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Complication Advice And Institutional Delivery In Asia

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Complication Advice and Institutional Delivery in Asia

Victoria Costales, MD

Abstract

Strategies targeted at decreasing delays in care-seeking behavior and increasing the use of skilled birth attendance and delivery at a health care facility have helped save maternal and neonatal lives. Counseling women on the danger signs of a possibly complicated pregnancy given during antenatal care (ANC) visits is one such strategy. This study aimed to examine the effect of such counseling on the likelihood of institutional delivery. Another aim is to determine the factors that may predict increased likelihood of advice receipt. Information from 74,873 mothers who received at least one ANC visit from the most recent Demographic and Health Surveys of 9 South and Southeast Asian countries were analyzed. Multilevel logistic regressions were used to predict the likelihood of advice receipt and institutional delivery, by maternal factors. Less than a quarter of women from Cambodia, Indonesia and Timor Leste while as high as 65.7% from India reported receipt of advice. Less than 25% of pregnancies were delivered at health care facilities in Bangladesh, Cambodia, Indonesia, and Timor Leste and was as high as half in India and Pakistan. Multilevel modeling revealed that mothers with at least a secondary education, primiparas, and those with more antenatal visits were significantly more likely to receive pregnancy advice during ANC visits than their counterparts, i.e. teenage mothers, the less educated, multiparas, and those with less ANC visits. There was a null effect of pregnancy complication advice on institutional delivery (OR=0.99). Likelihood of receipt of advice increased with additional ANC visits. Pregnancy complication advice interacts with the number of ANC visits to increase the likelihood of institutional delivery. In order to leverage pregnancy complication advice, quality should be improved with better training of ANC providers and repetition of consistent messaging that is understandable to mothers. Strategies should target mothers with low levels of education, high parity, and young mothers to narrow the equity gaps. Beyond this, it is necessary to address the known barriers of delivery costs, transportation issues, and cultural beliefs in order to substantially improve maternal and neonatal survival.

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Background

As a region, Asia has made substantial progress on maternal and child mortality but there is still much work to be done. Based on the most recent estimates, neonatal mortality is 28 deaths per 1,000 live births in Asia compared to 3 deaths per 1,000 live births in developed regions [1]. Lifetime risk of maternal death is 1 in 160 in South Asia and 1 in 290 in Southeast Asia compared to 1 in 3800 in developed regions [2]. Approximately 1.2 million of 2.6 million still births worldwide occur during labor [3], nearly 40% of deaths of children under 5 years occur in the neonatal period (first 28 days of life) of which majority occur in the first week of life [4], and the risk of maternal death is high during labor, delivery and up to 24 hours postpartum [5]. These underscore the importance of strategies targeted at decreasing delays in seeking care for possible signs of pregnancy complications and increasing use of skilled birth attendance and health care facility delivery. Counseling on the danger signs of pregnancy, a key component of birth preparedness planning, during antenatal care (ANC) visits is one such strategy.

Danger signs of pregnancy include vaginal bleeding, severe headache or blurred vision, abdominal pain, swollen hands and face, fever, decreased/stopped fetal movements, and excessive fatigue/breathlessness [6]. Early detection of such complications can lead to early care seeking by mothers and their families, which in turn can lead to better delivery care and improve survival for both mother and baby. There is evidence to support this presupposition. Prevention of maternal deaths involves early detection of comorbidities (hypertension, proteinuria, sexually transmitted infections/HIV, and anemia) as well as counseling women and family members to recognize and respond to signs of pregnancy complications [7, 8]. Furthermore, informing mothers of danger signs during pregnancy and creating an emergency contingency plan/birth preparedness plan are important means of decreasing inequities due to geographic (rural versus urban) and financial barriers to institutional delivery and skilled birth attendance [9, 10]. In addition, data from an analysis of efficacious interventions for neonatal survival suggests that emphasis on antenatal and postnatal care through family and community interventions including counseling on care-seeking for illness could potentially yield early success in saving neonatal lives particularly in countries with weak health systems and high neonatal mortality rates [11].

Despite evidence supporting the importance of counseling on pregnancy complications, this appears to be an underutilized strategy. Many studies assessing women's awareness of obstetric complications were done in Africa and have demonstrated that women have poor knowledge of complications and there are low levels of counseling by providers [9, 12-14]. Similar studies in Asia, such as one done in Pakistan [15] and more recently in Thailand [16] have shown similar trends. To our knowledge, there are no prior studies looking into cross-national and within-country trends of counseling on danger signs during pregnancy in Asia. This study endeavors to examine possible factors that may predict the likelihood of higher receipt of counseling during ANC visits in South and Southeast Asian countries and its implications on women's health seeking behavior, particularly institutional delivery.

The specific objectives of this study are (1) to determine the factors that predict higher likelihood of receiving information on the danger signs of a complicated pregnancy during ANC visits in South and Southeast Asian countries; (2) to examine the association between institutional delivery and whether or not the mother received counseling on pregnancy complications; and (3) to examine if the number of antenatal visits modifies the association between the receipt of pregnancy complication advice and the likelihood of institutional delivery.

Methods

Data and Study Population

This study is a secondary analysis of the most recent Demographic and Health Surveys (DHS) data for nine South and Southeast Asian countries. The selected countries and year of survey are as follows: Bangladesh (2011), Cambodia (2010), India (2006), Indonesia (2007), Maldives (2009), Nepal (2011), Pakistan (2007), Philippines (2008), and Timor Leste (2010). The DHS are nationally-representative household surveys conducted approximately every 5 years. All women aged 15-49 in the selected households are eligible to participate. The approach of the DHS is to collect data that are comparable across countries through standard model questionnaires which are adaptable to a country's specifications. The DHS has 3 core questionnaires – the Household, Women's and Men's. Variables included in this study were derived from the Women's survey. The detailed sampling method of the DHS has been reported elsewhere [17]. The DHS data are available in the public domain through <http://www.measuredhs.com> and have been used in many studies for multi-country comparisons investigating different socio-demographic and health indicators [18-22]. The overall sample for this study consists of 74,873 women who responded to the question about pregnancy complication advice and received at least one antenatal care visit from any ANC provider during the mother's most recent pregnancy (singleton/multiple births) within the preceding 5 years.

Study Variables

Dependent Variables

The two outcome variables are defined dichotomously: (1) whether or not a mother was counseled on pregnancy complications during her ANC visit and (2) whether a mother delivered in a healthcare facility or not. Home deliveries refer to mothers delivering at home, the respondent's home, and other homes. Healthcare facility delivery refers to deliveries in the public sector (government hospitals, centers or facilities) and the private sector (hospitals, clinics, or private health professional facilities). The DHS interview asked women to report if they were informed of pregnancy complications during the antenatal/prenatal care visit using the following question (or a slight variation of): "During (any of) your antenatal care visit(s), were you told about the signs of pregnancy complications?"

Independent Variables

The main explanatory variables of interest were chosen (limited by availability of indicators in the survey) because they are predictors of high risk for pregnancy complications: mother's age during delivery (<20 years, 20-34, and >34 years), birth order/parity (one, 2-3, 4-5, ≥6 children), residence (rural, urban), mother's education (no education, completed primary education, completed secondary or higher education), and whether the mother experienced a prior pregnancy termination. Lastly, with the assumption that greater contact with health care providers will likely increase the likelihood of receiving counseling, the number of antenatal care visits (1, 2, 3, 4, ≥5) were also examined as a proxy of exposure to the health care system.

Statistical Analysis

First, to describe the characteristics of the mothers included in the study, frequency tabulations of all the independent variables were generated (Table 1), by country. Second, the prevalence of advice and institutional deliveries among antenatal care users were calculated for each country. Next, univariate associations between the independent variables and receipt of complication were determined using logistic regression (Table 2). Then, the data from the 9 countries were merged for multilevel modeling to examine the multivariate associations between the 2 outcome variables and the predictors of interest. Multilevel logistic regression, adjusted for the mother's age, parity, education, previous history of terminated pregnancy and area of residence, was used to examine the effect of being told about

pregnancy complications and the number of antenatal visits on the likelihood of institutional delivery. Odds ratios (OR) and 95% confidence intervals (CI) are presented. Finally, to analyze whether the magnitude of the known positive association between antenatal visits and institutional delivery differs by advice reception (effect modification) the final regression model included an interaction term which multiplies receipt of pregnancy complication advice by the number of ANC visits. All statistical associations were considered significant at a $p < 0.05$. Observations with missing data were retained in the analyses by using missing indicators [23]. SAS version 9.3 (SAS Institute Inc., Cary, NC) was used to conduct the analyses.

Results

Sample Description

A total of 74,873 women had antenatal care visits during their most recent pregnancy in the included 9 South and Southeast Asian countries (ranging from 3,213 to 29,989 by country). Table 1 shows the mothers' socio-demographic characteristics. Majority of the interviewed mothers were between the ages of 20-34 (78.1%), had 2-3 children (45.2%), without a history of a terminated pregnancy (82.4%), had at least some secondary education (52.3%), received at least 5 antenatal care visits (52.2%) and were rural residents (61.8%). In all but two countries, Cambodia (53.4% primary education) and Pakistan (56.3% with no education), majority of mothers in each country had at least a secondary education, and as high as 74.9% in the Philippines. Less than 50% of mothers sampled in Bangladesh (27.5%), Pakistan (30.8%), Nepal (36.0%), India (45.8%), and Cambodia (47.0%) had at least 5 ANC visits while as high as 85.3% did so in the Maldives. Figure 1 shows the percentage of women recalling receiving advice on pregnancy complications. There was a wide variation between countries, with less than a quarter of women from Cambodia (21.6%), Indonesia (23.7%) and Timor Leste (14.0%) receiving pregnancy complications counseling during ANC visits and as high as 65.7% among women from India.

Univariate associations

Results of the univariate analysis are presented in Table 2. Certain across-country trends were observed. The likelihood of receiving complication advice significantly increases with more antenatal care visits (all countries), higher educational attainment (all but Timor Leste), among urban dwellers (all except Maldives and Timor Leste). For parity, for each increase in birth order, mothers were significantly less likely to receive advice in all countries except Cambodia. For maternal age, the only statistically significant finding was in the Philippines, where with increasing age mothers were less likely to receive pregnancy complication advice. For history of pregnancy complications, mothers with a history of terminated pregnancies in the Philippines were significantly less likely to receive pregnancy complication advice, while in Pakistan mothers with such histories were more likely to receive advice.

Multivariate Associations

Receiving pregnancy complication advice and maternal factors

Table 3 summarizes the multivariate analysis of the pooled data of the 9 countries. Taking into account the hierarchical structure of the data and adjusting for the effects of all other predictors, mothers 20-34 years old (OR=1.09; 95% CI: 1.01-1.19) and older than 34 (OR=1.16; 95% CI=1.05-1.28) were significantly more likely to receive pregnancy advice compared to teenage mothers. Interestingly, mothers with the higher birth orders (4-5 or >5) were significantly less likely to receive pregnancy advice while primipara mothers were more likely to receive advice (OR=1.12; 95% CI: 1.07-1.16) compared to mothers for whom this was their 2nd or 3rd child (i.e. multiparous). Rural women were more likely to receive advice (OR=1.04; 95% CI: 0.99-1.09) than urban women but this was not a statistically significant difference. Compared to mothers with at least a secondary education, mothers with no education (OR=0.60; 95% CI: 0.57-0.63) or just some primary education (OR=0.83; 95% CI: 0.80-0.87) were less likely to receive

advice on complications. Increasing contact with the health care system through antenatal care visits increased the likelihood of receipt of advice. Compared to those with just one antenatal care visit, those with 2 visits were 1.81 times more likely to receive advice and those with at least 5 visits were 2.76 times more likely to do so. Country and cluster level data was expected to vary and a multilevel random effects model found a 0.9 variance at the country level.

Receiving pregnancy complication advice and Institutional Delivery

In terms of institutional delivery, there was a wide variation between countries. In Bangladesh (24.1%), Cambodia (20.4%), Indonesia (18.3%), and Timor Leste (16.2%) less than a quarter of pregnancies was delivered at health care facilities and was as high as half of pregnancies in India (51.3%) and Pakistan (50.2%). Consistently across all countries, receiving advice on pregnancy complications increases the likelihood of institutional deliveries. All were statistically significant differences except in the Maldives (Table 4).

Based on multilevel multivariate regressions, there is a positive effect of the number of antenatal care visits on the likelihood of institutional delivery but no such effect was seen for receiving advice on pregnancy complications during ANC visits (Model 1, Table 5). The analysis showed a null effect of receiving pregnancy complication advice on the likelihood of institutional delivery (OR=0.99; 95% CI: 0.94-1.03). There was an increasing gradient of likelihood of institutional delivery with increasing number of antenatal visits. Mothers with four ANC visits are 2.16 times as likely while those with at least 5 ANC visits were 3.62 times as likely to deliver at health care facilities compared to those with one ANC visit.

Model 2 of Table 5 demonstrates that the receipt of advice increased the impact of increasing antenatal care visits on institutional delivery but not markedly so. Among mothers who attended one antenatal visit, those who received pregnancy complication advice were 10% more likely to have delivered at an institution (OR=1.11) compared to those who had one ANC visit but no advice. Similarly, compared to those with one ANC visit and no pregnancy complication advice, mothers with at least five visits were 3.66 times more likely to have institutional deliveries, while those who additionally received advice were 3.72 times more likely to deliver at a health care facility.

Discussion

Maternal Factors and Receipt of Pregnancy Complication Advice

In this secondary analysis of 74,873 women surveyed through the DHS of 9 South and Southeast Asian countries, older mothers, those with at least a secondary education, primiparas, and those with more antenatal visits were significantly more likely to receive pregnancy advice during ANC visits than their counterparts, i.e. teenage mothers, the less educated, multiparas, and those with less ANC visits (Table 3). Some patterns of inequities were seen particularly with maternal age and education. Consistent with other studies, teenage mothers often receive less or inadequate quality antenatal care services compared to older mothers [9, 18, 24]. The quality of the ANC visit relates to its content like pregnancy complication counseling and vaccination provision. The antenatal period represents a critical chance to deliver interventions that can improve maternal and perinatal health and survival [8]. Missed ANC visits are therefore particularly dire for adolescent mothers who are more likely to have higher rates of anemia [25, 26], low birth weight infants [27], perinatal and infant mortality [28, 29] and maternal mortality [30] compared to mothers in their twenties. The results of the multivariate analysis confirmed the importance of maternal education in relation to pregnancy complication counseling. This finding supports the results of previous studies [31-34] that have shown that mothers with a secondary education or higher are more likely to use adequate ANC visits compared to those with less or no

education. Prior studies [9, 35, 36] have also specifically shown that less educated women were less likely to receive pregnancy complication advice. Moreover, there is disparity even among women who deliver in health care facilities when education is considered. In an analysis of nearly 300,000 women who gave birth at health institutions in 24 countries, mothers with lower educational levels had higher mortality rates than those with higher educational attainment [37].

The analysis also showed that primiparas were more likely to receive pregnancy complication advice than mothers who were having their 2nd and 3rd child. One possible reason is that ANC providers assume that primiparas have less knowledge about parturition so they are given more counseling. A corollary is providers' assumption that multiparous women should have more knowledge about pregnancy danger signs because of experience and prior pregnancy counseling. Several studies have shown that multiparous women indeed have increased awareness of pregnancy complications [12, 35, 38].

The analysis also found a gradient of increasing likelihood of pregnancy complication counseling with increasing number of antenatal care visits. The results of a similar analysis [9] of DHS data from 19 sub-Saharan countries also exhibited this pattern. As seen in other studies [35, 39-41], women with antenatal care visits (even at least one) have more knowledge of pregnancy danger signs than those who had no antenatal care visits. In each ANC visit, the expecting mother receives preventive services, screening and treatment of infections, and counseling on danger signs and other pregnancy, intrapartum, and postnatal-related issues. Based on evidence from a multi-country randomized controlled trial [42] and a systematic review [43] of routine antenatal care, the World Health Organization (WHO) recommends a model of ANC based on four-goal oriented visits (at 8-12 weeks, at 24-26 weeks, 32 weeks and 36-38 weeks gestation), also known as focused antenatal care (FANC) [44]. In the structure of FANC, the woman should receive advice and counseling each session. Logically with each additional visit, the mother gets further opportunity for more pregnancy complication advice.

Pregnancy Complication Counseling and Likelihood of Institutional Delivery

Our multivariate analysis yielded a null effect of pregnancy complication advice on institutional delivery (OR=0.99; 95% CI Table 5, Model 1). While a number of studies [9, 45, 46] have demonstrated that pregnancy complication counseling increases the likelihood of a mother delivering at a healthcare facility, it is also understood that healthcare service utility is a complex behavioral phenomenon [47, 48]. While knowledge of danger signs of pregnancy will likely encourage care-seeking behavior, it is important to "distinguish the mother's own motivation to use services from whether she can act on her wishes [49]". The process that brings a woman to a health facility for delivery has many involved factors. The model by Andersen and Newman [47] that asserts that health care utilization is dependent on (1) the predisposition of the individual to use services, (2) her ability to secure the services, and (3) her illness level can help explain this multifaceted relationship.

According to Andersen and Newman, certain individuals have a propensity to use services more than others and this inclination toward use can be predicted by the individuals' characteristics which exist prior to specific illness episodes [47]. These so-called predisposing factors include demographic (age, gender), social structural (education, occupation) and attitudinal-belief variables. Receipt of pregnancy advice during ANC visits falls under the category of health beliefs. Being sensitized to danger signs of pregnancy may increase a mother's desire to deliver at an institution where she can avail of services that can deal with obstetric complications but it may not necessarily lead her to deliver at a health care facility. It is thus important to examine the mother's wherewithal and motivation to avail of the service, which are examined in the 2 other aspects of the model, respectively.

The second aspect of the model is the ability to be able to secure the service [47] in this case going to a health care facility. High cost/lack of funds, poor quality of services, distance, and cultural beliefs have been identified as some of the main barriers to institutional delivery. A number of studies have examined the high cost of institutional deliveries [50-53]. A Nepal study [51] estimates that a home delivery by a healthcare worker costs \$11.63 while a normal delivery at a facility costs \$8.97 but increases to \$70 if opportunity and transportation costs were added and as much as \$150 for a caesarean section. Consequently, when women have access to health care facilities the next barrier faced by a woman is poor service quality. Quality of service encompasses that a service both (1) meet the standard of care and (2) please its clients [54]. A number of studies have shown that if these two aspects are not addressed then mothers become discouraged from future contact with and delivery at health care facilities [55-58]. Geographic barriers /lack of transportation [45, 51, 59, 60] can also play a role in deterring a woman from even considering institutional delivery. Lastly, cultural factors might affect care-seeking patterns [61]. For example, having the ultimate decisions for pregnancy and delivery-related matters are not always the woman's choice because decision making power lies with her husband or mother-in-law [62-64].

The third aspect of the model is the mother's level of illness. Pregnancy-related problems increase the likelihood of a woman seeking specialized care that can be provided for in a health care facility [65]. For example, a study [66] found that Ugandan and Bangladeshi women were able to overcome cost, transportation and distance issues through social network support (husband, other women in their village, borrowing money) because of recognized need for facility care such as when women experience pregnancy complications or when family see that they are in distress during labor. In another study [59] conducted in Indonesia, a number of interviewed women held the view that institutional delivery or skilled birth attendance was only aimed at women who experience obstetrical complications.

Some argue that focusing on one strategy such as pregnancy complication advice will have limited effect because it only addresses one aspect that leads to maternal and perinatal deaths [67]. The Three Delays model [68] explains that maternal mortality is a function of delays in seeking care, delays in reaching care, and delays in receiving adequate care when at the health care facility. Pregnancy complication advice is a strategy to decrease delays in seeking care. Strategies such as cash-incentive programs like the Janani Suraksha Yojana in India [69-71] and the voucher programs in Bangladesh [72] and Pakistan [73] that help pay for delivery services or transportation costs have been shown to increase health care facility use by addressing issues that delay how a woman reaches care at a healthcare facility. Strategies such as good basic training and continuing medical education of health providers and ensuring correct remuneration and adequate working conditions [58] lead to a better, more motivated health workforce and increase standards of care that address the delays in receiving quality care. Thus, to address one delay alone, like pregnancy complication advice, would be an incomplete response in confronting maternal and neonatal mortality.

Another important point to consider is whether institutional delivery is the right benchmark to aim for in maternal and neonatal mortality reduction. An analysis of strategies to reduce maternal mortality proposed that a health center intrapartum care, with midwives as the main providers with support from other skilled attendants, was the ideal strategy because of the assumption of access to life-saving skilled birth attendance, particularly the capability to deal with complications for e.g. caesarean sections [74]. Their findings also assumed that provided that the major deterrents such as distance, cost and cultural acceptability are bridged, women will opt for institutional delivery. Some commentators have cautioned that though easier to measure than skilled birth attendance, institutional delivery is a faulty indicator of progress in maternal mortality reduction [67]. This strategy assumes that most professional birth

assistance is provided for in health facilities [75]. The worry is that institutional delivery does not always mean access to skilled birth attendance thus even if the goal rates of institutional deliveries are reached women would still miss out on life-saving intrapartum professional assistance. Furthermore, even when mothers have access to health professional in health care facilities (i.e. increased service utilization), the quality of care they receive may be inadequate, e.g. unqualified birth attendants, thus still leading to lost women's and infants' lives [58, 76].

Pregnancy Complication Advice, Number of ANC visits and Institutional Delivery

Lastly, our analysis showed that receipt of pregnancy complication advice significantly increased the impact of increasing antenatal care visits on the likelihood of institutional delivery (Table 5, model 2). This finding is consistent with other studies that have demonstrated increased rates of institutional delivery with increasing ANC visits [9, 77-80]. The logic is that repeated counseling on pregnancy complications with each ANC visit reinforces the need for institutional delivery to the mothers. Our finding though statistically significant did not show a marked difference. For example, mothers who attended one antenatal visit and received complication advice during the visit were only 10% more likely to have delivered at an institution (OR=1.11) compared to those who had one ANC visit but no advice. One possible reason for this dampened effect is suboptimal counseling (lack of repetition of good quality, consistent pregnancy complication messages) delivered during the antenatal care visit which contributes to the poor awareness of danger signs among women [14, 35, 81, 82]. From the provider end, some identified reasons for this poor quality counseling are poor motivation (low salaries, poor working conditions), understaffing (can lead to less time spent counseling mothers), and poor knowledge (insufficient training and supervision) of the importance of giving pregnancy complication advice [13, 83-86]. From the mothers' side, a possible reason is that despite counseling, women do not retain the knowledge of pregnancy complications so being counseled does not translate to care-seeking behavior [13, 14, 38, 87]. Lastly, while women may understand the knowledge they receive in ANC visits, cultural beliefs (e.g. it is God's will that some women die from childbirth) and social dynamics such as lack of decision making power (husband's preference trumps the woman's choice of delivery location) impede them from seeking delivery care at health care facilities [88-90]. On the other hand, about 15 percent of all pregnant women have childbirth complications that will require emergency obstetric care [44] thus even just a 10% increase in institutional delivery might be considered significant and can make a difference in terms of saved maternal and neonatal lives.

Strengths and Limitations

The data used in this study was derived from the Demographic and Health Surveys which have the key advantages of consistent, standardized data collection procedures across countries that allow for comparison across populations, high response rates, and high quality training of interviewers [91]. The large sample size used in the study allowed for the examination of different possible predictors of pregnancy complication advice and institutional delivery. The samples were also restricted to the most recent birth of mothers within the last 5 years of each survey which minimized the potential for recall bias.

There are several data limitations that should be kept in mind in interpreting the findings of this study. Given the cross-sectional nature of the data analyzed, we are unable to infer precise causal relationships. Therefore, the relationships between receipt of pregnancy complication advice and institutional delivery rates are associations rather than causal relationships. Also, some potential predictors, such as cultural beliefs, costs (e.g. out of pocket expenses for home delivery versus institutional delivery) or distance/availability of healthcare facilities were not available in the surveys.

Furthermore, all the information is self-reported. However, these limitations are unlikely to impact the validity of the analyses.

Conclusions

Our study showed a null effect of pregnancy complication advice given during ANC visits on institutional delivery. This is a complex relationship. There is a need to improve the quality of pregnancy complication counseling through better training and supervision of ANC providers and repetition of consistent, quality pregnancy complication messaging that can be understood by mothers of different literacy levels. These steps will help ensure that when a woman comes to an ANC visit she is given adequate information that she can retain and act upon. The strategy should also address inequities of receipt of advice by targeting mothers with low levels of education, high parity mothers, and young mothers (<20). While pregnancy complication advice and other birth preparedness planning activities are critical, it is necessary to address known barriers to seeking institutional delivery and skilled birth attendance namely costs of delivery, transportation issues, and cultural beliefs. Voucher programs/conditional cash transfers, health promotion in communities that tackle local beliefs, and including key decision makers (e.g. mother-in-law, husband) in ANC visits are strategies that could help increase women's utilization of delivery services and in turn save lives of mothers and infants.

References

1. UNICEF. State of the World Children: Children in an Urban World. New York, USA: UNICEF; 2012.
2. WHO U, UNFPA and The World Bank estimates. Trends in Maternal Mortality: 1990 to 2010. Geneva, Switzerland: World Health Organization; 2012.
3. Yakoob MY, Ali MA, Ali MU, Imdad A, Lawn JE, Van Den Broek N, et al. The effect of providing skilled birth attendance and emergency obstetric care in preventing stillbirths. *BMC public health*. 2011;11 Suppl 3:S7. PubMed PMID: 21501458. Pubmed Central PMCID: PMC3231913. Epub 2011/04/29. eng.
4. Harrison KA. Why are 4 million newborn babies dying every year? *Lancet*. 2004 Sep 25-Oct 1;364(9440):1121. PubMed PMID: 15451210. Epub 2004/09/29. eng.
5. Khan KS, Wojdyla D, Say L, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. *Lancet*. 2006 Apr 1;367(9516):1066-74. PubMed PMID: 16581405. Epub 2006/04/04. eng.
6. WHO. Managing Complications in Pregnancy and Childbirth - A Guide for Midwives and Doctors. Geneva: World Health Organization; 2000.
7. Carroli G, Rooney C, Villar J. How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence. *Paediatric and perinatal epidemiology*. 2001 Jan;15 Suppl 1:1-42. PubMed PMID: 11243499. Epub 2001/03/13. eng.
8. Abou-Zahr C, Wardlaw, TM. Antenatal care in developing countries: promises, achievements, and missed opportunities: an analysis of trends, levels and differentials, 1990-20012003. Available from: http://www.childinfo.org/files/antenatal_care.pdf.
9. Nikiema B, Beninguisse G, Haggerty JL. Providing information on pregnancy complications during antenatal visits: unmet educational needs in sub-Saharan Africa. *Health policy and planning*. 2009 Sep;24(5):367-76. PubMed PMID: 19401360. Epub 2009/04/30. eng.
10. Jahn A, Dar lang M, Shah U, Diesfeld HJ. Maternity care in rural Nepal: a health service analysis. *Tropical medicine & international health : TM & IH*. 2000 Sep;5(9):657-65. PubMed PMID: 11044281. Epub 2000/10/24. eng.
11. Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L. Evidence-based, cost-effective interventions: how many newborn babies can we save? *Lancet*. 2005 Mar 12-18;365(9463):977-88. PubMed PMID: 15767001. Epub 2005/03/16. eng.
12. Hailu M, Gebremariam A, Alemseged F. Knowledge about Obstetric Danger Signs among Pregnant Women in Aleta Wondo District, Sidama Zone, Southern Ethiopia. *Ethiopian journal of health sciences*. 2010 Mar;20(1):25-32. PubMed PMID: 22434957. Pubmed Central PMCID: PMC3275898. Epub 2010/03/01. eng.
13. Pembe AB, Carlstedt A, Urassa DP, Lindmark G, Nystrom L, Darj E. Quality of antenatal care in rural Tanzania: counselling on pregnancy danger signs. *BMC pregnancy and childbirth*. 2010;10:35. PubMed PMID: 20594341. Pubmed Central PMCID: PMC2907301. Epub 2010/07/03. eng.
14. Anya SE, Hydera A, Jaiteh LE. Antenatal care in The Gambia: missed opportunity for information, education and communication. *BMC pregnancy and childbirth*. 2008;8:9. PubMed PMID: 18325122. Pubmed Central PMCID: PMC2322944. Epub 2008/03/08. eng.
15. Hasan IJ, Nisar N. Womens' perceptions regarding obstetric complications and care in a poor fishing community in Karachi. *JPMA The Journal of the Pakistan Medical Association*. 2002 Apr;52(4):148-52. PubMed PMID: 12174478. Epub 2002/08/15. eng.
16. Sharma SK, Vong-Ek P. Perceptions and care seeking behavior of obstetric complication in Thailand. *Kathmandu University medical journal (KUMJ)*. 2012 Apr;10(38):63-70. PubMed PMID: 23132479. Epub 2012/11/08. eng.

17. International I. Demographic and Health Survey Sampling and Household Listing Manual. Calverton, Maryland, U.S.A2012.
18. Magadi MA, Agwanda AO, Obare FO. A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: evidence from Demographic and Health Surveys (DHS). *Social science & medicine* (1982). 2007 Mar;64(6):1311-25. PubMed PMID: 17174017. Epub 2006/12/19. eng.
19. Palermo T, Peterman A. Are female orphans at risk for early marriage, early sexual debut, and teen pregnancy? Evidence from sub-Saharan Africa. *Studies in family planning*. 2009 Jun;40(2):101-12. PubMed PMID: 19662802. Epub 2009/08/11. eng.
20. Nguyen H, Snider J, Ravishankar N, Magvanjav O. Assessing public and private sector contributions in reproductive health financing and utilization for six sub-Saharan African countries. *Reproductive health matters*. 2011 May;19(37):62-74. PubMed PMID: 21555087. Epub 2011/05/11. eng.
21. Kennedy E, Gray N, Azzopardi P, Creati M. Adolescent fertility and family planning in East Asia and the Pacific: a review of DHS reports. *Reproductive health*. 2011;8:11. PubMed PMID: 21545708. Pubmed Central PMCID: PMC3113330. Epub 2011/05/07. eng.
22. Dibley MJ, Roy SK, Senarath U, Patel A, Tiwari K, Agho KE, et al. Across-country comparisons of selected infant and young child feeding indicators and associated factors in four South Asian countries. *Food and nutrition bulletin*. 2010 Jun;31(2):366-75. PubMed PMID: 20707239. Epub 2010/08/17. eng.
23. Miettinen O. *Theoretical Epidemiology: Principles of Occurrence Research in Medicine*. New York: Delmar Publishing; 1985.
24. WHO/UNFPA. *Pregnant adolescents: delivering on global promises of hope*. Geneva, Switzerland: World Health Organization; 2006.
25. Scholl TO, Hediger ML. Anemia and iron-deficiency anemia: compilation of data on pregnancy outcome. *The American journal of clinical nutrition*. 1994 Feb;59(2 Suppl):492S-500S discussion S-1S. PubMed PMID: 8304287. Epub 1994/02/01. eng.
26. UNICEF. *Progress for Children: A report card on maternal mortality*. New York, New York: UNICEF; 2008 September 2008.
27. WHO, editor *Early marriages, adolescent and young pregnancies*. Sixty-fifth World Health Assembly 2011; Geneva, Switzerland: WHO.
28. Zabin LS, Kiragu K. The health consequences of adolescent sexual and fertility behavior in sub-Saharan Africa. *Studies in family planning*. 1998 Jun;29(2):210-32. PubMed PMID: 9664633. Epub 1998/07/17. eng.
29. WHO. *Adolescent pregnancy: unmet needs and undone deeds a review of the literature and programmes*: WHO; 2007. Available from: http://whqlibdoc.who.int/publications/2007/9789241595650_eng.pdf.
30. PAHO. *Maternal Mortality and Morbidity Background Paper*. Inaugural Conference on Global Health, Gender and Human Rights (March 2012)2012.
31. Ali AA, Osman MM, Abbaker AO, Adam I. Use of antenatal care services in Kassala, eastern Sudan. *BMC pregnancy and childbirth*. 2010;10:67. PubMed PMID: 20973972. Pubmed Central PMCID: PMC2987884. Epub 2010/10/27. eng.
32. Arthur E. Wealth and antenatal care use: implications for maternal health care utilisation in Ghana. *Health economics review*. 2012;2(1):14. PubMed PMID: 22866869. Pubmed Central PMCID: PMC3484029. Epub 2012/08/08. eng.
33. Navaneetham K, Dharmalingam A. Utilization of maternal health care services in Southern India. *Social science & medicine* (1982). 2002 Nov;55(10):1849-69. PubMed PMID: 12383469. Epub 2002/10/18. eng.

34. Simkhada B, Teijlingen ER, Porter M, Simkhada P. Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *Journal of advanced nursing*. 2008 Feb;61(3):244-60. PubMed PMID: 18197860. Epub 2008/01/17. eng.
35. Pembe AB, Urassa DP, Carlstedt A, Lindmark G, Nystrom L, Darj E. Rural Tanzanian women's awareness of danger signs of obstetric complications. *BMC pregnancy and childbirth*. 2009;9:12. PubMed PMID: 19323836. Pubmed Central PMCID: PMC2667432. Epub 2009/03/28. eng.
36. Okour A, Alkhateeb M, Amarin Z. Awareness of danger signs and symptoms of pregnancy complication among women in Jordan. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2012 Jul;118(1):11-4. PubMed PMID: 22503521. Epub 2012/04/17. eng.
37. Karlsen S, Say L, Souza JP, Hogue CJ, Calles DL, Gulmezoglu AM, et al. The relationship between maternal education and mortality among women giving birth in health care institutions: analysis of the cross sectional WHO Global Survey on Maternal and Perinatal Health. *BMC public health*. 2011;11:606. PubMed PMID: 21801399. Pubmed Central PMCID: PMC3162526. Epub 2011/08/02. eng.
38. Doctor HV, Findley SE, Cometto G, Afenyadu GY. Awareness of critical danger signs of pregnancy and delivery, preparations for delivery, and utilization of skilled birth attendants in Nigeria. *Journal of health care for the poor and underserved*. 2013 Feb;24(1):152-70. PubMed PMID: 23377725. Epub 2013/02/05. eng.
39. Nisar N, White F. Factors affecting utilization of antenatal care among reproductive age group women (15-49 years) in an urban squatter settlement of Karachi. *JPMA The Journal of the Pakistan Medical Association*. 2003 Feb;53(2):47-53. PubMed PMID: 12705483. Epub 2003/04/23. eng.
40. Yousuf F, Haider G, Shaikh RB. Factors for inaccessibility of antenatal care by women in Sindh. *Journal of Ayub Medical College, Abbottabad : JAMC*. 2010 Oct-Dec;22(4):187-9. PubMed PMID: 22455294. Epub 2010/10/01. eng.
41. Alam AY, Qureshi AA, Adil MM, Ali H. Comparative study of knowledge, attitude and practices among antenatal care facilities utilizing and non-utilizing women. *JPMA The Journal of the Pakistan Medical Association*. 2005 Feb;55(2):53-6. PubMed PMID: 15813628. Epub 2005/04/09. eng.
42. Villar J, Ba'aqeel H, Piaggio G, Lumbiganon P, Miguel Belizan J, Farnot U, et al. WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care. *Lancet*. 2001 May 19;357(9268):1551-64. PubMed PMID: 11377642. Epub 2001/05/30. eng.
43. Carroli G, Villar J, Piaggio G, Khan-Neelofur D, Gulmezoglu M, Mugford M, et al. WHO systematic review of randomised controlled trials of routine antenatal care. *Lancet*. 2001 May 19;357(9268):1565-70. PubMed PMID: 11377643. Epub 2001/05/30. eng.
44. The Partnership for Maternal NaCH. *Opportunities for Africa's newborns: Practical data, policy and programmatic support for newborn care in Africa*. Joy Lawn StC, and Kate Kerber, Save the Children and BASICS, editor: World Health Organization; 2006.
45. Gage AJ. Barriers to the utilization of maternal health care in rural Mali. *Social science & medicine (1982)*. 2007 Oct;65(8):1666-82. PubMed PMID: 17643685. Epub 2007/07/24. eng.
46. Stekelenburg J, Kyanamina S, Mukelabai M, Wolffers I, van Roosmalen J. Waiting too long: low use of maternal health services in Kalabo, Zambia. *Tropical medicine & international health : TM & IH*. 2004 Mar;9(3):390-8. PubMed PMID: 14996369. Epub 2004/03/05. eng.
47. Andersen R, Newman JF. Societal and Individual Determinants of Medical Care Utilization in the United States. *The Milbank Memorial Fund Quarterly Health and Society*. 1973;51(1):95-124.
48. Thomas RK. *Health Services Planning*. Second edition
ed. 2002: Kluwer Academic Publishers; 2002.

49. Gabrysch S, Campbell OM. Still too far to walk: literature review of the determinants of delivery service use. *BMC pregnancy and childbirth*. 2009;9:34. PubMed PMID: 19671156. Pubmed Central PMCID: PMC2744662. Epub 2009/08/13. eng.
50. Kesterton AJ, Cleland J, Sloggett A, Ronsmans C. Institutional delivery in rural India: the relative importance of accessibility and economic status. *BMC pregnancy and childbirth*. 2010;10:30. PubMed PMID: 20525393. Pubmed Central PMCID: PMC2898676. Epub 2010/06/08. eng.
51. Borghi J, Ensor T, Neupane BD, Tiwari S. Financial implications of skilled attendance at delivery in Nepal. *Tropical medicine & international health : TM & IH*. 2006 Feb;11(2):228-37. PubMed PMID: 16451348. Epub 2006/02/03. eng.
52. Griffiths P, Stephenson R. Understanding users' perspectives of barriers to maternal health care use in Maharashtra, India. *Journal of biosocial science*. 2001 Jul;33(3):339-59. PubMed PMID: 11446398. Epub 2001/07/12. eng.
53. Mohanty SK, Srivastava A. Out-of-pocket expenditure on institutional delivery in India. *Health policy and planning*. 2012 Jun 17. PubMed PMID: 22709923. Epub 2012/06/20. Eng.
54. Mavalankar D. Quality of care in institutional deliveries: the paradox of the Dominican Republic: a commentary on management. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2003 Jul;82(1):107-10. PubMed PMID: 12834955. Epub 2003/07/02. eng.
55. Matthews Z, Ramakrishna J, Mahendra S, Kilaru A, Ganapathy S. Birth rights and rituals in rural south India: care seeking in the intrapartum period. *Journal of biosocial science*. 2005 Jul;37(4):385-411. PubMed PMID: 16082853. Epub 2005/08/09. eng.
56. Acharya LB, Cleland J. Maternal and child health services in rural Nepal: does access or quality matter more? *Health policy and planning*. 2000 Jun;15(2):223-9. PubMed PMID: 10837046. Epub 2000/06/03. eng.
57. Shiferaw S, Spigt M, Godefrooij M, Melkamu Y, Tekie M. Why do women prefer home births in Ethiopia? *BMC pregnancy and childbirth*. 2013;13:5. PubMed PMID: 23324550. Pubmed Central PMCID: PMC3562506. Epub 2013/01/18. eng.
58. Koblinsky M, Matthews Z, Hussein J, Mavalankar D, Mridha MK, Anwar I, et al. Going to scale with professional skilled care. *Lancet*. 2006 Oct 14;368(9544):1377-86. PubMed PMID: 17046470. Epub 2006/10/19. eng.
59. Titaley CR, Hunter CL, Dibley MJ, Heywood P. Why do some women still prefer traditional birth attendants and home delivery?: a qualitative study on delivery care services in West Java Province, Indonesia. *BMC pregnancy and childbirth*. 2010;10:43. PubMed PMID: 20701762. Pubmed Central PMCID: PMC2928756. Epub 2010/08/13. eng.
60. Otis KE, Brett JA. Barriers to hospital births: why do many Bolivian women give birth at home? *Revista panamericana de salud publica = Pan American journal of public health*. 2008 Jul;24(1):46-53. PubMed PMID: 18764994. Epub 2008/09/04. eng.
61. Barros AJ, Ronsmans C, Axelson H, Loaiza E, Bertoldi AD, Franca GV, et al. Equity in maternal, newborn, and child health interventions in Countdown to 2015: a retrospective review of survey data from 54 countries. *Lancet*. 2012 Mar 31;379(9822):1225-33. PubMed PMID: 22464386. Epub 2012/04/03. eng.
62. Seljeskog L, Sundby J, Chimango J. Factors influencing women's choice of place of delivery in rural Malawi--an explorative study. *African journal of reproductive health*. 2006 Dec;10(3):66-75. PubMed PMID: 17518132. Epub 2007/05/24. eng.
63. Shrestha SK, Banu B, Khanom K, Ali L, Thapa N, Stray-Pedersen B, et al. Changing trends on the place of delivery: why do Nepali women give birth at home? *Reproductive health*. 2012;9:25. PubMed PMID: 23050689. Pubmed Central PMCID: PMC3538619. Epub 2012/10/12. eng.

64. Morrison J, Osrin D, Shrestha B, Tambahangphe KM, Tamang S, Shrestha D, et al. How did formative research inform the development of a women's group intervention in rural Nepal? *Journal of perinatology : official journal of the California Perinatal Association*. 2008 Dec;28 Suppl 2:S14-22. PubMed PMID: 19057563. Pubmed Central PMCID: PMC3428870. Epub 2008/12/17. eng.
65. Fikre AA, Demissie M. Prevalence of institutional delivery and associated factors in Dodota Woreda (district), Oromia regional state, Ethiopia. *Reproductive health*. 2012;9:33. PubMed PMID: 23241397. Pubmed Central PMCID: PMC3546055. Epub 2012/12/18. eng.
66. Parkhurst JO, Rahman SA, Ssengooba F. Overcoming access barriers for facility-based delivery in low-income settings: insights from Bangladesh and Uganda. *Journal of health, population, and nutrition*. 2006 Dec;24(4):438-45. PubMed PMID: 17591340. Pubmed Central PMCID: PMC3001147. Epub 2007/06/27. eng.
67. Maine D. Detours and shortcuts on the road to maternal mortality reduction. *Lancet*. 2007 Oct 13;370(9595):1380-2. PubMed PMID: 17933653. Epub 2007/10/16. eng.
68. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Social science & medicine* (1982). 1994 Apr;38(8):1091-110. PubMed PMID: 8042057. Epub 1994/04/01. eng.
69. Gupta SK, Pal DK, Tiwari R, Garg R, Shrivastava AK, Sarawagi R, et al. Impact of Janani Suraksha Yojana on institutional delivery rate and maternal morbidity and mortality: an observational study in India. *Journal of health, population, and nutrition*. 2012 Dec;30(4):464-71. PubMed PMID: 23304913. Epub 2013/01/12. eng.
70. Gopalan SS, Durairaj V. Addressing maternal healthcare through demand side financial incentives: experience of Janani Suraksha Yojana program in India. *BMC health services research*. 2012;12:319. PubMed PMID: 22978630. Pubmed Central PMCID: PMC3470975. Epub 2012/09/18. eng.
71. Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *Lancet*. 2010 Jun 5;375(9730):2009-23. PubMed PMID: 20569841. Epub 2010/06/24. eng.
72. Nguyen HT, Hatt L, Islam M, Sloan NL, Chowdhury J, Schmidt JO, et al. Encouraging maternal health service utilization: an evaluation of the Bangladesh voucher program. *Social science & medicine* (1982). 2012 Apr;74(7):989-96. PubMed PMID: 22326107. Epub 2012/02/14. eng.
73. Agha S. Impact of a maternal health voucher scheme on institutional delivery among low income women in Pakistan. *Reproductive health*. 2011;8:10. PubMed PMID: 21539744. Pubmed Central PMCID: PMC3108911. Epub 2011/05/05. eng.
74. Campbell OM, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. *Lancet*. 2006 Oct 7;368(9543):1284-99. PubMed PMID: 17027735. Epub 2006/10/10. eng.
75. Stanton C, Blanc AK, Croft T, Choi Y. Skilled care at birth in the developing world: progress to date and strategies for expanding coverage. *Journal of biosocial science*. 2007 Jan;39(1):109-20. PubMed PMID: 16522226. Epub 2006/03/09. eng.
76. Hofmeyr GJ, Haws RA, Bergstrom S, Lee AC, Okong P, Darmstadt GL, et al. Obstetric care in low-resource settings: what, who, and how to overcome challenges to scale up? *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2009 Oct;107 Suppl 1:S21-44, S-5. PubMed PMID: 19815204. Epub 2009/10/10. eng.
77. Teferra AS, Alemu FM, Woldeyohannes SM. Institutional delivery service utilization and associated factors among mothers who gave birth in the last 12 months in Sekela District, north west of Ethiopia: a community-based cross sectional study. *BMC pregnancy and childbirth*. 2012;12:74. PubMed PMID: 22849421. Pubmed Central PMCID: PMC3449175. Epub 2012/08/02. eng.
78. Pradhan A. Situation of antenatal care and delivery practices. *Kathmandu University medical journal (KUMJ)*. 2005 Jul-Sep;3(3):266-70. PubMed PMID: 18650590. Epub 2008/07/25. eng.

79. Ndao-Brumblay SK, Mbaruku G, Kruk ME. Parity and institutional delivery in rural Tanzania: a multilevel analysis and policy implications. *Health policy and planning*. 2012 Nov 5. PubMed PMID: 23132915. Epub 2012/11/08. Eng.
80. Amano A, Gebeyehu A, Birhanu Z. Institutional delivery service utilization in Munisa Woreda, South East Ethiopia: a community based cross-sectional study. *BMC pregnancy and childbirth*. 2012;12:105. PubMed PMID: 23043258. Pubmed Central PMCID: PMC3506545. Epub 2012/10/10. eng.
81. Mpmembeni RN, Killewo JZ, Leshabari MT, Massawe SN, Jahn A, Mushi D, et al. Use pattern of maternal health services and determinants of skilled care during delivery in Southern Tanzania: implications for achievement of MDG-5 targets. *BMC pregnancy and childbirth*. 2007;7:29. PubMed PMID: 18053268. Pubmed Central PMCID: PMC2222241. Epub 2007/12/07. eng.
82. Mutiso SM, Qureshi Z, Kinuthia J. Birth preparedness among antenatal clients. *East African medical journal*. 2008 Jun;85(6):275-83. PubMed PMID: 18817024. Epub 2008/09/27. eng.
83. Mathauer I, Imhoff I. Health worker motivation in Africa: the role of non-financial incentives and human resource management tools. *Human resources for health*. 2006;4:24. PubMed PMID: 16939644. Pubmed Central PMCID: PMC1592506. Epub 2006/08/31. eng.
84. Dieleman M, Cuong PV, Anh LV, Martineau T. Identifying factors for job motivation of rural health workers in North Viet Nam. *Human resources for health*. 2003 Nov 5;1(1):10. PubMed PMID: 14613527. Pubmed Central PMCID: PMC280735. Epub 2003/11/14. Eng.
85. Manafa O, McAuliffe E, Maseko F, Bowie C, MacLachlan M, Normand C. Retention of health workers in Malawi: perspectives of health workers and district management. *Human resources for health*. 2009;7:65. PubMed PMID: 19638222. Pubmed Central PMCID: PMC2722569. Epub 2009/07/30. eng.
86. Medhanyie A, Spigt M, Dinant G, Blanco R. Knowledge and performance of the Ethiopian health extension workers on antenatal and delivery care: a cross-sectional study. *Human resources for health*. 2012;10(1):44. PubMed PMID: 23171076. Pubmed Central PMCID: PMC3536599. Epub 2012/11/23. eng.
87. Kabakyenga JK, Ostergren PO, Turyakira E, Pettersson KO. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reproductive health*. 2011;8:33. PubMed PMID: 22087791. Pubmed Central PMCID: PMC3231972. Epub 2011/11/18. eng.
88. Malata A, Chirwa E. Childbirth information needs for first time Malawian mothers who attended antenatal clinics. *Malawi medical journal : the journal of Medical Association of Malawi*. 2011 Jun;23(2):43-7. PubMed PMID: 23074811. Epub 2011/06/01. eng.
89. Magoma M, Requejo J, Campbell OM, Cousens S, Filippi V. High ANC coverage and low skilled attendance in a rural Tanzanian district: a case for implementing a birth plan intervention. *BMC pregnancy and childbirth*. 2010;10:13. PubMed PMID: 20302625. Pubmed Central PMCID: PMC2850322. Epub 2010/03/23. eng.
90. Agus Y, Horiuchi S, Porter SE. Rural Indonesia women's traditional beliefs about antenatal care. *BMC research notes*. 2012;5:589. PubMed PMID: 23106915. Pubmed Central PMCID: PMC3532090. Epub 2012/10/31. eng.
91. Corsi DJ, Neuman M, Finlay JE, Subramanian SV. Demographic and health surveys: a profile. *International journal of epidemiology*. 2012 Dec;41(6):1602-13. PubMed PMID: 23148108. Epub 2012/11/14. eng.

Appendices
(Tables 1-5 and Figure 1)

Appendix A-1: Table 1: Distribution of the mothers' characteristics across the 9 selected South and Southeast Asian countries

Maternal Characteristics	N= 74873	Country % (n)								
		Totals	Bangladesh	Cambodia	India	Indonesia	Maldives	Nepal	Philippines	Pakistan
Mother's Age										
< 20	5.3% (3951)	15.4% (746)	3.3% (187)	5.8% (1728)	3.2% (460)	0.78% (25)	8.2% (284)	4.3%(196)	4.4% (160)	3.2% (165)
20-34	78.1% (58453)	77.4% (3759)	45.6% (4290)	85.2% (25542)	72.8% (10428)	78.4%% (2520)	82.4% (2856)	69.2% (3121)	74.8% (2750)	60.8% (3187)
>34	16.7% (12469)	7.3% (354)	20.0% (1122)	9.1% (2719)	24.0% (3428)	20.8% (668)	9.5% (328)	26.5 (1194)	20.9% (768)	36.0% (1888)
Parity										
1	30.8% (23029)	39.8% (1933)	32.3% (1808)	31.5% (9437)	32.3% (4622)	40.1% (1289)	34.0% (1180)	27.8% (1253)	20.1% (740)	14.6% (767)
2-3	45.2% (33873)	47.6% (2313)	46.5% (2602)	49.1% (14738)	47.4% (6781)	37.6% (1207)	46.8% (1623)	39.6% (1787)	35.7% (1312)	28.8% (1510)
4-5	15.5% (11623)	10.4% (505)	14.4% (808)	13.8% (4148)	14.8% (2123)	14.0% (450)	14.2% (491)	19.7% (890)	23.2% (852)	25.9% (1356)
≥6	8.5% (6348)	2.2% (108)	6.8% (381)	5.6% (1666)	5.5% (790)	8.3% (267)	5.0% (174)	12.9% (581)	21.0% (774)	30.7% (1607)
Ever had a terminated pregnancy										
No	82.4% (61691)	81.7% (3971)	72.8% (4075)	82.1% (24613)	87.8% (12567)	82.0% (2636)	78.5% (2723)	79.5% (3587)	74.2% (2728)	91.4% (4791)
Yes	17.6% (13182)	18.3% (888)	27.2% (1524)	17.9% (5376)	12.2% (1524)	18.0% (577)	21.5% (745)	20.5% (924)	25.8% (950)	8.6% (449)
Mother's highest educational level										
None	22.1% (16533)	10.8% (526)	16.1% (901)	30.7% (9217)	2.8% (393)	13.9% (442)	37.9% (1314)	1.7% (75)	56.3% (2070)	30.4% (1595)
Primary	25.6% (19148)	26.0% (1263)	53.4% (2992)	14.4% (4318)	37.8% (5417)	39.6% (1256)	20.6% (713)	23.4% (1057)	16.3% (601)	29.2% (1531)
≥ Secondary	52.3% (39146)	63.2% (3070)	30.5% (1706)	54.9% (16453)	59.4 (8504)	46.4% (1472)	41.6% (1441)	74.9% (3379)	27.4% (1007)	40.3% (2114)
Number of antenatal care visits										
1	6.8% (5120)	21.1% (1027)	5.4% (302)	6.7% (2011)	2.9% (416)	0.37% (12)	6.8% (234)	3.4% (153)	20.8% (764)	3.8% (201)
2	13.2% (9874)	20.2% (980)	9.5% (532)	18.8% (5629)	4.4% (625)	0.68% (22)	12.3% (426)	6.2% (280)	19.1% (703)	13.0% (677)
3	15.3% (11437)	19.0% (920)	19.1% (1071)	17.9% (5370)	9.2% (1317)	1.2% (38)	18.9% (657)	11.0% (494)	16.1% (593)	18.7% (977)
4	11.2% (8407)	12.3% (596)	18.5% (1038)	9.6% (2882)	8.0% (1140)	1.5% (48)	26.0% (901)	10.4% (471)	11.6% (425)	17.3% (906)
≥ 5	52.2% (39049)	27.5% (1335)	47.0% (2631)	45.8% (13734)	74.6% (10680)	85.3% (2743)	36.0% (1250)	68.8% (3102)	30.8% (1132)	46.6% (2442)
Don't Know	1.3%(986)	0.02% (1)	0.5% (27)	1.2% (363)	1.0% (138)	11.0% (350)	0.0% (0)	0.24%% (11)	1.7% (61)	0.7% (37)
Area of Residence										
Urban	38.2% (28593)	38.7% (1878)	29.3% (1643)	44.1% (13215)	40.3% (5765)	12.9 % (415)	24.1% (835)	43.7% (1970)	43.4% (1595)	24.4% (1277)
Rural	61.8% (46280)	61.4% (2981)	70.7% (3956)	55.9% (16774)	59.7% (8551)	87.1% (2798)	75.9% (2633)	56.3% (2541)	56.6% (2083)	75.6% (3963)

DHS Data Periods: Bangladesh (2011), Cambodia (2010), India (2006), Indonesia (2007), Maldives (2009), Nepal (2011), Pakistan (2007), Philippines (2008), and Timor Leste (2010)

Appendix A-2: Table 2: Univariate association of the independent predictors with the reported receipt of pregnancy complication advice during the antenatal visits of 9 South and Southeast Asian countries

Maternal Characteristics	Country																	
	Bangladesh		Cambodia		India		Indonesia		Maldives		Nepal		Philippines		Pakistan		Timor Leste	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Mother's Age	0.97 ^a	(0.86, 1.11)	1.14 ^a	(0.98, 1.32)	1.01 ^a	(0.95, 1.08)	0.99 ^a	(0.93, 1.07)	0.85 ^a	(0.72, 1.00)	0.91 ^a	(0.75, 1.11)	0.84 ^a	(0.74, 0.94)	0.92 ^a	(0.79, 1.08)	0.99 ^a	(0.89, 1.10)
Parity	0.85 ^e	(0.78, 0.92)	1.01 ^a	(0.94, 1.09)	0.73 ^e	(0.71, 0.76)	0.81 ^e	(0.77, 0.84)	0.91 ^b	(0.85, 0.98)	0.73 ^e	(0.66, 0.80)	0.73 ^e	(0.69, 0.78)	0.93 ^b	(0.87, 1.00)	1.06 ^b	(1.00, 1.11)
Ever had a terminated pregnancy	1.08 ^a	(0.92, 1.26)	0.94 ^a	(0.81, 1.09)	1.05 ^a	(0.98, 1.12)	1.07 ^a	(0.97, 1.19)	0.90 ^a	(0.75, 1.07)	1.11 ^a	(0.91, 1.37)	0.80 ^c	(0.69, 0.93)	1.28 ^c	(1.08, 1.51)	1.14 ^a	(0.93, 1.39)
Mother's highest educational level	1.21 ^e	(1.11, 1.31)	1.33 ^e	(1.20, 1.47)	1.59 ^e	(1.54, 1.64)	2.02 ^e	(1.89, 2.16)	1.28 ^e	(1.16, 1.41)	1.79 ^e	(1.62, 1.98)	1.87 ^e	(1.65, 2.13)	1.48 ^e	(1.36, 1.61)	1.02 ^a	(0.96, 1.09)
Number of antenatal care visits	1.29 ^e	(1.24, 1.35)	1.36 ^e	(1.30, 1.43)	1.46 ^e	(1.43, 1.49)	1.45 ^e	(1.40, 1.51)	1.17 ^b	(1.02, 1.32)	1.87 ^e	(1.74, 2.00)	1.61 ^e	(1.52, 1.70)	1.34 ^e	(1.28, 1.41)	1.29 ^e	(1.23, 1.34)
Area of Residence	0.76 ^e	(0.67, 0.86)	0.66 ^e	(0.56, 0.76)	0.61 ^e	(0.58, 0.64)	0.64 ^e	(0.60, 0.69)	1.17 ^a	(0.95, 1.43)	0.68 ^d	(0.55, 0.84)	0.70 ^e	(0.62, 0.80)	0.86 ^b	(0.74, 1.00)	1.46 ^e	(1.28, 1.65)

^a – non-significant; ^b – significant at p<0.05; ^c – significant at p<0.01; ^d – significant at <0.001; ^e – significant at p<0.0001

Appendix A-3: Table 3: Likelihood of receiving advice about pregnancy complications during antenatal visits in 9 South and Southeast Asian countries (parameter estimates are from a multilevel multivariable logistic model N=74873)

	Odds Ratio	95% Confidence Interval	
		Lower	Upper
Fixed Effects			
Maternal age			
<20	reference		
20-34 years	1.09	1.01	1.19
>34	1.16	1.05	1.28
Parity			
1	1.12	1.07	1.16
2-3	reference		
4-5	0.91	0.86	0.96
>5	0.90	0.84	0.97
Ever had a terminated pregnancy			
Yes	1.13	1.08	1.17
No	reference		
Mother's education:			
None	0.60	0.57	0.63
Primary	0.83	0.80	0.87
≥ secondary	reference		
Number of antenatal visits:			
1	reference		
2	1.27	1.17	1.39
3	1.81	1.67	1.97
4	2.37	2.17	2.58
5	2.76	2.56	2.98
Don't Know	1.34	1.14	1.58
Area of residence			
Urban	ref		
Rural	1.04	0.99	1.09
Random Effects ^b			
Cluster level variance			
Constant	1.07*	0.03	
Country level variance			
Constant	0.99*	0.49	
Area of residence	0.03*	0.01	

*Significant at 5% level; ^a - Fixed effects takes into account the variance by cluster; ^b - Variances are in the Logit scale

Appendix A-4: Table 4: The likelihood of institutional delivery among women and its association with having been told about pregnancy complications, among antenatal care users in the 9 selected countries of South and Southeast Asia

Country	Overall rate of institutional deliveries among ANC users	Rate of institutional deliveries by receipt of pregnancy complications advice				P value of the difference*
		No		Yes		
		n	%	n	%	
	% (n)					
Bangladesh	24.1% (1165)	305	19.4%	860	26.3%	<0.0001
Cambodia	20.4% (1137)	168	15.4%	969	21.6%	<0.0001
India	51.3% (15439)	9750	45.5%	5599	65.7%	<0.0001
Indonesia	18.3% (2615)	1374	15.2%	1241	23.7%	<0.0001
Maldives	48.2% (1534)	695	46.8%	839	49.4%	0.1460
Nepal	39.8% (1359)	183	26.1%	1176	43.4%	<0.0001
Philippines	44.7% (2018)	456	31.4%	1562	51.2%	<0.0001
Pakistan	50.2% (1846)	1284	47.0%	562	59.8	<0.0001
Timor Leste	16.2% (846)	403	19.4%	443	14.0%	<0.0001

DHS Data Periods: Bangladesh (2011), Cambodia (2010), India (2006), Indonesia (2007), Maldives (2009), Nepal (2011), Pakistan (2007), Philippines (2008), and Timor Leste (2010)

*Statistical significance $p < 0.05$ for the χ^2 statistic

Appendix A-5: Table 5: Likelihood of Institutional delivery in the 9 selected countries of South and Southeast Asia

	Odds Ratio	95% Confidence Interval	
		Lower	Upper
Model 1: Main Effects/Fixed Effects^a			
Received counseling on pregnancy complications			
No	Reference		
Yes	0.99	0.94	1.03
Number of antenatal care visits			
1	Reference		
2	1.26	1.13	1.40
3	1.61	1.45	1.79
4	2.16	1.94	2.40
≥5	3.42	3.11	3.77
Don't Know	4.14	3.45	4.97
Model 2: Interactions Effects			
Effect of the number of antenatal care visits among women DID NOT received counseling on pregnancy complications			
1	Reference		
2	1.46	1.20	1.78
3	1.81	1.51	2.18
4	2.11	1.76	2.55
≥5	3.66	3.08	4.34
Don't Know	5.13	3.78	6.95
Effect of the number of antenatal care visits among women RECEIVED counseling on pregnancy complications			
1	1.11	0.91	1.36
2	1.31	1.09	1.58
3	1.76	1.41	2.03
4	2.54	2.11	3.06
≥5	3.72	3.13	4.43
Don't Know	4.12	3.18	5.34

^a - the results are from multilevel logistic regressions are adjusted for women's age, parity, education, previous history of terminated pregnancy and area of residence.

Appendix B-1: Figure 1: Percentage of antenatal care users who were told about pregnancy complications during their most recent pregnancy in 9 South and Southeast Asian Countries

