Sibling composition and child mortality in South Asia: Assessing trends beyond male-female dichotomy

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Abstract

This study assess trends in child survival by older surviving sibling composition in four South Asian countries, namely Bangladesh, India, Nepal and Pakistan, using multiple survey rounds of Demographic and Health Surveys conducted during 1990-2007. A total of twelve combinations of sex composition of older surviving siblings were constructed. Predicted hazard were estimated based on Cox Proportional Hazard analysis by older surviving sibling composition in four countries to assess the trend and pattern of difference. The results show selective neglect of children with certain sex and birth-order combinations that operate differentially for girls and boys in all selected countries. Both girls and boys who were born after multiple same-sex siblings experience poor outcomes. However, the preference for sons persists, and boys who were born after multiple daughters have the best possible outcomes.

Key words: Child mortality, gender, sibling composition, South Asia

Background

The extended literatures from low-and-middle income countries have highlighted the importance of mothers, households and community level factors in determining child survival (Sheikh et al., 2011; Banerjee et al., 2010; Uddin et al., 2010). For instance, studies have documented maternal age at birth, birth order and interval (Gavrielov-Yusim et al., 2012), mass media exposure (Gatchell et al., 2008) are significant determinants of child mortality. Mother's education is one of the most widely discussed factors in global public health literature and has consistently been recognized as a key determinant that enhances the survival probability through better nourishing and health care use (Fatiregun and Okoro, 2012). Contextual factors such as urban-rural difference (Uddin et al., 2010), accessibility to healthcare facility (Cockcroft et al., 2009), healthcare expenditure (Lauridsen and Pradhan, 2011) and availability of healthcare infrastructure (Ghei et al., 2010) also determine the extent of child survival in majority of low-and-middle income countries.

In public health literature, one of the most discussed issues is of gender discrimination in the provision of child health and survival. While the socioeconomic differentials in child mortality are a universal phenomenon in low-and-middle income countries, gender gap is especially acute in South Asian countries. Evidence of gender bias in health, survival, education and work participation has been well documented in South Asian context (Ghosh, 2012; Corsi et al., 2009; Oster, 2009; Gwatkin, 2007). Scholars argue that the persistence of gender discrimination stems from the perceived greater economic, social, and religious utility of sons over daughters (Ghosh, 2012). Sons are preferred to daughters because sons have higher earning potential and are expected to assist in times of crisis or when parents are aged and no longer able to support themselves. However, daughters are perceived as more of burden in view of the high costs of dowries required at their marriage and their limited economic opportunities (Muhuri and Preston, 1991). Studies in South Asian context have documented that parents visit modern medical facilities less frequently for girls than boys (Ghosh, 2012; Basu, 1989; Rahaman et al., 1982). Similarly, Basu (1989) argues that the elevated risk of female child death results primarily from discrimination with respect to medical treatment rather than diet. Despite substantial evidence of son preference, there are indicators suggest that girls too are valued. Many field studies in South Asia documented care and assistant provided by married daughters in parents later life (Nag, 1992; Cadwell, 1990). Married daughters appear to be especially valued for their potential in giving care to sick or disabled parents.

In this paper, an attempt has been made to examine the association between gender differences in child survival in four selected South Asian countries with respect to the older surviving sibling composition. Although, previous studies have documented the extent and nature of selected sibling bias in mortality (Arulampalam and Bhalotra, 2006; Makepeace and Pal, 2006; Dasgupta, 1990; Zenger, 1993), no assessment has been done to assess the trends over time. For example, Pande (2003) finds that both girls and boys born after multiple same-sex siblings have lower vaccination while the best outcomes occur among boys with multiple older sisters. Similarly, a study observed worst health outcomes occur among girls of birth order three and above with no older brothers (Mishra et al. 2004). Further, a recent study documented daughters' survival disadvantage increases in the number of older sisters and decreases in the number of older brothers they have (Chamarbagwala, 2011). Evidences suggest parents could selectively

discriminate against children with certain sex-birth-order to achieve their desired sex composition (Pande, 2003).

The underline motivation behind this study is to investigate the progression in child survival beyond male-female dichotomy, while considering sex composition of older surviving sibling. In last few years the gender difference in child mortality, immunization, and the utilization of other health care services like health facility use for diarrhoea treatment has been declining. Now the question is whether the declining trend is similar for every child, irrespective of sex composition and birth order? Globally, monitoring inequalities in health is foremost on the agenda of public health surveillance (Bhutta and Reddy, 2012).

Data & Methods

Data

The present study utilizes data from the different rounds of Demographic and Health Survey (DHS) conduced in four selected South Asian countries namely, Bangladesh (1996, 1999 & 2007), India (1992, 1998 & 2006) Nepal (1996, 2000 & 2006) and Pakistan (1990 & 2007). The repeated cross-sectional design of the DHS supports a variety of epidemiological analyses to monitor health and population trend. The uniform sampling design of the survey facilitates cross-country comparison. Additionally, survey does provide scope to assess the trends while pooling the different rounds of survey. It is worth mentioning that there are more than three surveys conducted in Bangladesh and Nepal during 1989-2007, but to maintain the maximum consistency between countries, closer surveys have been utilized. Although, due consideration were given to capture the maximum length of the survey to examine the trends in child mortality by older surviving sibling compositions, but attention was also given to select those survey rounds that has an optimum information and that could easily be comparable with other surveys across four countries. In case of Pakistan, since no survey is available between 1990 and 2007, it was decided to restrict the analysis with two surveys only.

Dependent variables

In DHS, all qualified women were asked about their complete birth history. For each live born child, the month and year of birth are recorded, and whether or not the child is still alive at the moment of the interview. If a child died during the observation period, the age at which the child died is asked. The age of death is observed within intervals, in case a child died within a month after birth, the age of death is recorded in days, if the child died between one month and two years, it is recorded in months, and otherwise, it is recorded in years. This study use data on births that took place during the 10 years preceding the survey.

Defining older surviving sibling composition

DHS asked every eligible woman in the age group 15-49 years, her complete birth history including the sex, order of birth, survival status and healthcare services provided to her. Using this information, a combination of the sex composition of surviving older siblings was constructed for all births. The index of the sex-sibling composition is classified into 12 categories

– six older surviving sibling categories for each male and female child. This study defines older surviving sibling composition based on following criteria:

- ✓ The size of the sibling group, i.e., the number of children in the family. Here the size refers to the older as well as younger siblings.
    - ♦ The size of the sibling group can be further elaborated as number available at the time of birth and the number of dead siblings.
    - ♦ The sex composition of the siblings.
- ✓ The ordinal position of the child, i.e., the child's position in the age hierarchy of siblings in the family.

There may be several cases where older sibling died after the birth of the index child, in that case we have included as a surviving sibling since the particular sibling was alive when the time index child born. Thus, the older surviving sibling composition is the combination of the total number of older surviving sibling available at the time birth of last child and, total number of died sibling after the birth of last child.

Other independent variables

The present study considers several demographic, socioeconomic and contextual characteristics. These indicators are based on their theoretical and observed importance applied in literature, particularly in developing countries and availability of information in all rounds of survey for better comparability. Socioeconomic and demographic predictors such as birth order & interval, status of the child, age of the mother, mother's education, mother's working status, mass media exposure, household size, household wealth, place and region of residence were included as predictor variables in the study.

Methodological approach

This study is based on multi-country analysis and of different rounds of survey. Keeping this fact, an utmost effort has been made to maintain the consistency in defining dependent variables, section of independent variables, and analytical strategy across four selected countries over time. At first, gross differentials (bivariate analysis) were carried out to understand the differentials in child mortality by 12 categories of older surviving sibling composition in each country for all rounds of survey. An attempt has also been made to assess the differentials in survival on combined sample after pooling all rounds of survey in each country along with merging all country datasets together. To test the association between dependent and independent variables Chi-squared test has been applied.

Kaplan-Meier survival function are used to plot survival curves in order to depict the proportion of children who would survive a given length of time (12 to 48 months) by older

surviving sibling composition. Adopting Kaplan Meier estimates of survival functions and hazard functions, we generated the survival times and risk of child death at time *t* of the data that may be incomplete. An important advantage of the Kaplan–Meier estimates of survival and hazard plots is that the method can effectively deal with censored data. Further, since no previous study have included such a exhaustive categories of older surviving sibling composition in survival analysis, Log-Rank test has been perform to test the difference in survival probability across 12 categories of sibling composition for each survey period in all four selected countries. It is worth to mention that for effective comparison of survival curves of two or more groups of independent variables, we used log rank test (Altman, 1991). This test is often used because it does not assume any particular distribution of the survivor function but provides with confirmation of statistical evidence for two or more survival curves being different.

To examine the net effect of older surviving sibling composition on child survival Cox Proportional Hazard regression has been applied. At first has been applied for each rounds of survey for all four countries. Further, we have pooled all rounds of survey for each country to assess the net effect of older surviving sibling composition on selected health indicators after adjusting the time in the model along with other independent variables. It is worth mentioning that for better comparability across surveys and countries, we have restricted to those independent variables which are common. Moreover an attempt has also been made to examine the estimates after pooling four countries sample together, considering county as a fixed effect. To examine the trend in child health by older surviving sibling composition over time, interaction effect between three categories of survey time and 12 categories older surviving sibling composition (3*12=36) were examined on pooled sample for each country after adjusting other independent variables in the model. We have presented results in a set of predicted hazard (PH) for better interpretation. An attempt has also been made to combine all rounds of dataset for each county and examined the pooled effect of older surviving sibling composition on child survival after adjusting the time and country of residence along with other variables mentioned above. The entire analyses were done using Stata version 10 (Statacorp, 2007).

Results

Trends and differentials in child survival by sibling composition in South Asia

The general pattern suggests that the overall proportion of child death in all selected countries were ranges between 1% in Bangladesh to 1.4% in India and Nepal respectively, considerable difference were evident by older surviving sibling composition (**Table 1**). Across all 12 categories of older surviving sibling composition, the highest child death was either observed among those female who had 1+ older surviving brother and 1+ sister (Bangladesh 1.4% and India 2.9%), or among those female who had 1+ older surviving sisters (Nepal 2.2% and Pakistan 1.7%). Moreover, the pooled estimate (2006-07) for all four countries also revealed higher child death among female who had 1+ older surviving brother and 1+ sister (2.5%), followed by female who had 2+ older surviving sisters (1.9%).

Finding shows in India and Nepal the proportion of death was 0.9% and 1.4% among male who did not have any older surviving sibling respectively, while it was 1.7% and 2.1%

respectively among those female who had 1+ older surviving brother and 1+ sister. In three out of four countries, namely India, Nepal and Pakistan the proportion of child death was higher among male who had one older surviving brother than to male with one older surviving sister. For example, in Pakistan the proportion of death among male who already had one older brother was 0.7%, whereas it was just 0.2% among male who had one older sister. Similarly, considerable difference in child death was also found among those male who had 2+ older surviving brother and, male with 2+ older surviving sisters. Like, in Bangladesh and Pakistan the proportion of child death among male who had 2+ older surviving sisters was 0.7% and 1.3% respectively, but among those male with 2+ older surviving brothers it was 1.3% and 2% respectively. As far as the pattern of child death among female by older surviving sibling composition is concern, finding suggest that in all four selected countries child death was higher among those female who had 2+ older surviving sisters as compare with female with 2+ older surviving brothers. For example in case of India and Pakistan, the proportion of child death among female who had 2+ older surviving brothers were 1.5% and 0.9% respectively, while among those female who had 2+ older surviving the proportion of death was 2.2% and 1.7% respectively. In Nepal, the proportion of child death was 0.7% among female with one older surviving brother, but it was 1.4% among female who had one older surviving brother. Other than Nepal, no difference was observed between female who had one older surviving brother and with those female who had one older surviving sister.

Child survival probability by sibling composition in South Asia

The log-rank test (Mantel-Cox) result for all four selected countries clearly shows that the probability of child survival was significantly different across 12 categories of older surviving sibling composition. Moreover, the test was remains significant in all rounds of survey for each country along with on pooled sample (**Table 2**). The survival plot for child death by 12 categories of older surviving sibling composition also suggests considerable divergence in survival probability in all four selected countries (**Figure 1**). Except Bangladesh, the worst survival plot was observed among those female who had 1+ older surviving brother and 1+ sister. However in Bangladesh the worst survival plot was observed among those female who had 2+ older surviving sisters. Further, in Bangladesh the second worst survival plot was evident among those female who had 1+ older surviving brother and 1+ sister; whereas in Nepal it was among male who had 1+ older surviving brother and sister. However, female with 2+ older surviving sisters had a second worst survival probability in India and Pakistan. As far the best survival cure across 12 categories of older surviving sibling composition is concern, male with 2+ older surviving sisters was evident in Bangladesh and Pakistan. In India, the best survival plot was found among male who did not have any older surviving sibling composition, while in Nepal it was among male who had one older surviving sister. Out of four selected countries the second best survival plot was evident among those male who had 2+ older surviving sisters in India and Nepal. However, in Bangladesh and Pakistan, the second best survival probability plot was observed among those male who had one older surviving sister and, among those male who did not have any older surviving sibling respectively.

Interaction effect between time and sibling composition 1990-2007: Multivariate analysis

Result of interaction effect between older surviving sibling composition and survey time for child death obtained from the pooled multilevel analysis shows significant difference in Predicted Hazard of death across 12 composition of older surviving sibling in all four selected countries and for pooled South Asia estimates separately. In all countries on of the most consistent pattern was highest predicted hazard of dying among those female who had 1+ older surviving brother and 1+ sister during 1990-2007 (**Table 3,4,5,6,7**) . On the other side, male that had either no older surviving sibling or those male who had one older surviving sister, the predicted hazard of child death was lowest in all countries. For instance in India, the predicted hazard of dying among male who had no older surviving sibling in 2006 was 0.005, whereas among those female who had 1+ older surviving brother and 1+ sister the predicted hazard of child death in was 0.019 in 2006. In all four selected countries the predicted hazard of dying was higher among those male who had 2+ older surviving brothers as compare with male who had 2+ older surviving sisters during 1990-2007. For example, in India and Bangladesh the predicted hazard of dying among female who had 2+ older surviving sisters were 0.006 and 0.007 respectively, while among male with 2+ older surviving brothers it was 0.012 and 0.015 respectively. A similar pattern was also evident as the predicted hazard of dying was higher among those male who had one older surviving brother as compare with male with one older surviving sibling in India, Nepal and Pakistan. The finding further suggests considerable higher predicted hazard of child death those female who had one older surviving sisters than to female who had one older surviving brothers in India, Nepal and Pakistan. For instance, in Nepal the predicted hazard of dying among female who had one older surviving sister was higher (PH=0.011) as compare with female with one older surviving brother (PH=0.007). Similarly, in India and Pakistan the predicted hazard of child death among female who had 2+ older surviving sisters were higher than to female who had 2+ older surviving male during 1990-2007.

The gender difference in child death by older surviving sibling composition was quite evident in this study. Except Pakistan, the predicted hazard of child death was comparatively higher among those male who had 2+ older surviving brothers as compare with female who had 2+ older surviving brothers. Similarly, those male who one older surviving brother the predicted hazard of dying was lower as compare with those female who had one older surviving brothers in Bangladesh, India and Pakistan. If a male who had 1+ older surviving brother and 1+ sister and a female who had the same older surviving sibling composition, the predicted hazard of dying was higher among female than to male in all four South Asian countries.

Conclusion

The overall trends and patterns suggest considerable differences in survival (i.e., child mortality) status by older surviving sibling composition in all selected countries. Further, finding confirms that older surviving sibling composition primarily holds the dynamics of child mortality in South Asia during 1990-2007. However, the effect of older surviving sibling composition is not constant for all rounds of survey, nor is it same for all countries. Nevertheless, the finding clearly reveals unexplored sibling dynamics that typically hidden in simple tabulation by gender or birth order. Results revealed that discrimination against female is largely apparent for those who had either 2+ older surviving sisters and, with 1+ older surviving brother and 1+ sister.

Importantly, result also found evidence of compromised survival probability against male who had 2+ older surviving brothers.

Although, indentifying possible mechanism of sibling difference in child survival is neither the scope of this study nor it is possible by utilizing available datasets. However, earlier studies show that parental and societal norms about the value of girls relative to boys and about a desirable family sex composition help to explain why certain children fare worse than their siblings (Omariba et al., 2008; Pande, 2003). Sociological literature suggests that gender bias occurs when male and female identities are assigned different 'values' within the community or indeed the household, leading to boys and girls receiving different treatment, care and resources (Choi & Lee, 2006). In India, as well as most of the South Asian countries, sons are preferred to daughters for a number of economic, social and religious reasons, including financial support, old age security, property inheritance, dowry, family lineage, prestige, power, and rituals and beliefs about religious duties. Studies cite that males are perceived as the economic lynchpin of future generations in the Indian context (Ganatra & Hirve, 1994) while girls are considered a burden on resources, which will eventually leave the family home upon marriage. Parents may have made pragmatic choices based on their perception of how useful or valuable a male would prove over a female (Omariba et al., 2008).

On the other hand some theories suggest that parents invest in their child with the hope of great potential returns (Garg & Morduch, 1998), and this may depend on the sibling sex compositions in the household. According to models of the family developed by Becker and Tomes (1976), parents care about the welfare of their children and, as a result, finance human capital investments in their children. In the absence of credit constraints and preferences for equality of earnings, investments in children are made until the return to additional investment equals the market rate of interest. For example, if the rate of return on investment in education or health is greater for male children than for female children, males will receive more of such investments than females. As Butcher and Case note, these circumstances can lead to a systematic relationship between sibling sex composition and educational attainment, which might be applicable in the case of health care utilization as well.

To conclude, the extent literatures from the global south have long been highlighted the persistent gender and birth order difference in child survival. This study is an attempt in the sequence to unfold the dynamics related to child mortality through examining association beyond the conventional 'male-female dichotomy', by considering gender, surviving sibling(s), birth order and different compositions of older sibling in tandem, in four South Asian countries namely Bangladesh, India, Nepal and Pakistan. The present work suggests that in spite of decline in fertility and of overall improvement in health, health care infrastructure along with socioeconomic and technological development "selective bias" in child survival towards preferred sex and composition remains visible in all selected South Asian countries.

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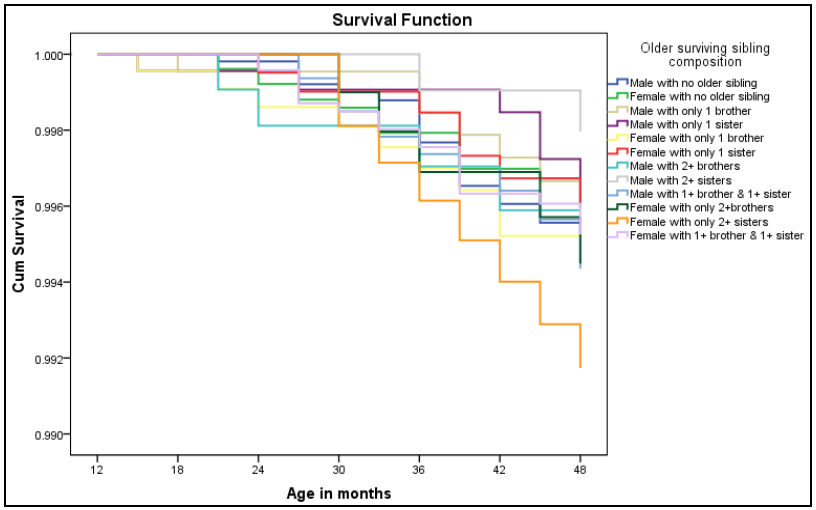
Table 1. Trends and patterns of child death (in %) by older surviving sibling composition in four South Asian countries, DHS 1990-2007

Sibling composition/survey time	1990-96	1999-00	2006-07	1990-2007		1990-96	1999-00	2006-07	1990-2007
Bangladesh					**Nepal**				
Total	2.6	1.9	1.0	1.9	**Total**	3.1	2.1	1.4	2.2
Sex of the child	*[p=0.005]*	*[p=0.002]*	*[p=0.080]*	*[p=0.000]*	**Sex of the child**	*[p=0.039]*	*[p=0.000]*	*[p=0.177]*	*[p=0.002]*
Male	2.2	1.6	0.9	1.6	Male	2.8	1.7	1.5	2.0
Female	2.9	2.3	1.2	2.1	Female	3.4	2.5	1.3	2.5
Older surviving sibling composition	*[p=0.012]*	*[p=0.000]*	*[p=0.092]*	*[p=0.000]*	**Older surviving sibling composition**	*[p=0.000]*	*[p=0.000]*	*[p=0.006]*	*[p=0.000]*
Male with no older survival sibling	2.0	1.2	0.9	1.4	Male with no older survival sibling	1.6	1.3	1.4	1.5
Male with only 1 brother & no sister	2.3	1.5	0.9	1.5	Male with only 1 brother & no sister	3.1	0.8	1.1	1.6
Male with only 1 sister & no brother	2.2	2.0	0.9	1.7	Male with only 1 sister & no brother	2.5	1.3	0.9	1.6
Male with 2+ brothers & no sister	3.1	2.0	1.3	2.1	Male with 2+ brothers & no sister	4.7	1.5	2.0	2.8
Male with 2+ sisters and & no brother	1.1	1.1	0.7	1.0	Male with 2+ sisters and & no brother	3.4	1.5	1.3	2.1
Male with 1+ brothers & 1+ sisters	2.5	1.9	0.8	1.8	Male with 1+ brothers & 1+ sisters	3.3	2.4	2.1	2.7
Female with no older survival sibling	2.0	1.2	1.0	1.4	Female with no older survival sibling	2.4	1.4	0.9	1.6
Female with only 1 brother & no sister	2.9	3.5	1.4	2.6	Female with only 1 brother & no sister	1.8	1.8	0.7	1.5
Female with only 1 sister & no brother	3.8	1.9	1.1	2.2	Female with only 1 sister & no brother	3.0	2.9	1.4	2.5
Female with 2+brothers & no sister	2.8	2.6	1.2	2.2	Female with 2+brothers & no sister	4.3	3.7	1.9	3.5
Female with 2+ sisters & no brother	4.2	2.2	1.3	2.5	Female with 2+ sisters & no brother	5.9	2.5	2.2	2.9
Female with 1+ brothers & 1+ sister	3.3	3.0	1.3	2.6	Female with 1+ brothers & 1+ sister	4.0	3.3	2.2	3.3
India					**Pakistan**				
Total	2.3	2.0	1.4	1.9	**Total**				
Sex of the child	*[p=0.000]*	*[p=0.000]*	*[p=0.000]*	*[p=0.000]*	**Sex of the child**	*[p=0.000]*		*[p=0.002]*	*[p=0.000]*
Male	1.9	1.6	1.1	1.5	Male	1.7		1.0	1.3
Female	2.7	2.5	1.7	2.3	Female	2.6		1.4	2.0
Older surviving sibling composition	*[p=0.000]*	*[p=0.000]*	*[p=0.000]*	*[p=0.000]*	**Older surviving sibling composition**	*[p=0.000]*		*[p=0.014]*	*[p=0.000]*
Male with no older survival sibling	1.5	1.2	0.9	1.2	Male with no older survival sibling	0.6		1.2	1.0
Male with only 1 brother & no sister	2.0	1.6	1.0	1.5	Male with only 1 brother & no sister	0.8		0.7	0.8
Male with only 1 sister & no brother	1.7	1.3	0.7	1.2	Male with only 1 sister & no brother	2.5		0.2	1.1
Male with 2+ brothers & no sister	2.4	2.3	1.3	2.0	Male with 2+ brothers & no sister	2.4		0.6	1.5
Male with 2+ sisters and & no brother	1.9	1.5	0.9	1.4	Male with 2+ sisters and & no brother	1.2		1.1	1.2
Male with 1+ brothers & 1+ sisters	2.1	2.1	1.7	2.0	Male with 1+ brothers & 1+ sisters	2.1		1.1	1.5
Female with no older survival sibling	2.0	1.6	0.9	1.5	Female with no older survival sibling	1.3		1.1	1.2
Female with only 1 brother & no sister	2.3	2.0	1.4	1.9	Female with only 1 brother & no sister	1.9		1.6	1.7
Female with only 1 sister & no brother	2.7	2.5	1.4	2.2	Female with only 1 sister & no brother	5.4		1.4	3.0
Female with 2+brothers & no sister	2.5	2.6	1.5	2.2	Female with 2+brothers & no sister	2.2		0.9	1.5
Female with 2+ sisters & no brother	3.0	3.0	2.2	2.7	Female with 2+ sisters & no brother	2.1		1.7	1.9
Female with 1+ brothers & 1+ sister	3.6	3.5	2.9	3.3	Female with 1+ brothers & 1+ sister	2.9		1.6	2.2

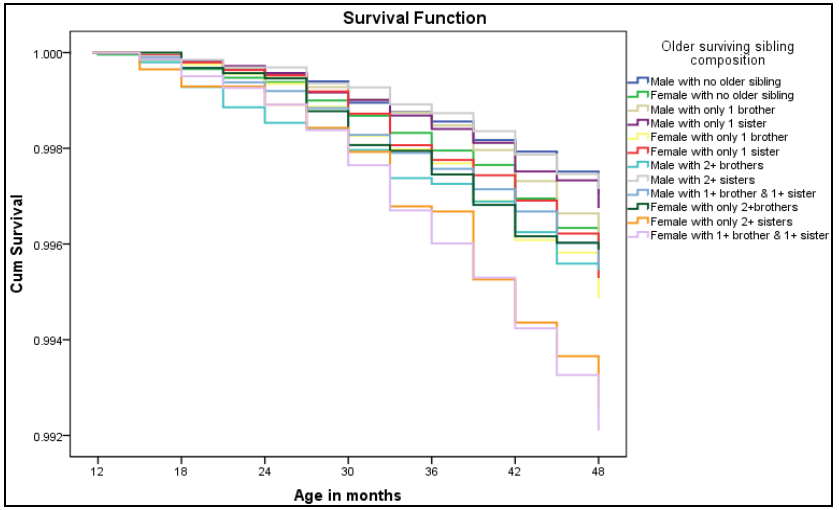
Note: Figure in parenthess are the p values based on chi-squared test

Figure 1. Survival curves for the children aged 12-48 months by 12 categories older surviving sibling composition, DHS 1990-2007

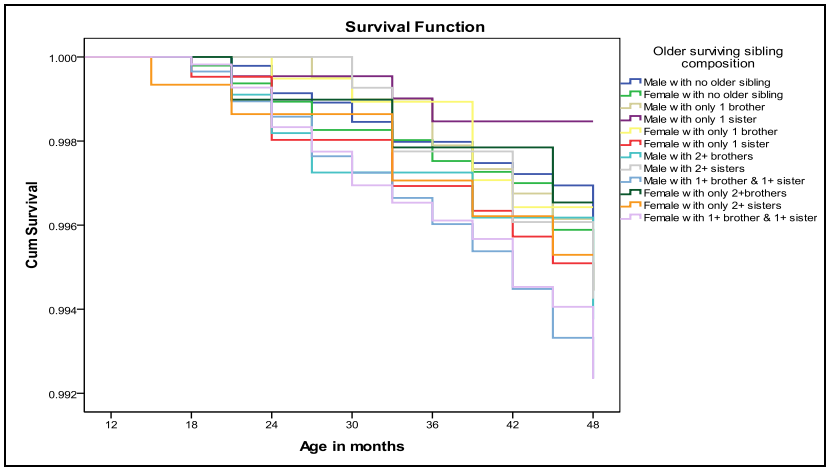
Bangladesh



India



Nepal



Pakistan

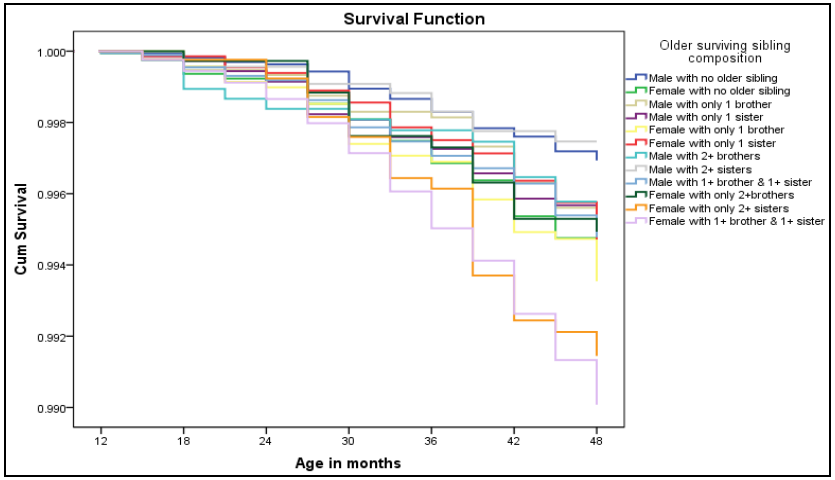


Table 2. Log Rank (Mantel-Cox) test for child mortality across 12 categories of older surviving sibling composition, South Asia, DHS 1990-2007

Sibling composition/survey time	**1990-96**	**1999-2000**	**2006-07**	**1990-2007**
Bangladesh	$\chi2$=24.03; *p=0.013*	$\chi2$=30.80; *p=0.001*	$\chi2$=16.40; *p=0.014*	$\chi2$=39.55; *p=0.000*
India	$\chi2$=163.44; *p=0.000*	$\chi2$=183.31; *p=0.000*	$\chi2$=182.95; *p=0.000*	$\chi2$=514.35; *p=0.000*
Nepal	$\chi2$=49.75; *p=0.000*	$\chi2$=40.24; *p=0.000*	$\chi2$=36.24; *p=0.000*	$\chi2$=79.71; *p=0.000*
Pakistan	$\chi2$=28.57; *p=0.003*	na	$\chi2$=16.92; *p=0.015*	$\chi2$=21.03; *p=0.010*
Pooled	$\chi2$=186.51; *p=0.000*	$\chi2$=201.75; *p=0.000*	$\chi2$=171.96; *p=0.000*	$\chi2$=545.41; *p=0.000*

Note: Na; not available

Table 3. Predicted Hazard (PH) of child mortality obtained from the pooled regression for the interaction between older surviving sibling compositions with time, Bangladesh, BDHS 1996–2007

Interaction effect between older surviving sibling composition and time	1996		1999		2007	
	PH	95% CI	PH	95% CI	PH	95% CI
Male compositions						
Male with no older survival sibling	0.017	[0.013-0.021]	0.012	[0.009-0.015]	0.006	[0.005-0.008]
Male with only 1 brother & no sister	0.019	[0.014-0.026]	0.014	[0.010-0.019]	0.007	[0.005-0.011]
Male with only 1 sister & no brother	0.018	[0.013-0.025]	0.013	[0.009-0.018]	0.007	[0.005-0.010]
Male with 2+ brothers & no sister	0.026	[0.018-0.039]	0.020	[0.013-0.029]	0.012	[0.008-0.018]
Male with 2+ sisters and & no brother	0.013	[0.010-0.021]	0.010	[0.006-0.016]	0.006	[0.004-0.010]
Male with 1+ brothers & 1+ sisters	0.021	[0.017-0.026]	0.017	[0.013-0.021]	0.010	[0.008-0.013]
Female compositions						
Female with no older survival sibling	0.017	[0.014-0.022]	0.012	[0.010-0.016]	0.007	[0.005-0.009]
Female with only 1 brother & no sister	0.032	[0.025-0.041]	0.023	[0.018-0.030]	0.014	[0.010-0.018]
Female with only 1 sister & no brother	0.025	[0.020-0.034]	0.019	[0.014-0.025]	0.011	[0.008-0.015]
Female with 2+brothers & no sister	0.024	[0.017-0.036]	0.020	[0.013-0.029]	0.012	[0.008-0.018]
Female with 2+ sisters & no brother	0.027	[0.019-0.038]	0.020	[0.013-0.028]	0.012	[0.008-0.018]
Female with 1+ brothers & 1+ sister	0.029	[0.024-0.034]	0.023	[0.019-0.028]	0.015	[0.012-0.019]
Differences#						
Male with no older survival sibling - Female with no older survival sibling	-0.06		-0.06		-0.04	
Male with only 1 brother & no sister - Female with only 1 brother & no sister	-1.26		-0.97		-0.63	
Male with only 1 sister & no brother - Female with only 1 sister & no brother	-0.77		-0.60		-0.37	
Male with 2+ brothers & no sister - Female with 2+brothers & no sister	0.21		0.00		-0.01	
Male with 2+ sisters and & no brother - Female with 2+ sisters & no brother	-1.39		-0.98		-0.61	
Male with 1+ brothers & 1+ sisters - Female with 1+ brothers & 1+ sister	-0.80		-0.65		-0.45	

All the predicted probabilities were significantly different at p=0.001 ($\chi 2$=56.28) indicates the acceptance of alternative hypothesis in Wald test. Note: Probability adjusted for mother's age, mother's education, household size, household wealth index, place of residence, and region of residence. #Difference calculated as male compositions - female compositions*100.

Table 4. Predicted Hazard (PH) of child mortality obtained from the pooled regression for the interaction between older surviving sibling compositions with time, India, IDHS 1996–2007

Interaction effect between older surviving sibling composition and time	1992		1998		2006	
	PH	95% CI	PH	95% CI	PH	95% CI
Male compositions						
Male with no older survival sibling	0.010	[0.009-0.011]	0.009	[0.008-0.010]	0.005	[0.004-0.006]
Male with only 1 brother & no sister	0.012	[0.012-0.014]	0.010	[0.009-0.012]	0.006	[0.005-0.007]
Male with only 1 sister & no brother	0.010	[0.009-0.012]	0.009	[0.008-0.010]	0.005	[0.004-0.006]
Male with 2+ brothers & no sister	0.019	[0.017-0.022]	0.018	[0.016-0.021]	0.011	[0.010-0.013]
Male with 2+ sisters and & no brother	0.012	[0.011-0.014]	0.011	[0.010-0.013]	0.007	[0.006-0.008]
Male with 1+ brothers & 1+ sisters	0.018	[0.017-0.019]	0.017	[0.016-0.018]	0.011	[0.010-0.012]
Female compositions						
Female with no older survival sibling	0.012	[0.011-0.013]	0.010	[0.009-0.011]	0.006	[0.005-0.007]
Female with only 1 brother & no sister	0.015	[0.013-0.017]	0.013	[0.012-0.015]	0.008	[0.007-0.009]
Female with only 1 sister & no brother	0.017	[0.016-0.019]	0.016	[0.014-0.017]	0.009	[0.008-0.010]
Female with 2+brothers & no sister	0.020	[0.018-0.023]	0.019	[0.016-0.021]	0.012	[0.011-0.014]
Female with 2+ sisters & no brother	0.023	[0.021-0.026]	0.022	[0.020-0.025]	0.015	[0.013-0.016]
Female with 1+ brothers & 1+ sister	0.029	[0.027-0.031]	0.027	[0.026-0.029]	0.019	[0.017-0.020]
Differences#						
Male with no older survival sibling - Female with no older survival sibling	-0.002		-0.002		-0.001	
Male with only 1 brother & no sister - Female with only 1 brother & no sister	-0.003		-0.003		-0.002	
Male with only 1 sister & no brother - Female with only 1 sister & no brother	-0.007		-0.007		-0.004	
Male with 2+ brothers & no sister - Female with 2+brothers & no sister	-0.001		-0.001		-0.001	
Male with 2+ sisters and & no brother - Female with 2+ sisters & no brother	-0.011		-0.011		-0.008	
Male with 1+ brothers & 1+ sisters - Female with 1+ brothers & 1+ sister	-0.011		-0.010		-0.007	

All the predicted probabilities were significantly different at p=0.000 ($\chi 2$=341.73) indicates the acceptance of alternative hypothesis in Wald test. Note: Probability adjusted for women's age at last birth, women's education, household size, household wealth index, place of residence, and region of residence. #Difference calculated as male compositions - female compositions*100.

Table 5. Predicted Hazard (PH) of child mortality obtained from the pooled regression for the interaction between older surviving sibling compositions with time, Nepal, NDHS 1996–2007

Interaction effect between older surviving sibling composition and time	1996		2001		2007	
	PH	95% CI	PH	95% CI	PH	95% CI
Male compositions						
Male with no older survival sibling	0.018	[0.014-0.022]	0.011	[0.008-0.014]	0.006	[0.004-0.008]
Male with only 1 brother & no sister	0.019	[0.014-0.026]	0.011	[0.008-0.016]	0.007	[0.005-0.011]
Male with only 1 sister & no brother	0.018	[0.013-0.025]	0.011	[0.008-0.015]	0.006	[0.004-0.009]
Male with 2+ brothers & no sister	0.039	[0.029-0.053]	0.025	[0.018-0.034]	0.017	[0.012-0.024]
Male with 2+ sisters and & no brother	0.026	[0.019-0.036]	0.016	[0.012-0.023]	0.011	[0.007-0.015]
Male with 1+ brothers & 1+ sisters	0.032	[0.027-0.037]	0.021	[0.018-0.026]	0.016	[0.013-0.019]
Female compositions						
Female with no older survival sibling	0.019	[0.015-0.024]	0.011	[0.009-0.015]	0.006	[0.004-0.008]
Female with only 1 brother & no sister	0.018	[0.013-0.025]	0.011	[0.008-0.016]	0.007	[0.005-0.010]
Female with only 1 sister & no brother	0.029	[0.023-0.038]	0.019	[0.014-0.025]	0.011	[0.008-0.015]
Female with 2+brothers & no sister	0.037	[0.027-0.051]	0.024	[0.017-0.034]	0.018	[0.013-0.026]
Female with 2+ sisters & no brother	0.036	[0.027-0.048]	0.022	[0.016-0.030]	0.015	[0.011-0.021]
Female with 1+ brothers & 1+ sister	0.042	[0.036-0.048]	0.027	[0.023-0.032]	0.020	[0.016-0.024]
Differences#						
Male with no older survival sibling - Female with no older survival sibling	-0.001		-0.001		0.000	
Male with only 1 brother & no sister - Female with only 1 brother & no sister	0.000		0.000		0.001	
Male with only 1 sister & no brother - Female with only 1 sister & no brother	-0.011		-0.008		-0.005	
Male with 2+ brothers & no sister - Female with 2+brothers & no sister	0.002		0.001		-0.001	
Male with 2+ sisters and & no brother - Female with 2+ sisters & no brother	-0.010		-0.006		-0.004	
Male with 1+ brothers & 1+ sisters - Female with 1+ brothers & 1+ sister	-0.010		-0.006		-0.004	

All the predicted probabilities were significantly different at p=0.000 (χ2=165.85) indicates the acceptance of alternative hypothesis in Wald test. Note: Probability adjusted for mother's age, mother's education, household size, household wealth index, place of residence, and region of residence. #Difference calculated as male compositions - female compositions*100.

Table 6. Predicted Hazard (PH) of child mortality obtained from the pooled regression for the interaction between older surviving sibling compositions with time, Pakistan, PDHS 1990–2007

Interaction effect between older surviving sibling composition and time	1990		2007	
	PH	95% CI	PH	95% CI
Male compositions				
Male with no older survival sibling	0.012	[0.008-0.016]	0.007	[0.005-0.010]
Male with only 1 brother & no sister	0.011	[0.007-0.018]	0.007	[0.005-0.012]
Male with only 1 sister & no brother	0.009	[0.006-0.016]	0.006	[0.003-0.010]
Male with 2+ brothers & no sister	0.016	[0.011-0.025]	0.012	[0.008-0.018]
Male with 2+ sisters and & no brother	0.012	[0.007-0.020]	0.008	[0.004-0.014]
Male with 1+ brothers & 1+ sisters	0.015	[0.013-0.019]	0.011	[0.009-0.014]
Female compositions				
Female with no older survival sibling	0.012	[0.009-0.017]	0.008	[0.005-0.011]
Female with only 1 brother & no sister	0.018	[0.012-0.026]	0.011	[0.007-0.016]
Female with only 1 sister & no brother	0.024	[0.017-0.033]	0.015	[0.010-0.021]
Female with 2+brothers & no sister	0.017	[0.011-0.027]	0.012	[0.007-0.018]
Female with 2+ sisters & no brother	0.016	[0.010-0.025]	0.010	[0.006-0.017]
Female with 1+ brothers & 1+ sister	0.018	[0.015-0.022]	0.013	[0.011-0.016]
Differences#				
Male with no older survival sibling - Female with no older survival sibling	0.000		0.000	
Male with only 1 brother & no sister - Female with only 1 brother & no sister	-0.006		-0.003	
Male with only 1 sister & no brother - Female with only 1 sister & no brother	-0.014		-0.009	
Male with 2+ brothers & no sister - Female with 2+brothers & no sister	-0.001		0.000	
Male with 2+ sisters and & no brother - Female with 2+ sisters & no brother	-0.004		-0.002	
Male with 1+ brothers & 1+ sisters - Female with 1+ brothers & 1+ sister	-0.002		-0.002	

All the predicted probabilities were significantly different at p=0.000 ($\chi 2$=33.66) indicates the acceptance of alternative hypothesis in Wald test. Note: Probability adjusted for women's age at last birth, women's education, household size, household wealth index, place of residence, and region of residence. #Difference calculated as male compositions - female compositions*100.

Table 7. Predicted Hazard (PH) of child mortality obtained from the pooled regression for the interaction between older surviving sibling compositions with time, South Asia Pooled, DHS 1990–2007

Interaction effect between older surviving sibling composition and time	1990-96		1998-01		2005-07	
	PH	95% CI	PH	95% CI	PH	95% CI
Male compositions						
Male with no older survival sibling	0.011	[0.011-0.012]	0.009	[0.009-0.010]	0.005	[0.004-0.006]
Male with only 1 brother & no sister	0.013	[0.012-0.015]	0.011	[0.010-0.012]	0.006	[0.006-0.007]
Male with only 1 sister & no brother	0.012	[0.010-0.013]	0.010	[0.009-0.011]	0.006	[0.005-0.007]
Male with 2+ brothers & no sister	0.021	[0.019-0.024]	0.019	[0.017-0.021]	0.012	[0.010-0.013]
Male with 2+ sisters and & no brother	0.014	[0.012-0.015]	0.012	[0.010-0.013]	0.007	[0.006-0.008]
Male with 1+ brothers & 1+ sisters	0.019	[0.018-0.020]	0.018	[0.017-0.019]	0.011	[0.010-0.012]
Female compositions						
Female with no older survival sibling	0.013	[0.012-0.014]	0.011	[0.010-0.017]	0.006	[0.006-0.007]
Female with only 1 brother & no sister	0.017	[0.016-0.019]	0.014	[0.013-0.016]	0.009	[0.008-0.010]
Female with only 1 sister & no brother	0.020	[0.018-0.021]	0.017	[0.015-0.018]	0.010	[0.009-0.011]
Female with 2+brothers & no sister	0.021	[0.019-0.024]	0.020	[0.017-0.022]	0.012	[0.011-0.014]
Female with 2+ sisters & no brother	0.024	[0.022-0.027]	0.022	[0.020-0.024]	0.014	[0.013-0.016]
Female with 1+ brothers & 1+ sister	0.029	[0.027-0.030]	0.027	[0.025-0.028]	0.018	[0.017-0.019]
Differences#						
Male with no older survival sibling - Female with no older survival sibling	-0.002		-0.002		-0.001	
Male with only 1 brother & no sister - Female with only 1 brother & no sister	-0.004		-0.003		-0.002	
Male with only 1 sister & no brother - Female with only 1 sister & no brother	-0.008		-0.007		-0.004	
Male with 2+ brothers & no sister - Female with 2+brothers & no sister	0.000		0.000		-0.001	
Male with 2+ sisters and & no brother - Female with 2+ sisters & no brother	-0.011		-0.010		-0.007	
Male with 1+ brothers & 1+ sisters - Female with 1+ brothers & 1+ sister	-0.010		-0.009		-0.006	

All the predicted probabilities were significantly different at p=0.000 ($\chi 2$=417.93) indicates the acceptance of alternative hypothesis in Wald test. Note: Probability adjusted for women's age at last birth, women's education, household size, household wealth index, place of residence, region of residence and country of residence. #Difference calculated as male compositions - female compositions*100.