HIGH PARITY AND CHILD MORTALITY: IS THERE REALLY A PARITY EFFECT?

A DISSERTATION

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Patterns of family planning use among high and low-parity women and risk of child mortality

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Abstract

Background

Recent research showing that high parity does not lead to increased risk of child mortality, has necessitated additional analysis to better understand how high- and low-parity women differ. Women who end their fertility as high-parity have an increased risk of child mortality compared to those who end their fertility as low-parity, starting at their first birth. This analysis explores if family planning use differs between these two groups (high and low parity) and whether or not differences in use help explain the increased risk of child mortality.

Objectives

The objectives of this analysis are to answer the following questions: Do low-parity women initiate family planning earlier than high-parity women? Does early initiation of family planning mitigate the increased risk of child mortality seen in high-parity women? Can timing of family planning initiation (in terms of the number of live children at the time of initiation) provide information that can assist in early identification of women at an increased risk of child mortality?

Methods

Using three Demographic and Health Surveys (from Indonesia, Kenya, and Zambia), women over age 35 are stratified into high- and low-parity bands (five or more live births vs. fewer than five live births) and differences in both family planning use and incidence of mortality are analyzed, while controlling for confounding variables. A log-binomial regression is used to estimate the relative risk of child mortality.
Results

Differences in the profiles of high- and low-parity women are identified in terms of education level and wealth status. There are also differences in timing of initiation of family planning and the percentage of women who have never used family planning. However, early initiation of family planning only reduces the risk of child mortality in one country, Zambia.

Conclusions

This analysis provides some, although minimal, information to help understand the differences in women who are high- and low-parity at the end of their reproductive lives. Further analysis using countries of varying levels of fertility may provide some additional insight, but that is limited by the key variable, number of births at initiation of family planning, not being a standard part of survey questionnaires.

Keywords: Family planning, parity, high-parity, risky births, child mortality
**Paper Context**

It is commonly believed that high parity is associated with high child mortality; that higher order births are at an elevated risk of mortality compared to low order births. However, recent research has challenged this belief by showing that women who end their fertility as high-parity have an elevated risk of mortality for all of their births, starting with their first birth, compared to women who end their fertility as low parity. This analysis expands on these findings by exploring whether use of family planning, and the timing of its first initiation, influences or mitigates this elevated risk of mortality.

**Background**

Recent research has challenged the commonly held belief that high parity leads to an increased risk of child mortality [1]. The analysis found that women who ended their fertility as high-parity (five or more live births) had almost twice the relative risk of child mortality compared to low-parity women, starting at the first birth. After controlling for standard variables such as birth spacing, woman’s education, and wealth status, factors which only slightly mitigated the relationship, the study found that residual confounding and not parity, explained the correlation between high parity and mortality.

Unpacking this residual confounding could potentially help to identify these women early and be used to direct program interventions toward women who are at an elevated risk of child mortality. However, since the previously cited research controlled for many variables commonly correlated with high parity, including education [2], poverty [3], and birth spacing [4], analysis must be expanded to look at other ways these women differ.
One would expect that family planning use plays a role in how these two groups differ, with high-parity women being less likely to use family planning compared to low-parity women. Other research has identified differences related to family planning use among high- and low-parity women based on data from Demographic and Health Surveys (DHS). Use of family planning among high-parity women was linked with husband’s acceptance of family planning while use among low-parity women was associated with family planning acceptance of both husbands and peers. These findings support other research that finds women’s autonomy to be a determinant of family planning use [5]. However, these findings only look at current family planning use and do not provide information about use throughout a woman’s reproductive years or measures of her autonomy over time.

Additional information is crucial to determine if family planning use throughout a woman’s reproductive years differs between high-parity and low-parity women. To build on previous analyses that did not find a relationship between high-parity and child mortality, this current analysis will use available DHS data and structure the data in the same way; that is, to include women over age 35 and stratify them into high (five or more live births) and low (fewer than five live births) parity bands. However, this structure creates some limitations for analysis. Since the analysis only includes women at the end of their reproductive years, the commonly compared indicators – current use of family planning and unmet need – do not provide the required information because the interest is the point in time when they first initiated family planning use, not in their current status. Instead, it is necessary to look at use of family planning before women became high-parity and at what parity women first initiated use of family planning in the two groups.
The analysis presented in this paper uses DHS data from three countries to investigate how previous family planning use, and parity at the time of first use, differs between high and low-parity women. The intent is to answer the following questions: Do low-parity women initiate family planning earlier than high-parity women? Does early initiation of family planning mitigate the increased risk of child mortality seen in high-parity women? Can timing of family planning initiation (in terms of the number of live children at the time of initiation) provide information that can assist in early identification of women at an increased risk of child mortality?

Methods

Data sets

The data presented is based on secondary analysis of three DHS: Indonesia (2012), Kenya (2009), and Zambia (2007). Analysis was limited to these three data sets because the required question, number of living children at the time of first use of family planning, is not part of the standard DHS questionnaire.

DHS provides multiple datasets with different units of analysis (women, children, births). For the purposes of this analysis, the birth dataset, which includes all births to women interviewed in the country, was used. Having births as the unit of analysis allows for calculation of child mortality rates and facilitates analysis by parity. The dataset includes characteristics of the mothers as well as the children. This does create some issues related to timing for some of the variables. For example, when measuring the education level of the mother, the current level of education is reported, not the level of education at the time of each birth, resulting in the same value being applied to all births to the same woman.
Only births between the ages of 18 and 35 were included in the analysis to control for increased associations with child mortality for births to women less than 18 and older than 35 [6,7]. Also, since the analysis intends to look at women stratified into high and low-parity bands, only women over age 35 were included in the analysis, assuming this is the end, or close to the end, of their childbearing years.

**Statistical Analysis**

Following the Kozuki et al analysis, we define parity as a dichotomous variable, with women with five or more live births as high-parity and women with fewer than five live births as low-parity.

The analysis was carried out in three parts. The first creates profiles of high- and low-parity women by exploring their distribution within wealth quintiles and education levels. Analysis was also completed to identify women who have never used family planning and the timing of initiation of family planning, defined as number of live births at time of initiation, in high- and low-parity women. The second part of the analysis looks at the relationship between family planning use and under-five mortality. The third part of the analysis determines the association between the patterns found in parts one and two and the relative risk of child mortality for high- and low-parity women. A log-binomial regression is used to estimate relative risks. Regressions were run twice for each country, one for high-parity and one for low-parity women with under-five mortality as the dependent variable (coded as 1 if there is a child death). Independent variables included wealth quintile, education, birth spacing during the pre-pregnancy interval, and year of birth (the same confounding variables as in Kozuki et al). Calendar year of birth is used to control for time trends.
Analysis was performed using STATA 12.

Results

The number of women that fall into the low- and high-parity bands differ by country. In Kenya, 75% of women are in the high-parity group (n=6,841 for high-parity and n=2,302 for low-parity); 29% are in the high-parity group in Indonesia (n=12,304 for high-parity and n=29,776 for low-parity); and 88% are in the high-parity group in Zambia (n=6,915 for high-parity and n=979 for low-parity), as seen in Figure 1. This is unsurprising given total fertility rates in the countries, which range from a low in Indonesia of 2.6 [8] to a high in Zambia [9] of 6.2, with Kenya [10] falling in the middle with 4.6.

Profiles of high- and low-parity women

The distribution of wealth quintile and education level varies between the high- and low-parity women in each country, as seen in Figures 2 and 3. The overall patterns are expected, with poorer, less educated women being more likely to be high-parity than low-parity.

In the absence of any relationship between parity and wealth, women in these three countries would be equally distributed (20 percent each) across the five wealth quintiles. Instead, as shown in Figure 2, high-parity women are more likely to be in the poorer quintiles while low-parity women are more likely to be in the richer quintiles.

Wealth patterns among low-parity women are the same in all three countries, with the largest percentage of low-parity women falling into the wealthiest quintile (25% in Indonesia, 38% in
Kenya, and 39% in Zambia) and a decreasing linear pattern for each quintile ending in the smallest proportion in the poorest quintile (14% in Indonesia, 7% in Kenya, and 8% in Zambia). The distribution of low-parity women is very similar in Kenya and Zambia, both having a large difference between the percentages in the poorest and richest quintiles (31 percentage points difference). The pattern in Indonesia is slightly less extreme, with similar percentages of women in each of the quintiles except the poorest.

Distribution across wealth quintiles among high-parity women is not as linear as it is for low-parity women; however, it is important to note that in all three countries there are fewer high-parity women in the richest category than the poorest. The scale of difference varies by country, with one-third of high-parity women in the poorest quintile in Indonesia compared to 10% in the richest, and about one-quarter of high-parity women in both Zambia and Kenya in the poorest quintile compared to 7% in Kenya and 16% in Zambia in the richest quintile.

These patterns mirror the distribution of births into the high- and low-parity bands; in Zambia and Kenya, both considered higher-parity countries, being high-parity is more of a norm and not restricted to specific quintiles. Indonesia, considered a low-parity country, shows a different pattern, with the majority of high-parity women confined to the poorer quintiles.

Most women across all three countries, irrespective of parity, have a primary school education. However, when comparing the groups, differences can be seen at the extremes – women with no education and women with higher education. Among high-parity women, there are very few women with higher education in any of the three countries (2% in Indonesia and Zambia and 1% in Kenya), while among low-parity women there are very few women who have no education.

Figure 2 Here
Family planning use by parity band

The first part of the analysis also examines the use of family planning among the high- and low-parity bands. Table 1 shows never-use of family planning and Table 2 shows mean number of living children at time of family planning initiation for the three countries. Although one might assume that family planning played a role in whether or not a women finished her reproductive years in the high- or low-parity bands, that pattern is not explicitly seen in these three countries.

In both Indonesia and Kenya, more high-parity women reported never having used family planning, as would be expected, although a notable proportion of low-parity women (9% in Indonesia and 20% in Kenya) also reported never-use. In Zambia, however, there was more never-use among low-parity women (30%) than among high-parity women (21%), showing a pattern that goes against expectations.

For those women who did use family planning, the timing of first use (as measured by the number of live children at the time of initiation) was earlier among low-parity women compared to high-parity women. In all countries, the initiation of family planning was at half the parity in the low-parity group compared to the high-parity group. The mean number of live births at the time of first family planning use among low-parity women in all three countries is around the second birth. In contrast, high-parity women do not start using family planning until around their fourth birth (slightly earlier for Zambia), so they are already on the verge of becoming high-parity when they first use family planning. This suggests that low-parity women start using family planning early and use it for both spacing and limiting births.
Family planning initiation and child mortality

The second part of the analysis adds the component of child mortality into the timing of family planning initiation to examine whether the differences in family planning use and timing of use influence the differences in child mortality. The replacement theory postulates that women who experience a child death are more likely to have additional children as a “replacement” [11]. Although this analysis does not examine the directionality of the relationship (whether the death or family planning initiation happens first), it does look at timing of family planning initiation and the levels of never-use of family planning among women who have had a child die.

Table 3 shows the timing of family planning initiation for women who have and have not had a child death. There is little variation between the two groups in each country. Table 4 examines levels of never-use of family planning by parity and child mortality. Among high-parity women, levels of never-use are similar regardless of whether or not there has been a child death. Among low-parity women, levels of never-use are higher among women with a child death, with the greatest difference seen in Indonesia, where the proportion of never-use among women with a child death is twice the proportion of never-use among women without a child death.
The analysis thus far has identified some patterns and highlighted different behaviors related to family planning among high- and low-parity women, but no information on the relative importance of the different components: wealth, education, use of family planning, and the time of initiation of family planning. To understand whether family planning use explains the difference in child mortality between high- and low-parity women, the third and final part of this analysis shows the results of multivariate log-binomial regressions to estimate the relative risk of child mortality for each group of women. Table 5 shows the relative risk for under-five mortality by number of children at the time of initiation of family planning. If the relative risk is less than one, then early initiation of family planning decreases the risk of child mortality. The only significant relative risk is for high-parity women in Zambia, showing that women with an earlier initiation of family planning had a lower risk of mortality, but the relative risk is close to one, showing the scale of impact is small.

Table 5 Here

Discussion

The findings show that, as expected, high and low-parity women differ in terms of wealth and education. They also have different patterns of family planning use, with high-parity women initiating family planning later than low-parity women.

Linking family planning use and timing of use to under-five mortality demonstrated that death of a child does not appear to influence the timing of family planning initiation. This finding contradicts the belief that fertility behavior, defined by the demand for family planning, is influenced by child deaths or the inclination to “replace” children that have died. This is reinforced by the results from Kenya and Indonesia which show that never-use of family
planning varies more between high- and low-parity women that have not experienced the death of a child, compared to those who have used family planning.

The final analysis examined the difference in relative risk for under-five mortality depending on number of children at the time that family planning was initiated. Findings show that initiation at low levels of parity plays a role in final parity (which is to be expected), but that early initiation does not have an impact on the relative risk of under-five mortality.

Parity at the time of family planning initiation does not explain the difference in mortality rates between high- and low-parity women in Kenya and Indonesia. A small exception occurs in Zambia where children of high-parity women have a slightly lower, but statistically significant, relative risk of mortality the earlier their mothers initiated family planning. Zambia is the highest-fertility country of the three, which may be influencing the findings. Ideally, one would want to repeat the analysis in other countries with comparable fertility rates. However, this is not feasible because of data limitations; the required question on the number of live births at the time of family planning initiation is not a standard part of the DHS questionnaire.

Conclusions

Low-parity women initiate family planning before high-parity women, but this does not lead to a reduced risk of child mortality, except in Zambia. Using cross-sectional data limits some of the interpretability of the findings since it is not possible to confirm that family planning use led to low parity (although one would assume that this is the case). Zambia is the highest-fertility country in the analysis and it had the earliest initiation of family planning in both the high- and low-parity groups and higher never-use among low-parity women than high-parity women.
Although this research presents evidence that supports differences between high- and low-parity women and contradicts the relationship between family planning use and child death, it may not be directly relevant to providers implementing family planning programs. That is, the non-initiation of family planning by parity of four could be an indicator of increased risk of child mortality, but at that point it may be too late, since the elevated levels of mortality begin at the first birth.

Competing interests

The author declares that she has no competing interests.

Authors' contributions

Acknowledgments

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Figure 1: Distribution of all Births into those that Occur to High and Low Parity Women in Kenya, Indonesia, and Zambia.

Figure 2: Distribution of High and Low Parity Women by Wealth Quintile in Kenya, Indonesia, and Zambia.
Figure 3: Distribution of High and Low Parity Women by Level of Education in Kenya, Indonesia, and Zambia

Table 1: Percentage of High and Low Parity Women that Report they have never used Family Planning

<table>
<thead>
<tr>
<th>Country</th>
<th>High Parity</th>
<th>Low Parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>19%</td>
<td>9%</td>
</tr>
<tr>
<td>Kenya</td>
<td>33%</td>
<td>20%</td>
</tr>
<tr>
<td>Zambia</td>
<td>21%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Table 2: Mean Number of Living Children for High and Low Parity Women at time of First Family Planning Initiation

<table>
<thead>
<tr>
<th>Country</th>
<th>High Parity Women</th>
<th>Low Parity Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>3.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Kenya</td>
<td>4.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Zambia</td>
<td>3.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 3: Mean Number of Living Children, Among Women who have and have not Experienced a Child Death, at the time of First Family Planning Initiation

<table>
<thead>
<tr>
<th>Country</th>
<th>No Child Death</th>
<th>Child Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>3.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Zambia</td>
<td>3.2</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Table 4: Percentage of Women who Report never having used Family Planning, by Parity and Child Death

<table>
<thead>
<tr>
<th>Country</th>
<th>High Parity</th>
<th></th>
<th>Low Parity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Child Death</td>
<td>Without Child Death</td>
<td>With Child Death</td>
<td>Without Child Death</td>
</tr>
<tr>
<td>Kenya</td>
<td>39%</td>
<td>32%</td>
<td>34%</td>
<td>19%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>23%</td>
<td>18%</td>
<td>18%</td>
<td>9%</td>
</tr>
<tr>
<td>Zambia</td>
<td>26%</td>
<td>21%</td>
<td>38%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Table 5: Relative Risk of Experiencing the Death of a Child Under 5 for High and Low Parity Women, Comparing Early to Late Initiation of Family Planning

<table>
<thead>
<tr>
<th>Country</th>
<th>High Parity</th>
<th></th>
<th>Low Parity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kenya</td>
<td>Indonesia</td>
<td>Zambia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.98 (.92, 1.02)</td>
<td>.94 (.83, 1.05)</td>
<td>.97* (.93, 1.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.99 (.97, 1.02)</td>
<td>.89 (.67, 1.18)</td>
<td>1.03 (.79, 1.33)</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .05 level.
Introduction
It is well documented by various research and analyses that high parity is correlated to higher rates of child mortality (1-3). However, the mechanism that is driving this relationship remains unclear. It is unknown if the cause is biological, behavioral, or related to some sociological factor.

There are multiple theories that try to explain the relationship between high parity and child mortality. These include biological options, including the maternal depletion theory, which hypothesizes that higher parity births are at greater risk of child mortality because the woman herself is biologically depleted from multiple pregnancies, inhibiting her ability to pass on many of the health benefits that early births received (4-7). Other theories for this relationship focus on behavioral factors related to the seeking and consumption of health services. These theories posit that higher order births benefit from less parental involvement either because a) there are too many other children to care for and time per child is limited (sibling competition), b) there are no longer enough available resources due to family size expansion, and/or c) whatever limited resources exist are being distributed among too many people (8-10).

Recent findings have challenged the maternal depletion theory. A new analysis stratified women into high and low parity bands, using only women over age 35 to capture those at the end, or near the end, of their fertility. This analytical design enabled mortality rates to be calculated for each birth order for the same women, to see if the risk increased as parity increased. By comparing risk among the same women, the study also potentially controlled for some biological differences that were not captured in the dataset. Relative risks of mortality were then calculated for each of these bands retrospectively for their first four births. The analysis found that women who ended their reproductive years as high parity (defined as five or more births) had a higher relative risk of child mortality, compared to those who end as low parity, starting at their first birth (11). The finding that the risk of mortality does not come with increased parity, instead the group of women who end up with high parity experience higher rates of child mortality starting from their first birth, suggests that the elevated risk is related to the women themselves, not their parity status. That analysis also adjusted the results for variables that are known confounders such as poverty, education, birth spacing, and births to young and older women (12). The adjusted model showed small changes in the relative risks, but overall findings remain the same. The study concluded that the difference in mortality is related to residual confounding due to selection bias.

This suggests the importance of finding strategies to identify women who will become high parity. If these women are experiencing higher mortality rates for all of their births, early identification, before they become high parity, would help to target interventions and ensure early access to family planning and other important health information necessary to reduce the risk of child mortality. In light of the analysis controlling for standard variables and still finding high parity women to be different than low parity women, it is necessary to explore other options of identification or prediction.

Figure 1 Shows a recent effort to identify specific pathways that link family planning and child mortality rates and provides a framework to explore differences between high and low parity women (13).
Figure 1: Illustration of the different pathways that may link family planning and child mortality.

Pathways of Effects Linking FP and Child Mortality Rates

The framework combines known and hypothesized pathways for how family planning may play a role in reducing child mortality. The specific elements along the pathways provide an opportunity to identify differences between high and low parity women. This analysis will focus on utilization of health services.

Some helpful information can be extracted from research focusing on the behavioral theories linking high parity to high mortality. Since another analysis did find a significant relationship between coverage of important preventative and curative maternal and child health interventions and birth order (14), a study focusing on health seeking behavior provides an important opportunity for a deeper understanding of this relationship. The previous findings found that coverage declined as birth order increases, with the relationship being more directly linear for maternal health interventions, but still significant for many child health interventions. These findings lend support to the behavioral theories that higher order births do not receive services because of a lack of time, resources, and/or some other unidentified reason.

This analysis builds on these findings by linking them together and taking the next step, testing whether coverage is associated to high and low parity women, not just birth order. If there is a relationship between coverage of all or some child health interventions and high and low parity women, it would provide a step toward being able to predict which women will become high parity. Specifically, we will test the hypothesis that different patterns of treatment seeking behaviors of critical child health services explains some of the difference in child mortality between high and low parity women.

Methods

Dataset

The Kenya 2014 Demographic and Health Survey (DHS) (15) births dataset was selected for this analysis. This selection was based on multiple factors: it is a new dataset with a large sample size, powered so that it is possible to get county level estimates and there are variations in fertility, child mortality, and contraceptive use throughout the country, allowing for exploration of intra-country comparisons and variations. Focusing on one country can avoid some of the complexities and limitations due to
differences in some child health variable definitions between countries. However, there are limits even with the large sample size, it is not possible to look at mortality variations by county, necessitating a regional level analytical approach. The total sample size in the births dataset is 83,591.

Key indicators for this analysis are shown in table 1. The national level under-five mortality rate (USMR) is 52 per 1,000 live births, with rates as low as 42 in the Central Region and as high as 82 in Nyanza. There is similar variation when looking at the total fertility rate: the national level is 3.9 with the lowest in Nairobi (2.7) and the highest in the North Eastern Region (6.4). The extreme variation in modern contraceptive use (mCPR) is seen with a low of 3.4 percent in the North Eastern Region and 66.9 percent in the Central Region. This variation makes this dataset particularly relevant for this analysis.

<table>
<thead>
<tr>
<th></th>
<th>USMR</th>
<th>mCPR (Married Women)</th>
<th>TFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>52</td>
<td>53%</td>
<td>3.9</td>
</tr>
<tr>
<td>Central Region</td>
<td>42</td>
<td>66.9%</td>
<td>2.8</td>
</tr>
<tr>
<td>Coast Region</td>
<td>57</td>
<td>38.3%</td>
<td>4.3</td>
</tr>
<tr>
<td>Eastern Region</td>
<td>45</td>
<td>63.9%</td>
<td>3.4</td>
</tr>
<tr>
<td>North Eastern Region</td>
<td>44</td>
<td>3.4%</td>
<td>6.4</td>
</tr>
<tr>
<td>Nyanza Region</td>
<td>82</td>
<td>53.9%</td>
<td>4.3</td>
</tr>
<tr>
<td>Rift Valley Region</td>
<td>45</td>
<td>46.8%</td>
<td>4.5</td>
</tr>
<tr>
<td>Western Region</td>
<td>64</td>
<td>56.9%</td>
<td>4.7</td>
</tr>
<tr>
<td>Nairobi</td>
<td>72</td>
<td>58.3%</td>
<td>2.7</td>
</tr>
</tbody>
</table>

**Data Analysis**

Analysis will be completed in two steps. The first step is to replicate the analysis that found women who end their fertility as high parity have an elevated risk of child mortality starting from their first birth, compared to women who end their fertility as low parity. Using the births dataset, births to women older than 35 will be stratified into high and low parity bands. Women who have had five or more births will be classified as high parity and those with 4 or fewer as low parity. Births that happened before the woman was 18 and after 35 will be dropped, to eliminate the higher risk associated with births to younger and older women. The dependent variable for this first part is under five deaths. Therefore, births in the last five years will also be eliminated since it is yet unknown if they will survive to age five.

A log binomial regression will be run to estimate the relative risks at each birth order, one through four, for births to both high and low parity women. Relative risk will be used because the dependent variable is mortality. The model will then be rerun adjusting for known confounding variables. These include poverty (using the wealth quintile variable as a proxy), woman’s education level, residence (urban vs rural), calendar year of birth (to control for reductions in mortality rates over time) and spacing of the previous birth. For birth spacing, a categorical variable was created that classified less than two years as inadequately spaced.

The full adjusted model will also be run for three regions: Eastern, Rift Valley, and Nyanza. Issues related to sample size negate the ability to do the full adjusted estimation for the remaining five regions.
Since our intent with this paper is to further understand the differences between births to high and low parity women that contribute to elevated relative risks of mortality among the high parity band, it is necessary to replicate these findings to ensure that our dataset also shows similar findings.

The second step explores if coverage of child health interventions differs between births to high and low parity women. The overall intent is to identify any interventions that would allow for early identification of women who go on to become high parity. Analyses will be replicated using variables on health seeking behavior for two of the main causes of child deaths: fever and diarrhea. Although it is possible to test a full range of child health services, this analysis will focus on curative services, with the assumption that they are a better measure of health seeking behavior compared to preventative services. In Kenya, the incidence of diarrhea is 3.3 cases per child per year and the incidence of severe diarrhea is .072 cases per year (16). The proportion of all post neonatal mortality due to diarrhea is 13 percent and 9.3 percent for malaria. Only pneumonia (20 percent) and AIDS (10 percent) contribute higher proportions (17).

Three common variables related to diarrhea and fever are included:
- Received medical treatment
- Received any treatment
- If treatment was sought the same day symptoms started

Simple coverage by birth order will be estimated, using individual birth orders, with greater than 10 births being collapsed into a ten plus category. Chi square tests will be used to test for significance. Analysis will then be repeated using high and low parity bands instead of birth order. This will only include women over age thirty-five, so that the classification of high and low parity matches the approach done in the first analysis.

Finally, coverage variables will be put into a final binomial regression using high parity as the dependent variable to estimate the odds ratio of coverage variables and being from a high or low parity mother. An odds ratio will be used to differentiate the findings from those using mortality as the dependent variable in part one of the analysis. However, both estimation methods produced the same results. The model will be adjusted with the same confounding variables that were used in the first step of the analysis (poverty, education, and residence). All analysis will be conducted using STATA 12.

Results

Stage 1: Relative Risk of Under-Five Mortality for Births from High versus Low Parity Women

The results confirm that Kenya follows the same findings as those seen in previous analyses. Women who end their reproductive years as high parity experience higher U5MR for their children compared to women who end their fertility as low parity, starting at their first birth. The log adjusted relative risks, after adjusting for known confounding variables, are shown in table 2.

<table>
<thead>
<tr>
<th>Birth Order</th>
<th>National</th>
<th>Eastern</th>
<th>Rift Valley</th>
<th>Nyanza</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.64</td>
<td>1.71</td>
<td>1.41</td>
<td>1.66</td>
</tr>
<tr>
<td>2</td>
<td>1.87</td>
<td>1.81</td>
<td>1.33</td>
<td>4.52</td>
</tr>
<tr>
<td>3</td>
<td>1.55</td>
<td>1.92</td>
<td>1.85</td>
<td>2.41</td>
</tr>
<tr>
<td>4</td>
<td>1.44</td>
<td>1.68</td>
<td>1.65</td>
<td>2.94</td>
</tr>
</tbody>
</table>
Across all areas and all birth orders, the children of high parity women have higher relative USMR than low parity women. The national level estimates produce values very similar to the original analysis. Results from Eastern and Rift Valley are generally similar in scale to the national level findings, with some variation in pattern. Nyanza, although finding the same general results, has much higher relative risks for birth orders two, three, and four, with the relative risk at birth order two of 4.52 for high compared to low parity women. Our definition of low parity, which includes births up until and including number four, makes it impossible to continue the comparison. There are only high parity women included in all higher birth orders.

This finding allows us to continue to step two and explore the role that coverage plays in understanding the differences between these two groups of women.

Stage 2: Coverage by Birth Order
Charts 1 and 2 show the full trends of coverage for fever and diarrhea for the following variables: child received any treatment (Any Tx), child received any medical treatment (Any Med Tx), and child received treatment on the same day the illness started (Same Day Tx) by birth order. All three variables were significant at the .05 level for fever. For diarrhea, only same day treatment was found to be significant at the .05 level. These results suggest that birth order and at least some of the interventions are related, but looking at the graphs shows that the patterns may be hard to interpret, especially for diarrhea.

For fever, in all cases the coverage is higher at birth order one compared to birth order ten, but none of the relationships appear to be strictly linear. For diarrhea, coverage for both any treatment and any medical treatment are higher at birth order 10 compared to birth order one, with lots of variation in between. Same day treatment does have higher coverage at birth order one compared to birth order ten.

Charts 1 and 2: Percent of births that received any treatment, any medical treatment, and same day treatment among those that experienced fever or diarrhea in the last two weeks, by birth order.

Focusing on Women over 35
The remaining analysis was done only on women over age thirty-five. This allows for their births to be categorized as low or high parity. Although there will be some women that are classified as low parity that may still become high parity, this cut off allows us to get an estimate while also controlling for
births when the woman is over thirty-five (that have a higher risk) and provides us with a greater sample size for the analysis, since health seeking behavior for childhood illnesses is only available for the previous five years.

Nationally, almost 70 percent of the births in the dataset are high parity and about 30 percent are low parity. There are variations between the three regions with the highest percentage of high parity births occurring in Nyanza (80 percent) and the lowest in Eastern (62 percent). This is consistent with Total Fertility Rates (TFR) in Kenya and the three regions. The Rift Valley and Nyanza have the highest TFRs (4.5 and 4.3, respectively) while Eastern has the lowest (3.4) and the national level lies in between (3.9).

Table 3: Distribution of all births into high and low parity bands and incidence of diarrhea and fever in the last two weeks, nationally and in 3 regions.

<table>
<thead>
<tr>
<th></th>
<th>National</th>
<th>Eastern</th>
<th>Rift Valley</th>
<th>Nyanza</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Parity Births</td>
<td>69.5%</td>
<td>61.5%</td>
<td>76.5%</td>
<td>80.3%</td>
</tr>
<tr>
<td>Low Parity Births</td>
<td>30.5%</td>
<td>38.5%</td>
<td>23.5%</td>
<td>19.7%</td>
</tr>
<tr>
<td>% Children with Fever in the last two weeks</td>
<td>24.4%</td>
<td>16.3%</td>
<td>22.5%</td>
<td>34.9%</td>
</tr>
<tr>
<td>% Children with diarrhea in the last two weeks</td>
<td>12.7%</td>
<td>12.9%</td>
<td>11.3%</td>
<td>14.9%</td>
</tr>
</tbody>
</table>

Nyanza has the highest reported incidence of both diarrhea and fever. Overall, fever is a more common occurrence than diarrhea. However, incidence of fever has more variation, while incidence of diarrhea is more similar across all areas.

Performing individual chi square tests for each intervention with high and low fertility found only two significant relationships (at the .05 level). The first was in the Rift Valley Region which showed that when looking at same day treatment for fever, the percent receiving treatment on the same day among the low parity group is almost 30 percent but just under seven percent for high parity births. The second significant relationship is in the Eastern Region for receiving any treatment for diarrhea. However, this relationship is in the opposite direction, with 87 percent of high parity births receiving treatment versus fifty-four percent of low parity births. Sample size prevented the analysis to be run for same day treatment for diarrhea at the regional level. At the national level the relationship was not found to be significant.

Chart 3: Comparison of treatment seeking behavior for children with fever in the last two weeks, comparing high and low parity births, nationally and in 3 regions.
For the final analysis, a log binomial regression is used to estimate the odds ratio relating coverage to being a high or low parity birth. Because of collinearity, only one variable for each illness will be used. Whether any treatment was received will be used for both fever and diarrhea. At the national level, both illness variables will be included. At the regional levels, only fever will be used due to sample size. Incidence of fever is higher than incidence of diarrhea in all areas.

Table 4: Odds ratio that a birth is high parity based on treatment seeking behavior.

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio</th>
<th>P Value</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any tx for fever</td>
<td>.732</td>
<td>.472</td>
<td>.313,1.716</td>
</tr>
<tr>
<td>Any tx for diarrhea</td>
<td>.666</td>
<td>.551</td>
<td>.174,2.543</td>
</tr>
</tbody>
</table>

The results from the national model are shown in table 4. Neither illness variable is significant. The findings for all three regions similarly found that the treatment seeking variables are not significantly related to being high or low parity.

Discussion

This analysis attempted to do two things. First, replicate recent findings that challenge the widely believed “parity effect”: that risk of experiencing a child death increases as parity increases. This analysis confirms the new findings, that women who end their fertility as high parity have higher rates of child mortality for all of their births when compared to women who end their fertility as low parity. The increased risk does not come as parity increases, instead, it is with this group of women from the beginning.

This remains true, even after controlling for other known confounders, such as early births, late births, inadequate spacing, the women’s level of education, poverty, and residence. The findings are somewhat mitigated with these confounders, so some overlap exists. However, there is a remaining effect that is
not being explained by the model. It could be that some of these variables, such as poverty, are not adequate measures. The variable available for this analysis is the standard DHS wealth quintile variable, which is focused on the household, and therefore may not be capturing whether or not the woman has access to resources. However, this alone is unlikely to explain all of the increased risk.

With these findings, it becomes important to determine if it is possible to predict who these high parity women will be, even before they become high parity. Are there other behaviors or characteristics that can be used to identify these women and direct health services towards them so they can both prevent unintended pregnancies and receive other essential health services? Many countries already have programs targeted towards the poor and rural women, but these findings suggest that this approach is not sufficient. With the end of the Millennium Development Goals and the start of the Sustainable Development Goals, there is a renewed interest in decreasing child mortality and early identification of these high risk women would be strategically beneficial.

The second part of this paper is an attempt to identify a behavioral difference between births to low and high parity women that could help with early identification or prediction. The main causes of childhood death are well documented and the OHS dataset includes a full range of both curative and preventative services. This analysis chose to focus on curative interventions because it allows for a more central focus on health seeking behaviors when a child is identified as being sick. It also avoids some of the complexities when comparing health seeking behavior for different types of services due to different government implementation processes. For example, there are national immunization days where providers go into communities to provide vaccines to children. A woman who accepts that service in her community when many others are also accepting that service, is different from seeking services when she identifies a need as a result of a child being ill. Since lack of access to health services, and not accessing services even if they are available, are correlated to both child mortality and non-use of contraception (leading to increased fertility), differences in treatment seeking behavior are a feasible place to start identifying differences between high and low parity women.

Although there is a significant relationship between seeking or not seeking treatment when a child has a fever or diarrhea and birth order, that relationship is no longer significant when women are grouped into high and low parity bands. Nevertheless, it is important to note that there are a few exceptions. Results at the national level and in each of the three regions only found a significant relationship in one region for seeking any treatment for diarrhea and in another region for same day treatment for fever. When both fever and diarrhea are considered together, along with control variables, no relationship was found with high and low parity. Findings showed the expected significant relationship with the control variables.

One of the limitations of this research is that data on health seeking behavior is only asked about children who were born in the last five years. Specifically, for each child born in the last five years, the question asks if they experienced diarrhea or fever in the last two weeks and then specific questions about treatment follow. Ideally, it would be possible to compare health seeking behavior for all births and to see if the behavior changes for the same woman as her parity increases. However, this analysis suggests that this approach may not return different results. There appears to be some reduction in treatment seeking behavior among the high parity women as parity increases (using their births from the last five years), but there is little difference in the level of coverage in comparison to those who are low parity.
This analysis found that differences in treatment seeking behavior for essential child health services are not a pathway to early identification of women who will go on to become high parity. We found no explanatory power for these few health seeking behaviors that could be measured well using the DHS dataset. It could be that there is a true relationship but we do not see it due to the specific indicators that are currently available.

Other analyses based on the framework introduced earlier have attempted to find causal factors or significant pathways between family planning, utilization of health services, and child mortality. One analysis used DHS clusters to test if coverage is determined by parity or access to services. Findings showed that both community coverage and parity are significantly related to child coverage, but that parity only explains a very small amount of the variation in coverage (13). These findings are comparable to those presented here. Another study looked at levels of empowerment between high and low parity women to determine if they were related to child mortality (18). Results found some interesting relationships, but results are limited by the measures of empowerment available in the DHS, which are not consistent across surveys.

There are yet unexplored pathways in the framework that may provide helpful information, particularly unintended births. The framework hypothesizes that the planning status of the pregnancy (whether it was intended or not) is linked to many other components, including family planning use, utilization of health services, and empowerment. Testing a relationship between intendedness and child mortality may provide some useful information.

Of course, there could be other factors at play that have either been explored but are hindered by the difficulties of finding good quantitative indicators to use (such as empowerment) or indicators that have yet to be identified. For example, there may be some unknown biological or genetic factor that are linked to high fertility or high child mortality.

The major implication of these collective findings is that early identification of women who will go on to become high parity is not possible given available data. This is particularly important because the findings also indicate that expanding health service utilization will only go so far in reducing under five-mortality.
17. WHO estimates for 2000-2015:
How many is too many?
A different perspective on high parity and its links to infant mortality.
Emily Sonneveldt

Recent research has contradicted the long held belief in the parity effect, which posits higher risk of mortality for birth orders higher than four, and opened up the possibility of redefining high parity from an individual woman’s perspective. This research explores the creation of a new excess fertility category that includes all births after a woman has reach her specified ideal number of children and then tests whether these births have a higher risk of infant mortality.

Although there is no existing research on excess fertility, there is information available on unplanned pregnancies. This information is typically based on a woman specifying that a current or previous pregnancy was not wanted at that time or was not wanted at all. A pregnancy being mistimed is a much more common response than not wanted. Looking across all Demographic and Health Surveys (DHS) from the last five years, finds that on average 19 percent of pregnancies are reported as being mistimed, while 7.5 percent are reported as unwanted (1).

Most studies focus on the demographic and socio-economic characteristics of women reporting unplanned pregnancies. These unplanned pregnancies are more likely among women with little or no education, those who live in rural areas, and those women who are poor (2). There is some evidence that adverse birth outcomes are associated with unplanned pregnancies, showing they are more likely to result in babies that are born prematurely and have a low birth weight (3-5). Both of these outcomes are associated with higher risks of neonatal mortality (6). A few studies have found that unintended pregnancies are associated with lower utilization of health services. The strongest effect is for use of antenatal care, which means they also do not receive the basic healthcare services, such as tetanus vaccines, that are given during those visits (7-9).

There are some limitations to using the planning status of pregnancy. First, whether the pregnancy is mistimed or unwanted is not always disaggregated, making it impossible to disentangle the “too many” aspect of the analysis. Second, there is some evidence of problems related the measurement of the concept. These include contradictions in responses to other questions (not all women reporting pregnancies related to contraceptive failure as unintended) and evidence that women are less likely to say a pregnancy was unplanned, and even less likely to specify that it was unwanted, after the child is born. Some of the evidence suggests it can be a useful measure at the population level, but not at the individual level (10-11). This could lead to underestimating the incidence of unwanted pregnancies and therefore their impact. The incidence of mistimed may be overestimated, as woman may report some unwanted pregnancies as mistimed. Third, the information on planning status is not typically available for all pregnancies. For example, in the DHS this particular variable is only collected for pregnancies in the last five years. Therefore, making it impossible to determine if the relationship between wantedness and birth outcomes varies for high order versus low order births. Fourth there is the issue of recall bias since it is collected retrospectively on previous pregnancies.

This analysis explores the creation of a new definition for high parity and then tests if there is a parity effect, defined here as an increased risk of infant mortality. The new definition is measured at the individual level and is from the woman’s perspective. This assumes there is no global cut off for determining high parity, instead, each woman specifies how many are too many for her. Too many will
be estimated using a woman’s ideal number of children, with any birth that exceeds that number being classified as too many. The hypothesis is that there is a parity effect under these new assumptions.

If this new definition is found to be significantly related to infant mortality, it could provide family planning programs with a new angle in prioritizing women. Programs would then benefit from engaging in discussions with women about their ideal number of children and would allow the reframing of some family planning interventions and interactions to center on identifying women who have met or already exceeded their ideal number of children. It would also suggest that ensuring women have access to the information and services necessary to enable them to meet their own fertility intentions is not only positive from a human rights and women’s empowerment perspective, but may also support reductions in infant mortality.

Methods
Source of Data
Demographic and Health Survey (DHS) birth datasets from ten countries will serve as the study population. These are the surveys in the last five years with the highest levels of infant mortality and the largest sample sizes. DHS are cross sectional surveys conducted using standardized questionnaires and analysis templates that allows easy cross country comparisons. They are typically conducted every five years in developing countries and provide standardized datasets that contain information on women’s fertility and reproductive health, among other health topics. Respondents include women of reproductive age (age 15-49) and a subset of their partners/husbands and data is organized into multiple datasets with different units of analysis. As mentioned, the births dataset will be used for this analysis because the dependent variable is infant mortality.

Table 1: Countries, year of last survey, Infant Mortality Rate (IMR), and sample size of the datasets included in the analyses.

<table>
<thead>
<tr>
<th>Country</th>
<th>Year of Survey</th>
<th>IMR</th>
<th>Sample Size (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chad</td>
<td>2014/15</td>
<td>72</td>
<td>68,989</td>
</tr>
<tr>
<td>Demographic Republic of Congo (DRC)</td>
<td>2013/14</td>
<td>58</td>
<td>59,276</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2011</td>
<td>59</td>
<td>45,540</td>
</tr>
<tr>
<td>Liberia</td>
<td>2013</td>
<td>54</td>
<td>30,800</td>
</tr>
<tr>
<td>Mozambique</td>
<td>2011</td>
<td>64</td>
<td>37,984</td>
</tr>
<tr>
<td>Niger</td>
<td>2012</td>
<td>51</td>
<td>44,183</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2013</td>
<td>69</td>
<td>119,386</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2012/13</td>
<td>74</td>
<td>50,238</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2013</td>
<td>92</td>
<td>47,392</td>
</tr>
<tr>
<td>Zambia</td>
<td>2013/14</td>
<td>45</td>
<td>49,207</td>
</tr>
</tbody>
</table>

Study Variables
The independent variable of interest is excess fertility. This variable is created using ideal number of children and birth order. For each pregnancy, the birth order is subtracted from her ideal number of children. If the birth order is greater than her ideal number, the birth is considered to be excess fertility (coded 1) and if the birth order is less than or equal to her ideal number of children it is not considered to be excess fertility (coded 0).
The dependent variable for this analysis is the death of a child before his or her first birthday (infant mortality). Consequently, any birth in the last year is omitted from the final regression. This is necessary because it is not yet known if the child will survive its first year.

In addition to excluding births in the last year, the final regression also excludes births that occurred when a woman was older than 35 or younger than 18, since these have been found to have an elevated risk of mortality (12-13).

Methods of Analysis
Log binomial regression is used to estimate the relative risk of infant mortality for births that are excess fertility compared to births that are not excess fertility. The model was run unadjusted and then adjusted, for appropriate confounders: birth spacing, wealth, women’s education level, and residence (urban or rural) (14-15). Relative risk is used because although country selection focused on high mortality countries, deaths are still relatively rare. Analysis will be conducted using STATA 12 and calculated using survey weights.

Findings
Establishing Excess Fertility
Table 2 shows the variation between countries for different indicators of actual and desired fertility. Comparing mean ideal number of children and total fertility rates (TFR) indicates that on average, women in Chad, Liberia, Niger, Nigeria, and Pakistan women have not yet met their desired fertility. Women in DRC, Ethiopia, Mozambique, and Zambia have more children than their ideal, and in Sierra Leone TFR and ideal number of children are equal.

The concept of excess fertility is a more individual level approach which allows for variation that may be obscured in the aggregate. Excess fertility is calculated by identifying all births that happen after the women has reached her stated ideal number of children. This is calculated using births as the unit of analysis, not women. The highest percentage of excess births is in Pakistan, with almost 20 percent of births occurring after a woman has reached her ideal number of children. There is large variation from country to country. As expected, countries with the highest ideal number of children have the lowest percentage of births classified as excess fertility.

<table>
<thead>
<tr>
<th>Country</th>
<th>Ideal number of children</th>
<th>TFR</th>
<th>% Excess fertility</th>
<th>% of births that are high parity (traditional definition)</th>
<th>% of Births in the last 5 years that are unplanned</th>
<th>Mistimed</th>
<th>Unwanted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chad</td>
<td>8.2</td>
<td>6.4</td>
<td>4.4</td>
<td>33.7</td>
<td>10.8</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>DRC</td>
<td>6.1</td>
<td>6.6</td>
<td>8.7</td>
<td>27.8</td>
<td>24.0</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>4.3</td>
<td>4.8</td>
<td>18.6</td>
<td>27.8</td>
<td>19.5</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>Liberia</td>
<td>4.8</td>
<td>4.7</td>
<td>11.3</td>
<td>24.3</td>
<td>25.9</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td>4.8</td>
<td>5.9</td>
<td>9.4</td>
<td>22.6</td>
<td>11.6</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Niger</td>
<td>9.2</td>
<td>7.6</td>
<td>2.8</td>
<td>33.9</td>
<td>7.6</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>6.5</td>
<td>5.5</td>
<td>5.3</td>
<td>28.7</td>
<td>6.6</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>4.1</td>
<td>3.8</td>
<td>19.6</td>
<td>25.7</td>
<td>8.5</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>4.9</td>
<td>4.9</td>
<td>9.0</td>
<td>23.9</td>
<td>10.9</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>4.7</td>
<td>5.3</td>
<td>11.0</td>
<td>25.4</td>
<td>31.4</td>
<td>5.8</td>
<td></td>
</tr>
</tbody>
</table>
Comparing Excess Fertility to Unwanted Births
In all countries, excess fertility is higher than the percentage of pregnancies classified as unwanted and in all cases except Pakistan, it is lower than the percentage identified as mistimed. As mentioned above, one assumption about this type of data is that it is difficult for a woman to label an existing child or pregnancy as unwanted and she may be more likely to call it mistimed. So, having excess fertility fall between unwanted and mistimed seems reasonable. It can be expected that some of the mistimed responses are actually unwanted responses, but not all of them. Also, it is necessary to remember that these two concepts have some important methodological differences. Wantedness is only measured for pregnancies in the last five years and comes directly from a woman being asked if her pregnancies were wanted at that time or not at all. As described earlier, the response to this question may be subject to bias. Excess fertility is estimated using all pregnancies and is based on a woman’s stated ideal number of children. The basis of this assumption is that it is easier for a woman to specify a number than it is to label an existing child as unwanted.

Comparing Excess Fertility to the Traditional Definition of High Parity
When comparing excess fertility to the traditional definition of high parity (S+ births) it shows that there are far fewer “high parity” births using the new definition. This is consistent with the ideal number of children being higher than four in all countries, allowing for more births to be classified as low parity under the new definition (defined as not excess fertility). Countries with the highest ideal number of children have the highest percentage of births that are high parity using the traditional definition and the lowest percentage of births that are excess parity using the new definition. The country that does not follow this pattern is Pakistan, where ideal and actual TFR is very close, but there is still a high percentage of both high parity births and excess fertility.

Variations in Excess Fertility by Age
In all ten countries excess fertility is significantly associated with age (using chi square test, all are significant at the .05 level). Graph 1 shows the percentage of births in each age group that are excess fertility. As expected, excess fertility is more likely to occur in older women. However, there is a lot of country variation in the younger age groups. In Pakistan, almost 17 percent of births to women between the ages of 30 and 34 occur after a woman has reached her ideal number of children. In Niger, where both TFR and ideal parity are extremely high, less than two percent of pregnancies to women aged 30 to 34 are classified as excess fertility.

Graph 1: Percentage of births that occur after a woman has reached her ideal number of children, by age group
A Closer look at Ideal Parity

A major assumption in this analysis is that a woman's ideal number of children does not change significantly over her lifetime. Ideally, there would be longitudinal data available that allowed individuals to be tracked over time. This is a disadvantage of using cross-sectional data, the information is only available for one point in time. Although it is not possible to directly measure change at the individual level, it is possible, using DHS datasets, which provides a time-series of cross-sectional data, to construct synthetic age cohorts and look at mean ideal number of children by age group over time.

Ethiopia and Mozambique have intervals between DHS surveys that provide an opportunity to explore ideal number of children over time. Although there has been a reduction in mean ideal number of children over time for both countries (5.3 to 4.3 in Ethiopia and 5.9 to 4.8 in Mozambique), there has not been much change over time when looking at synthetic age cohorts. The largest change is seen in Mozambique for women who were aged 35 to 39 in 2000. The number changes from 6.8 to 6.2 for their synthetic age cohort between the first and last survey.

Table 3: Ethiopia: Mean ideal number of children over time, by age.

<table>
<thead>
<tr>
<th>Ethiopia Survey year (national mean ideal)</th>
<th>15-19</th>
<th>20-24</th>
<th>25-29</th>
<th>30-34</th>
<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011 (4.3)</td>
<td></td>
<td>4.3</td>
<td>5.3</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005 (4.5)</td>
<td>4.1</td>
<td></td>
<td>5.2</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 (5.3)</td>
<td>4.2</td>
<td>5.2</td>
<td>5.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Mozambique: Mean ideal number of children over time, by age.

<table>
<thead>
<tr>
<th>Mozambique survey year (national mean ideal)</th>
<th>15-19</th>
<th>20-24</th>
<th>25-29</th>
<th>30-34</th>
<th>35-39</th>
<th>40-44</th>
<th>45-49</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011 (4.8)</td>
<td></td>
<td>4.8</td>
<td>5.7</td>
<td>6.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005 (5.3)</td>
<td>4.6</td>
<td></td>
<td>5.7</td>
<td>6.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 (5.9)</td>
<td>4.7</td>
<td>5.8</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This analysis indicates using a one-time value for mean ideal number of children for each woman is reasonable.
Distribution of Child Deaths

The dependent variable for this analysis is infant deaths. Table 5 shows the percentages of births that resulted in death for the dataset used in this analysis. Recall that certain births have been excluded: those that occurred before a woman was 18 and after she was 35 and births in the last year, since they have not yet proven survivability for the first year. In most countries, more than half of the deaths occur before the child turns one, except Niger and Nigeria. When comparing the % of deaths that are to excess parity (the last column in table 5) to percentage of births that are categorized as excess fertility from Table 2, only in Liberia, Pakistan, and Zambia does the percentage of deaths to excess parity exceed the percentage of all births that are excess parity. Suggesting, there is disproportionate death among this group. This will be further tested in the next step of the analysis.

Table 5: Percentage of births that resulted in a child death and the distribution of those deaths by age and whether or not they were defined as excess parity. This is only inclusive of births that were used in the analysis. As described in the methodology section, some births have been excluded based on mothers age at time of birth and births in the last year.

<table>
<thead>
<tr>
<th>Country</th>
<th>% of births that ended in death</th>
<th>% of deaths that occurred before the child turned one</th>
<th>% of deaths before age one that are to excess parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chad</td>
<td>16%</td>
<td>50%</td>
<td>4%</td>
</tr>
<tr>
<td>DRC</td>
<td>13%</td>
<td>53%</td>
<td>7%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>16%</td>
<td>56%</td>
<td>18%</td>
</tr>
<tr>
<td>Liberia</td>
<td>17%</td>
<td>58%</td>
<td>14%</td>
</tr>
<tr>
<td>Mozambique</td>
<td>15%</td>
<td>59%</td>
<td>8%</td>
</tr>
<tr>
<td>Niger</td>
<td>20%</td>
<td>38%</td>
<td>2%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>17%</td>
<td>48%</td>
<td>5%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>11%</td>
<td>77%</td>
<td>23%</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>21%</td>
<td>60%</td>
<td>8%</td>
</tr>
<tr>
<td>Zambia</td>
<td>11%</td>
<td>55%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Relating Excess Fertility to Mortality

The final part of this analysis is to determine if there is a parity effect at the individual level. Does the excess fertility found and presented above, have a higher risk of mortality?

The relative risk of dying before one year of age for excess fertility is estimated using a log binomial regression. Results for both the unadjusted and the adjusted model are presented in table 6 for the four countries with significant findings: Liberia, Nigeria, Pakistan, and Zambia. Table 7 contains the results of the full adjusted model for the countries without significant results.

In all four significant countries, excess fertility, births that occur after a woman has reached her ideal parity, have an increased risk of infant mortality in both the unadjusted and adjusted models at the .05 level.

Table 6: Relative risk of infant mortality for excess fertility, unadjusted and adjusted models. Adjusted model includes birth spacing, wealth, women's education level, and residence (urban or rural). Depicted as Exp (b) when using survey settings to correct for sample design in STATA output.

<table>
<thead>
<tr>
<th>Country</th>
<th>Exp (b)</th>
<th>Standard Error</th>
<th>P Value</th>
<th>Sample Size (Births)</th>
</tr>
</thead>
</table>

6
<table>
<thead>
<tr>
<th>Country</th>
<th>Adjusted</th>
<th>Std Error</th>
<th>P Value</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chad</td>
<td>1.27</td>
<td>0.171</td>
<td>0.04</td>
<td>18,386</td>
</tr>
<tr>
<td>DRC</td>
<td>1.35</td>
<td>0.086</td>
<td>0.00</td>
<td>72,667</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>1.35</td>
<td>0.092</td>
<td>0.00</td>
<td>41,357</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1.33</td>
<td>0.141</td>
<td>0.00</td>
<td>30,292</td>
</tr>
<tr>
<td>Niger</td>
<td>1.35</td>
<td>0.105</td>
<td>0.00</td>
<td>30,292</td>
</tr>
</tbody>
</table>

Table 7: Results from adjusted model for countries without significant findings. Adjusted model includes birth spacing, wealth, women's education level, and residence (urban or rural). Depicted as Exp (b) when using survey settings to correct for sample design in STATA output.
Limitations

One of the main limitations of using cross sectional data is only having information for one point in time. Ideally, there would be information at the time of each birth. For some of these variables it is more important than others. For example, level of education of the mother may not change very much, since in many developing countries women discontinue their education at the time of a pregnancy. In some countries there are current policy initiatives to allow or encourage (depending on the current policy) girls to return to school. However, these are new and would not affect the data used in this analysis. Other control variables, such as wealth, may indeed change over time.

Another limitation is either non-response or a non-numeric response when a woman is asked her ideal number of children. Births to these women are excluded from this analysis. There is not much variation between countries, with all of them being between 4 and 10 percent, except Chad which is 23 percent.

Discussion

This analysis attempted to redefine high parity and then test if there is a parity effect on infant mortality. The new definition shifts the concept from a global perspective, with the assumption that there is a cut off that determines high parity for all women, to an individual perspective that allows for variation depending on the fertility desires of each woman. This builds on recent findings that the global perspective of high parity (using the traditional definition of 5 or more being too many) does not carry an increased risk of mortality. The traditional definition of high parity was based, at least partly, on the recognition that mortality rates are higher for these births. The recent analysis shows that those higher rates are due to characteristics related to the woman, not the birth.

The first step is to create a new indicator, excess fertility, using a woman’s reported ideal number of children as the cut off for too many births instead of a universal figure. For the countries included in this analysis, the percentage of births categorized as excess fertility varied from a low of 2.8 percent in Niger to a high of almost 20 percent in Pakistan. A major assumption in using this indicator is that there is not much change in a woman’s ideal number of children over time. Although it was not possible to test this directly using cross sectional data, age synthetic cohorts across a time-series of cross sectional surveys found that there was little variation over time.

A potential additional advantage to using this new indicator, excess fertility, over existing measures about the wantedness of a pregnancy is the avoidance of requiring women to classify existing children as being mistimed or unwanted, potentially resolving some of the bias inherent is collecting this type of information. In all cases, excess fertility was higher than the percentage of pregnancies that were reported as unwanted.

The second part of the analysis tested a repositioning of the “parity effect” to see if births whose birth order is higher than a woman’s ideal number of children have an increased risk of infant mortality. This was found to be true in four of the ten countries tested. In Liberia, Nigeria, Pakistan, and Zambia births classified as excess fertility have an increased risk of infant mortality. This suggests that in these countries there may be a parity effect, just not one that can be globally defined by a single number. Instead, women may be able to identify what number is too many for them and there are negative outcomes for births that exceed this number. It is still unclear why there is a difference, whether it is differences in how children are cared for or if there are insufficient resources (both theories pertaining
to the original high parity concept), or something else. Potentially in some countries there are pockets of women that have higher levels of uncertainty about fertility intentions.

When comparing the countries were an effect was found with those where one wasn’t, no clear pattern exists. Liberia, Pakistan, and Zambia, where results are significant have had rapid growth in family planning use in recent years, but so has Ethiopia and Sierra Leone, where results were not significant. Among the four countries with significant findings, two have shown reductions in ideal number of children over time (Liberia and Zambia) and two have shown little or no change (Nigeria and Pakistan). There is little difference in non-numeric responses between the countries, with all countries except Chad having rates between four and ten percent. Chad is much higher with 23 percent of women not giving a numeric response to the question of what is your ideal number of children.

Results from this analysis do not allow any conclusive findings on the potential new definition of high parity. Being significant in less than half of the countries included in the analysis (4 out of 10), without an understanding as to why, prevents any generalizable findings. However, the significant findings in the four countries does suggest a need for additional analysis to further explore this concept. Follow on analysis should include expansion to additional countries. This could lead to a clearer pattern as to which countries have significant findings and which do not.

There is also a need to further explore differences, other than mortality, between “excess fertility” births and other births. This should include associations related to the gender of living children and husband fertility desires. Analysis should also include births to women who did not provide a numeric response to the question about ideal number of children, which were excluded from this analysis. Finally, behaviors that are known to be linked to child mortality, such as health seeking behaviors, should be analyzed to identify if there are differences between “excess fertility” births and other births. All this information would be helpful in assessing the usefulness or refinement of this new definition high parity.
References


