Maternal health-seeking behavior and child's birth order: Evidence from Malawi, Uganda, and Zimbabwe

Makate, Marshall

Department of Economics, State University of New York at Albany

10 June 2016

Maternal health-seeking behavior and child's birth order: Evidence from Malawi, Uganda, and Zimbabwe

Marshall Makate[1]

Abstract: Factors influencing maternal health-seeking behavior before and shortly after birth have been widely studied, while the role of birth order in shaping these actions is infrequently examined. This study sought to examine the critical role played by a child's birth order in altering the maternal health-seeking behavior of women in developing countries. The analysis uses the most recent rounds of the nationally representative standard Demographic and Health Survey for Malawi, Uganda, and Zimbabwe. The empirical analysis utilizes two-level random intercept logistic regression models to assess the potential influence of birth order on prenatal care utilization, birth in a health facility, and breastfeeding. We find that women in Malawi, Uganda, and Zimbabwe were 34.9%, 34.6%, and 43.5% respectively, less liable to complete more than four prenatal care visits for a fifth or later born child than they are for a first born child. Women in Malawi, Uganda, and Zimbabwe were 56.4%, 58.8%, and 77.2% respectively less liable to give birth to a fifth born child in a hospital facility. Also, women who seek prenatal care in Malawi were 50.9% less liable to experience a neonatal death. Also, in Malawi and Zimbabwe the odds of a child dying before reaching the age of one year were 23.7% and 41.6% respectively. Breastfeeding had a protective effect on child survival in all the countries. Overall, we found that women tend to make low investments in maternal health and child well-being for higher order births than they do for first order births. This suggests the need for providers to encourage and re-educate mothers on the importance of investments in maternal health inputs even for higher order births.

Keywords: Birth order; prenatal care; facility delivery; breastfeeding; sub-Saharan Africa

[1] Ph.D. Candidate, Department of Economics, The State University of New York at Albany, Albany, New York, Email: mmakate@albany.edu

Maternal health-seeking behavior and child's birth order: Evidence from Malawi, Uganda, and Zimbabwe

Background

Mothers face various opportunities for enhancing their health or the health and well-being of their children during pregnancy and shortly after delivery through investments in maternal health care inputs. For instance, pregnant women are encouraged to seek prenatal care early in the first trimester of gestation [1]. Timely and adequate prenatal care has been shown to lower the risks of adverse birth outcomes including infant mortality [2, 3]. Besides, pregnant women benefit from the educational advice they receive from health care providers regarding dietary and nutritional choices, risks of smoking and drinking alcohol, complications during pregnancy among others [4]. Shortly following birth women may opt to breastfeed their newborn or seek postnatal care within the first two months of life. Breastfeeding is widely regarded and recommended as a means of enhancing infant health and nutrition and offers copious other benefits to women and the environment [5-7]. There is also ample evidence documenting the benefits associated with institutional birth deliveries, postnatal care, and child immunizations on maternal and infant health outcomes [8-10].

Given the perceived benefits associated with maternal health inputs, many previous studies have attempted to identify the factors explaining these behaviors. These factors include maternal education, household income, cultural beliefs, and availability of health care centers, employment status, and marital status [9-15]. Some of the factors mentioned above have also been associated with breastfeeding initiation including immigration status [16, 17]. Previous studies have identified community-level factors such as religious beliefs, literacy levels, and

access to information (through reading newspapers, listening to the radio and watching television) to be among the factors associated with breastfeeding initiation [18-20].

This study focuses on an important determinant of prenatal and postnatal investments in maternal and infant health and nutrition that has received relatively less attention especially in the context of developing countries. We focus on the birth order of the child. There is some reason to consider that a mother may not invest equally in children of different birth order [21, 22]. For instance, K Buckles and S Kolka [21] shows that women in the United States are 6.6 percent less liable to utilize available prenatal care inputs for higher birth orders. Other studies indicate that families have tendencies to spend less time reading or playing with children of higher birth orders [22, 23]. The central hypothesis to be tested is whether women reduce prenatal and postnatal health investments for higher order births compared to first order births. An understanding of the behavioral tendencies of women by birth order status will be of importance to public health policy makers and health care providers as this would identify higher parity as a risk factor in the use of maternal health care services. The differences in maternal health investments by birth order status may also contribute to birth order effects to later life child outcomes [21].

Despite the importance of this issue for public health policy, very little is known in the context of developing countries. Using data from the nationally representative Demographic and Health Survey (DHS) of selected countries in Asia, sub-Saharan Africa (SSA) and Latin America H Guliani, A Sepehri and J Serieux [24] found that higher order births are less liable to occur in hospital facilities. While the study by H Guliani, A Sepehri and J Serieux [24] gives valuable insights, it fails to disaggregate health seeking behavior within each country. On the other hand,

M De Haan, E Plug and J Rosero [25] found that Ecuadorian women have tendencies to breastfeed higher order births longer than lower order births. They also found that children of higher order births had a much higher human capital development compared to their older siblings. Using data from twelve countries in SSA, M Tenikue and B Verheyden [26] found that earlier born children from low-income families acquire low levels of schooling compared to their counterparts from richer families.

We build from the above literature and add to the prevailing discussions in three ways. First, we examine whether mothers have a tendency to reduce investments in prenatal and postnatal health care for children of higher order births compared to first order births. Second, since health-seeking behavior might potentially differ by household wealth status, we test whether there are any observed differences in health-seeking behavior by household wealth status. Third, we examine the potential association between maternal health-seeking behavior and child health outcomes.

Methods

Data source

The analysis in this study uses data from the nationally representative DHS for Malawi, Uganda, and Zimbabwe. For each country, we collect the most recent round of the available standard DHS survey. For Malawi we have survey data collected in 2010; Uganda, 2011; Zimbabwe, 2010/11. No ethical approval is required for this study which is sorely based on secondary data. The data for this study was formally requested online from the DHS website (http://dhsprogram.com/data/available-datasets.cfm) and an approval to download the data for the respective countries was granted. All the questionnaires and data collection procedures for

the DHS survey have been reviewed and approved by the ICF international Institutional Review Board. The DHS is a cross-sectional household survey conducted by ICF International in collaboration with the governments of each country. The survey collects detailed health information for women of reproductive ages 15-49 and their children. The survey uses a stratified two-stage cluster sample design based on the population censuses for each country as provided by the national statistical offices. The first stage involved a random sampling of clusters or enumeration areas followed by a random sampling of listed households within the randomly selected clusters (excluding families living in institutional facilities like boarding schools, hospitals, army barracks, or police camps) at the second stage. The response rates in the DHS are very high averaging over 90% in each country [27].

The analysis in this study uses the birth recode data file of the DHS, which contains all the birth histories for all the children born to each respondent (woman). This data file also contains parental and household characteristics as well as child health information for the most recent birth that occurred within the last five years before each survey. For that reason, our analysis uses data for children aged between 0-59 months for which information on prenatal care, facility birth and breastfeeding is available. The final analytical samples are based on the most recent birth occurring five years prior to each survey. All observations with missing values on the dependent variable were dropped from the analysis.

Measures

The DHS collects detailed information regarding maternal health care utilization to women of reproductive ages 15-49. This information includes, prenatal care use, postnatal care for children after birth, child immunizations, places of childbirth, and breastfeeding among other

information. The analysis in this study uses the responses to the survey questions related to prenatal care use, facility birth and breastfeeding to construct three measures of maternal health-seeking behavior by mothers. First, prenatal care is measured by an indicator variable taking 1 if woman completed four or more prenatal care visits for her most recent pregnancy and 0 otherwise. This definition is in-line with the World Health Organization (WHO) standard recommendations of four or more prenatal care visits for women with less-complicated pregnancies and who are living in developing countries [4]. Second, facility birth is measured by an indicator variable taking 1 if the woman gave birth in a clinic or hospital facility and 0 otherwise. Lastly, we measure breastfeeding using an indicator variable taking 1 if the respondent is currently breastfeeding and the child is two years and below and 0 otherwise.

Health-seeking behavior by the woman is thought to depend on a set number of individual, parental, household, and community-level characteristics as identified by the previous literature. At the mother-level, our model controls for the age of the mother at the time of birth, marital status, employment status, body mass index, previous birth experiences, contraceptive usage, and the years of completed education. A woman's previous birth experiences are likely to influence her decision to seek more maternal health care services. As postulated by JE Harris [28], the decision to utilize maternal health services is potentially subject to selectivity bias which takes two main forms namely, adverse and favorable self-selection. Adverse self-selection arises when women in ill-health have a tendency to use more prenatal care services to protect the health of their unborn children [28]. On the one hand, favorable self-selection arises when knowledgeable or better educated women see it must to invest in maternal health services since they possess superior knowledge about the associated benefits to their personal health as well as the health of their children [29]**.** Though we do not adequately address these concerns, we make an attempt by

including variables related to the women's previous birth experiences and body mass index which measures the health status of the woman. At the child-level, we include the child's gender, birth order, and the year of birth. We also included indicators for household wealth, household size, year of survey, regional indicators, and an indicator for urban residence.

Empirical model

To examine the relationship between birth order and maternal health inputs during and after pregnancy, we estimate a random-intercept logistic regression model [30]. This model allows us to take into account the hierarchical nature of the DHS data. More specifically, the model takes into account the importance of the community context in explaining the demand for maternal health inputs. Health-seeking behavior by pregnant women might be shaped by the communities or clusters (enumeration areas) in which they reside [31]. We thus estimate the following model:

$$Y_{ij} = X'_{ij}\beta + u_i + \epsilon_{ij} \qquad (1)$$

where Y_{ij} is the main outcome variable for woman j living in community i, u_i is the random intercept capturing the unobserved community characteristics affecting health-seeking behavior, and ϵ_{ij} is a residual component. The random intercept and residual components are assumed to be independently and normally distributed with zero means and constant variances τ^2 and σ^2, respectively [30]. Equation (1) represents a two-level random intercept logistic regression. Following the DHS complex survey design, level two units are the clusters or enumeration areas (primary sampling units). The enumeration areas in the DHS correspond to smaller geographic units.

Additionally, we examine the association between maternal health behaviors on selected child health outcomes. Specifically, we examine the relationship between maternal health care

outcomes and child mortality outcomes and birth weight. We focus on the likelihood of a child dying before reaching the age of 28 days, the age of one year, and the likelihood of having a low birth weight (birth weight less than 2500 grams). We estimate a series of logistic regression models to examine the association between the maternal health and child outcomes. The decisions to use maternal outcomes such as prenatal care suffer from potential self-selectivity bias problems due to their voluntary nature. The analysis in this paper makes no attempt to address such issues and as such report mere correlations between maternal and child health outcomes.

Results

Descriptive analysis

Table 1 presents the characteristics of our sample for each country by birth order. The average number of prenatal care visits range from 3.5 in Uganda to 4.2 in Zimbabwe. The proportion of women receiving antenatal care is highest in Zimbabwe where approximately 64.8% of pregnant women receive the recommended number of visits. The World Health Organization (WHO) recommends that pregnant women living in developing countries and with normal pregnancies complete at least four prenatal care visits during pregnancy [4]. The percentage of women receiving four or more prenatal care visits for the most recent pregnancy was 47.6% in Uganda and 45.5% in Malawi. Regarding the timeliness of care, very few women initiate prenatal care early in the first trimester, 12.4% in Malawi, 20.8% in Uganda and 19.4% in Zimbabwe. It appears that women in all the countries tend to complete more prenatal care visits and are most liable to seek prenatal care in the first trimester for first-born children than they do for higher order births. Nearly 75.1% of women deliver in a health facility in Malawi,

58.0% in Uganda and 66% in Zimbabwe. The proportion of children receiving all the recommended number of immunizations (for tetanus, Bacillus Calmette-Guerin (BCG) vaccine, polio and measles) is highest in Malawi, 83.2%, 67.1% in Uganda and 60.9% in Zimbabwe. Regarding seeking postnatal care for children two months after delivery, 59% of Zimbabwean women seek care for their child with 30.8% and 30.3% in Malawi and Uganda respectively. Breastfeeding rates are lowest in Zimbabwe (74.2%) while in Uganda and Malawi nearly 77.8% and 86.1% respectively, breastfeed their children. While it appears that women have a tendency to favor first order births compared to higher order births with regards to prenatal care and delivery care, the same cannot hold true for breastfeeding practices. There are very small differences in breastfeeding rates between first order births and later births. For example, in Malawi, 49.6% of first births have access to four or more prenatal care visits compared to 44.1% for birth order five and above. In Uganda we observe 55.2% prenatal care use for first born children than 44% for fifth borns and above while in Zimbabwe 67.3% of first borns receive four or more visits compared to only 59.7%.

[Insert Table 1 here]

Table 1 also summarizes the demographic characteristics of the women in our sample. In all the countries, the average age at birth is almost similar at nearly 24 years. Nearly all the children in our sample were born to married mothers (99%) while about 17.7%, 28.8%, and 13.1% of the children in Malawi, Uganda, and Zimbabwe respectively were born to mothers who had previously terminated a pregnancy. The average years of completed education for women are 4, 4.3, and 8 years in Malawi, Uganda, and Zimbabwe respectively. The share of girls and boys is

nearly equal in all the countries (approximately 49% for girls). The average year of birth for children in Malawi was 1999.6, 2000.5 in Uganda and 1999.8 in Zimbabwe.

Figure 1 shows the differences in health-seeking behavior by women in Malawi, Uganda and Zimbabwe relative to the first born child. Here, we index maternal health-seeking behavior to the first born child. In other words, we compare maternal health-seeking behavior for the first born child to the rest of later births. The percentage of health-seeking behavior is calculated using the odds ratios from the random intercept logit regression models for each outcome variable and for each country. Here, we observe that women in Malawi are less liable to make investments in their child's well-being with each successive birth especially for prenatal care and facility delivery. For instance, women in Malawi are 25% liable likely to complete four or more prenatal care visits for a second born child than the first. In Uganda and Zimbabwe mothers are nearly 18% and 26% respectively, less likely to complete four or more prenatal care visits for the second born than the first born child on the average. For delivery care, second born children in Malawi, Uganda and Zimbabwe are almost 42%, 39%, and 36% less liable to be delivered in a health facility respectively compared to their first born counterparts. Regarding breastfeeding, we observe that the odds of being breastfed increases for by 26%, 5.1%, and 24% for second born children in Malawi, Uganda and Zimbabwe respectively compared to their first born counterparts. Concerning breastfeeding, the child's birth order was not a statistically significant predictor for breastfeeding behavior by women in all the countries.

[Insert Figure 1 here]

Econometric results

Table 2 presents the regression results from the random intercept regression model (equation (1)) for each country for all the three outcome variables measuring prenatal and postnatal health-seeking behavior by women. For brevity and since the focus of this study is on examining the role of birth order in influencing maternal health-seeking behavior, we only report the coefficient estimates for birth order. The likelihood ratio test statistic comparing the standard logit regression model to the two-level logit model clearly favors the random intercept model over the standard logit model in all the specifications. Table 2 also shows the intra-cluster correlation coefficient from each of the three models and for each country. The intra-cluster correlation measures the proportion of the total remaining (unobserved) variance in the outcome variable that is due to the variability between subjects in the same cluster [30]. The intra-cluster correlation coefficient for the model for prenatal care in Malawi was 0.028, 0.039 in Uganda and 0.032 in Zimbabwe. The intra-cluster correlation coefficients imply that approximately 2.8%, 3.9%, and 3.2% of the variation in prenatal care in Malawi, Uganda, and Zimbabwe respectively is explained by unobserved community differences. Approximately 20.9%, 18.7%, and 10.9% of the variation in facility delivery use in Malawi, Uganda, and Zimbabwe respectively is due to unobserved cluster-specific effects. Regarding breastfeeding, approximately 8.72%, 3.53%, and 1.95% of the variation in breastfeeding in Malawi, Uganda, and Zimbabwe respectively, is explained by unobserved cluster-specific effects.

[Insert Table 2 here]

The first panel of Table 2 shows the regression estimates from the model for the receipt of four or more prenatal care visits. Here we observe that women are increasingly and significantly

less liable to complete four or more antenatal care visits for higher order births compared to first order births. For example, in Malawi we observe that mothers are 34.9% less likely to complete four or more prenatal care visits for children of birth order five and above compared to first order births. Mothers in Uganda and Zimbabwe are 34.6% and 43.5% less liable to complete four or more prenatal care visits respectively to fifth born children compared to first-born children. A clear linear gradient is clearly observable for Zimbabwean mothers favoring first born children to later born children with regards to prenatal care utilization.

The second panel of Table 2 shows the regression estimates for the model for facility delivery. Compared to their first pregnancies, women in all the three countries are less liable to deliver higher-order births in a health center. For instance, women in Malawi are 56.4% less likely to deliver fifth or higher order births in a health facility than first order births. The odds are even higher for women in Uganda and Zimbabwe, 58.8% and 77.2% respectively compared to first births. The findings are statistically significant at the 1% significance level in all the countries. The last panel of Table 3 shows the regression results for the demand for breastfeeding among women. The results indicate that the child's birth order does not statistically and significantly influence the decision to breastfeed children in all the countries.

Table 3 presents the results disaggregated by household wealth for each country. The first panel in Table 3 shows the results for the prenatal care model. The results indicate that in Malawi women in low wealth households are 23.4% less liable to complete four or more prenatal care visits for second order births than first order births and the result is statistically significant at the 5% significant level. We do not find any statistical significance for higher order births. However, women living in high wealth families appear to favor first born children compared to their later

born counterparts. For example we observe that nearly 44.9% of women in high wealth families are less liable to complete four or more prenatal care visits for fifth order births than first order births. In Uganda, women from low income families appear to invest more in maternal health care for first order births than they do for later births. We do not find a significant effect of birth order for women in high income families. In Zimbabwe, women from low and high wealth households have a tendency to favor first order births than later births with regards to prenatal care use.

[Insert Table 3 here]

The middle panel of Table 3 also shows the results for the facility delivery model. Concerning facility delivery, we find evidence to suggest that women invest more in maternal care for first order births than for higher order births. This behavior is much more apparent among women living in high income households. The last panel shows the results for breastfeeding and we fail to find a statistically significant impact of birth order on health-seeking behavior by mothers. We only observe that Zimbabwean women in high income households are 3.48 times more liable to breastfeed a second born child than a first born child. This result is statistically significant at 10% significance level.

Table 4 presents the results for the association between maternal health care outcomes and child health outcomes. The results indicate that Malawian women who complete four or more prenatal care visits during pregnancy are 50.9 % less likely to experience a neonatal death compared to their counterparts who did not complete four or more prenatal care visits. This finding is statistically significant at 5% significance level. We did not find any statistically

significant association between prenatal care and neonatal survival in Uganda and Zimbabwe. Also, women who breastfeed their children are less liable to experience a neonatal death than their counterparts. Particularly, we observe that women in Malawi, Uganda, and Zimbabwe are nearly 98.1%, 94.1%, and 96.4%, respectively less likely to experience a neonatal death than their non-breastfeeding counterparts. This result is statistically significant at the 1% significance level.

[Insert Table 4 here]

Regarding infant mortality, we find that women in Malawi and Zimbabwe who seek prenatal care are 23.7% and 41.6% (significant at 10% level) less likely to experience an infant death than their counterparts who failed to complete the recommended number of prenatal care visits. We find an even stronger protective effect of breastfeeding on infant survival in all the countries. In Malawi and Zimbabwe, women who seek prenatal care are also 16.1% and 35.3%, respectively less liable to have a child die before the survey date. Prenatal care has a protective impact on child's birth weight in all the countries though it's only in Malawi that we observe a statistically significant impact.

Discussion

The findings from this study appear to show and support our initial hypothesis that mothers tend to invest less in health and child well-being for higher-order births than first order births. This result is particularly true for maternal health-seeking behavior related to prenatal care and facility delivery. Our empirical analysis uses nationally representative data from the DHS for Malawi, Uganda and Zimbabwe. Using a random intercept logistic regression model that

accounts for the unobserved factors at the cluster level, we found that women in all the countries have a tendency to complete four or more prenatal care visits as well as seek delivery assistance for first born children than they do for later born kids. This behavior is not true with regards to breastfeeding practice. Unobserved community characteristics explain a significant part of this behavior in all the models. We also found that the odds that women fail to invest in health-seeking behavior are much higher among women from high wealth families than for low wealth households. The findings in this study corroborate the results of J-Y Lehmann, A Nuevo-Chiquero and M Vidal-Fernandez [32] who examined the effect of birth order on different education and labor market outcomes for children in the United States. Our study differs from their analysis in that we do not consider the effect of birth order on children's education and labor market outcomes.

We also find that women in Malawi, Uganda and Zimbabwe are more likely to complete four or more prenatal care visits for first order births than higher order births. This finding is consistent with the findings in K Buckles and S Kolka [21]. Nevertheless, other studies did not find any variations between first and higher-order births [33]. Our results for breastfeeding are at odds with the findings in K Buckles and S Kolka [21]. Our results also corroborate the findings of M De Haan, E Plug and J Rosero [25] who also considered the influence of birth order on maternal health-seeking behavior among Ecuadorian women. While the focus of the present study is not of the effect of birth order on human capital development, we restrict our analysis to investments in prenatal and postnatal care investments. In a related study H Guliani, A Sepehri and J Serieux [24] examined the role of prenatal care on hospital delivery low and middle-income countries. In a model that controls for birth order, their results are also consistent with

the findings of this study regarding the influence of birth order on facility delivery. Our preliminary analysis of the association of maternal health outcomes on child mortality and low birth weight are not at odds with previous other studies [9, 34].

This study is one of the first studies to consider birth order differences in the context of low-income countries in sub-Saharan Africa. Previous other studies have explored this possibility in the context of developed countries [21]. In the context of developing countries, most studies have not focused on the influence of birth order on maternal health-seeking behavior both prenatal and postnatal [25, 35]. Besides, there is the need for empirical evidence in sub-Saharan Africa since health-seeking behavioral patterns might differ by regions and across different cultures [21]. We believe that the findings in this study are of importance to providers, who can identify higher order birth as an important determinant of low investments in maternal and child well-being in Malawi, Uganda, and Zimbabwe as well as sub-Saharan Africa as a whole. Many providers have a tendency to focus on first-time mothers, but the findings of this study suggest the need for continued education on the importance of adequate prenatal care and facility delivery to non-first time birth mothers. Also, since we found a significant and important role played by the community context, it is imperative for health planners to design programs that educate women at the community level on the importance of use of maternal health care services for all children regardless of birth order. Community-level programs of this nature might go a long way in improving the well-being of women and their children.

Our study is not without limitations. First, we acknowledge that the DHS data we use allows us to focus on the child outcomes for women only for the most recent birth occurring in the last five years. This limitation does not enable us to compare health-seeking behavior for women

among her children. Nevertheless, we believe that the findings in this study will be of importance to providers and health policy planners in developing countries. Second, this study does not explain why women tend to invest more in first-order births than higher-order births. Possible explanations for this behavior might include the potential role played by time and financial constraints inhibiting mothers to invest more in the health of their children [36]. Furthermore, women might learn from previous pregnancy experiences. For instance, a woman might realize that breastfeeding might be more time consuming and costly that she might decide not to breastfeed the next child [37]. Knowledge and explanations of why women lower investments in maternal health-seeking behavior across birth order will be relevant to providers and public health policy makers in their quest to encourage the use of maternal health services among women of higher-order pregnancies. Lastly, the analysis in this study does not control for potential self-selection bias which has been found to bias the results. However, despite all the above limitations, this study provides important insights regarding maternal health-seeking behavior and child well-being and thus makes an important contribution to the body of literature.

Conclusion

The present study suggests that women in our sample invest more in maternal health and child well-being for first born children than higher-order births especially for prenatal and delivery care. Therefore, health providers in Malawi, Uganda and Zimbabwe should focus on the need to educate and encourage women of higher birth orders on the importance of maternal and child health investments to their children regardless of their order in the family. Also, there is a need to focus on designing specific community-level programs that educate women on the importance of adequate health investments for all their children regardless of their position in the

family. Our results thus stress the importance of continued education on the importance of completing four or more prenatal care visits during pregnancy, giving birth in a health facility and breastfeeding children at the community or cluster level. Our results are easily generalizable to a number of other developing countries in sub-Saharan Africa since comparable survey data are available for these countries.

References

1. Abou Zahr C, Wardlaw TM: **Antenatal care in developing countries : promises, achievements and missed opportunities : an analysis of trends, levels and differentials, 1990-2001 / [prepared by Carla AbouZahr and Tessa Wardlaw]**: Geneva : World Health Organization ; New York : UNICEF, c2003.; 2003.

2. Evans WN, Lien DS: **The benefits of prenatal care: evidence from the PAT bus strike**. *Journal of Econometrics* 2005, **125**(1):207-239.

3. Subramanian S, Katz KS, Rodan M, Gantz MG, El-Khorazaty NM, Johnson A, Joseph J: **An integrated randomized intervention to reduce behavioral and psychosocial risks: pregnancy and neonatal outcomes**. *Maternal and child health journal* 2012, **16**(3):545-554.

4. Lincetto O, Mothebesoane-Anoh S, Gomez P, Munjanja S: **Antenatal care**. *Opportunities for Africa's newborns: Practical data, policy and programmatic support for newborn care in Africa* 2006.

5. Gartner LM, Morton J, Lawrence RA, Naylor AJ, O'Hare D, Schanler RJ, Eidelman AI: **Breastfeeding and the use of human milk**. *Pediatrics* 2005, **115**(2):496-506.

6. Kramer MS, Chalmers B, Hodnett ED, Sevkovskaya Z, Dzikovich I, Shapiro S, Collet J-P, Vanilovich I, Mezen I, Ducruet T: **Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus**. *Jama* 2001, **285**(4):413-420.

7. Coulibaly R, Séguin L, Zunzunegui M-V, Gauvin L: **Links Between Maternal Breast-Feeding Duration and Québec Infants' Health: A Population-Based Study. Are the Effects Different for Poor Children?** *Maternal & Child Health Journal* 2006, **10**(6):537-543.

8. Bustreo F, Okwo-Bele JM, Kamara L: **World Health Organization perspectives on the contribution of the Global Alliance for Vaccines and Immunization on reducing child mortality**. *Archives of Disease in Childhood* 2015, **100**(Supp1):s34-s37.

9. Maitra P: **Parental bargaining, health inputs and child mortality in India**. *Journal of Health Economics* 2004, **23**(2):259-291.

10. Dhakal S, Chapman GN, Simkhada PP, van Teijlingen ER, Stephens J, Raja AE: **Utilisation of postnatal care among rural women in Nepal**. *BMC Pregnancy & Childbirth* 2007, **7**:19-27.

11. Adamu YM, Salihu HM: **Barriers to the use of antenatal and obstetric care services in rural Kano, Nigeria**. *Journal Of Obstetrics And Gynaecology: The Journal Of The Institute Of Obstetrics And Gynaecology* 2002, **22**(6):600-603.

12. Chama-Chiliba CM, Koch SF: **Utilization of focused antenatal care in Zambia: Examining individual- and community-level factors using a multilevel analysis**. *Health Policy and Planning* 2015, **30**(1):78-87.

13. Magadi MA, Madise NJ, Rodrigues RN: **Frequency and timing of antenatal care in Kenya: explaining the variations between women of different communities**. *Social Science & Medicine* 2000, **51**(4):551-561.

14. Muchabaiwa L, Mazambani D, higusiwa L, Bindu S, Mudavanhu V: **Determinants of Maternal Healthcare Utilization in Zimbabwe**. *International Journal of Economic Sciences & Applied Research* 2012, **5**(2):145-162.

15. Guliani H, Sepehri A, Serieux J: **Determinants of prenatal care use: evidence from 32 low-income countries across Asia, Sub-Saharan Africa and Latin America**. *HEALTH POLICY AND PLANNING* 2014, **29**(5):589-602.

16. Singh GK, Kogan MD, Dee DL: **Nativity/immigrant status, race/ethnicity, and socioeconomic determinants of breastfeeding initiation and duration in the United States, 2003**. *Pediatrics* 2007, **119**(Supplement 1):S38-S46.

17. Celi AC, Rich-Edwards JW, Richardson MK, Kleinman KP, Gillman MW: **Immigration, race/ethnicity, and social and economic factors as predictors of breastfeeding initiation**. *Archives of pediatrics & adolescent medicine* 2005, **159**(3):255-260.

18. Maonga AR, Mahande MJ, Damian DJ, Msuya SE: **Factors Affecting Exclusive Breastfeeding among Women in Muheza District Tanga Northeastern Tanzania: A Mixed Method Community Based Study**. *Maternal and Child Health Journal* 2016, **20**:77-87.

19. Kong SK, Lee DT: **Factors influencing decision to breastfeed**. *J Adv Nurs* 2004, **46**(4):369-379.

20. Heck KE, Braveman P, Cubbin C, Chávez GF, Kiely JL: **Socioeconomic Status and Breastfeeding Initiation Among California Mothers**. *Public Health Reports* 2006, **121**(1):51-59.

21. Buckles K, Kolka S: **Prenatal investments, breastfeeding, and birth order**. *Social Science & Medicine* 2014, **118**:66-70.

22. Price J: **Parent-Child Quality Time Does Birth Order Matter?** *Journal of Human Resources* 2008, **43**(1):240-265.

23. Monfardini C, See SG: **Birth order and child outcomes: does maternal quality time matter?** 2012.

24. Guliani H, Sepehri A, Serieux J: **What impact does contact with the prenatal care system have on women's use of facility delivery? Evidence from low-income countries**. *Social Science & Medicine* 2012, **74**(12):1882-1890.

25. De Haan M, Plug E, Rosero J: **Birth Order and Human Capital Development Evidence from Ecuador**. *Journal of Human Resources* 2014, **49**(2):359-392.

26. Tenikue M, Verheyden B: **Birth Order and Schooling: Theory and Evidence from Twelve Sub-Saharan Countries**. *Journal of African Economies* 2010, **19**(4):459-495.

27. Rutstein SO, Rojas G: **Guide to DHS statistics**. *Calverton, Maryland: ORC Macro* 2006.

28. Harris JE: **Prenatal medical care and infant mortality**. In: *Economic aspects of health.* edn.: University of Chicago Press; 1982: 13-52.

29. Gortmaker SL: **The effects of prenatal care upon the health of the newborn**. *Am J Public Health* 1979, **69**(7):653-660.

30. Rabe-Hesketh S, Skrondal A: **Multilevel and longitudinal modeling using Stata**: STATA press; 2008.

31. Gage AJ, Calixte MG: **Effects of the Physical Accessibility of Maternal Health Services on Their Use in Rural Haiti**. *Population Studies* 2006, **60**(3):271-288.

32. Lehmann J-Y, Nuevo-Chiquero A, Vidal-Fernandez M: **Explaining the birth order effect: The role of prenatal and early childhood investments**. 2012.

33. LaVeist TA, Keith VM, Gutierrez ML: **Black/white differences in prenatal care utilization: an assessment of predisposing and enabling factors**. *Health services research* 1995, **30**(1 Pt 1):43.

34. Wehby GL, Murray JC, Castilla EE, Lopez-Camelo JS, Ohsfeldt RL: **Prenatal Care Demand and its Effects on Birth Outcomes by Birth Defect Status in Argentina**. *Economics and human biology* 2009, **7**(1):84-95.

35. Barcellos SH, Carvalho LS, Lleras-Muney A: **Child Gender and Parental Investments in India: Are Boys and Girls Treated Differently?** *American Economic Journal: Applied Economics* 2014, **6**(1):157-189.

36. Forste R, Weiss J, Lippincott E: **The decision to breastfeed in the United States: does race matter?** *Pediatrics* 2001, **108**(2):291-296.

37. Morris SN, Johnson NR: **Exercise during pregnancy: a critical appraisal of the literature**. *The Journal of reproductive medicine* 2005, **50**(3):181-188.

Table 1: Descriptive statistics by birth order

		Malawi						Uganda						Zimbabwe					
	Overall	Birth order					Overall	Birth order					Overall	Birth order					
Variables		1	2	3	4	5+		1	2	3	4	5+		1	2	3	4	5+	
Prenatal care																			
Mean number of visits	3.5	3.6	3.5	3.5	3.5	3.5	3.5	3.7	3.6	3.6	3.4	3.4	4.2	4.5	4.1	4.3	4.4	3.7	
% received four or more visits	45.5	49.6	43.6	44.4	46.9	44.1	47.6	55.2	49.9	50.1	45.0	44.0	64.8	67.3	63.4	65.9	65.6	59.7	
% received care in first trimester	12.4	15.7	14.4	12.4	11.3	9.9	20.8	27.1	24.1	20.3	20.5	17.4	19.4	21.1	17.8	18.3	23.1	17.5	
% received care in third trimester	12.4	7.9	11.2	11.4	12.0	16.4	12.4	6.0	10.4	13.1	13.2	15.1	14.4	12.4	16.0	17.0	12.2	13.9	
% delivered in health facility	75.1	83.0	76.1	75.5	73.3	69.4	58.0	73.6	64.7	58.0	52.5	49.6	66.0	74.6	68.8	65.0	60.8	43.7	
% postnatal after two months	30.3	28.9	29.8	29.7	31.0	30.9	30.8	35.9	34.1	30.9	33.9	26.6	59.0	64.7	62.9	56.5	53.9	48.0	
% fully immunized	83.2	83.1	82.8	84.4	81.9	83.5	67.1	70.1	70.4	66.5	66.7	64.6	60.9	64.2	61.5	64.3	56.4	50.0	
% breastfed	86.1	85.7	87.1	86.2	85.3	86.2	77.8	74.8	79.0	78.5	81.0	77.3	74.2	72.1	76.4	73.4	75.3	74.2	
Mean age at birth	24.5	18.8	21.5	24.1	26.7	32.0	24.7	18.7	21.1	23.4	25.6	31.1	24.4	20.0	23.3	26.4	29.0	33.0	
Mean years of education	4.0	4.9	4.5	4.0	3.5	2.7	4.3	5.2	4.8	4.5	4.1	3.3	8.0	8.7	8.4	7.9	7.1	5.9	
% terminated pregnancy	17.7	15.4	16.0	17.1	18.4	21.7	28.8	24.5	25.9	27.6	29.1	33.9	13.1	11.7	12.6	14.0	14.8	15.3	
% married	99.4	97.9	99.7	99.9	99.9	100.0	98.7	96.2	98.9	99.3	99.6	99.7	98.0	96.2	98.4	99.3	99.3	99.6	
Mean household size	6.1	5.5	5.7	6.0	6.3	6.8	6.8	6.1	6.3	6.5	6.8	7.6	5.6	5.2	5.3	5.6	5.9	6.9	
% urban	14.4	17.3	16.1	14.5	12.7	10.6	12.7	17.9	15.8	13.6	11.8	7.1	28.9	34.8	32.6	27.2	21.0	13.1	
% female	49.7	49.2	49.4	50.0	49.4	50.3	49.2	49.4	48.5	49.7	47.8	49.7	49.8	50.2	50.0	49.0	48.4	50.7	
Mean year of birth	1999.6	1997.8	1998.8	1999.6	2000.3	2001.6	2000.5	1998.2	1999.2	2000.0	2000.8	2002.8	1999.8	1998.7	1999.8	2000.1	2000.6	2001.5	
Observations	72301	18041	15172	12105	9190	17793	28609	6393	5421	4429	3611	8755	19279	6725	5003	3221	1961	2369	

Notes: All estimates are weighted to be nationally representative of each country. Source: Demographic and Health Surveys for Malawi, Uganda and Zimbabwe.

Table 2: Regression results for effect of birth order on maternal health-seeking behavior

	MALAWI		UGANDA		ZIMBABWE	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Four or more prenatal care visits						
Fixed part						
2nd child	0.752***	[0.665,0.851]	0.820	[0.660,1.020]	0.741**	[0.605,0.908]
3rd child	0.742***	[0.649,0.849]	0.819	[0.646,1.040]	0.665**	[0.514,0.861]
4th child	0.764***	[0.657,0.889]	0.686**	[0.533,0.883]	0.592**	[0.431,0.812]
5th child+	0.651***	[0.545,0.778]	0.654**	[0.495,0.864]	0.565**	[0.387,0.825]
Random part						
Intra-cluster correlation	0.0283		0.0388		0.0323	
Standard error of random-intercept term	0.310		0.364		0.331	
Likelihood ratio test statistic	45.45		22.06		10.04	
Level 1 units	13473		4879		3837	
Level 2 units	802		396		304	
Delivery in health facility						
Fixed part						
2nd child	0.583***	[0.512,0.663]	0.606***	[0.494,0.744]	0.640***	[0.526,0.779]
3rd child	0.521***	[0.452,0.601]	0.454***	[0.364,0.566]	0.439***	[0.343,0.562]
4th child	0.513***	[0.437,0.603]	0.399***	[0.314,0.506]	0.392***	[0.290,0.530]
5th child+	0.436***	[0.362,0.526]	0.412***	[0.317,0.535]	0.228***	[0.158,0.329]
Random part						
Intra-cluster correlation	0.209		0.187		0.109	
Standard error of random-intercept term	0.931		0.869		0.634	
Likelihood ratio test statistic	1223.3		426.0		106.7	
Level 1 units	19185		7785		5066	
Level 2 units	823		402		333	
Breastfeeding						
Fixed part						
2nd child	1.262	[0.964,1.653]	1.051	[0.757,1.460]	1.238	[0.811,1.891]
3rd child	1.244	[0.925,1.674]	1.064	[0.739,1.532]	1.531	[0.897,2.611]
4th child	1.165	[0.834,1.628]	1.007	[0.678,1.494]	1.270	[0.667,2.419]
5th child+	0.897	[0.607,1.325]	0.719	[0.468,1.107]	1.200	[0.566,2.541]
Random part						
Intra-cluster correlation	0.0872		0.0353		0.0195	
Standard error of random-intercept term	0.561		0.347		0.256	
Likelihood ratio test statistic	28.64		3.081		0.442	
Level 1 units	7126		3149		1349	
Level 2 units	600		346		130	

Note: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. In all the specifications, we included controls for the age of the woman at birth, body mass index, marital status, employment status, household wealth, household size, family planning status, child's year of birth, proportion of individuals in a cluster belonging to majority religion, information access (proportion listening in cluster listening to the radio, and reading newspapers) and an indicator for urban residence. CI = confidence interval.

Table 3: Regression results for effect of birth order on maternal health-seeking behavior by household wealth category

	Malawi				Uganda				Zimbabwe			
	Low wealth		High wealth		Low wealth		High wealth		Low wealth		High wealth	
	Odds ratio	SD	Odds ratio	SD	Odds ratio	SD	Odds ratio	SD	Odds ratio	SD	Odds ratio	SD
Four or more prenatal care visits												
Fixed part												
2nd child	0.766**	(0.076)	0.795*	(0.085)	0.718	(0.135)	0.929	(0.160)	0.674*	(0.105)	0.643*	(0.111)
3rd child	0.859	(0.092)	0.686**	(0.081)	0.677	(0.138)	1.022	(0.196)	0.561**	(0.108)	0.615*	(0.147)
4th child	0.899	(0.105)	0.690**	(0.094)	0.564**	(0.118)	0.887	(0.185)	0.550**	(0.124)	0.412**	(0.125)
5th child+	0.775	(0.107)	0.551***	(0.088)	0.475**	(0.109)	1.064	(0.248)	0.496**	(0.131)	0.620	(0.251)
Random part												
Intra-cluster correlation	0.0323		0.0342		0.0646		0.0106		0.0344		0.000000472	
Standard error of random-intercept term	0.331		0.341		0.477		0.188		0.342		0.00125	
Likelihood ratio test statistic	15.01		9.245		17.18		0.310		4.144		0.0000626	
Level 1 units	5964		4473		2086		1722		1839		1271	
Level 2 units	729		769		283		285		212		234	
Delivery in health facility												
Fixed part												
2nd child	0.582***	(0.054)	0.628**	(0.090)	0.586***	(0.087)	0.589**	(0.114)	0.692**	(0.094)	0.500**	(0.107)
3rd child	0.520***	(0.053)	0.518***	(0.081)	0.407***	(0.066)	0.507**	(0.109)	0.438***	(0.074)	0.311***	(0.089)
4th child	0.537***	(0.061)	0.502***	(0.090)	0.419***	(0.073)	0.368***	(0.087)	0.450***	(0.090)	0.230***	(0.083)
5th child+	0.484***	(0.065)	0.390***	(0.080)	0.540**	(0.102)	0.280***	(0.073)	0.251***	(0.061)	0.135***	(0.063)
Random part												
Intra-cluster correlation	0.215		0.243		0.217		0.155		0.123		0.0875	
Standard error of random-intercept term	0.948		1.028		0.954		0.776		0.679		0.562	
Likelihood ratio test statistic	561.7		165.2		215.0		44.90		62.22		5.442	
Level 1 units	8659		6167		3533		2766		2441		1677	
Level 2 units	732		788		295		313		220		257	
Breastfeeding												
Fixed part												
2nd child	1.413	(0.296)	0.985	(0.236)	1.189	(0.373)	1.244	(0.417)	0.871	(0.272)	3.478*	(1.753)
3rd child	1.307	(0.308)	1.028	(0.271)	1.072	(0.341)	2.077	(0.847)	2.155	(0.877)	1.095	(0.726)
4th child	1.452	(0.392)	0.974	(0.288)	1.219	(0.406)	0.997	(0.429)	0.911	(0.400)	5.245	(4.777)
5th child+	0.574	(0.172)	1.106	(0.395)	0.864	(0.317)	0.614	(0.291)	1.080	(0.544)	3.130	(3.168)
Random part												
Intra-cluster correlation	0.147		0.0289		0.000000531		0.0153		0.0633		0.00908	
Standard error of random-intercept term	0.754		0.313		0.00132		0.226		0.472		0.174	
Likelihood ratio test statistic	20.34		0.528		0.00000904		0.0917		1.661		0.00357	
Level 1 units	3469		1988		1220		701		779		271	
Level 2 units	572		542		189		158		116		83	

Note: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. In all the specifications, we included controls for the age of the woman at birth, body mass index, marital status, employment status, household wealth, household size, family planning status, previous pregnancy history, child's year of birth, survey fixed effects, and an indicator for urban residence. Low wealth = wealth quintiles 1 & 2; High wealth = wealth quintiles 4 & 5. SD = standard deviation.

Table 4: Regression results for the effect of maternal health-seeking behavior on child health outcomes

	Malawi		Uganda		Zimbabwe	
Variables	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Child is dead before 28 days						
Four or more prenatal care visits	0.491**	[0.302,0.796]	1.124	[0.565,2.239]	0.692	[0.422,1.136]
Professional delivery assistance	0.807	[0.546,1.193]	1.065	[0.613,1.850]	0.964	[0.597,1.556]
Breastfeeding	0.019***	[0.009,0.041]	0.049***	[0.015,0.157]	0.036***	[0.015,0.084]
Child is dead before one month						
Four or more prenatal care visits	0.763*	[0.614,0.950]	0.912	[0.613,1.356]	0.584*	[0.384,0.886]
Professional delivery assistance	0.954	[0.815,1.118]	0.978	[0.736,1.299]	0.969	[0.696,1.348]
Breastfeeding	0.041***	[0.027,0.060]	0.156***	[0.084,0.288]	0.285***	[0.152,0.534]
Child is dead before survey date						
Four or more prenatal care visits	0.839*	[0.718,0.981]	1.003	[0.746,1.347]	0.647**	[0.488,0.859]
Professional delivery assistance	1.018	[0.899,1.151]	1.027	[0.836,1.262]	0.851	[0.651,1.112]
Breastfeeding	0.008***	[0.006,0.012]	0.024***	[0.013,0.044]	0.036***	[0.018,0.070]
Low birth weight (less than 2500 grams)						
Four or more prenatal care visits	0.744*	[0.585,0.947]	0.700	[0.437,1.120]	0.744	[0.550,1.006]

Notes: ***Significant at 1% level; **significant at 5% level; *significant at 10% level. All estimates are weighted to be nationally representative. Robust standard errors are assumed with clustering at the primary sampling unit. In all the specifications, we included controls for the age of the mother at birth, years of education, previous pregnancy history, household size, household wealth, non-single birth, child is female, child's birth order, child's year of birth, region fixed effects, and an indicator for urban residence. CI = Confidence interval.

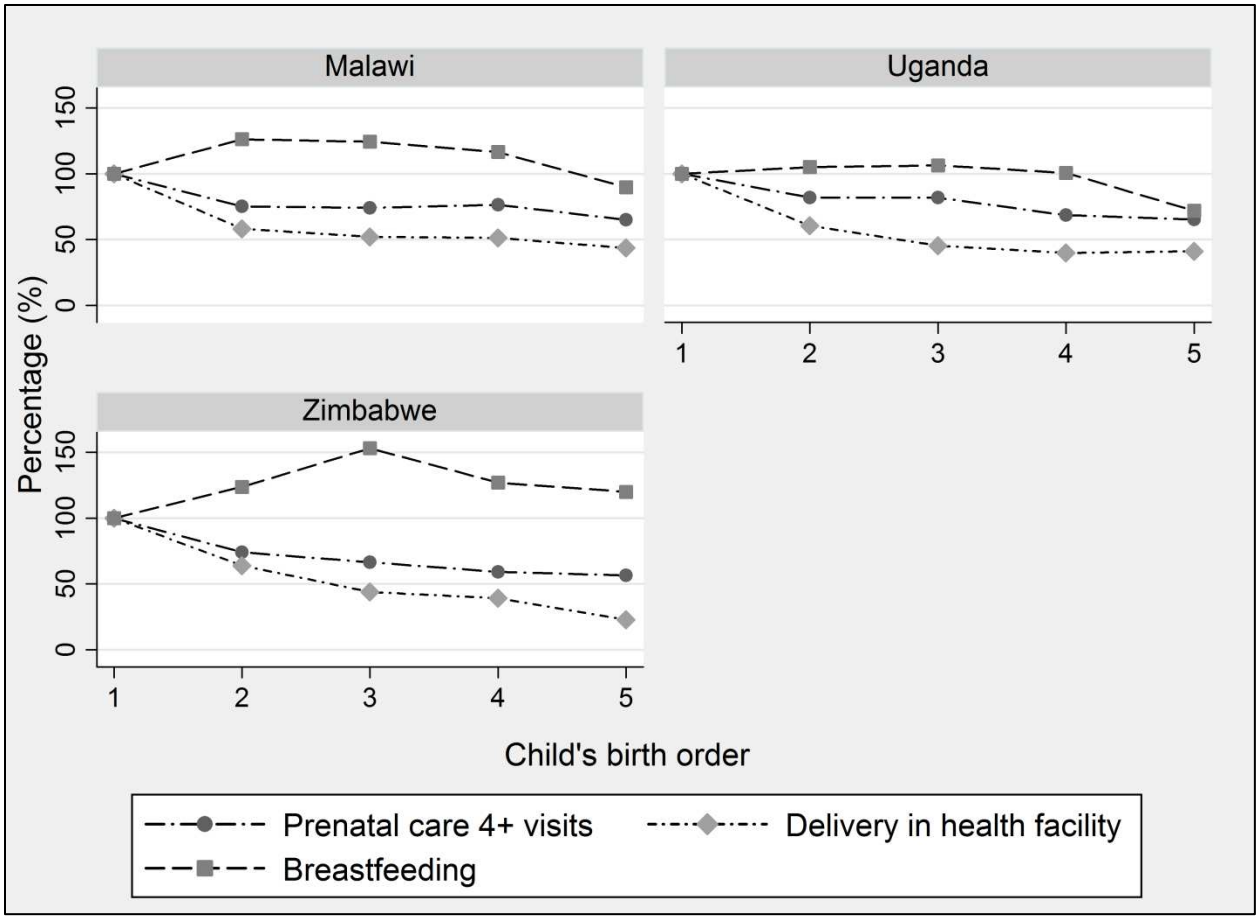

Figure 2 Maternal health-seeking behavior by birth order. Figure 1 shows maternal health seeking behavior relative to the first born child. Percent changes are calculated using the odds ratios from the random intercept logit model.