: the knowledge of medical conditions	**Knowledge and language**	The problem of naming the conditions	Refer to one sickness with a word used to describe other sicknesses; Biomedical providers and healers use same word to refer to different illnesses, same name regroup several different diseases (e.g. name given to symptom complexes believed to b caused by supernatural powers); Name used for a vaccine doesn't correspond to the illness in all the dialects of a region, or use of another language than vernacular (Spanish, English, etc.); The term to design disease reflects traditional ideas about supernatural causations	Bastien 1995; Bernahel 2000; Bisht 2000; Renne 2006
			To name evil is to call it	Fassin 1986
	The understanding of illness causation	Supernatural illness causation	Supernatural causes: God, witchcraft, deceased child, werewolf, hereditary "washable" cause, etc. most commonly perceived primary causes of disease in a child	Azevedo 1991, Bastien 1995, Bernahel 2000, Bisht 2000, Eng 1991, Fassin 1986, Renne 2006, Odebiyi 1982, Tadesse 2009
		Dramatic symptoms must be caused by supernatural forces	Because of dramatic nature of diseases, it must be caused by witchcraft, by the use of "deadly forces by sorcerers and enemies"	Bastien 1995
		Wind, vapours, hot and cold causation	Hippocratic/Galenic humoral theory of the balance between the hot and the cold, release of excess heat from the body, miasma theory, Smells, vapours and/or wind (physical wind(s) or wind as spirit blowing diseases)	Bastien 1995, Bernahel 2000, Bisht 2000, Coreil 1994, Fassin 1986
		Absence of natural causes	Natural causes (impure water, disease environment, uncleanliness, germs, and other) were rarely named; no germ theory, although a `dirty' environment was often blamed, no mention of bacteria or other micro-organisms as a cause of childhood infections	Azevedo 1991; Helman 2004; Odebiyi 1982
		Behavioural causes	Mother's behaviour: mother was nervous, shouted at somebody, lost her temper or was physically abused, pregnant mother walks past putrid matter, mother unhappy	Bastien 1995, Bisht 2000, Fassin

			during pregnancy, didn't breast feed correctly,	1986
			Misbehaviour (e.g. mother's unfaithfulness)	Azevedo 1991, Bastien 1995
		Contagion theories, diseases= outside world	Contagion theory, disease brought to village from outside world, "construction of an otherness as the space of contagion"	Bisht 2000
	The understanding of symptoms	Symptomatology coincide	the symptoms as described by the mothers coincide with the biomedical symptomatology	Bisht 2000, Fassin 1986
		Symptomatology doesn't coincide	Difficult to isolate one particular disease: matrix cluster of symptoms associated with different pathologies; cluster symptoms that are characteristic of different diseases; culturally defined symptom complexes or syndromes; symptom complexes are embedded in magical and supernatural symbols; not recognize symptoms because of cultural practices (e.g. clothing); certain symptoms more worrying than others; treating some symptoms (e.g. fever, cough) but not the disease as such	Bastien 1995, Bernahel 2000; Bisht 2000
	Knowledge of Vaccine Preventable Disease (VPDs)	Knowing VPDs	Being able to name vaccine preventable diseases or childhood illnesses	Bernahel 2000, Coreil 1994, Helman 2004
		Unbalanced knowledge of VPDs	Disproportionate knowledge of some VPDs compared with others, due to the impact of campaigns (Coreil) or visual impact of physical signs (Helman). Seriousness of diseases expressed in their physical outcome (Bernahel 2000)	Bernahel 2000, Coreil 1994, Helman 2004
Prevention vs. cure: the understanding of treatment	**Concept of prevention**	Understanding prevention	Able to understand preventive role of vaccine because it corresponds to preventive traditional practices (e.g. herbs to protect babies); even when witchcraft is believed to be the cause: something can be done to prevent illnesses caused by unappeased spirits, violations of the cosmic order, breaking a taboo, or disrupting the social order (use of amulets and rituals); similarities with the use of mosquito nets; using local concepts to explain the preventive role of vaccination	Bernahel 2000, Bastien 1995, Bisht 2000, Eng 1991, Fassin, 1986, Odebiyi 1982, Pool 2006
		Prevention is essential part of child care	Protecting child from evil eye and other danger constitute an essential part of child care. The practices of protection and prevention ranging from breast feeding, dietary and bathing practices to warding off the evil eye, or making a vow to particular deities, are intended to produce good health by protection and prevention	Bisht 2000
		Children diseases understood as not preventable	Disease not understood as preventable, in particular because disease "is considered a supernatural and traumatic event with psychological, supernatural and social interpretations"; not a disease but a curse; disease only preventable by "natural immunity" gained by experiencing the disease	Bastien 1995; Bernahel 2000; Bisht 2000; Fassin 1986; Odebiyi 1982; Tadesse 2009
	Knowledge of vaccine and immunization	Understanding immunization	Understanding what the vaccine/immunization is	Oluwadare 2009, Pool 2006, Tadesse 2009
		Awareness of the necessity of immunization	Awareness of the need to have children vaccinated is widespread	Bernahel 2000, Azevedo 1991, Eng 1991, Helman 2004, Oluwadare 2009, Tadesse 2009, Topuzoglu

				2007, Unisa 2006
	Misconceptions	Misconceptions: confusion between prevention and cure or protection	Vaccine = something "good for the health" of the child (or/and of mother) in general; beliefs that it helps to build strength, improve a child's health, etc.; belief that diseases would develop only mildly and stay limited if the child had been vaccinated; disbeliefs in vaccination if "their infant fails to show adequate growth" after first injections; confusion between prevention and cure (vaccine as `treatment' for `weak' children); confusion between prevention and protection: beliefs that vaccine influences only the intensity of the disease	Bernahel 2000, Bisht 2000, Coreil 1994, Eng 1991, Fassin 1986, Helman 2004, Odebiyi 1982, Pool 2006, Schwarz 2009, Tadesse 2009, Topuzoglu 2007
		Misconceptions: immunization understood as doing more than prevent VPDs	Thinking that one vaccine covers against **all** (childhood) diseases; mistaking one vaccine for another; thinking that it covers other kinds of illnesses (cough, headache, pneumonia, vitamin A deficiency, malaria, etc.) Oral vaccine taken for something else (e.g. vitamins), or on the opposite: taken for full immunization (Unisa 2006)	Bernahel 2000, Bisht 2000, Coreil 1994, Helman 2004, Oluwadare 2009, Unisa 2006
			Thinking that one can't vaccinate a sick child	Topuzoglu 2007
	Lack of knowledge of vaccine and immunization	Not understanding immunization	No knowledge about what vaccine/immunization is, or about its preventive role; not believing the preventive role of vaccine because some children who had been immunised still contracted illnesses in later years	Bisht 2000, Coreil 1994, Helman 2004, Odebiyi 1982, Oluwadare 2009, Pool 2006, Tadesse 2009, Unisa 2006
		Not relating vaccines to specific diseases	Not able to relate a vaccine to an illness, necessity to give more information during vaccination	Bisht 2000, Coreil 1994, Fassin 1986, Helman 2004, Pool 2006, Tadesse 2009, Topuzoglu 2007
		Not knowing the regimen	Not knowing the regimen, how many doses of each were needed, or which ones were taken orally vs. by injection, timing, etc. Thinking that one shot is enough, or that children over the age of one don't need any more vaccination.	Coreil 1994, Suresh 2000, Topuzoglu 2007, Unisa 2006
			Importance of EPI support groups for knowledge of regimen	Eng 1991, Uddin 2010
Between tradition and biomedical discourse: seeking treatment	**Beliefs in treatment options**	Using both western medicine and traditional medicine	Both WM and TM practitioners; beliefs that vaccine are only good when combined with traditional medicine	Azevedo 1991, Bastian1995, Bernahel 2000, Bisht 2000, Odebiyi 1982, Renne 2006, Tadesse 2009

		Illness-specific treatments	Treatment is illness-specific: Certain illnesses can only be treated by traditional healers; Traditional healers to address the believed causes, biomedical to treat symptoms. TM: If disease are caused by supernatural causes, only a traditional healer can cure it (sterility, all mental illnesses, epilepsy, convulsions, leprosy)	Azevedo 1991, Bastian1995, Bernahel 2000, Bisht 2000, Renne 2006, Tadesse 2009
		First TM, then WM	First TM, then WM when intensity of disease increases, or doesn't follow an expected pat-Tern; expert treatment sought only if symptoms persist beyond what is considered to be the 'normal' duration of the illness;	Bernahel 2000, Bisht 2000
		Preference for TM	TM: traditional healer acts on more than just physical health (spiritual, social, etc.); TM referred for treatment of culturally caused diseases; WM: diagnosis only on physical health is too simplistic/poor to generate trust	Azevedo 1991, Bastien 1995, Bernahel 2000
		Healing through divine intervention	God: pray, pilgrimage to the temple, etc. Healing through divine intervention. Practices of fasting prior to prayers, etc. Use of Holy water	Azevedo 1991, Bastien 1995, Bisht 2000, Odebiyi 1982, Oluwadare 2009
		Preference for home treatment	Home treatment, family pharmacy, home made lotions and herbs, etc.	Fassin 1986, Bernahel 2000, Bisht 2000
		Preference for WM	TM perceived negatively, inefficient, etc.	Helman 2004
	Treatment through traditional practises	Non-therapeutic practices	Divers practices using food, clothing, etc. are used as spiritual/magical protection or as cure (not specific to childhood diseases)	Bernahel 2000, Fassin 1986, Odebiyi 1982
		Unhealthy/dangerous practices	Traditional practices can be unhealthy by biomedical standards: e.g. when cutting the umbilical cord, refusal to wash a sick child because it is considered dangerous, or covering children in warm cloths, all of which can generate convulsions; children weakened by nutritional taboos; negative role of traditional midwife	Azevedo 1991, Bastien 1995, Bernahel 2000, Fassin 1986
	Treating diseases caused by malfunctioning social relations: witchcraft	Secrecy of witchcraft	Witchcraft is secret, so respondent might not mention it as cause of disease or treatment seeking option although it is used; mothers hiding their sick children (and therefore avoiding health facilities) to conceal the curse of witchcraft	Bastien 1995, Fassin 1986
		Use of witch-doctors	Witch-doctors used only when disease evolve in a dangerous direction	Fassin 1986
		Witchcraft as a power discourse	Local etiology of disease used as a power discourse to ostracize people and reinforce control; symptoms of certain childhood diseases connote very aggressive social relationships caused by imbalances in resources; "NNT becomes a power discourse of political and social control through sorcery that is dynamically manipulated for certain gains of individuals and families against each other"	Bastien 1995
		Witchcraft as a gendered power discourse	Witchcraft gendered aspect: blame is imputed on the mother for having done something to inflict sorcery upon her child; she is not only victimized by her child's death but also as a cause of this death; blame on women linked to imported conception of women: "beliefs regarding women as passing on evil, such as witches, and as the corrupting influence on children and men, Eve seducing Adam and positing the Original Sin"	Bastien 1995

Education, information and communication				
General education and literacy	**Impact of education levels and literacy on immunization status**	Literacy is correlated with acceptance/demand	Education is correlated to coverage (as is with child diseases and child mortality in general); illiteracy is a problem for immunization; literacy linked with "type of beliefs held about the vaccine"; mother's education particularly important; father's education is also indicator	Azevedo 1991, Bastien 1995, Eng 1991, Li 2004, Odebiyi 1982, Oluwadare 2009, Renne 2006, Topuzoglu 2007
		Correlation between education and immunization is limited	Education has no impact on beliefs in supernatural causes of diseases; literate mothers "did not believe in the vaccine"; Awareness of immunization's programmes irrespective of education level	Azevedo 1991; Odebiyi 1982
	Unequal access to education	Gender inequality	Gender difference in literacy, women receive less education than man.	Bastien 1995, Li 2004
		Religious inequality	Religious inequality: Muslim regions with poorer education; Muslim education yields lower coverage	Oluwadare 2009, Renne 2006
		Geographic inequality	Geographical inequality	Bastien 1995
Health education and information	**Enhanced health education yields higher coverage rates**	Need for more health education	Need for more health education/information, for example by including health education in universal education	Azevedo 1991, Helman 2004, Odebiyi 1982, Tadesse 2009
	Access to health information	Problem of access to education/information	Lack of information is caused by a lack of access to information, rather inability to learn	Eng 1991
	Sources of health education	Sources: health personnel – during vaccination	Health personnel should inform about immunization, vaccines and childhood illnesses during vaccination. Explain which illness is covered by which vaccine, etc.	Bastien 1995, Bisht 2000, Fassin 1986, Topuzoglu 2007
		Lack of info from health personnel during vaccination	The lack of information provided during immunization is the main problem; Reminds past colonial experience (Bastien); health personnel should also inform about symptoms	Bastien 1995, Coreil 1994, Schwarz 2009, Topuzoglu 2007
		Sources: older women	older women play an important role in providing information to younger mothers	Bisht 2000
		Sources: opinion leaders	Local leaders (Suresh 2000); Celebrities: no impact (Chaturvedi 2009) chiefs: positive (Eng 1991); town criers, churches and mosques (Oluwadare 2009); TV and radio: mass media (Renne 2006, Suresh 2000); teachers (Suresh 2000)	Chaturvedi 2009, Eng 1991, Oluwadare 2009, Renne 2006, Suresh 2000
	Education of health personnel	Education and training of health personnel	Health personnel poorly trained; or simply more training needed	Bastien 1995, Topuzoglu 2007, Uddin 2010
Communications and campaigns	**Information campaigns generates demand**	Need for (more) information campaigns	Intensification of health awareness campaign is one of "the best solutions"	Azevedo 1991, Fassin 1986
	Campaigns: too much	Focus on one disease/or	Focus on women (vs. men) makes it suspicious (Bastian 1995); focus on one disease (e.g. in	Bastian 1995,

	information?	type of patient is perceived as suspicious	polio immunisation programme) tends to overwhelm information and communication about other antigens (Oluwadare 2009) or generates suspicion when other health services are lacking (Renne 2006); Focus of campaigns: top-down approach create resistance (Renne 2006)	Renne 2006, Oluwadare 2009
	"Cross-cultural" communication	Need for a cross-cultural communication	Health personnel must adapt the information model of immunization to people's conceptions, etiologies and treatment of immunifacient diseases.	Bastien 1995
		Need to train health personnel on local etiologies	Health providers are unaware of local syndromes and of the signification of these illnesses for communities (magical, social, etc.), so they need to be trained for cross-cultural communication	Bastien 1995
	Non-gendered communication	Need to include men	Need to include men as target of campaigns	Pool 2006
Agency, Decision-Making and Gender Roles				
Agency roles and decision making	**Empowering and disempowering gender roles**	Productive role	Women who work don't have the time to bring children to immunization. Work done for payment in kind or similar;	Coreil1994; Oluwadare 2009; Schwarz 2009
		Domestic role	Responsibility of domestic task (Housewife responsibilities). Gender inequality in division of household work	Coreil1994; Li 2004; Topuzoglu 2007; Schwarz, 2009
		Maternal role	Childbearing/rearing responsibilities; in the absence of alternative caretakers, children must be taken along to the clinic, kept clean and properly dressed, and supervised over long periods time	Bastien 1995; Coreil 1994; Li 2004; Odebiyi 1993; Topuzoglu 2007
		Community/Social role	Community activities that are voluntary and unpaid which contribute to its welfare and social status (attending to sick family members, visiting, attending of guests, etc). In traditional societies obligatory social responsibilities abound and cannot be dismissed lightly `The guests had come unexpectedly; you can not say to the guest to stay at home so that I could take the child to the session, we can not do such things....' (Topuzoglu 2007)	Coreil 1994; Oluwadare 2009; Topuzoglu 2007
	Women's status	Women's status/role in society	Women required to have their husband's permission to go to the market, to go to the clinic, etc. They also need to get the money for transport from husband. Gender division of household work is important dimension of women's status. Female children who had older sisters were the least likely to receive necessary immunizations. Impact of age on women's status (younger more excluded). Women receive less education than men. Women's status in society not valued; the type of work she does not considered	Bastien 1995, Coreil 1994; Li 2004, Pool 2006, Topuzoglu 2007
	Men's Status	Men's status/role in society	Men have to give authorisation to go for immunization; to out of the house in general; their input in decision-making and payment is needed. Rural men don't know about immunization	Oluwadare 2009, Tadesse 2009, Topuzoglu 2007
		Men's role in childbirth	Men's involvement in child birth	Bastien 1995
	Son preference	Son preference	Mothers who had a daughter blamed; older boy not taken to vaccination because of son preference	Li 2004, Topuzoglu 2007
	Gender specific	Gendered based blame	Mothers blamed for children health status	Bastien 1995

	blame			
	Decision-making	Control over resources	Degree of access to and control over household and social resources	Coreil 1994; Li 2004; Renne 2006; Pool 2006; Oluwadare 2009; Topuzoglu 2007; Schwarz 2009
		Intra-family power relations	Mother's power to decide of bringing the child to the immunisation services. Two types of power: Generational (mother in law) and/or gender. Women's lack of negotiating power in the household. Mother's decision making power and autonomy relevant to immunization status	Bastien 1995; Eng 1991; Pool 2006; Oluwadare 2009; Tadesse 2009, Topuzoglu, 2007
		Socio-cultural norms (Rule of law)	Comply with immunisation services without conscious reflection: it has become part of 'local culture'.	Berhannel 2000; Pool 2006
	Prioritization	Physic overload	Burden of work resulted of unbalance gender roles	Coreil1994; Oluwadare 2009; Schwarz 2009
		Psychic overload	Psychological burden which discourages from thinking about non-essential things	Coreil 1994; Topuzoglu 2007
		Interpersonal violence (IPV)	Presence of domestic violence can prevent mother from being able to bring her children to immunization	Coreil 1994; Topuzoglu 2007
Poverty and Livelihoods				
Poverty /Livelihoods	**Material resources**	Financial constraints	Inability to pay costs associated with vaccination (direct and indirect costs).	Azevedo 1991; Bisht 2000; Coreil 1994; Oluwadare 2009; Schwarz 2009; Topuzoglu 2007
		Competing priorities	Activities for day-to-day acquisition of food and other necessities considered more compelling than immunizations.	Chaturvedi 2009, Coreil 1994; Schwarz 2009; Topuzoglu 2007
	Social Resources	Social exclusion	Social networks to assist financially and/or taking over of other responsibilities; social connections that may encourage/discourage vaccination attendance; many women do not have trusted relatives or friends to call on, and organized child care is unavailable. Lack of support in urban/semi-urban contexts. Sub-group like migrants suffering more from exclusion	Coreil 1994; Chaturvedi 2009; Fassin 1986; Odebiyi 1993; Oluwadare 2009; Topuzoglu 2007
		Social support	Social support appears to be an important positive reinforcement for utilization. Importance of social network to remind mothers to take their children to immunization	Coreil 1994; Uddin 2010
	Poverty	Poverty influences immunization	Children from socio-economically disadvantaged groups are less vaccinated because their non-literate mothers don't believe in immunization. Poor get services for the poor (vs. private services for riches). Poverty compounds other barriers, especially gender related ones as fewer	Chaturvedi 2009, Coreil 1994; Odebiyi 1982

			resources are available	
		Shame/discrimination linked to poverty	Fear to be humiliated when poverty becomes evident to the public (lack of fine clothes, have thin babies); avoiding the completion of the full vaccine series because infant fails to show adequate growth, fear of criticism	Coreil 1994; Fassin 1986; Schwarz 2009

Swiss TPH
Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut
Institut Tropical et de Santé Publique Suisse

Swiss Centre for International Health

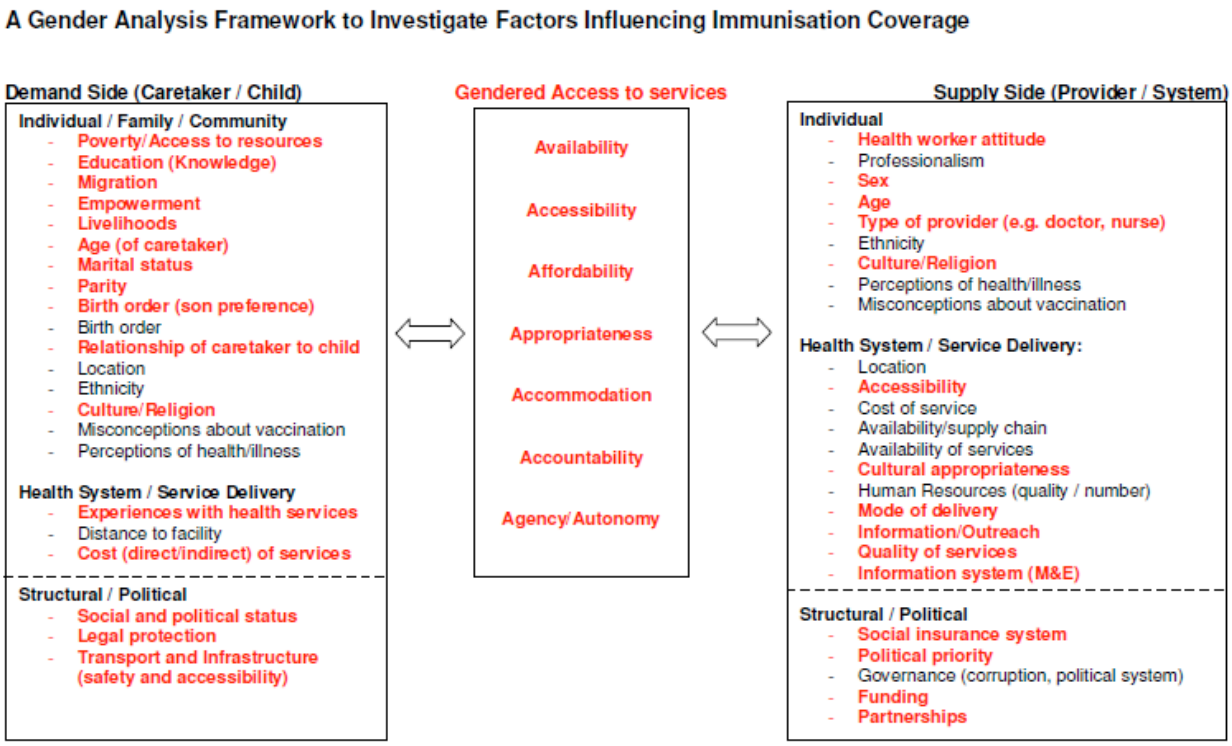
ANNEXES

ANNEXES

ACRONYMS

ANC	Antenatal care
CDC	Centre for Disease Control
CI	Confidence interval
DHS	Demographic Health Survey
GAVI	Global Alliance for Vaccines and Immunisation
IVR	Initiative for Vaccine Research
MICS	Multiple Indicator Cluster Survey
OR	Odd Ratio
PATH	Program for Appropriate Technology in Health
SAGE	Strategic Advisory Group of Experts on Immunisation
Swiss TPH	Swiss tropical and Public Health Institute
TAG	Technical Advisory Group
TT	Tetanus Toxoid
UNDP	United Nations Programme for Development
UNVAC	Epidemiology of the Unvaccinated Child (Project)
WHO	World Health organisation

Annex 1 – Gender framework



Annex 2 - Included and excluded DHS datasets

	Country	Year		Country	Year
	Included				
1	Armenia	2000	41	Dominican Republic	1999
2	Armenia	2005	42	Dominican Republic	2002
3	Azerbaijan	2006	43	Dominican Republic	2007
4	Bangladesh	1994	44	Egypt	1988
5	Bangladesh	1996	45	Egypt	1992
6	Bangladesh	2000	46	Egypt	1995
7	Bangladesh	2004	47	Egypt	2000
8	Bangladesh	2007	48	Egypt	2003
9	Benin	1996	49	Egypt	2005
10	Benin	2001	50	Ethiopia	1992
11	Benin	2006	51	Ethiopia	1997
12	Bolivia	1989	52	Gabon	2000
13	Bolivia	1994	53	Ghana	1988
14	Bolivia	1998	54	Ghana	1993
15	Bolivia	2003	55	Ghana	1998
16	Brazil	1986	56	Ghana	2003
17	Brazil	1996	57	Guatemala	1987
18	Burkina Faso	1993	58	Guatemala	1995
19	Burkina Faso	1999	59	Guatemala	1999
20	Burkina Faso	2003	60	Guinea	1999
21	Burundi	1987	61	Guinea	2005
22	Cameroon	1991	62	Haiti	1994
23	Cameroon	1998	63	Haiti	2000
24	Cameroon	2004	64	Haiti	2006
25	Central African Republic	1994	65	Honduras	2006
26	Chad	1997	66	India	1993
27	Chad	2004	67	India	1999
28	Colombia	1986	68	India	2006
29	Colombia	1990	69	Indonesia	1991
30	Colombia	1995	70	Indonesia	1994
31	Colombia	2000	71	Indonesia	1997
32	Colombia	2005	72	Indonesia	2002
33	Comoros	1996	73	Indonesia	2007
34	Congo	2005	74	Jordan	1990
35	Congo DR	2007	75	Jordan	1997
36	Côte D'Ivoire	1994	76	Jordan	2002
37	Côte D'Ivoire	1999	77	Jordan	2007
38	Dominican Republic	1986	78	Kazakhstan	1995
39	Dominican Republic	1991	79	Kazakhstan	1999
40	Dominican Republic	1996	80	Kenya	1989

	Country	Year		Country	Year
81	Kenya	1993	121	Paraguay	1990
82	Kenya	1998	122	Peru	1986
83	Kenya	2003	123	Peru	1991
84	Kyrgyzstan	1997	124	Peru	1996
85	Lesotho	2004	125	Peru	2000
86	Liberia	1986	126	Peru	2004
87	Liberia	2007	127	Philippines	1993
88	Madagascar	1992	128	Philippines	1998
89	Madagascar	1997	129	Philippines	2003
90	Madagascar	2004	130	Rwanda	1992
91	Malawi	1992	131	Rwanda	2000
92	Malawi	2000	132	Rwanda	2005
93	Malawi	2004	133	Senegal	1986
94	Mali	1987	134	Senegal	1993
95	Mali	1996	135	Senegal	2005
96	Mali	2001	136	South Africa	1998
97	Mali	2006	137	Sri Lanka	1987
98	Mexico	1987	138	Sudan	1990
99	Morocco	1987	139	Swaziland	2006
100	Morocco	1992	140	Tanzania	1991
101	Morocco	2003	141	Tanzania	1996
102	Morocco	2005	142	Tanzania	1999
103	Mozambique	1997	143	Tanzania	2004
104	Mozambique	2003	144	Thailand	1987
105	Namibia	1992	145	Togo	1998
106	Namibia	2000	146	Trinidad and Tobago	1987
107	Namibia	2007	147	Tunisia	1988
108	Nepal	2052	148	Turkey	1993
109	Nepal	2057	149	Turkey	1998
110	Nepal	2063	150	Turkey	2004
111	Nicaragua	1998	151	Uganda	1988
112	Nicaragua	2001	152	Uganda	1995
113	Niger	1992	153	Uganda	2001
114	Niger	1998	154	Uganda	2006
115	Niger	2006	155	Uzbekistan	1996
116	Nigeria	1990	156	Viet Nam	1997
117	Nigeria	1999	157	Viet Nam	2002
118	Nigeria	2003	158	Yemen	1991
119	Pakistan	1991	159	Zambia	1992
120	Pakistan	2006	160	Zambia	1996

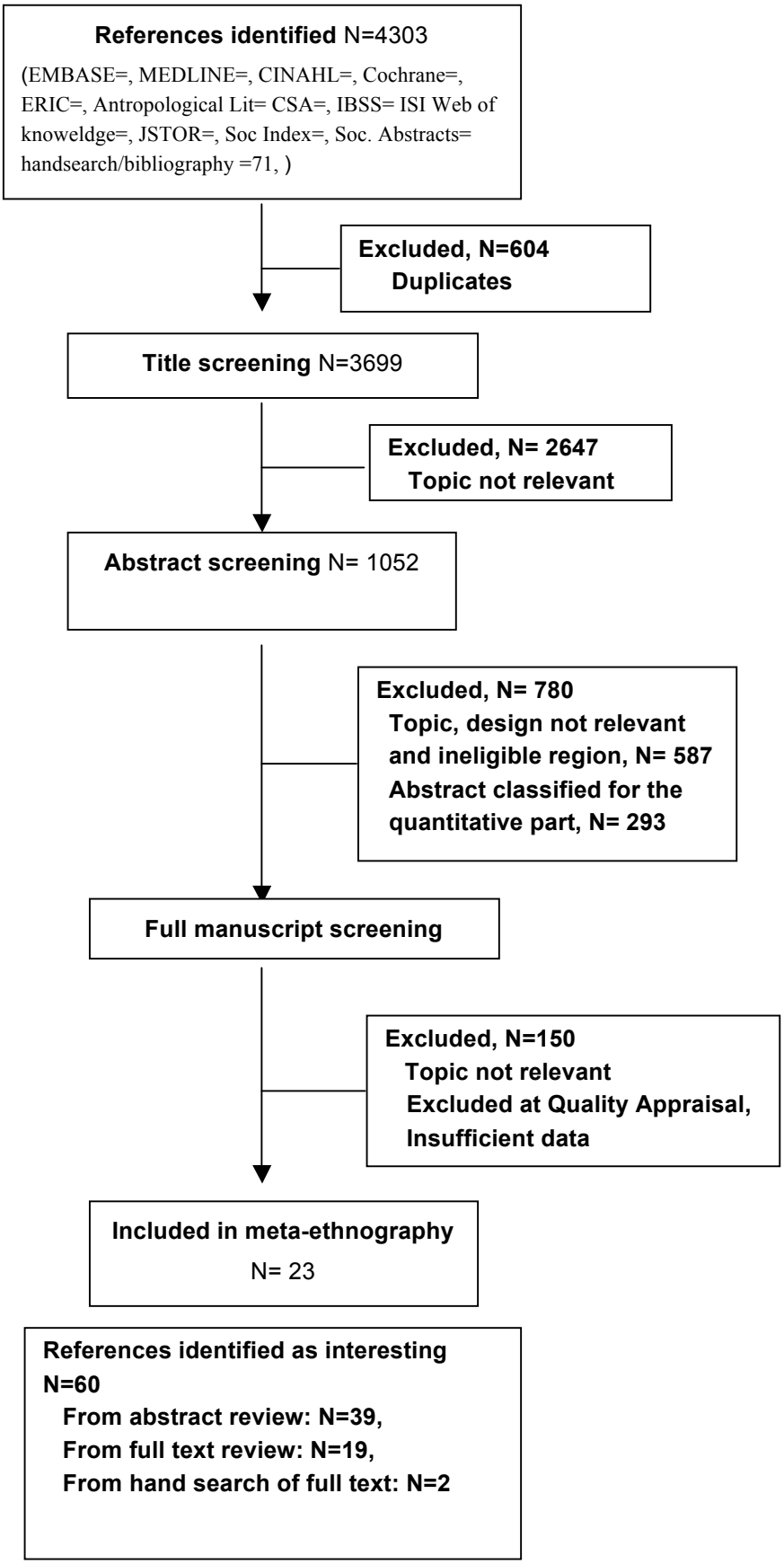
	Country	Year		Country	Year
161	Zambia	2002	164	Zimbabwe	1994
162	Zambia	2007	165	Zimbabwe	1999
163	Zimbabwe	1988	166	Zimbabwe	2005
	Excluded				
167	Brazil	1991	171	Nigeria (Ondo State)	1986
168	Dominican Republic	2007	172	Senegal	1997
169	Ecuador	1987	173	Togo	1988
170	Indonesia	1987	174	Ukraine	2007

Annex 3 - Predictor variables and values

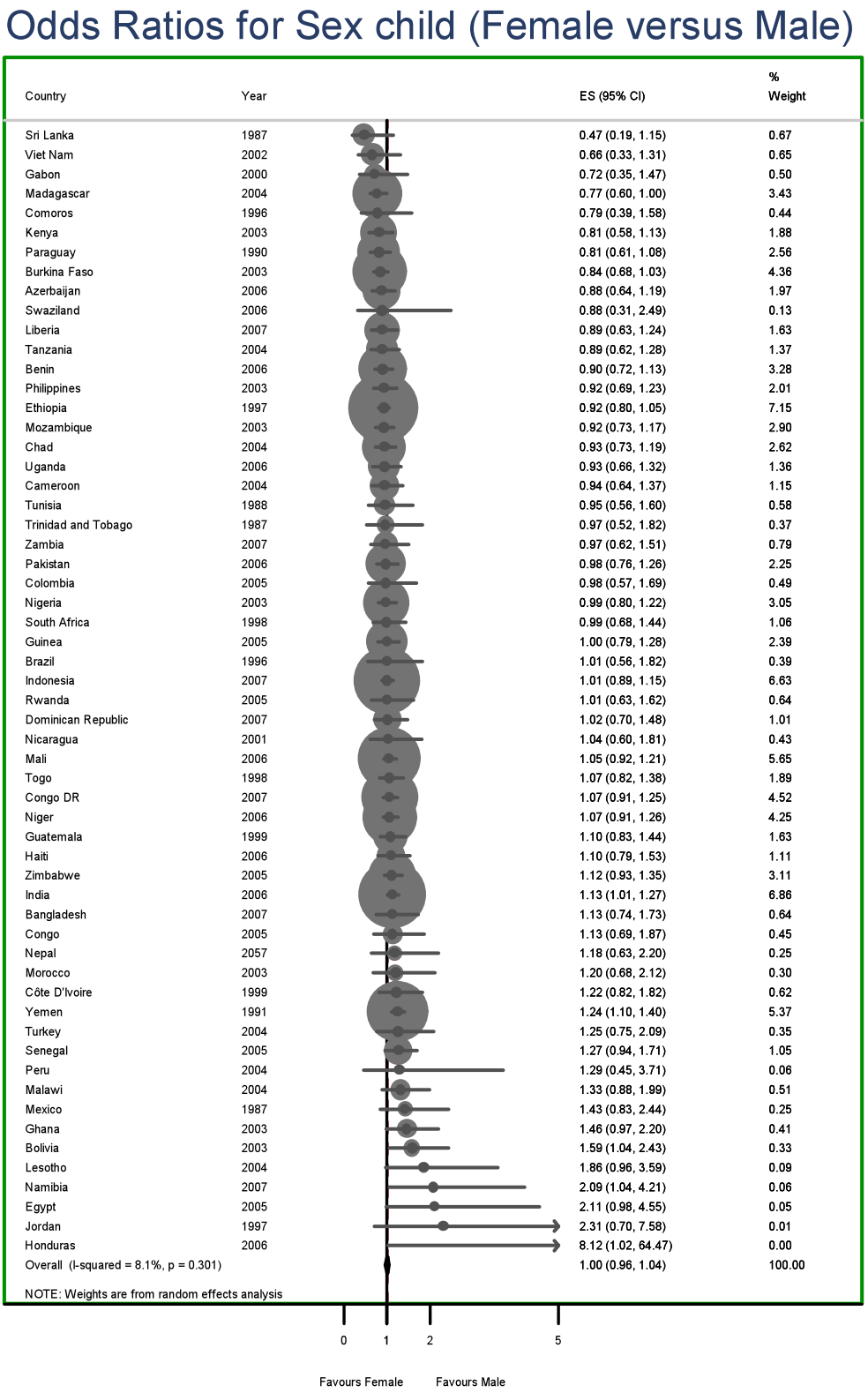
Variable description	Default value labels	Other value labels
Sex of the child	Female	Male
Birth order of the child.	Oldest	Younger
Level of education of the mother	Least educated (The least level of education, whether no education, or primary…)	Most educated (The other levels of education combined)
Level of education of the partner	Least educated (The least level of education)	Most educated (The other levels of education combined)
Marital status of the mother	Alone	In couple (All marital status implying being together with a partner)
TT vaccination status of the mother	Less than 2 TT doses (in any pregnancy; some surveys distinguish between last and previous pregnancy; here was combined)	2 or more TT doses (in any pregnancy)
Urbanisation	Rural (Combined with other codes that suggest rural)	Urban
Radio ownership	No radio in the household	Radio in the household (if more than one radio, like in some surveys, the actual number of radios not considered)
Television ownership	No TV in the household	TV in the household (if more than one TV, like in some surveys, the actual number of radios not considered)
Frequency of listening to radio	Woman never listens to the radio	Woman listens to the radio at least once a week
Frequency of watching TV	Woman never watches TV	Woman watches TV at least once a week
Wealth index	Poorest quintiles	Each one of the other quintiles
Age difference in the couple	Large (more than 10 years)	Small (10 years or less)
Sex of the head of the household	Female	Male
Earns cash for work	No	Yes
Concerns about male health provider	Yes	No
Concerns about getting permission for care	Yes	No
Concerns about distance to health facility	Yes	No
Concerns about going alone for health care	Yes	No
Concerns about knowing where to get health care	Yes	No

Variable description	Default value labels	Other value labels
Agrees going out justifies beating	Yes	No
Agrees neglecting children justifies beating	Yes	No
Agrees arguing with partner justifies beating	Yes	No
Agrees on refusing to have sex if partner has another woman	Yes	No
Decision making on large purchase	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on daily purchase	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on health care for herself	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on visits to relatives	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone
Decision making on money use	Mother does not decide alone (or decide in conjunction with the partner or someone else)	Mother decides alone

Annex 4 - Qualitative systematic review flowchart



Annex 5 - Likelihood of not being vaccinated between girls and boys.



Meta-analysis, by survey, sorted by OR

lr_c01_01__i_12 to 59.dta

Annex 6 - OR for sex (females versus males) in different groups of other variables

	Core predictors:	Sex		
	Values:	Female versus Male		
		OR	lower	upper
All	**No subgroups**	**1.00**	**0.96**	**1.04**
Sex	**Female**			
	Male			
Education	**Least educated**	0.91*	0.83	0.99
	Most educated	1.01	0.96	1.05
Education partner	**Least educated**	0.90	0.80	1.00
	Most educated	0.99	0.95	1.03
Tetanus before birth	**No**	0.96	0.88	1.03
	Yes	0.99	0.94	1.04
Wealth index	**Poorest**	0.92*	0.87	0.98
	Richest	0.99	0.94	1.04
Birth order	**1st born**	1.00	0.95	1.05
	Younger	0.81*	0.72	0.89
Sex head household	**Female**	1.01	0.96	1.06
	Male	0.79*	0.70	0.88
Marital	**Alone**	1.02	0.98	1.06
	In couple	0.66*	0.54	0.78
Age difference couple	**Large**	1.00	0.95	1.04
	Small	0.91*	0.83	1.00
Residence	**Rural**	0.96	0.88	1.05
	Urban	0.99	0.95	1.03
Radio	**No**	0.96	0.89	1.04
	Yes	0.96	0.91	1.01
Radio how often	**Never**	1.01	0.95	1.07
	At least once a	0.95	0.89	1.00
Television	**No**	0.98	0.90	1.06
	Yes	0.98	0.94	1.02
TV how often	**Never**	0.96	0.89	1.04
	At least once a	0.98	0.93	1.03
Arguing with partner justifies beating	**No**	0.96	0.89	1.02
	Yes	1.00	0.95	1.06
Neglecting children justifies beating	**No**	0.95	0.89	1.01
	Yes	1.02	0.96	1.08
Going out justifies beating	**No**	0.96	0.90	1.01
	Yes	1.01	0.95	1.07
Cash for work	**No**	0.92*	0.86	0.98
	Yes	0.94	0.86	1.02
Woman decides health care	**No**	1.01	0.96	1.06
	Yes	0.92	0.74	1.09
Woman decides money	**No**	0.83*	0.73	0.93
	Yes	0.95	0.85	1.04
Woman decides large purchase	**No**	1.01	0.96	1.05
	Yes	0.87*	0.76	0.97
Woman decides daily purchase	**No**	1.00	0.95	1.05
	Yes	0.96	0.81	1.11
Woman decides visit	**No**	1.00	0.95	1.04
	Yes	0.88	0.72	1.04
Distance to health facility	**Yes**	0.94	0.84	1.04
	No	0.98	0.87	1.09
Going alone for health care	**Yes**	1.00	0.92	1.08
	No	0.90	0.78	1.01
Knowing where health care	**Yes**	0.97	0.88	1.05
	No	0.90	0.76	1.04
Concerns permission for care	**Yes**	1.03	0.96	1.10
	No	0.78*	0.64	0.92
Concerns not female provider	**Yes**	0.96	0.88	1.04
	No	0.98	0.77	1.18
Partner's women reason not to have sex	**Yes**	0.96	0.91	1.02
	No	1.03	0.95	1.11

Annex 7 - OR for core variables in different groups.

	Core predictors:	Sex			Education			Education partner			Tetanus before birth			Wealth index		
	Values:	Female versus Male			Least educated versus Most educated			Least educated versus Most educated			No versus Yes			Poorest versus Richest		
		OR	lower	upper	OR	lower	upper	OR	lower	upper	OR	lower	upper	OR	lower	upper
All	**No subgroups**	**1.00**	**0.96**	**1.04**	**1.65***	**1.49**	**1.81**	**1.36***	**1.23**	**1.50**	**2.42***	**2.11**	**2.73**	**1.52***	**1.37**	**1.66**
Sex	**Female**				1.52*	1.35	1.69	1.30*	1.14	1.45	2.30*	1.98	2.61	1.41*	1.27	1.55
	Male				1.47*	1.32	1.61	1.23*	1.10	1.37	2.36*	2.01	2.72	1.51*	1.34	1.67
Education	**Least educated**	0.91*	0.83	0.99				1.13*	1.01	1.24	1.34*	1.05	1.63	1.35	0.98	1.73
	Most educated	1.01	0.96	1.05				1.37*	1.24	1.50	2.55*	2.22	2.88	1.48*	1.34	1.63
Education partner	**Least educated**	0.90	0.80	1.00	1.45*	1.24	1.67				1.69*	1.42	1.97	1.41*	1.17	1.66
	Most educated	0.99	0.95	1.03	1.51*	1.34	1.68				2.63*	2.31	2.94	1.45*	1.31	1.60
Tetanus before birth	**No**	0.96	0.88	1.03	1.13	0.96	1.31	1.00	0.87	1.13				1.22*	1.07	1.36
	Yes	0.99	0.94	1.04	1.67*	1.45	1.89	1.42*	1.27	1.57				1.57*	1.40	1.73
Wealth index	**Poorest**	0.92*	0.87	0.98	1.59*	1.43	1.75	1.43*	1.23	1.63	2.08*	1.74	2.42			
	Richest	0.99	0.94	1.04	1.86*	1.46	2.26	1.17*	1.05	1.29	2.59*	2.21	2.98			

Annex 8 - Likelihood of not being vaccinated for gender related variables.

	Subgroups:	All	Sex		Education		Education partner		Tetanus before birth		Wealth index	
			Female	Male	Least educated	Most educated	Least educated	Most educated	No	Yes	Poorest	Richest
Sex	Female versus Male	=			v	=	=	=	=	=	v	=
Education	Least educated versus Most educated	^	^	^			^	^	=	^	^	^
Education partner	Least educated versus Most educated	^	^	^	^	^			=	^	^	^
Tetanus before birth	No versus Yes	^	^	^	^	^	^	^			^	^
Wealth index	Poorest versus Richest	^	^	^	=	^	^	^	^	^		
Birth order	1st born versus Younger	v	v	v	v	v	v	v	=	v	v	v
Sex head household	Female versus Male	v	=	v	v	v	=	v	=	v	v	v
Marital	Alone versus In couple	=	=	=	v	=	=	=	v	=	=	v
Age difference couple	Large versus Small	=	=	=	=	=	=	=	=	=	=	=
Residence	Rural versus Urban	^	^	=	=	^	=	=	v	^	=	=
Radio	No versus Yes	^	^	^	=	^	=	^	=	^	^	^
Radio how often	Never versus At least once a week	^	^	^	=	^	=	^	=	^	^	^
Television	No versus Yes	^	^	^	=	^	=	^	=	^	=	^
TV how often	Never versus At least once a week	^	^	^	=	^	=	^	=	^	^	^
Arguing with partner justifies beating	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Neglecting children justifies beating	No versus Yes	v	v	=	v	=	v	v	=	v	=	v
Going out justifies beating	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Cash for work	No versus Yes	^	^	^	v	=	=	^	=	^	=	=
Woman decides health care	No versus Yes	v	v	=	=	v	v	v	=	v	=	v
Woman decides money	No versus Yes	v	v	v	v	v	v	v	v	v	v	v
Woman decides large purchase	No versus Yes	=	=	=	=	=	=	=	v	=	=	=
Woman decides daily purchase	No versus Yes	v	v	v	=	v	v	v	v	v	v	v
Woman decides visit	No versus Yes	=	=	=	=	=	=	=	=	=	=	=
Distance to health facility	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Going alone for health care	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Knowing where health care	Yes versus No	^	^	^	v	^	=	^	^	^	^	^
Concerns permission for care	Yes versus No	^	^	^	=	^	=	^	=	^	^	^
Concerns not female provider	Yes versus No	^	^	=	=	^	=	^	=	^	=	^
Partner's women reason not to have sex	Yes versus No	^	=	=	=	^	=	^	=	^	=	=

This table show the likelihood of not being vaccinated for the same variables in the subgroups of the core variables. For easy reading, the table has been substituted with symbols: '=' means that there are no differences (the CI of the OR contains 1); 'v' means that the OR is statistically significantly below 1; and '^' means that the OR is statistically significantly above 1.

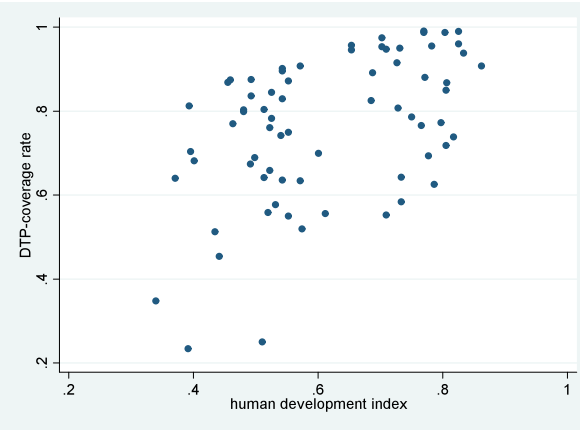
Annex 9 - Rank correlations between national rates of different types of vaccination coverage and various national indicators

	At least one dose of vaccine		Full vaccination		DTP3	
	R	**p-value[1]**	**R**	**p-value[1]**	**R**	**p-value[1]**
HDI (N=66)	0.46	<0.0001	0.10	n.s.	0.44	0.0001
GDP per capita (n=66)	-0.14	n.s.	-0.07	n.s.	-0.16	n.s.
GINI (n=173)	0.08	n.s.	-0.08	n.s.	-0.03	n.s.
Poverty rate (N = 117)	-0.25	0.007	-0.08	n.s.	-0.19	0.04
Adult illiteracy rate (N = 140)	-0.44	<0.0001	-0.19	0.03	-0.43	<0.0001
Infant mortality (N = 85)	-0.52	<0.0001	-0.24	n.s.	-0.59	<0.0001
Government health expenditures per capita (N=74)	0.53	<0.0001	0.35	0.002	0.60	<0.0001
Gender development index GDI (N = 58)	0.48	<0.0001	0.15	n.s.	0.40	<0.0001
Female combined gross enrolment ratio (N = 61)	0.52	<0.0001	0.25	0.053	0.53	<0.0001
Gender empowerment measure (n=34)	0.12	n.s.	-0.17	n.s.	0.01	n.s.
Female earned income (n=66)	-0.14	n.s.	0.13	n.s.	-0.06	n.s.
Income ratio between women and men (n=66)	0.07	n.s.	0.10	n.s.	0.09	n.s.
Percentage of women in ministerial positions (n=63)	-0.13	n.s.	0.005	n.s.	-0.10	n.s.

[1] n.s. = non-significant at the level of 0.05, i.e., $p > 0.05$

Annex 10 - DTP coverage rates in relation to different national indicators

A



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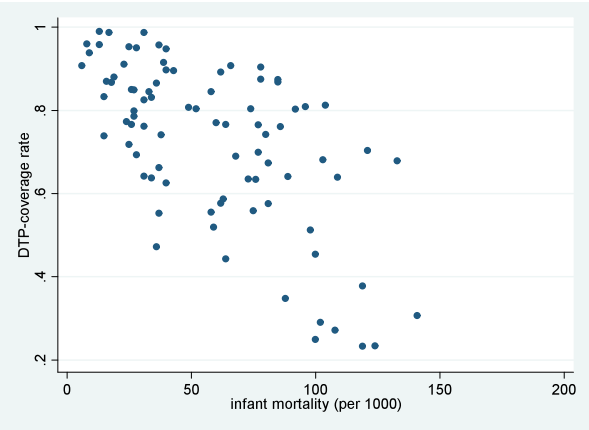

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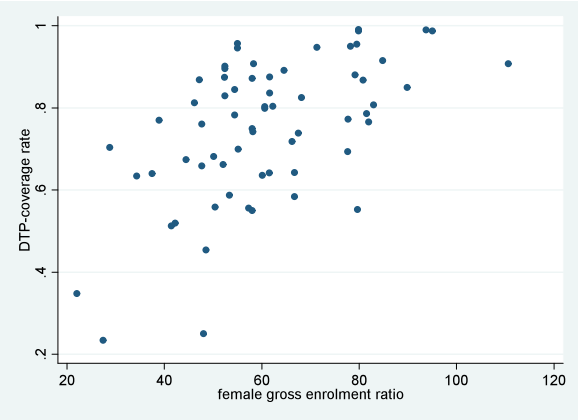

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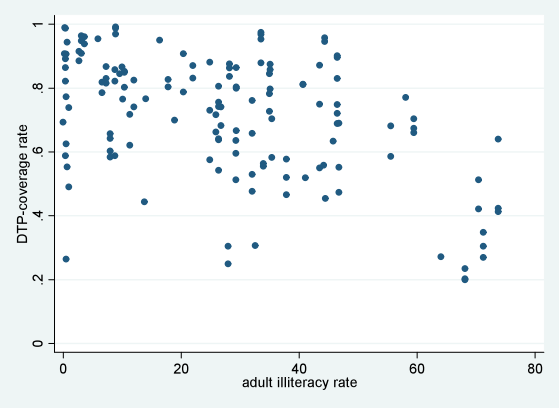

Annex 11 - Gender-related barrier to immunisation

Theme	Specific Barrier	Gender related dimension	Authors citing the issue
Health systems	▪ Direct and indirect costs	▪ Women with limited access to household financial resources can not access care	Fassin 1986; Azevedo1991; Coreil 1994; Bernahel 2000; Helman 2004; Topuzoglu 2007; Oluwadare 2009; Tadesse 2009; Schwarz 2009;
	▪ Provider attitudes; ▪ Poor provider skills	▪ Disrespect of mother's time, effort, specific circumstances, social status ▪ Women accept poor treatment due to low self esteem/conditioning	Coreil 1994; Bastien 1995; Bernahel 2000; Helman 2004; Topuzoglu 2007; Schwarz 2009
	▪ Health system authority	▪ Dependency on clinic for ANC, pregnancy and child health care; fear of reprisal for not following the recommendation/"law"	Bernahel 2000; Pool 2006,
	▪ Service organisation and logistics (including lack of privacy)	▪ Unpredictability and hours of service ▪ Women experience shame/humiliation at facility ▪ Time and distance affect women with multiple roles more acutely	Coreil 1994; Bernahel 2000; Helman 2004; Topuzoglu 2007; Oluwadare 2009; Schwarz 2009; Tadesse 2009;
	▪ Accommodation of women specific needs	▪ Male providers limit access for some women ▪ Language and cultural barrier for ethnic minorities	Coreil 1994; Bernahel 2000; Suresh 2000; Uddin 2010
Power and politics	▪ Politicization of immunisation	▪ Rival political and religious factions spread misinformation and rumours often aimed at fertility, women's source of power ▪ Susceptibility to rumour related fear more profound among women ▪ Calls (by male leaders) for resistance have to be enacted by women as the caretakers	Bastien 1995; Pool 2006; Renne 2006; Topuzoglu 2007; Dasgupta 2008; Chaturvedi 2009; Oluwadare 2009;
	▪ Government priorities, policies and methods	▪ Coercive family planning and immunisation programmes and policies target women ▪ Colonial style of administration of Immunisation disrespects women in the service (e.g. passive agents, not consulted)	Bastien 1995; Renne 2006; Pool 2006; Dasgupta 2008; Chaturvedi 2009;
	▪ Mother responsible or blamed for child's health status	▪ Western and traditional medical system, and social norms make woman responsible for child's health status, not the husband or family ▪ Health programmes perpetuate this gender norm	Fassin 1986; Bastien 1995; Li 2004
Knowledge and	▪ Health seeking decision-	▪ Women as caretakers of child chose health care system based	Odebiyi 1982; Fassin 1986;

Health Beliefs	making (and consequences) based on experience and knowledge	on experience and are influenced by family and social network; ▪ Choice of treatment option is a balancing of local beliefs and views with biomedical explanations – again negotiated by women; ▪ The consequence of their treatment choice they are alone responsible for	Azevedo 1991; Coreil 1994; Bastian1995; Bernahel 2000; Bisht 2000; Renne 2006, Topuzoglu 2007; Tadesse 2009,
	▪ Mother's transgressions linked to child health	▪ Mother's behaviour (or misbehaviour) blamed for child health that must be addressed through witchcraft, sorcery, etc ▪ Mother's accept blame/shame related to child health as sign of their "neglect" or "insufficiency"	Fassin 1986; Azevedo 1991; Bastien 1995; Bisht 2000;
	▪ Mother's lack of knowledge of vaccines; yet awareness of importance of vaccines	▪ Awareness is high of the importance although vaccine specific knowledge is low due to alternative understanding of VPDs, and the notion of prevention vs. cure; ▪ Providers do not explain in a way that can be understood by women with alternative world view;	Azevedo 1991; 1991; Helman 20004; Bernahel 2000; Eng 2004; Pool 2006; Unisa 2006; Topuzoglu 2007; Oluwadare 2009; Schwarz 2009; Tadesse 2009;
Education, Information, Communication	▪ Women's lower educational level (versus men) cited as reason for non or under vaccination	▪ "Lack of knowledge" or alternative knowledge claims dismissed and equated with illiteracy and lack of education ▪ Knowledge is built on experience by women of immunisation service ▪ Low literacy is linked to "types of belief" held about vaccines ▪ Father's education also an issue	Odebiyi 1982; Azevedo 1991; Eng 1991; Bastien 1995, Li 2004; Renne 2006; Topuzoglu 2007; Oluwadare 2009
	▪ Health education targets women only; inadequate	▪ Men do not get information ▪ There is too little health information ▪ Information is transferred but not in a way that women can access the messages	Odebiyi 1982; Fassin 1986; Azevedo 1991; Eng 1991; Bastien 1995; Bisht 2000; Helman 2004; Tadesse 2009;
	▪ Lack of information provided to women and to men	▪ Past colonial method of not providing information jeopardizes women's capacity to act ▪ Men can't be involved because they have no information	Coreil 1994; Bastien 1995; Topuzoglu 2007; Schwarz 2009
Women's agency and decision-making	▪ Unbalanced intra-family power relations	▪ Mother's choice of bringing the child to the immunisation services depends on other family members (e.g. father, mother in law, parents, etc.) ▪ Limited degree of access to and control over household resources limits women's capacity to act on her own and her child's behalf	Eng 1991; Coreil 1994; Bastien 1995; Li 2004; Renne 2006; Pool 2006; Topuzoglu, 2007; Oluwadare 2009; Schwarz 2009
Gender and social norms	▪ Disempowering gender roles limit mothers' access	▪ Women have to divide their time between maternal tasks (childbearing/rearing responsibilities), domestic tasks, diversified	Coreil 1994; Bastien 1995; Li

	to immunization services	livelihoods activities (productive tasks) and social tasks (attending sick family members, unexpected guests, etc) ▪ The consequences in terms of time management of maintaining balance between the different roles of women hinders access to immunization ▪ Although mothers are responsible for child health care, their socially subordinate role limits their access to health services	2004; Topuzoglu 2007; Schwarz 2009; Oluwadare 2009
	▪ Association of children diseases with maternal negligence or women insufficiency	▪ Blame on mothers for "negligence" or "insufficiency" in case of a sick child may limit their motivation to attend public health services	Bastien 1995; Coreil 1994; Li 2004; Topuzoglu 2007; Schwarz 2009
	▪ Domestic violence	▪ Marital discord and domestic violence have been cited as creating psychic overload that discourages women from thinking about non-essential things	Coreil 1994; Topuzoglu 2007
Poverty and Livelihoods	▪ When poverty leads to social exclusion, mothers access to immunization services is limited	▪ In contexts where poverty leads to social exclusion, social networks may be be too weak to assist mothers to take children to immunization, both financially and by allowing them to take some time off work ▪ Women from less well-integrated families often lack social connections that encourage clinic attendance ▪ Specific groups like migrant women are even more marginalized	Fassin 1986; Odebiyi 1993;Coreil 1994; Chaturvedi 2009; Oluwadare 2009
	▪ Mothers don't attend health services to avoid poverty induced shame	▪ Poor mothers avoid health services as they fear to be humiliated when they cannot dress themselves and their babies in clean clothes and/or when children are too thin	Fassin 1986; Coreil 1994; Schwarz 2009

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GENDER AND IMMUNISATION

Final Report on Case Studies

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Disclaimer

Abbreviations

ANC	Antenatal care
CDC	Centre for Disease Control
CI	Confidence interval
DHS	Demographic Health Survey
GAVI	Global Alliance for Vaccines and Immunisation
IVR	Initiative for Vaccine Research
MICS	Multiple Indicator Cluster Survey
OR	Odd Ratio
PATH	Program for Appropriate Technology in Health
SAGE	Strategic Advisory Group of Experts on Immunisation
Swiss TPH	Swiss tropical and Public Health Institute
TAG	Technical Advisory Group
TT	Tetanus Toxoid
UNDP	United Nations Programme for Development
UNVAC	Epidemiology of the Unvaccinated Child (Project)
WHO	World Health organisation

Table of Contents

1 Introduction

A part of the "Gender and Immunisation" project, the case studies come as a complement to the other lines of research within this project and aims at demonstrating the relevance of data from different sources and their utility in showing how they impact on the understanding of a specific problem at a national level.

The objective of the case studies was 1) to provide a multi-disciplinary view of trends and patterns in children immunization and 2) to assess the internal validity of our findings using different methods. Case studies were selected based on an analysis of key national indicators related to gender and child health. Countries with poor results on at least five of the major indicators were considered along with the demonstrative capacity of the case study. The selected case studies were Lao P.D.R and a comparison of two contrasted Indian States (Kerala and Rajasthan). The selection of the countries was done in consultation with WHO and TAG. Lao was selected as an example of a country with low coverage rate and high percentage of ethnic groups with low utilisation of services. Within India, Kerala and Rajasthan were selected representing two states with different vaccination rates.

For each case study, qualitative and quantitative information was drawn from the database of articles retrieved, and from additional hand and web-based searches. Literature that met the inclusion criteria was retained for the case study. For each case study, an analysis was done of the quantitative survey data using methods employed in the UNVAC project's quantitative review on barriers to immunisation[1]. For the qualitative literature, qualitative synthesis methods were used. The review of the literature was complemented by an analysis of surveys from India (DHS) and Lao (MICS). For the case studies, we analysed the attributable benefit of modifying factors that were shown to play a statistically significant role in childhood immunisation status in the country. Results of the findings from the various methods were then triangulated to systematically compare, refute or validate the findings in order to achieve a consistent line of argument.

Value of the triangulation method[2]

Our triangulation method consisted in analyzing findings of each method and having them validated or refuted through concurrent or competing findings of other methods.
Findings of MICS or DHS, quantitative studies and qualitative studies partially validate one another on immunization barriers related to socio-demographic characteristics, geographical situation, livelihoods and quality of service. Triangulation in this case, helps achieve some consistency in the overall patterns of data despite the variety of methods, sources and settings, and this adds to the credibility of findings.

[1] CDC, *Epidemiology of the unvaccinated child: findings from the peer-reviewed published literature*, 1999-2009: USA: 2009, 114 p.
[2] Humble Á.M. Technique Triangulation for Validation in Directed Content Analysis. *International Journal of Qualitative Methods* 2009;8(3).
[2] Denzin, N. *The research act*. Chicago: Aldine Publishing,1970.

Triangulation makes also a contribution to the subject by allowing for the expression of a wide variety of viewpoints. While quantitative data as captured by MICS and other local surveys in this report can help to demonstrate patterns of responses to standardized questions related to immunization access and utilisation, they can not provide the contextual basis for the response recorded in the questionnaire. The qualitative literature, though limited in generalisability, can complement survey findings and provide the detailed explanatory framework behind listed barriers found in quantitative studies by bringing in the voice of the population themselves. This triangulation, despite the limited data available, has offered a contextual understanding of key findings which one method alone may have under emphasized or misinterpreted.

2 Lao People's Democratic Republic

2.1 Introduction

Landlocked and predominantly mountainous, Lao People's Democratic Republic (P.D.R.) is one of the least developed countries, ranking 133 with a Human Development Index of 0.619. Its population of approximately 6.2 millions inhabitants (2008)[3], the lowest density of all countries in South East Asia (25 in 2007)[4], is comprised of some 49 ethnic groups. While the Lao lowland inhabitants are politically and culturally dominant, mountain and hills tribes encompass a wide variety of ethnic and linguistic groups. Hard-to-reach areas also happen to be the poorest of the country. Relatively low health infrastructure nationwide creates access challenges for midland and upland minorities. According to LECS3 (2004), 5% of the total population has to travel 8 hours or more to the nearest hospital. In rural areas without access to road, it is 20% of the population which have 8 hours or more to travel to the nearest hospital or health centre.

As the 2008 Lao MDG Progress Report point out that while Goal 4 "Reducing child mortality" seems within reach due to an overall improvement of child health indicators between 1995 and 2005, child immunization has yet to show such progress. Child immunization rate has remained constant over the last decade, at around 69%, and routine immunization programmes persistently fail to reach many children in remote rural areas, with vaccination coverage rates as low as 26% in the Oudomxay province and 29% in the Champasak province. In addition, children lacking immunization often also suffer chronic malnutrition making them even more disadvantaged. In addition, there are large urban-rural discrepancies in access to and utilization of health care services.

The availability of recent, sub-national and sex-disaggregated data is an issue and there seems to be a serious gap in high quality, internationally-reviewed research in English on the issue of children immunization in Lao PDR.

Methods

Using the Immunisation and gender project's systematic search results conducted in February 2010 we reviewed the database for quantitative and qualitative studies conducted in Laos PDR. This was complemented by a free Internet-based search for additional grey literature and additional background information on health and gender issues in the country. Key words were grouped around immunization, child health, and access to health services in Laos.
This search resulted in 15 documents: 7 were excluded for not meeting the quality criteria as established in the primary systematic review (See methods section of the Immunisation and Gender Qualitative Systematic Review). Of the remaining 8 papers, 2 contained qualitative data. In addition, an analysis of the Laotian MICS studies (2006) was conducted specifically for the case study, with a focus on barriers to immunization and gender-related factors.

[3] World Bank, Country Brief: Lao P.D.R.
[4] http://unstats.un.org/unsd/demographic/products/dyb/dybsets/2007%20DYB.pdf, p. 72

For the non-MICS survey studies, we elaborated descriptive summaries of qualitative data papers. After coding the studies in Atlas TI, data on barriers/factors were translated into comparable categories and inputted in an extraction form allowing for juxtaposition, systematic comparison and creation of connections between papers. Frequency of factors/reasons mentioned in studies as barriers were assessed through the grid presented in Annex 2.
With qualitative studies, we used grounded theory to code, and group results. Interpretation was facilitated by a gender theory-based framework of analysis developed for the project (See qualitative Review methodology for a description of the Framework).

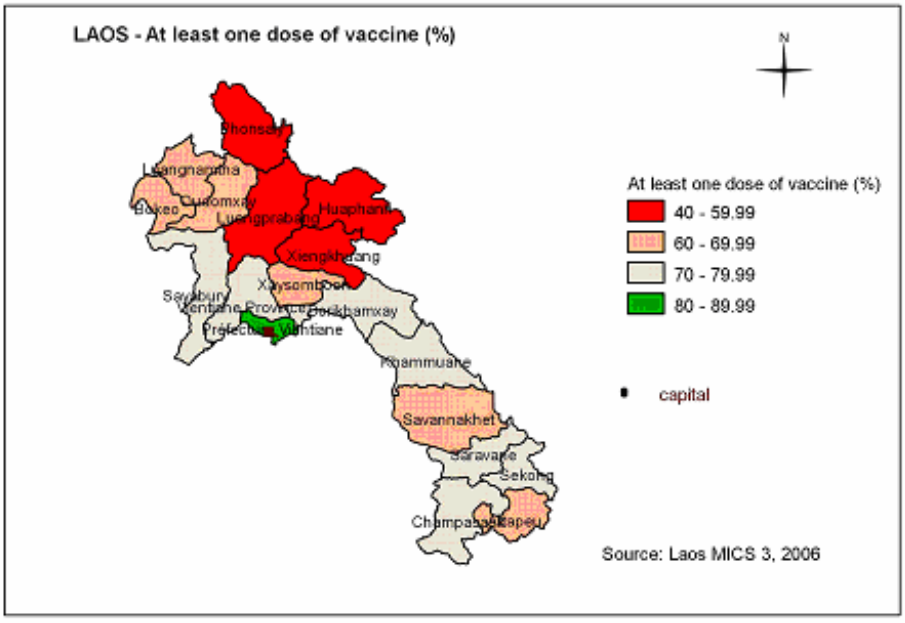
After completion of the individual analysis of the data, we triangulated by making systematic comparisons of the findings of the three methodologies, ranking factors by frequency of appearance and interpretation of qualitative data. We used Atlas TI for this process. This triangulation proved essential to identify and interpret gaps in the current state of the research in Laos.

2.2 Results

2.2.1 Multiple Indicator Cluster Survey (MICS)[5]

Regional coverage of child immunization

The map below represents the percentage of children under five who received at least one dose of vaccine by province in Laos. (The regional level taken into account in the MICS 3 embedded 16 provinces, one municipality and one special administrative zone, valid until 2006).



[5] Dataset, year: MICS 3, 2006. Outcome: C01 (at least one dose of vaccine versus unvaccinated)

The immunization coverage country-wide is variable: in four provinces in the north-east of the country, the levels are very low, between 42.31% in Phongsaly and 56.86% in Huaphanh. The north-west of the country is also below this threshold even if a little better off. Finally, only one province, i.e. Vientiane municipality which is an urban area including the capital is over 80% (87.31%). The centre and the south of the country also have insufficient immunization coverage.

The gap between the higher and lower coverage is about 45%, indicating high discrepancies between provinces. More generally, the immunization coverage in Laos remains too low and very inequitable between the provinces.

Logistics Regression Outcomes

- **Sex discrepancies in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to the sex of the child (male vs. female) in general and in subgroups where some sex differences may be expected i.e. in subgroups where mother or relatives' attitudes towards girls and boys' immunization might differ due to hardest living conditions.

OR linked with child sex in the following subgroups[6]:	**OR**	**CI**
Male vs. female*	**0.78**	**0.56 - 1.09**
Core variables**		
Among less educated women	0.69	0.45 – 1.05
Among the poorest	0.59	0.40 – 0.89
When woman received less than 2 doses of tetanus toxoid	0.90	0.61 – 1.33
Socio-demographic characteristics***		
Living in rural area	0.75	0.53 – 1.07
Woman lives alone	0.36	0.09 – 1.39
Access to information***		
Has no TV	0.89	0.58 – 1.36
Has no radio	1.24	0.61 – 2.50

NB: No information about Women's empowerment in Laos DPR is available in MICS

The overall OR linked with child sex is below 1, i.e. boys are less vaccinated than girls but the relation is not significant. When looking at the different subgroups, the lower immunization remains for boys but this disadvantage can be more or less important according to the subgroups. The boys are particularly less likely to get at least one vaccine among women living

[6] * *Multivariable with only core variables*. E.g. Model x : α + **β Sex** + β Edu + β Edup + β TT
** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + **β Sex* Edu**
*** *Multivariable with core variables, gender variables and an interaction*
E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ **β Sex* TV**

alone (OR=0.36), but the association is not significant. It seems that in this subgroup, mothers tend more particularly to favour the girls rather than the boys who seem to suffer from a gender inequality.

- **Mother's education differences in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to mother's education (more educated vs. less educated) in general and in subgroups where the effects of a lack of education on child immunization can be intensified i.e. in subgroups where the living conditions can be more precarious.

OR linked with mother's education in the following subgroups[7]:	**OR**	**CI**
Most educated vs. less educated mother*	**2.47**	**1.65 - 3.67**
Core variables**		
Among girls	2.13	1.28- 3.54
Among the poorest	3.07	1.78 – 5.30
When woman received less than 2 doses of tetanus toxoid	2.55	1.54 – 4.24
Socio-demographic characteristics***		
Living in rural area	2.43	1.57 – 3.74
Woman lives alone	2.18	0.15 – 32.42
Access to information***		
Has no TV	2.79	1.51 – 5.17
Has no Radio	2.11	0.95 – 4.70

Education level of the mother is highly associated with child immunization: the OR is 2.47 when taking into account the core variables and the relation is significant.
When looking at the different subgroups, this relation is maintained and quite similar which suggest that in Laos, children of the most educated women are far more advantaged in comparison with children whose mother are the least educated, especially when living conditions can be less favourable.

- **Effect of having at least 2 doses of tetanus toxoid on immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to the mother's tetanus toxoid (TT) status (at least two TT vs. less than two TT) in general and in subgroups where the mother's TT status can be less favourable, i.e. in subgroups leading to more difficult living conditions.

[7] * *Multivariable with only core variables*. E.g. Model x : α + β Sex + **β Edu** + β Edup + β TT
** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + **β Edu* Edup**
*** *Multivariable with core variables, gender variables and an interaction*
E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ **β Edu* TV**

OR linked with the tetanus toxoid status of the mother in the following subgroups[8]:	**OR**	**CI**
At least 2TT vs. less than 2TT*	**3.27**	**2.23 - 4.81**
Core variables**		
Among girls	4.09	2.42 – 6.91
Among the poorest	2.61	1.59 – 4.27
Among less educated woman	3.45	2.00 – 5.95
Socio-demographic characteristics***		
Living in rural area	3.73	2.44 – 5.70
Woman lives alone	3.42	0.38 – 30.59
Access to information***		
Has no TV	2.92	1.71 – 5.00
Has no Radio	2.80	1.31 – 5.97

NB: No information about Women's empowerment in Laos DPR MICS

The mother's TT status is highly associated with being vaccinated as a child: when only taking into account the core variables, the OR is 3.27 and significant.
In the different subgroups this strong association remains, especially among girls (OR=4.09) i.e. when women got at least 2 doses of TT, both girls and boys highly received at least one dose of vaccine but girls often received at least one.

As in the most of the countries, when the mother's TT status is better, they are more disposed to vaccinate their children, either because these mothers are particularly aware of the child's need to get vaccine, or as they received the TT during the ANC, they are particularly encouraged to do the same for their child. In any case, the TT status of the mother in Lao is a key component of the child immunization enhancement.

- **Wealth inequities in immunization in different subgroups**

The table below shows the likelihood (Odds Ratio = OR) to be vaccinated according to the wealth (richest vs. poorest) in general and by subgroups, controlling for the effects of the other core variables.

[8] * *Multivariable with only core variables*. E.g. Model x : α + β Sex + β Edu + β Edup + **β TT**
** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + **β TT* Edu**
*** *Multivariable with core variables, gender variables and an interaction*
E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ **β TT* TV**

OR linked with child sex in the following subgroups[9]:	OR	CI
Richest vs. poorest*	**1.12**	**0.77 – 1.62**
Core variables**		
Among girls	0.81	0.49 – 1.35
Among less educated women	1.41	0.87 – 2.29
When woman received less than 2 doses of tetanus toxoid	0.95	0.58 – 1.57
Socio-demographic characteristics***		
Living in rural area	1.09	0.72 – 1.65
Woman lives alone	0.14	0.01 – 2.32
Access to information***		
Has no TV	1.08	0.65 – 1.78
Has no Radio	0.82	0.36 – 1.89

When taking into account only the core variables, the association between wealth and immunization in Lao does not appear very strong nor significant. This low association is confirmed when looking at the different subgroups, OR being near 1. However, among the subgroup of less educated women, the OR is higher than when only considering the core variables meaning that these women pay particular attention to their children's vaccination, which seems to offset the effects of low educational status

Scenario computations

At last, scenario computations were performed to estimate benefits of different intervention scenarios (see Annex 3).

For Lao, maternal TT-coverage and higher maternal education were highly significant predictors of child vaccination. We tried to predict the impact of a general rise in the maternal TT-immunisation coverage rate. According to the parameters of this scenario, the likelihood of a child to get vaccination would rise to 81% from an original level of 58%.

We also tried to predict what the impact of an increase in the rate of higher maternal education to at least 75% across all clusters might be. The respective overall gain was small, however, with a rise in the vaccination coverage rate to 64%.

Conclusions

- **High percentage of unvaccinated children with large disparities within the country**
- **Possible sex discrepancies favourable to girls**
- **Importance of mother's education**
- **Importance of mother's tetanus toxoid status**
- **Wealth not strongly associated with child immunization**

[9] * *Multivariable with only core variables*. E.g. Model x : α + β Sex + β Edu + β Edup + β TT+ **β WI**

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI+ **β WI* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT+ β WI + β TV+ **β WI* TV**

2.2.2 Quantitative literature review

Characteristics of studies

The review included 8 studies published between 2007 and 2010. The characteristics of included studies are described in Annex 1. Out of the 8 documents included in the review, 6 are quantitative studies and 2 are quanti-qualitative (Katz and Phimmasane).
The results of the translation of quantitative data into comparable categories and their systematic comparison are presented in the table in Annex 2. This table also presents the frequency of appearance of barriers/factors among reviewed studies.
The quantitative studies predominantly mention barriers to children immunization in four broad categories, ranked by frequency as follows: knowledge, awareness and information; socio-demographic factors; geographical and physical accessibility; and finally obstacles related to the functioning of the immunization service (quality of service).

Knowledge, awareness and information barriers

In studies, levels of knowledge and awareness of care takers related to immunization practice are strongly correlated with the status of children's vaccination.
Mothers' knowledge is the most frequently mentioned factor affecting children's immunization. Studies frequently report an overall lack of understanding by the population of an immunization program such as the general benefit of vaccination for the child's health (Maekawa), or the use of the vaccination card (Katz), the target diseases of immunization, the vaccination schedule (Maekawa, Tokizawa) or the place of vaccination (Mayxay).

The mothers' "perception" of vaccination plays a key role in their attitude towards immunization (Phouphenghack, Shiyalap, Tokizawa, Phimmasane). Favourable perception by mothers of the immunization program is correlated with a completed immunization of the child (Phouphenghack). Perceptions by mothers of the nearest vaccination place and of the appropriate time to get the vaccination influence their choice to make use of this health service (Shiyalap). But perceptions of the inefficacy (Phimmasane) or danger (Phouphengack) of vaccines deter parents from taking their children to vaccination.

Sources of information on immunization significantly influence the practice of immunization depending on whom the informant is and on when the information is provided. Friends, relatives or key persons are often cited as informants whose advice or encouragements are positively correlated with a higher compliance to immunization (Masuno, Phimmasane, Phouphenhack).
Household visits by health staff also significantly influence the rate of fully immunized children in Maekawa's study while in Phoupheghack' study, mothers of fully immunized children predominantly received information from village leaders. Receiving information on immunization before delivery is reported by Maekawa to significantly influence the rate of fully immunized children.

Socio-demographics factors

Most quantitative studies included mothers as their sample subgroup, and thus correlate mother-related socio-demographic factors to the immunization status of children. Phimmasane's study is a notable exception because it conducts a sex-disaggregated analysis of both mothers' and

father's education and reports on the impact of father's education on the immunization status of children.

Education is one of the factors most frequently reported by studies (Masuno, Maekawa, Phoupehghack). As stated by Masuno (2009), children born to women with higher education are more likely to be protected against tetanus at birth. For Shiliyap, education of mothers is linked with their occupation as women with higher education would seek for/access more EPI information and bring their child to get vaccination more often. Maternal occupations that afford mother's more time is also a factor contributing to higher immunization of children (Shiyalap). In the case of Tokizawa, employment plays an important role as it gives women the opportunity to talk about immunization or children's diseases at their workplace. However, mother's occupation is not correlated to a higher immunization rate in Phouphenghack's study.

No significant correlation between income and immunization is shown by Mayxay, Phouphenghack, and Maekawa. However, in the latter study, the possession of livestock – which one can consider as a sign of economic wealth - is significantly associated with a higher immunization status of the child. Mother's willingness to pay at some stage (transport costs for example) in the immunization process is presented as an influential factor of full immunization (Maekawa).
Similarly, Phimmasane and Shiyalap show a positive association between income and immunization of children.
Studies also show that the younger age of mothers favourably influences a fuller immunization status of children (Phouphengack, Masuno, Shiyalap).

The number of children tends to affect the status or level of children immunization in different ways. Death of a child in the past would favour a care-seeking behaviour among women (Masuno). Mayxay's findings show that families were measles cases were reported tend to be larger than controls. Shiyalap also reports that mothers who had 1 to 2 children tend to complete the immunization of these children more frequently than mothers with larger families. However, Phouphenghack does not acknowledge a correlation between the number of children alive per mother and the number of children who received vaccination.

Geographical and physical accessibility factors

Distance has been identified as a factor impacting the status of child immunization (Maekawa, Shiyalap). Spatial factors were expressed in terms of zone of residence (Maekawa) proximity to a health facility and access to the immunization site (Maekawa).
The mode or costs of travelling to the vaccination place (Shiyalap, Phimmisane) were also associated with the utilization of immunization services by mothers.
Fixed health centres are positively associated with a higher and more complete immunization status of children according to Phouphenghack. But in Maekawa's study, the sites of immunization as well as the means of transport to immunization site are not associated with the immunization status.
Only in Masumo's study was distance not associated with immunization status but this may be explained by the geographical location of the study, in the capital province where health facilities are accessible by car/bus.

Maxay reported that the second most frequent reason for not taking children to vaccination was the inaccessibility of medical staff to the village.

Quality of immunization service

Factors linked to the delivery of immunization service stress the lack of timeliness of the vaccination programme. From the demand side, it often happens that the population is generally unaware of the vaccination schedule. The waiting time at the health facility is frequently perceived as a factor for non-vaccination (Phimmasane, Shiylap). There is a common perception that opening hours of health facilities and schedule of vaccination are conflicting with the (mostly agricultural) activities of the population (Katz, Phimmasane). Mothers and caretakers of children often claim to be too “busy” to take the children to vaccination (Shiyalap, Tokizawa).

The general attitude of health staff, such as their readiness to provide the service and the courtesy of vaccinators, affects the willingness of mothers to vaccinate their children. (Katz, Phouphenghack, Shiyalap).

From the immunization service side, studies reports that lack of motivation and incentive for health workers to provide quality immunization service as well as a lack of medical supplies negatively impact the immunization coverage (Katz, Phimmasane). Effective coordination, strong leadership and a better integration of health services are still missing to ensure an increase in coverage. (Katz, Phimmasane).

Conclusion

The findings reported by quantitative studies bring forward socio-demographic characteristics, accessibility factors and knowledge issues. While the data collected is of crucial importance to identify the overall pattern of immunization among the population, surveys were mostly descriptive except the one PhD thesis (Phouphenghack) which contained some analysis and interpretation of the author. All samples of reviewed surveys are sub-national and therefore the findings are not nationally representative.

In addition, surveys are usually gender-biased by selecting predominantly mothers as respondents. When survey samples include both parents, reported data is usually not sex-disaggregated (Katz, Mayxay). One exception to that is Phimmasane’s study which puts both mothers’ and fathers’ education in perspective. Other gender or cultural aspects, such as ethnicity or traditional health practices, are left unexplored by these quantitative studies.

2.2.3 Qualitative review

Qualitative studies on immunization in Laos were not found by our systematic search which underscores a gap in research in this area. Two studies out of the 8 included in the review are of a quali-quantitative nature and their findings are analyzed in this qualitative review.

5 major barriers to immunization emerged from the interpretive analysis of both papers.

- **Cultural issues**

Culture can act as a multifaceted barrier to immunization. In the context of Laos where a wide array of ethno linguistic minorities coexist, the way immunization messages are designed and conveyed by health staff is not always culturally appropriate, not only because of language barriers but also due to content which can be irrelevant or conflicting with specific ethno medical beliefs of minorities. Obstacles reported by studies include information campaigns in the language of the dominant ethnic group or outreach health staff with limited language skills to explain their mission.

> The rural population, steeped in traditional culture, is not accessible to messages using Western-style arguments. The demographic diversity justifies non-standard approaches, adapted to the cultural specificities of each ethnic group. Involvement of anthropologists in the design of public health programs would make health messages more understandable, leading to a better appropriation by the population. (Phimmasane, 2010, p.6728)

Likewise, Katz mentions:

> "[the] difficulties for ethnic minorities to receive immunization information in a language that they can understand and according to their own cultural beliefs" (Katz, 2007 p.9)

Ethno medical beliefs of the population often determine the cultural acceptability of a practice from Western medicine such as vaccination. Misperceptions, rumors and fears of the immunization perpetuate the population's mistrust and scepticism of Western medicine where traditional medicine is the norm. That is why many mothers report that "fever after vaccination" - that the child will fall sick- as a barrier to children immunization.

Gender inequalities that exist within the society can act as a barrier to immunization. Women occupy a quite contrasted position: they are often disadvantaged in decision making and health practice while being at the same time the primary care-giver of children.
However, studies rarely report how this gender inequality could be mitigated by emphasizing the role of fathers as decision-makers in Laos.

> The factor "education of the father" seems related to the traditional Lao culture: as chief of family, the father makes all decisions, including vaccination of children. Other studies have emphasized the importance of the educational level of the mother, but these investigations were focused on mothers of children targeted for vaccination. (Phimmasane, 2010, p.6728)

- **Lack of Information and knowledge**

The availability of information on immunization is rather limited in mass media and usage of the radio - the most convenient way to reach out to remote areas- to raise awareness on vaccines is low.
At the level of the community, awareness of immunization practices and rationale is often very low. Both village leaders and parents often do not know the value of immunization and ignore basic elements such as schedule of vaccination and use of the vaccination card. Even local health workers are uninformed about immunization. And yet, Katz reports that despite the barriers, the community has the wish to be more active in its own health but feels disempowered to do so.

- **Quality of service issue**

A major determinant of vaccination is the quality of service as reflected by the provider's attitude, motivation and general lack of incentive to deliver a quality service.

We are very unhappy about the health services provided at the Province level... if you have money you get a good service but if you are poor they scream at you and are very rude.... (village leader, Donmai Village, Luang Prabang District)- Katz, 2007, p.49

We noticed a change in the health workers at the sub-district health centre, they are warm and welcoming and explain clearly... but at the district level they say bad words and shout at the mothers (Mother, Thapho Village, Phonxay District)- Katz, 2007, p.46

We are not very satisfied with the results of the health worker training; maybe the trainers need more support to implement this activity. (health worker, Luang Prabang District)-Katz, 2007, p.46

The quality of service also suffers from a relatively poor overall coordination of services, particularly in the area of scheduling and organization of services. Poor management and lack of support from the leadership also affect the health workers' motivation as well as the overall quality of the service. Studies report a lack of capacity and training among health workers to make proper assessments of a situation and consistent decisions. Technical bottlenecks also affect the service provision:

The main factors affecting the provision of care are inadequate supply of vaccines and diluents, discontinuity of the cold chain, poor training of health workers regarding their vaccination tasks and inability to perform them. (Phimmasane, 2010, p.6728)

We had a lot of trouble to implement the fixed site strategy so far because we didn't have the time and we didn't coordinate the cold chain well... we need more time to improve... we believe we can improve ...we think the Phakham Village health centre can cover 8 villages .....and we will try to strengthen the management and support the sub-district health centre in the future (health worker, Luang Prabang District)- Katz, p.49

- **Poverty – Livelihoods**

Studies report poverty and conflicting priorities linked to seasonal work commitments as barriers to children immunization.

> *In our village we don't think peer education will work because the people are too busy…they didn't listen to each other... posters are the best for our village... (mother, Phakham Village, Luang Prabang District)*- Katz, 2007, p.47

- **Power**

The issue of power emerges from the tensions between knowledge, information, access to and demand for health care. Possessing and sharing information imply aspects of control over individuals in demand for this information. Lack of knowledge on immunization is presented as a disempowerment at the village level where people feel no ownership of the management of their own health.

> Leaders and villagers in Lao PDR want to be active in their own health and wellbeing, but they face competing priorities and language barriers; and lack the knowledge, skills, confidence and power to take a more active role in their own health and the health of their constituents. Katz, 2007, p.2

State representatives at the local level demonstrate quite a low level of leadership by being unaware of needs of the population and of the value of immunization.
While Phimmasane reports "a lack of coordination and a limited capacity to assess needs and make coherent decisions", Katz mentions the lack of coordination of health services between district and sub-district leaders, a lack of understanding of the importance of vaccination by those very same leaders, as well as non functional structure for the service organization (such as the District Committee for Mother and Children – DCMC). Sub-national state representatives themselves do not encourage trust in the service.

Our interpretation of the findings above suggests that the low investment of the State into effective service at the periphery level shows the relative lack of political will of the authorities to reach out to marginalized communities and offer equal access to health services. The way information on immunization is conveyed, devoid of any cultural sensitivity, could be interpreted as indifference to or neglect of cultural differences. In that sense, knowledge and information on immunization and health in general are tightly associated to power and control of resources by the majority ethnic group at a cost in terms of health and knowledge by ethnic minorities.

Data from qualitative studies were obtained from sub-national investigations and are not nationally representative.

- **Gender barriers identified in all studies**

The review eventually identified only a limited number of explicitly stated gender barriers to immunization.

Gender inequality is most apparent as the disempowerment of women within their families to make decisions concerning their own health and the health of their children, despite being assigned to the role of primary care-giver in the family.

MICS analysis associates mothers' TT status to a higher compliance with children's vaccination. This aspect also raises the issue of women's control over her own health, the possibility they have to make decisions concerning her own health and the control over resources (economic situation, possibility of travelling long distance to the health facility) to allow her to enact her decisions.

MICS and quantitative studies emphasize the impact of women's education on the status of children immunization. Women's traditionally lower position in society is also associated with lower education for women. Gender inequality in access to education also acts as a barrier to children immunization.

As many studies report the lack of time of women to take their children to immunization, one can identify the "double burden" on women, who have responsibility for both domestic labour, i.e. family care, and agricultural work or other economic generating activity for the family.

2.3 Discussion

Review of the limited data available is conflictual. While the MIC Survey suggests a strong correlation between mothers' TT status and children's vaccination status, several quantitative studies downplay the impact of antenatal care on children's immunization.

As sex-disaggregated data and research on health and gender in Lao are still lacking, it seems that the current state of research may create its own gender bias in the analysis of immunization practices in the country, by focusing research questions primarily on mothers' characteristics without contextualizing them to the position of women in Laotian society.

With one notable exception, all quantitative surveys were exclusively conducted among mothers, thereby correlating quite expectedly mothers' characteristics -such as education- and immunization compliance. The voice and considerations of fathers are strikingly missing from current research which perpetuates the idea that mothers are primarily responsible for children's health and immunization. And yet, the qualitative literature emphasizes women's disempowerment in her ability to make decision in their family or community. The gender bias towards child health must be addressed by including men, families and communities when designing immunization outreach strategies.

Surveys and qualitative studies concur reporting issues of time and availability of women as barriers to children vaccination. Constraints occur for women when they are at the same time responsible for housework including child care and engaged into economic activities. The "double burden" on women, a well-documented[10] phenomenon by gender analysis, would require that the

[10] Himmelweit S., Rethinking care, gender inequality and policies. United Nations Division for the Advancement of Women, 2008, 16 p. Badgett M.V.L and Nancy Folbre. Assigning care: Gender norms and economic outcomes Assigning care: Gender norms and economic out 1999, 138 (3).

delivery of immunisation service be adapted to women's time constraints, such as the seasonal pick of agricultural work (Katz) or late opening hours.

In addition, one needs to deconstruct this systematic association between education and knowledge. While access to education is an important barrier for Laotian women, branding education as the remedy to low rates of children immunization overlooks other factors at stake in the individual and collective assessment and negotiation of the immunization practice. The actual knowledge of vaccines, diseases and immunization depends at least as much on personal experience of immunization and health service, traditional beliefs and cultural acceptability. Programme managers need to consider women's knowledge rather than education alone as an important barrier that could be better understood and possibly overcome if framed in terms of access to information, cultural acceptability and power.

In the case of Laos, multi-level power dynamics interact and define possibilities and constraints for women. Power relationship between men and women, framed within power relationship between state and communities, creates differential constraints on men and women.
The way immunization information is conveyed and immunization service is delivered reinforces constraints pertaining to ethnicity, geographic location (rural populations) and gender. Immunization messages are communicated in non-culturally sensitive ways; services are organised irrespective of rural workload, and the attitudes of service providers often lack basic respect for women challenged to access their services. When services do not take the particular place of Laotian women in account, they can perpetuate the marginalization of rural women from ethnic minorities.

According to these studies, low immunization trends in Lao affect indifferently boys and girls. While gender constraints exist in Lao relative to mother's autonomy and position in society, the ethnic factor seems to weigh more than gender inequality to account for low immunization rate in Lao.

Limitations

The limitations of our review lay are the limited number of available quantitative and qualitative studies, thereby showing a gap in current health research in Lao. More sex-disaggregated data is needed to explore additional gender constraints on immunization. Issues of health and ethnicity in Lao are clearly insufficiently researched and our review had to adapt to the scarcity of available information.
There is a need to go beyond the simple quantification of barriers to achieve better immunization rates.

3 India: Kerala vs. Rajasthan

3.1 Introduction

Ranking 134th out of 182 countries in terms of Human Development Index, India presents sharp internal contrasts of development across its states.

Rajasthan, located in north-western India, is the largest state in the country in terms of geographic area. The dispersed settlement pattern of its 56 million inhabitants with a density of 165/km^2 (national average: 313)[11] makes reaching all children in the region a challenge. In Rajasthan, 25% of children receive full immunization and this state finds itself in a group of low performing Indian states where between 20% and 45% of 12-23 month children do not receive a single vaccination[12].

Kerala, a south-western state of India, is often cited as a "model" which combines a relatively low economic development with high standards of human development, reflected in the high levels of education and health of its population. While inequalities and developmental challenges remain, Kerala has an infant mortality of 14 (while the national average is 58)[13] and its immunization coverage is scoring rather high (in 2006-2007, 92.8% coverage for D.P.T, 88.1 for measles, and 77.9 for TT (5 years)[14].

As stated by Arokiasami (2004), "the sex differentials in child mortality in the northern states of India are amongst the highest ever recorded in demographic history "while "Kerala and Tamil Nadu in the southern region are the only two states where no evidence of excess female child mortality was found".

Our present study, based on DHS analysis, quantitative and qualitative literature review, examine the various factors impacting immunization coverage of children in these two States and the potential gender-related barriers to vaccination.

3.2 Methodology

The Demographic and Health Survey for India[15] was analysed using logistics regression to assess the sex discrepancies in immunization in both States as well as the variations in the likelihood to be immunized according to certain variables.

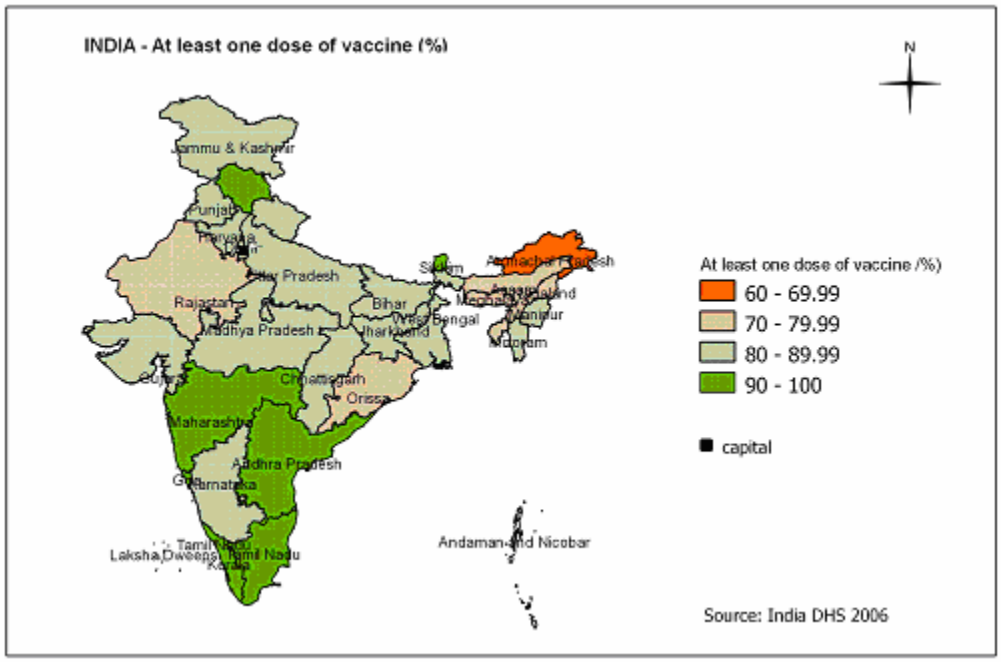
[11] *Government of India (2001)*. Census of India. http://www.censusindia.gov.in/Census_And_You/area_and_population.aspx.
[12] Suresh Sharma, 2007.
[13] Government of Kerala, Economic review 2007, Chapter 12, p.360
[14] Government of Kerala, Economic review 2007, appendix – 12.5-6.
[15] Dataset, year: DHS 2006; Outcome: C01 (at least one dose of vaccine versus unvaccinated)

Quantitative and qualitative literature was reviewed to map out factors and gendered barriers affecting children immunization.
A systematic literature search for this project (See the Qualitative Systematic Review for a complete description of the systematic search methodology) that built on the results of the previous UNVACC, as well as a free search for additional grey literature yielded a total of 60 papers. Out of these, 32 were excluded as either off-topic, for because they focused on different states or the national level. However, articles with national geographical coverage, using National Survey as primary data, but providing detailed analysis of either Rajasthan or Kerala were included in the review which finally comprises 28 studies.

3.3 Results

3.3.1 DHS

The map below represents the percentage of children under five who received at least one dose of vaccine by state in India.



Twenty-two of the twenty-nine Indian states reach a percentage of children with at least one dose of vaccine higher than 80%, the average in India being 85.6%. Among these states, several have a percentage higher than 90%, mainly states in the south of the country. Kerala is one of these states.

Nevertheless, six states have a percentage between 70% and 79.99% and one has a percentage of 63.9%. These lower percentages are especially located in the north-eastern part of the country, between Bangladesh and China. Nevertheless Rajasthan, which shares its boundaries with Pakistan, stays also below the average.

3.3.1.1 Kerala

Logistics Regression Outputs

- **Sex discrepancies in immunization in different subgroups**

The table below shows the likelihood (Odds Ratio = OR) to be vaccinated according to the sex of the child (male vs. female) in general and by subgroups, controlling for the effects of the other core variables.

OR linked with child sex in the following subgroups[16]:	**OR**	**CI**
Male vs. female*	**0.49**	**0.16 – 1.48**
Core variables**		
Among less educated women	0.50	0.4 – 6.24
Among less educated woman's partner	NC	NC
Among the poorest	NC	NC
When woman received less than 2 doses of tetanus toxoid	NA	NA
Socio-demographic characteristics***		
Living in rural area	NA	NA
When the sex of the head of the household is a woman	0.66	0.10 – 4.17
Woman lives alone	NA	NA
When there is a large age difference in the couple	NC	NC
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	0.31	0.03 – 3.08
Woman agrees that neglecting children justifies beating	0.55	0.05 – 6.19
Woman agrees that arguing partner justifies beating	1.08	0.06 – 17.78
Woman does not decide on health care for herself	0.40	0.03 – 4.55
Woman does not decide on how money is used	NA	NA
Woman does not decide on daily purchase	0.88	0.05 – 14.58
Health provider is not a woman is a problem	NC	NC
Distance to health facility is a problem	0.93	0.05 – 16.72
Access to information***		
Has no TV	0.14	0.02 – 1.18
Has no Radio	0.44	0.04 – 5.05

[16] * *Multivariable with only core variables.* E.g. Model x : α + **β Sex** + β Edu + β Edup + β TT+ β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI+ **β Sex* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT+ β WI + β TV+ **β Sex* TV**

When taking into account only the core variables, the OR is equal to 0.49 meaning that boys are less likely to receive at least one dose of vaccine than girls. In the most of the subgroups, the trend seems rather favourable to girls.

Nevertheless, it is difficult to strongly conclude that there are sex discrepancies within subgroups and to understand the shape of sex discrepancies in Kerala. As there are too few observations in the different subgroups, OR are never significant and confidence intervals can be quite large, making the interpretation of these findings difficult. Moreover, in several subgroups it is not possible to estimate the OR.

- **Mother's education differences in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to mother's education (more educated vs. less educated) in general and in subgroups where the effects of a lack of education on child immunization can be intensified, i.e. in subgroups leading to a lack of women's empowerment or where the living conditions can be less comfortable.

OR linked with mother's education in the following subgroups[17]:	**OR**	**CI**
Most educated vs. less educated* mother	**5.08**	**1.07 – 24.13**
Core variables**		
Among girls	5.11	0.47 – 55.82
Among less educated woman's partner	2.13	0.11 – 41.20
Among the poorest	NC	NC
When woman received less than 2 doses of tetanus toxoid	NA	NA
Socio-demographic characteristics***		
Living in rural area	NA	NA
When the sex of the head of the household is a woman	10.75	1.25 – 92.24
Woman lives alone	NA	NA
When there is a large age difference in the couple	NC	NC
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	NC	NC
Woman agrees that neglecting children justifies beating	NC	NC
Woman agrees that arguing partner justifies beating	NC	NC
Woman does not decide on health care for herself	NC	NC
Woman does not decide on how money is used	NA	NA
Woman does not decide on daily purchase	NC	NC
Health provider is not a woman is a problem	NC	NC

[17] * *Multivariable with only core variables*. E.g. Model x : α + β Sex + **β Edu** + β Edup + β TT + β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI + **β Edu* Edup**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ β WI + **β Edu* TV**

Distance to health facility is a problem	NC	NC
Access to information***		
Has no TV	2.88	0.44 – 18.67
Has no Radio	NC	NC

As with sex discrepancies, the there were two few observations in the subgroups resulting in large confidence intervals and making the results meaningless.

Nevertheless, when focusing on the general OR, it appears that children whose mother is most educated are far more likely to get at least one dose of vaccine than children whose mother is least educated (OR = 5.08). In subgroups for which information are available, the same trends are observed showing that mother's education may be a key factor of child immunization in Kerala.

- **Partner's education differences in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to partner's education (more educated vs. less educated) in general and in subgroups where the effects of a lack of partner education on child immunization can be intensified i.e. in subgroups where women suffer from a lack of empowerment or are less able to be emancipated.

OR linked with partner's education in the following subgroups[18]:	**OR**	**CI**
Most educated vs. less educated partner*	**0.82**	**0.13 – 5.22**
Core variables**		
Among girls	NC	NC
Among less educated woman	0.43	0.3 – 6.34
Among the poorest	NC	NC
When woman received less than 2 doses of tetanus toxoid	NA	NA
Socio-demographic characteristics***		
Living in rural area	0.81	0.12 – 5.38
Sex of the head of the household is a woman	NC	NC
Woman lives alone	NA	NA
There is a large age difference in the couple	NC	NC
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	1.37	0.10 – 17.85
Woman agrees that neglecting children justifies beating	NC	NC
Woman agrees that arguing partner justifies beating	11.08	0.52 – 236.68

[18] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + β Edu + **β Edup** + β TT + β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI + **β Edup* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ β WI + **β Edup* TV**

Woman does not decide on health care for herself	NC	NC
Woman does not decide on how money is used	NA	NA
Woman does not decide on daily purchase	NC	NC
Health provider is not a woman is a problem	NC	NC
Distance to health facility is a problem	1.42	0.06 – 34.26
Access to information***		
Has no TV	0.80	0.12 – 5.25
Has no Radio	NC	NC

When only taking into account the core variables, the children whose mother's partner is most educated are less likely to received at least one dose of vaccine (OR=0.82) (are more vaccinated) than those whose mother's partner is least educated.

However, OR associated with partner's education have the same issue as those associated with mother's education and the sex of the child: large confidence intervals due to few observations make analysis meaningless. Moreover, by contrast with mother education, the association can be in favour of the children whose mother's partner is either most educated or least educated, the direction of the association not being systematic. So, it is not really possible to come to a conclusion concerning the relation between partner's education and child's immunization.

- **Effect of having at least 2 doses of tetanus toxoid on immunization in different subgroups**

No information available for Kerala

- **Wealth inequities in immunization in different subgroups**

The table below shows the likelihood (Odds Ratio = OR) to be vaccinated according to the wealth (richest vs. poorest) in general and by subgroups, controlling for the effects of the other core variables.

OR linked with child sex in the following subgroups[19]:	**OR**	**CI**
Richest vs. poorest*	**0.57**	**0.052 – 6.22**
Core variables**		
Among girls	NC	NC
Among less educated women	0.88	0.60 – 12.91
Among less educated woman's partner	1.12	0.06 – 20.90

[19] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + β Edu + β Edup + β TT+ **β WI**

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI+ **β WI* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT+ β WI + β TV+ **β WI* TV**

When woman received less than 2 doses of tetanus toxoid	NA	NA
Socio-demographic characteristics***		
Living in rural area	0.44	0.04 – 5.09
When the sex of the head of the household is a woman	NC	NC
Woman lives alone	NA	NA
When there is a large age difference in the couple	NC	NC
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	NC	NC
Woman agrees that neglecting children justifies beating	NC	NC
Woman agrees that arguing partner justifies beating	NC	NC
Woman does not decide on health care for herself	NC	NC
Woman does not decide on how money is used	NA	NA
Woman does not decide on daily purchase	NC	NC
Health provider is not a woman is a problem	NC	NC
Distance to health facility is a problem	NC	NC
Access to information***		
Has no TV	0.42	0.04 – 4.37
Has no Radio	NC	NC

OR associated with wealth indexes have the same issues as those associated with mother's education, sex of the child or partner's education. Too few observation yields large confidence intervals and thus insufficient power for a meaningful analysis.

Nevertheless, in subgroups where OR is computable it seems rather that children belonging to richest households are less likely to get vaccinated than those belonging to poorest households. This finding is supported by the general OR associated with wealth which is lower than one (OR=0.57) but none of the OR is significant.

Conclusions

- **High percentage of children having received at least one dose of vaccine**
- **Possible sex discrepancies favourable to girls**
- **Importance of mother's education**

3.3.1.2 Rajasthan

Logistics Regression Outputs

- **Sex discrepancies in immunization in different subgroups**

The table below shows the likelihood (Odds Ratio = OR) to be vaccinated according to the sex of the child (male vs. female) in general and by subgroups, controlling for the effects of the other core variables.

OR linked with child sex in the following subgroups[20]:	**OR**	**CI**
Male vs. female*	**1.14**	**0.67 – 1.81**
Core variables**		
Among less educated women	1.09	0.71 – 1.99
Among less educated woman's partner	0.83	0.44 – 1.53
Among the poorest	1.19	0.66 – 2.16
When woman received less than 2 doses of tetanus toxoid	1.06	0.59 – 1.88
Socio-demographic characteristics***		
Living in rural area	1.16	0.65 – 2.06
When the sex of the head of the household is a woman	NC	NC
Woman lives alone	0.40	0.02 – 6.76
When there is a large age difference in the couple	1.09	0.19 – 6.40
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	0.97	0.46 – 2.05
Woman agrees that neglecting children justifies beating	1.37	0.64 – 2.97
Woman agrees that arguing partner justifies beating	1.27	0.79 – 3.41
Woman does not decide on health care for herself	0.95	0.25 – 3.60
Woman does not decide on how money is used	1.34	0.17 – 10.80
Woman does not decide on daily purchase	0.92	0.38 – 2.25
Health provider is not a woman is a problem	0.70	0.33 – 1.48
Distance to health facility is a problem	0.81	0.44 – 1.49
Access to information***		
Has no TV	1.11	0.62 – 1.99
Has no Radio	1.10	0.62 – 1.98

[20] * *Multivariable with only core variables.* E.g. Model x : α + **β Sex** + β Edu + β Edup + β TT+ β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI+ **β Sex* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT+ β WI + β TV+ **β Sex* TV**

In Rajasthan, when only looking at the core variables, the OR of 1.14 means that boys are more likely to be vaccinated than girls, this result being not significant.
When looking at the different subgroups, OR can be favourable either to girls or to boys but are often near 1, meaning that the sex discrepancies in these subgroups are not very strong. Moreover, confidence intervals always contain the value of 1 and can be more or less large, entailing that the association between the sex of the child and his / her immunization status is not significant.

- **Mother's education differences in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to mother's education (more educated vs. less educated) in general and in subgroups where the effects of a lack of education on child immunization can be intensified, i.e. in subgroups leading to a lack of women's empowerment or where the living conditions can be less comfortable.

OR linked with mother's education in the following subgroups[21]:	**OR**	**CI**
Most educated vs. less educated* mother	**2.22**	**0.62 – 7.86**
Core variables**		
Among girls	1.41	0.30 – 6.59
Among less educated woman's partner	NC	NC
Among the poorest	NC	NC
When woman received less than 2 doses of tetanus toxoid	1.39	0.16 – 11.91
Socio-demographic characteristics***		
Living in rural area	2.01	0.25 – 15.93
When the sex of the head of the household is a woman	NC	NC
Woman lives alone	NC	NC
When there is a large age difference in the couple	0.19	0.01 – 2.41
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	NA	NA
Woman agrees that neglecting children justifies beating	1.33	0.16 – 11.07
Woman agrees that arguing partner justifies beating	0.66	0.13 – 3.22
Woman does not decide on health care for herself	NC	NC
Woman does not decide on how money is used	NA	NA
Woman does not decide on daily purchase	NC	NC
Health provider is not a woman is a problem	NC	NC
Distance to health facility is a problem	NC	NC
Access to information***		

[21] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + **β Edu** + β Edup + β TT + β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI + **β Edu* Edup**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ β WI + **β Edu* TV**

Has no TV	NC	NC
Has no Radio	2.46	0.31 – 19.57

Taking into account only the core variables, the OR is quite high (2.22) meaning that children whose mother is the most educated are more likely to be vaccinated than those whose mother is the least educated. Nevertheless, this OR is not significant.

When taking into account the different subgroups, OR become irregular so that it makes it difficult to interpret the results. For example, among children whose mother agrees that neglecting children justifies beating, OR is equal to 0.66. This means that among the less empowered women (assuming that empowered women would not accept beating under any condition), being most educated could entail a lower likelihood for the child, to receive at least one dose of vaccine which is hard to interpret. Moreover, confidence intervals are either large or contain the value of 1, making the OR no significant.
Finally, it is difficult to conclude how mother's education interact with the likelihood of her child to get at least one dose of vaccine in Rajasthan given these analyses of the data.

- **Partner's education differences in immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to partner's education (more educated vs. less educated) in general and in subgroups where the effects of a lack of partner education on child immunization can be intensified i.e. in subgroups where women suffer from a lack of empowerment and thus might be disadvantaged.

OR linked with partner's education in the following subgroups[22]:	**OR**	**CI**
Most educated vs. less educated partner*	**1.00**	**0.57 – 1.78**
Core variables**		
Among girls	0.63	0.29 – 1.36
Among less educated woman	1.02	0.57 – 1.82
Among the poorest	0.93	0.46 – 1.86
When woman received less than 2 doses of tetanus toxoid	1.25	0.63 -2.45
Socio-demographic characteristics***		
Living in rural area	0.85	0.45 – 1.61
Sex of the head of the household is a woman	NC	NC
Woman lives alone	0.02	0.00 – 0.43
There is a large age difference in the couple	0.31	0.04 – 2.23
Women's empowerment in DHS***		

[22] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + β Edu + **β Edup** + β TT + β WI

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI + **β Edup* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ β WI + **β Edup* TV**

Woman agrees that going out justifies beating	1.54	0.62 – 3.85
Woman agrees that neglecting children justifies beating	0.91	0.38 – 2.18
Woman agrees that arguing partner justifies beating	1.33	0.54 – 2.92
Woman does not decide on health care for herself	0.61	0.16 – 2.38
Woman does not decide on how money is used	2.04	0.17 – 23.99
Woman does not decide on daily purchase	0.76	0.31 – 1.90
Health provider is not a woman is a problem	1.02	0.45 – 2.34
Distance to health facility is a problem	1.24	0.60 – 2.54
Access to information***		
Has no TV	0.97	0.50 – 1.89
Has no Radio	1.06	0.55 – 2.07

When looking at the partner's education controlling for the effects of the core variables, the OR is equal to 1, meaning there is no difference according the partner's level of education.
In several subgroups, a similar observation can be made, OR being near 1. It seems that the association between partner's education and children receiving at least one dose is weak whatever the subgroup. In Rajasthan, the partner's level of education does not seem a key factor in child immunization.

- **Effect of having at least 2 doses of tetanus toxoid on immunization in different subgroups**

The table below shows the likelihood to be vaccinated according to the mother's tetanus toxoïd (TT) status (at least two TT vs. less than two TT) in general and in subgroups where the mother's TT can be less favourable, i.e. in subgroups leading to less empowerment or to more difficult living conditions.

OR linked with the tetanus toxoid status of the mother in the following subgroups[23]:	**OR**	**CI**
At least 2TT vs. less than 2TT*	**4.22**	**2.31 – 7.71**
Core variables**		
Among girls	3.65	1.62 –8.23
Among less educated woman	4.09	2.22 – 7.53
Among the poorest	5.36	2.34 – 12.26
Among less educated woman's partner	6.10	2.51 – 14.78
Socio-demographic characteristics***		
Living in rural area	4.92	2.33 – 10.40
Sex of the head of the household is a woman	NC	NC

[23] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + β Edu + β Edup + β WI + **β TT**

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI + **β TT* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT + β TV+ β WI + **β TT* TV**

Woman lives alone	1.16	0.07 – 17.71
There is a large age difference in the couple	5.24	0.54 – 50.75
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	3.98	1.64 – 9.66
Woman agrees that neglecting children justifies beating	5.09	1.99 – 13.02
Woman agrees that arguing partner justifies beating	4.79	1.90 – 12.12
Woman does not decide on health care for herself	2.76	0.67 – 11.36
Woman does not decide on how money is used	NC	NC
Woman does not decide on daily purchase	5.28	1.69 – 16.50
Health provider is not a woman is a problem	4.60	1.81 – 11.67
Distance to health facility is a problem	5.77	2.58 – 12.90
Access to information***		
Has no TV	5.28	2.42 – 11.54
Has no Radio	4.98	2.40 – 10.35

In general, when mothers received at least two doses of tetanus toxoid, their children are far more likely to get at least one dose of vaccine than when they received zero or one dose (OR = 4.22), the association being strong and significant.

This relation remains strong and significant in the most of the subgroups, OR varying between 3.65 and 6.10. Here we can conclude quite strongly that in Rajasthan, mother receiving at least two doses of TT is an important factor of child's immunization.

- **Wealth inequities in immunization in different subgroups**

The table below shows the likelihood (Odds Ratio = OR) to be vaccinated according to the wealth (richest vs. poorest) in general and by subgroups, controlling for the effects of the other core variables.

OR linked with child sex in the following subgroups[24]:	**OR**	**CI**
Richest vs. poorest*	**1.79**	**0.99 – 3.17**
Core variables**		
Among girls	1.92	0.85 – 4.33
Among less educated women	1.87	1.02 – 3.42
Among less educated woman's partner	1.63	0.75 – 3.54
When woman received less than 2 doses of tetanus toxoid	2.14	1.04 – 4.43
Socio-demographic characteristics***		
Living in rural area	3.19	1.37 – 7.44

[24] * *Multivariable with only core variables.* E.g. Model x : α + β Sex + β Edu + β Edup + β TT+ **β WI**

** *Multivariable with core variables and an interaction* E.g. Model yi : α + β Sex + β Edu + β Edup + β TT + β WI+ **β WI* Edu**

*** *Multivariable with core variables, gender variables and an interaction*

E.g. Model zi : α + β Sex + β Edu + β Edup + β TT+ β WI + β TV+ **β WI* TV**

When the sex of the head of the household is a woman	NC	NC
Woman lives alone	0.03	0.00 – 0.66
When there is a large age difference in the couple	0.78	0.12 – 5.22
Women's empowerment in DHS***		
Woman agrees that going out justifies beating	3.30	1.06 – 9.91
Woman agrees that neglecting children justifies beating	2.25	0.85 – 5.97
Woman agrees that arguing partner justifies beating	2.15	0.82 – 5.65
Woman does not decide on health care for herself	3.08	0.61 – 15.42
Woman does not decide on how money is used	2.70	0.23 – 31.67
Woman does not decide on daily purchase	1.70	0.65 – 4.49
Health provider is not a woman is a problem	2.35	0.89 – 6.20
Distance to health facility is a problem	1.67	0.73 – 3.81
Access to information***		
Has no TV	2.85	1.16 – 7.04
Has no Radio	2.12	1.01 – 4.46

The OR associated with the wealth index is 1.79 meaning that when a child lives in a rich household, he is more likely to get at least one dose than a child who lives in a poor one. This finding is still valid in the most of the subgroups.

Nevertheless, in several subgroups this association is stronger than if only considering the core variables. For example, in subgroups where child lives in a rural area, the OR is 3.19. This means that the association between wealth and receiving at least one dose of vaccine is stronger in this subgroup and wealth could appear mostly important in the rural areas because it may increases the likelihood to get at least one vaccine.

The association is also stronger among children whose mother agrees with arguments justifying beating or among those whose mother's participation in making household decisions is poor. This suggests that when a woman is less empowered, the wealth is an important factor enhancing the likelihood to get vaccines. And effectively, the likelihood to get at least one vaccine when the mother agrees that going out justifies beating among the poorest and the richest is respectively 0.70 and 1.81, i.e. more than 2.5 times higher among the richest children (results not presented).

Scenario computation

At last, scenario computations were performed to estimate benefits of different intervention scenarios (see Annex 3). In Rajasthan and in Kerala, a rise in the TT-coverage rate to 100% would increase the probability of immunisation of a child to respectively 92% and 97%.

Conclusions

- **Low percentage of children with at least one dose of vaccine (78.4%)**
- **Sex discrepancies seem to be weak**
- **Importance of mother's tetanus toxoid status**
- **No effect of partner's education**
- **Wealth particularly important for children whose mother is less empowered.**

3.3.2 Quantitative literature review

Characteristics of studies

The review included 28 studies published between 1995 and 2010. The characteristics of included studies are described in Table 1. Out of the 28 documents included in the review, 8 are qualitative studies and 20 are quantitative (primarily surveys). The characteristics of the studies included in the Annex 4.

From coding and grouping for the systematic comparison and translation of quantitative survey data, four broad categories emerged and encompass the variety of factors affecting vaccination in the two Indian states.

Socio demographic characteristics

Several socio-economic factors affect the practice of vaccinating children in India.

Mothers' education stands out as a major determinant of immunization compliance. The likelihood of children to be fully vaccinated is substantially higher when the mothers are literate (Boorah, Mohan, Pande, Partha). According to Arokiasami, female children born to illiterate women in both the northern and north-central regions are significantly less likely to receive DPT vaccination.
Borooah suggests that if mothers' education favours a fuller immunisation of children, it does not affect the boy preference pattern that prevails in immunization practices:

> "maternal literacy, by raising the likelihood of being fully immunised by the same amount for boys as for girls, did nothing to erode the five point 'immunisation gap between boys and girls'".

Parashar and Kravdal agree that the education factor goes beyond the simple value of the mother's own education but that its effect must be found at the community level. Kravdal identifies a "community education effect" while Parashar states that a child's immunization status is "affected by more than his or her mother's education; it is also influenced by the larger context created and sustained by other women's education".
In Nair's study (2007) in Kerala, female literacy rates is high and people are more aware of their needs and they are generally in demand of services.
For Kravdal, raising community-level education also implies raising men's education. Partha concurs that increased father's educational level would have positive impact on children immunization.

Concerning parents' occupation, Unisa notes that in Rajasthan, when immunization is not performed in the villages, males take children to the nearest facility but low family income and agricultural occupation may deter them from covering these long distances. Likewise, Partha mentions that parents with a service sector occupation are more aware of the benefits of immunization for their children. Mother's occupation is more nuanced according to studies: while Partha links mother's occupation with a greater awareness of immunization in the case of Rajasthan, Pande correlates it with a greater neglect of children and reports increased immunization when women are either not working or engage in household work.

Family income and willingness to pay are also frequently reported by studies as factors influencing children's vaccination. (Arokiasami, Borooah, Mohan, Nair, Pande, Partha and Unisa). Along this line, Pande re-emphasizes the North/south divide among Indian States in terms of vaccination practices:

> "the extent of inequality in immunization between children from poor and rich households varies tremendously by state, though once again, southern states perform better on average than is the case in the north".

Pande's analysis of the overall costs of immunization reveals how they affect the girl child more severely than the boy child: "there are costs to immunization other than monetary costs, for example, opportunity costs of time taken to vaccinate a child or to take care of side effects that may contribute to a female disadvantage".

Choi, Gupta and Partha reports similar findings regarding the beneficial impact of Antenal Care (ANC) on children's immunization. While underlining the interplay between an urban/rural divide and differentials in sex preference for children, Choi states that "prenatal care does not increase the access to immunization for girls in rural area".

Issues revolving around size of family, sex composition of the family, number of children, birth order and siblingship reveal complex combinations leading to variations in children immunization. (Partha, Corsi, Arokiasami, Corsi, Choi, Pande, Mishra, Oster, Partha, Boorah).
Several authors report evidence of discrimination against high birth orders in the practice of vaccination (Choi, Corsi, Pande, Partha). High birth orders are correlated with a lower likelihood of being full immunized. This pattern is itself influenced by the number of children but also the sex composition of siblingship.

> "Girls who are born third to a family with two other girls are in the extreme of immunization disadvantage, when compared to boys who are born third to families with two older girls." Corsi

The North/South opposition remains important related to birth order and sex preference of children.

> "Sex bias in the utilization of childhood vaccination exists mainly in the northern and north-central regions and, to a limited extent, in the eastern region. For each of the recommended childhood vaccinations, namely BCG, DPT-three doses, polio-three doses and measles, the odds ratios indicate a clear regional pattern in the neglect of female children.
> Compared with boys, female children born during the last four years and surviving at ages 12-47 months have a significantly lower likelihood of receiving childhood vaccination in both the northern and north-central regions. The difference between odds for boys and girls is greater in the north than in the north-central region. By contrast, in the southern and western regions, the likelihood of receiving childhood immunization is nearly equal for both sexes." Arokiasami

In addition, authors suggest that the detrimental impact of high birth orders on immunization affects more severely girls than boys. (Arokiasami, Mishra)

Another factor is the parents' preference for boys (PATH). Various reasons are evoked which tend to explain boy preference throughout India, be it for economic reasons (when boys yield a higher return on investment to parents – Borooah) or other cultural and social norms (Mishra). In Rajasthan, boys are 30% more likely to be fully immunized in rural areas than are girls (Pande 2003 b).

Mishra however notices that not all discrimination is necessarily harmful to girls. He most notably mentions how boys are more likely than girls to be exclusively breastfed at 6 to 9 months of age, while this practice at this age is considered inadequate by international standards, or how mothers are more likely to carry boys or keep them in the kitchen area while cooking, exposing them to higher levels of air pollution. While Mishra reports also some level of discrimination in vaccination against boys, Pande demonstrate that the "protective effect of having only opposite-sex surviving older siblings is weaker for girls than for boys".

Gender patterns also interact with this north-south divide. Pande's findings illustrate how the "interactions of gender and region make girls in the South of India less likely to be severely stunted (…) and have higher odds of better immunization (…) than girls in the North".
Anand and Nair include explanations related to gender, such as high status of women in society, women's autonomy and women's empowerment at grass-roots level, to account for Kerala's high performance in child health indicators.

Caste and religion seem to also affect affect vaccination compliance. Lower caste and tribes have lower immunization rates (Nayar, Parashar, Partha). Inter-caste relationships sometimes act as a barrier to immunization when providers and clients of health services from different caste can not relate with one another (Streefland).

Knowledge, awareness and information

Awareness of the population and access to general information on immunization represent a major determinant to children immunization (Choi, Das, Gupta, Suresh, Unisa for Rajasthan, Patel). General lack of awareness of the need for vaccination or for a second dose/booster, lack of information about time and place of vaccination are the arguments most frequently brought forward by respondents of Gupta's study. While Choi relates exposure to media to a greater immunization, Patel brings evidence of the positive impact of mother's counseling and clear communication. Similarly, Mohan reports how the impact of educational messages varies according to the local environment (urban vs. rural, area of high women's literacy) where they are spread.

Health system and service quality

Authors concurs that Antenatal Care (ANC) attendance increases the likelihood for children to be immunized as ANC is an information channel relied upon in the rural areas (Choi, Partha). However, Choi notes the different impact of ANC in rural areas which tend to increase the likelihood of vaccination for boys and not for girls.

Issues around timeliness of service are frequently mentioned in studies (Corsi, Gupta, Patel). They mostly address issues of inconvenient time of vaccination sessions and waiting time.
Availability of staff is also a crucial factor affecting child vaccination (Suresh, Unisa). Presence of and access to services in the community, frequency of contact with health professionals are features of the health service that encourage vaccination compliance.

Likewise, availability of vaccine is reported (Borooah, Unisa). Unisa's study reveals that if vaccines are in sufficient quantity in Rajasthan, the storage conditions and general organization of service was an obstacle to a properly functioning immunization service. Organisation, management and coordination of service are the most frequently cited barriers to Immunization (Nair, Tandon, Unisa, Patel). Lack of maintenance and poor coordination in Rajasthan are cited as weak points of the immunization service (Unisa).

Geographical and physical accessibility

Accessibility is reported to be a key factor influencing immunization practices. According to Anand, Kerala benefits from accessible health services, even in rural areas, as it prominently comprises large villages well connected by roads. On the contrary, Unisa reports that scattered villages in Rajasthan are a particularly difficult terrain for immunizers.
Distance often deters parents from taking their children to vaccination (Mohan, Gupta, Unisa, Suresh).

Place of residency – urban or rural – reinforces the gap between Northern and Southern States in terms of child care and immunization. Choi demonstrates how antenatal care and therefore knowing the sex of the child in advance does not increase the access to immunization for girls in rural areas while there is an effect of prenatal care on immunization among rural boys.

According to Pande, this urban-rural divide in immunization practice can be found even in well performing State, with high levels of immunization. Public or private hospitals are generally associated with higher odds of immunization than health centres or subcentres (Pande).

3.3.3 Qualitative literature review

Qualitative studies concur with the quantitative findings related to geographical accessibility (distance, place of residency for Bisht, Streefland 1995 and 1999), and knowledge (Bisht, Sur), caste (Streefland 1995 and 1999).
In addition, these studies give more information on the overall socio-cultural context in which vaccination practices takes place.

Quality of service

Issues related to the quality of service are reported from both the supply and the demand side. From the supply side, pressure from the management on immunizers is a hurdle to the overall organization of the service delivery.

> Reaching fixed targets was much closer associated by vaccination teams with success than notions of prevention or public health. The operational staff experienced the pressure to immunize all eligible children as a burden. Streefland (1995)

On the other hand, Streefland (1995) also reports how people's health is hardly a priority of health workers when they are concerned about the continuity of their positions and responsibility for failure is put on the chain of command.

> In India specifically, a history of malfunctioning or inadequate services including misinformation about times and dates of immunization clinics, unscheduled staff and absenteeism though children were present, and truncation of sessions were common reasons for low demand. Patel (2009)

Local vaccination cultures

The focus of most qualitative studies is on the local context into which the immunization programme fits. It seems as if the success of a vaccination campaign depends on the "process of translation" (Streefland 1995) or the "articulation" (Streefland 1999) of the organizational features of an immunization programme into a local context local vaccination cultures (Patel, Streefland)

> The open articulation of a demand may not always be possible due to a local sociopolitical vaccination context. The demand then remains hidden and will not be noticed by the health services. Streefland (1999)

The immunization service must be developed and implemented with an "understanding of the wide social and political processes" (Streefland 1999) of a local culture where"past experiences with routine or campaign vaccination constitute the interpretational settings" (Streefland 1999).

In his study, conducted partially in Kerala, Bisht (date) elaborates on this aspect by referring to the community's "repertoire of knowledge and practices to manage the diseases":

> In every community there is a considerable repertoire of medical resources which people exploit critically and situationally for various illnesses. … Health seeking behaviour then is not governed by concerns of cure, as much as the need to give meaning to an experience within a larger (though specific) context. Bisht (2000)

This means that at the community level there exist local understandings of health, disease and treatment shaped by community's perception of protection, prevention and immunity. Naming a

disease, identifying its cause or the perception of its severity are parts of this "prototypical cultural model" of disease. Therefore, the encounter of these traditional beliefs or traditional medicine with biomedical knowledge shapes local acceptance of vaccine. Bisht reports that in Kerala these two types of knowledge are not mutually exclusive but that they can coexist in the local interpretation of biomedical techniques by the community.

> Most mothers … believed that the vaccine influences the intensity of the disease, but does not prevent the disease from occurring. …While communities have come to accept vaccinations, they do not necessarily do so with the bio-medical understanding of the nature of immunity provided by vaccines. Bisht (2000)

In other contexts, mistrust of Western medicine feeds adverse perceptions of vaccines and fears:

> "*This vaccine is very harmful to us. If you take this vaccine, you will become infertile. If you take this vaccine you will suffer from cancer after a few years*." (a 33 year old Muslim female living in Ward 29) Sur (2009)

Gradation of immunization acceptance

Across the literature, the politicization of immunization appears at two levels. From the supply side, it is an instrument which can helps providers bargain within a conflictual situation with their management. Streefland (1995) relates the underlying dynamics of a strike of health workers within major issues of political changes and resource shifting. Likewise, as seen before, achievement of vaccination targets are a symbol of political success for local leaders.
From the demand side, a form of politicization also exists among the population (Pinto, Patel). Streefland (1999), taking the Nichter's analysis[25] as a reference, works out "concepts of 'acceptance', 'social demand', and 'non-acceptance'" to understand vaccination behaviour, which have "individual and collective forms: 'refusal' and 'resistance' ".
Acceptance and non-acceptance dynamics are shaped by a myriad of factors evoked before. While inadequacy of poor quality of service seem to be the main reason for women refusing to comply with vaccination (Streefland 1999), some level of individual or collective resistance to immunization reflect a statement from the population regarding certain local sociopolitical conflict.

Factors explaining immunization differentials between Kerala and Rajasthan

Across all studies reviewed, a series of reasons are hypothesized to explain the specificities of vaccination patterns in Kerala and in Rajasthan.

The accessibility varies greatly between both States where densities and settlement patterns are contrasted.

For low-performing states like Rajasthan, Pande (2003b) suggests: a "demand" failure for immunization and especially immunization information, mostly from the rural poor; supply issues or system failure in poor and rural areas; resource allocation issues in states where there are deep inequalities and where less resources may go to poorer areas; persistent discrimination against the girl child in Indian society.

[25] Nishter, M., 1995. Vaccinations in the Third World: a consideration of community demand. Social Science and Medicine 41, pp.617-633.

To account for the specificities of the Kerala model, Nair (2007) mentions the following macro and microlevels factors: "(i) a wide network of health, social, tribal welfare infrastructure and manpower development; (ii) a wide network of Christian mission hospitals, even in the remote parts of the state; (iii) social movements based on principles of equality and equity; (iv) major land reform movements; (v) political stability; (vi) emphasis on female literacy and education; (vii) a high budget allocation for health, education and social welfare maintained by consecutive popular governments; (viii) the panchayati raj system (local self-government) with assured financial and administrative autonomy; (ix) women's empowerment programmes at grass-roots level with emphasis on self-income-generation; and (x) general health awareness and hygienic practices."

According to Nayar 2007, "the specificity of Kerala's can be attributed to its welfare state, especially in the field of health [and to] various socioeconomic factors like land reform movements, high female literacy rate, an effective public distribution system [and] a strong public health system."

Discussion on gender specific barriers to immunization

Triangulating the data from different methodologies gives a multi-perspective understanding of major gender barriers to immunization.

Kerala

DHS analysis concludes possible sex discrepancies favourable to girls. Surveys and qualitative studies agree on high level of gender equality in immunization practices in Kerala. Qualitative studies however pinpoints that neglect of the girl child is a consistent pattern across India but at much lower levels in well-performing states like Kerala.

The importance of mother's education is underlined by all three methodologies and it can be concluded that it is a major determinant to children's vaccination. Some quantitative and qualitative studies demonstrated that the level of education and knowledge in the community, by other women or fathers, is of equal importance to that of the education of individual women and constitute an enabling factor to children immunization.

Rajasthan

DHS analysis and some quantitative studies report weak sex discrepancies in vaccination. However, the bulk of survey data and qualitative literature reveal a deeply rooted societal tendency to neglect the girl child in health care practices and a persistent bias in favour of boys in immunization practices. All methodologies concur on the importance of family income and mother's TT status in both states.

Conclusions

This review shows how gender barriers to immunization in India must be analyzed within the specific local contexts where vaccination programmes are undertaken. More sensitivity towards mothers' and community's perceptions and knowledge is needed to create higher levels of social demands for immunization. Male involvement in child care practices and specifically vaccination is very low. To assess the reasons of low vaccination compliance, a better understanding of women's autonomy is required, which implies an analysis of all inter-woven conditions determining her mobility, her control over resource and her power to make decisions within the family. Gender constraints in the way immunization services are delivered need to be addressed. Poor quality, lack of timeliness and attitude of staff affect mothers' demand and usage of service.

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5 Annexes

Annex 1: Characteristics of the studies included in the Lao PDR Case Study

Annex 2: Translation Table – Lao Case Study

Annex 3: Estimation of benefits for different intervention scenarios

Annex 4: Characteristics of the studies included in the India Case Study

Annex 5: Translation Table – India Case Study

Annex 1: Characteristics of the studies included in the Lao PDR Case Study

	First author, year	Geographical coverage	Year of research	Sample subgroup	Method of data collection	Sample size	Aim
1	KATZ 2007	9 districts of Luang Prabang + 3 districts of Savannakhet	2006-2008	district leaders, mothers, fathers and village leaders; health providers; care-takers that had just received immunization service	For qualitative data: collection of feedback from project stakeholders and target groups using an adapted model of Most Significant Change and Appreciative Enquiry. For quantitative data: utilization of existing routine immunisation coverage data at village, district and province level.	66 depth interviews; 34 groups with mothers; 12 groups with father;12 village leader group;75 surveys with care givers	Operational research in 2006-2007. To assess how to create demand for immunization in low coverage communities and in fixed health facilities; to assess how to partner with and mobilize other sectors to advocate and communicate about immunization.
2	MAEKAWA 2007	2 districts in Oudomxay province	2005	mothers	a cross-sectional questionnaire survey	341	To explore factors affecting routine immunization coverage.
3	MASUNO 2009	5 districts in Vientiane Municipality	2005	women with children under 5 years of age	face-to-face interview, survey questionnaire	212	To assess the achievements of strategies towards maternal and neonatal tetanus elimination in the capital province.
4	MAYXAY 2007	Mahosot Hospital, Vientiane	2003	children who had clinical measles + children without a history of febrile rash	Questionnaires; review of immunization cards and medical records, assessment of nutritional status	100	To determine risk factors associated with measles amongst children admitted at Mahosot Hospital, Vientiane
5	PHIMMASANE 2010	3 provinces: Oudomxay, Vientiane, Champasak	?	Providers Mother and fathers of children aged 9-23 months	Questionnaires in semi-structured interviews; case control study	13 584	To identify factors of non-vaccination against measles in Laos, related to the offer of services and the consumption of services
6	PHOUNPHENG-HACK 2007	10 villages in Saythany District	2007	Mothers of children below 3 years old	Cross sectional study using a structured questionnaire	108	To identify the relationship between immunization of children and socio-demographic, knowledge, perception and source of information of mothers.
7	SHIYALAP 2004	Sanakham district	2003	mothers with children 2-5 years	Cross sectional descriptive study with questionnaires	126	To assess how mothers of children aged 2-5 utilize immunisation services and which factors affect this practice.
8	TOKIZAWA 2009	Vientiane province	2006-2007	mothers and guardians caring for children aged <5	2 stage Interviews; surveys	889 and 212	To identify factors influencing the low coverage in Lao PDR

Annex 2: Translation Table – Lao Case Study

	Shyialap 2004	Katz 2007	Maekawa 2007	Mayxay 2007	Phouphenhack 2007	Masuno 2009	Phimmasane 2010	Tokizawa 2010
Frequency of mothers'/parents' socio-demographic characteristics-related reasons from reviewed articles								
Subcategories								x
Father's education							x	
Mothers' education	x		x		x	x		x
Mothers' occupation	x				x	x		x
Mother's age	x		x			x		
Number of children	x			x	x	x		
Households income	x		x		x	x	x	
Willingness to pay	x		x		x		x	
Frequency of geographical and accessbility reasons from reviewed articles								
Subcategories								
Distance to facility	x		x	x			x	
Place of residency			x		x			
Place where immunization is received (outreach vs. health facility)	x				x			
Means of transport	x						x	
Frequency of knowledge/awareness/sources of information related factors from reviewed articles								
Subcategories								
Information		x						x
Source of information: family					x		x	
Source of information:friend/key person					x	x	x	
Source of information: health worker/households visits			x		x			
Source of information: head of village			x		x			
Parents'/mothers' knowledge about immunization	x	x	x	x	x		x	x
Perception, beliefs,	x			x	x		x	x

misconceptions and fears								
Frequency of factors realted to the offer of immunization service/health system								
Subcategories								
Timeliness (waiting time/inadequate opening hours)	x						x	
attitude of staff	x	x			x			
availability of staff	x			x				
availability of vaccine	x	x					x	
General management and organisation of service		x					x	
Frequency of factors and reasons linked to unvaccinated child								
Theme and subcategories	Frequency/n° of studies mentioning the factor							
Mothers/parents socio economic characteristics		7						
Geographical and Accessibility Characteristics		5						
Knowledge of mothers and source of information		8						
Quality of services		5						

Annex 3: Estimation of benefits for different intervention scenarios

Lao P.D.R.

In Lao, there are no sub-regions and there is also only one primary sampling unit. But there are many clusters, which we thus took as regional units.

In the model containing rates of maternal and paternal education, maternal TT-immunisation and wealth at the cluster level, both maternal TT-coverage and higher maternal education were highly significant predictors of vaccination of the child. Paternal education was eliminated due to collinearity with maternal education. The odds ratio for the factor “wealth” was close to 1.

After adding the respective individual level variables, the cluster level variables remained statistically significant but the individual variables were equally significant.

Based on the latter model, we tried to predict the impact of a general rise in the maternal TT-immunisation coverage rate across all primary sampling units to 100% (i.e., as observed in many of these units). For this purpose, we changed the values of the respective variables to 1 (i.e., the one at the individual and the one at the cluster level), while leaving all other variables unchanged. According to this prediction, the likelihood of a child to get vaccination would rise to 81% from an original level of 58%, and the rate would reach at least 70% across all clusters.

We also tried to predict what the impact of an increase in the rate of higher maternal education to at least 75% across all clusters might be. This value of 75% is close to the 3rd quartile of respective cluster rates. To derive the prediction, we thus changed the cluster level variable for maternal education to 0.75, if its observed value was smaller than 0.75, and zeros of the individual level variable to a value restoring consistency with the changed cluster level value. All other variables were left unchanged. The respective overall gain was small, however, with a rise in the vaccination coverage rate to 64%.

Again, the same caveats apply.

India

Since Kerala and Rajasthan are regions with very different characteristics (Kerala mostly at the high end) and Rajasthan much inferior in all respects, it is difficult to say more than "of course the immunisation coverage in Kerala is higher (97%) than in Rajasthan (85%)".

Rajastan

If we use xPSU as the sub-regional unit, then it turns out that the tetanus vaccination rate of the mother within PSU is the only significant predictive factor of immunization of the child in Rajasthan. Based on a logistic regression model including only the rates of Edu, EduP, TT and WIpc at PSU-level but no individual variables, a rise in the TT-coverage rate to 100% in all PSU-units would increase the probability of immunisation of a child to 92% in all PSU-units even if all other factors (i.e., Edu, EduP, WIpc) remained unchanged.

Based on this finding, one would hypothesize that raising TT-coverage of the mothers to close to 100% should be the primary aim in Rajasthan.

Kerala

```
Logistic regression                                     Number of obs    =
1000
                                                  LR chi2(4)             =
23.80
                                                  Prob > chi2            =
0.0001
Log likelihood = -126.29978                       Pseudo R2              =
0.0861

------------------------------------------------------------------------------
        xC01 | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        mEdu |   .0065551   .0123133    -2.68   0.007     .0001651    .2603141
       mEduP |   257.6018   337.2753     4.24   0.000     19.79155    3352.88
         mTT |   22.86277   23.16979     3.09   0.002     3.136873    166.6329
       mWIpc |   .0271433   .0575378    -1.70   0.089     .0004259    1.729894
```

Lowest predicted probability at PSU-level = 0.76.

There is strong collinearity between maternal and paternal education, making it difficult to understand results. Thus, the rate of higher paternal education is removed from the model.

```
Logistic regression                                     Number of obs    =
1000
                                                  LR chi2(3)             =
8.11
                                                  Prob > chi2            =
0.0438
Log likelihood =  -134.1465                       Pseudo R2              =
0.0293

------------------------------------------------------------------------------
        xC01 | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        mEdu |   .2105886   .3886089    -0.84   0.399     .0056581    7.837842
         mTT |   13.56898   12.59085     2.81   0.005     2.201431    83.63521
       mWIpc |   .2173192   .4528391    -0.73   0.464     .0036594    12.90595
```

This leaves TT coverage rate as the only significant variable.

Here, too raising the TT-vaccination coverage of the mother to 100% in all PSU-units while not changing any of the other predictors would raise the probability of immunization coverage of a child to 97% in all PSU-units.

There are, however, at least two caveats:

Firstly, a low TT-immunisation rate among mothers may suggest various situations. It can just be the expression of a deficit in availability or affordability of medical support in the respective region concerning mothers and children alike.

But in addition, even from a purely theoretical point of view, one can argue that it is not possible to change a certain factor without simultaneously impacting on other factors as well.

Annex 4: Characteristics of the studies included in the India Case Study

#	Author, Year	Geographical coverage	Sample subgroup	Method of data collection	Sample size	Aim
1	Anand 2000	Ballabgarh (Haryana State) and comparison with Kerala	village population	Households visits, medical records review, literature review	70 079	To see the trend in reduction of neonatal mortality rate (NNMR) and IMR at the Ballabgarh project, compare it with Kerala and rural India's trend and look at the causes of neonatal and infant mortality.
2	Arokiasami 2004	national	ever-married women in the ages 13-49--23, in urban and in rural areas	use of the NFHS-1 (1992-93) data	89,777	To study three dimensions relating to sex differentials in child mortality and health care provision across the regions of India: excess female child mortality and its progressive rise for female children of increasing rank in the family; sex discrimination in terms of provision of child health care is examined; regional influences of culture versus the development context of women's status on discrimination against female children and excess female child mortality.
3	Bisht 2000*	2 selected villages in 3 states including Kerala.	mothers with children between the ages of 0 to 2 years	survey	205	To understand the communities' perception of protection, prevention and immunity in the specific context of measles and child health in general.
4	Borooah 2004	sixteen states	children, between the ages of 1-2 years (inclusive), living in rural households	survey	4,333	To study two aspects of the neglect of children: their likelihood of being immunised against disease and their likelihood of receiving a nutritious diet.
5	Choi 2006	national	ever-married women, aged 13–49 children	use of data from the 1992–1993 National Family Health Survey (NFHS) in India.	89,777 34,386	To investigate how parents' health care behaviour changes after parents learn the gender of their babies.
6	Corsi 2006	national	All children below five years of age with complete immunization histories	review of data of the National Family Health Survey between 1992 and 2006	121,100	to investigate the influence of India's son preference on gender inequities in access to health care, specifically immunization, and how this may have varied with time and across regions.
7	Gupta 1998	The Phagi block of the Jaipur district in Rajasthan	pregnant women	a nonrandomized cohort study supplemented by a retrospective survey using in person interviews.	1760	To assess the effectiveness of a community-based intervention against neonatal tetanus in a rural area in Rajasthan.
8	Kvadral 2003	national	ever-married women aged 15-49	analysis based on data from the National Family Health Survey of 1998-	90000	To find out whether the education of other women in the community is substantially important for child mortality in India, taking various possible determinants of education into

				1999 (NFHS II)		account.
9	Mishra 2005	national	ever-married women and their young children (under age 4 years	data from India's first and second National Family Health Surveys	?	To assess, among children of specified birth order, the effects of the index child's sex and the mother's number of living sons on selected indicators of child feeding practices, health care, and nutritional status while controlling for a number of demographic and socioeconomic variables that might otherwise confound the relationship.
10	Mohan 2004	Rajasthan	children presenting at 12 primary health facilities in one district of Rajasthan	survey	2460	To assess whether the Rural Drinking Water Supply Program (RDWSP) and the Universal Immunization Program (UIP) have achieved equitable coverage in Rajasthan, India, and explored program characteristics that affect equitable coverage of preventive health interventions.
11	Mohan 2005	Rural district in Rajasthan	Children aged under 5 years presenting for curative care and their mothers	community randomised trial	2460 children were recruited (1248 interventions, 1212 control).	To assess whether training doctors in counselling improves care seeking behaviour in families with sick children.
12	Nair 2001	Kerala	health subcentres in selected districts	cross-sectional, community-based survey	274	To evaluate the role and participation of Multipurpose health workers in implementing different national health programmes.
13	Nair 2007	Kerala	parents of 0-3 year old children	interviews + questionnaires	2570	To explore early child-care practices from conception to 3 years with a focus on the family as caregiver.
14	Nayar 2007	national	n/a	Literature and survey review	n/a	To examine broad linkages between caste and some select health/health utilization indicators.
15	Oster 2008	national	women	Analysis of data from the National Family and Health Survey (NFHS) (1992-1993 and 1998-1999)	90 000	Two primary questions: at what ages does most of the excess female mortality occur, and what is the relative contribution of various forms of neglect to this excess mortality.
16	Pande 2003a	national	sample of children born to rural, ever-married 13- to 49-year-old women	National Family Health Survey, India (1992–1993)	25,549	To examine the role of the sex composition of surviving older siblings on gender differences in childhood nutrition and immunization
17	Pande 2003b	national	married women aged 13- to 49	paper uses data from the India National Family Health Survey 1992–93	9,777	To analyze socioeconomic, gender, urban, rural and regional inequalities in immunization in India for each of the largest states.
18	Parashar 2005	national	children between the ages of 12–24 months	Multilevel analyses of data from the 1994 Human Development	562	To examine the contextual effect of women's education on children's immunization in rural districts of India

				Profile Index and the 1991 district-level Indian Census		
19	Partha 2002	National	children born to married women age 13 to 49 years in the period of 1247 months prior to the survey.	Data from the National Family Health Survey, India, 19923 (IIPS, 1995a, 1995b, 1995c)	n/a	To determine the utilization pattern of various immunization services and to identify the underlying causes of their underutilization in the northern states of rural India.
20	Patel 2009*	national	n/a	literature review	n/a	To explore the potential contribution of CHWs in the expansion of immunization services in rural India.
21	Pinto 2004*	rural north India	n/a	field work, households visits, literature review	n/a	To explore the complexities of medical practice in rural locales by considering persons who work on the margins of legitimacy, practicing medicine and health-education, opening clinics, calling themselves "doctors," claiming the authority of development and medical institutions but without their formal sanction.
22	Sur 2009*	Kolkata	residents of ward 29 and ward 30	A 3b phase clinical trial in Kolkata India including pre- and post-vaccination socio-behavioural surveys.	503	To investigate the multiple and integrated individual, household, socio-cultural and political influences on vaccine trial participation.
23	Suresh 2000*	national	children between 12 and 35 months	review of nationwide coverage evaluation in 1998/1999+ nationwide RHC surveys 1998	17823	To review the trends in immunisation coverage levels and their determinants of the same.
24	Streefland 1995*	Gujarat	n/a	explorative research	n/a	To discuss the process of environmental adjustment and the organizational interference in relation to crucial aspects of vaccination programs.
25	Streefland 1999*	national	n/a	use of ethnographic material collected in the context of the Social Science and Immunization Project (SSIM) in 3 countries including India.	n/a	To investigate variations in vaccination acceptance from various analytical angles and tries to provide an explanatory framework.

26	Tandon 1992	19 rural, 8 tribal, and 9 urban ICDS projects	children mothers	Survey	5367 51 11 The control population consisted of 2018 children and 1890 mothers.	To study the impact of ICDS on immunization coverage of children aged 12-24 months and of the mothers of infants.
27	Unisa 2006	2 states : Jharkhand Rajasthan	parents	in-depth interviews; review of records, focus group	141 563	To explore the supply side of immunisation services - problems related to infrastructure, staff, supply of vaccination and implementation and coordination in the immunisation programme To examine the demand for immunization services, knowledge and utilization of different types of vaccines by the community.
28	PATH 2010*	Rajasthan	parents, community immunizers, health service providers	focus group discussion	110	To document the extent to which issues related to gender mobility and discrimination affect the usage of immunization services.

* = qualitative studies

Annex 5: Translation Table – India Case Study

	Quantitative			Qualitative		
	Rajasthan	**Kerala**	**National**	**Rajasthan**	**Kerala**	**national**
Socio demographic characteristics						
Subcategories						
Father's education	Partha		Kravdal -Partha			Suresh
Father's occupation	Unisa-Partha		Partha - Suresh			
Mothers' education	Mohan 2005- Partha		Arokiasami - Basu-Borooah - Parashar- Suresh -Pande 2003a			Suresh
Mothers' occupation	Partha		Pande 2003 a			
Mother's age	Partha					
Mother's ANC	Gupta - Partha		Choi			
Size of family : extended vs. Nuclear family			Pande			
Birth order of children / sibship /number of children vs. sex composition of the family	Partha	Corsi	Arokiasami - Corsi -Choi - Pande - Mishra - Oster - Partha - Boorah			
Boy preference / sex of the child	Mishra	Mishra	Arokiasami - Corsi - Pande b - Mishra - Oster - Choi	PATH		
Households income	Mohan 2005- Unisa-Partha	Nair 2007	Arokiasami - Borooah -Pande (b) - Partha - Unisa			
Willingness to pay			Das - Pande 2003 a			

Gender	Corsi -Suresh	Anand - Arokiasami - Corsi- Nair 2007	Barooah - Mishra - Kravdal - Corsi - Pande 2003 b	PATH		Suresh
Caste and religion			Nayar -Partha Streefland 1999 - Suresh - Streefland 1995- Parashar	Streefland 1999		Streefland 1999- Suresh
Geographical and accessibility factors						
Subcategories						
Distance to facility	Mohan- Suresh-Unisa			PATH		Suresh
Place of residency			Pande 2003 b			
Place where immunization is received (outreach vs. health facility)	Pande 2003 a					
Means of transport				Streefland 1999		
Knowledge, awareness and information						
Subcategories						
Information	Gupta - Unisa - Mohan 2004 - Partha		Mohan 2004- Pande 2003 b - Choi - Patel	PATH		Suresh -Streefland 1999 - Sur
Source of information: family			Kravdal	PATH		
Source of information: health worker/households visits	Mohan 2004					
Source of information: head of village						
Parents'/mothers' knowledge about immunization	Gupta-Mohan 2004				Bisht	
Perception, beliefs, misconceptions and fears	Pande - Unisa- Patel	Nair 2007	Tandon		Bisht	Sur 2009 - Suresh- Streefland 1995 and 1999
Power					Bisht	Streefland 1999- Pinto-Patel
Health system / quality service						
Subcategories						

ANC			Choi - Partha			
Timeliness (waiting time/inadequate opening hours)	Gupta, Corsi		Patel			
attitude of staff	Unisa		Patel			Streefland 1999
availability of staff	Unisa		Borooah	Barooah		Suresh-Streefland 1995
availability of vaccine	Unisa		Borooah	PATH		
General management and organisation of service	Streefland 1995 - Unisa	Nair 2001 - Booroah	Borooah - Tandon -Pande 2003 b -Patel			Streefland 1995