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Research Note

Is the mortality–fertility nexus gendered? A research note on sex differences in the impact of sibling mortality on fertility preferences

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Research guided by demographic transition theory has shown that exposure to mortality influences women's fertility preferences and behaviours. Despite the myriad contexts, methodological approaches, and linkages featured in past studies, they have shared a focus on women, leaving questions on the gendered salience of mortality exposures for adults' fertility-related outcomes unanswered. In this research note, we analyse data from three African countries with distinct fertility profiles (Nigeria, Zambia, and Zimbabwe) to examine associations between sibling mortality exposure and ideal family size among women, men, and couples. We also investigate the stability of these associations over time. The associations between adults' sibling mortality exposure and their own and their spouses' ideal family sizes vary across countries. However, the gendered nature of the results in every country and evidence of cross-spousal effects uniformly demonstrate the need to incorporate sex differences into the study of the mortality–fertility link.

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Keywords: gender; mortality; fertility; fertility preferences; demographic transition

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Introduction

The effect of mortality on fertility occupies a central place in demographic enquiry. Various aspects of living in a high-mortality context, from the intimate losses that sear holes in kin networks to the daily reminders of the lurking threat of mortality, have been linked to women's fertility preferences, timing, and levels (Pebley et al. 1979; Sandberg 2006; Hayford and Agadjanian 2011; Shapiro and Tenikue 2017; Broussard and Weitzman 2020). More recently, the literature on the mortality–fertility nexus has expanded far beyond the pre-transition, high-mortality societies that were its original focus: it now features analyses of acute mortality shocks (Rodgers et al. 2005; Nobles et al. 2015) and new linkages in low-fertility societies (Okun and Stecklov 2021).

This otherwise diverse literature shares an intense focus on women, offering few insights into the potentially gendered salience of mortality exposures for women's and men's fertility-related outcomes. The literature's focus on women is indicative of a broader pattern in demographic enquiry: despite calls to expand the demographic canon and incorporate men into fertility research (Greene and Biddlecom 2000; Forste 2002; Ratcliffe et al. 2002), we still know less about the correlates of men's fertility preferences and outcomes (Agadjanian 2002). This is true even in contexts where the gender system grants men considerable influence over spousal dynamics (Bankole 1995; Dodoo 1998; Hossain et al. 2007).

That women bear the physical and emotional burden of pregnancy and childbearing helps justify their maintaining the limelight in fertility research. Even so, men play important roles in reproduction,

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and a growing number of studies have shown that studying men can challenge the universality of stylized facts derived from research on women (Dodoo 1998; Guzzo and Furstenberg 2007; Conzo et al. 2017; Amo-Adjei and Tuoyire 2018; Schoumaker 2019; Batyra et al. 2021). Moreover, identifying whether the influences of mortality exposures on fertility-related outcomes are universal—or sex specific—can clarify the potential for mortality to drive aggregate fertility trends. Although individual-level relationships between mortality exposures and women's fertility preferences and behaviours have been well documented (Sandberg 2005, 2006; Nobles et al. 2015), the aggregate relationships they are presumed to drive have eluded empirical confirmation, puzzling demographers for decades (Cleland 2001). Are mortality exposures salient to fertility-related outcomes for only half of the population, diluting the significance of mortality as a couple-level and, in turn, population-level driver of fertility?

Building on evidence that some determinants of fertility preferences are gendered (Tragaki and Bagavos 2014) and that exposure to death can influence women and men differently (Worden 1999; Fletcher et al. 2013; Brooten et al. 2018), in this research note, we focus on the case of sibling mortality and examine if it influences women's and men's ideal family sizes in different ways. Experiencing the death of one or more siblings remains common across much of the globe (Smith-Greenaway and Weitzman 2020), and research has shown that it corresponds with women's higher fertility preferences and ideals in select contexts (Pebley et al. 1979; Broussard and Weitzman 2020). It is unclear, however, if these associations are replicated elsewhere and, specifically, whether they are replicated among men. Given the potential salience of each spouse's mortality exposures, fertility preferences, and fertility ideals to couple-level behaviours (Bankole 1995; Gipson and Hindin 2009), we also examine if men's experiences inform their spouses' ideal family size and vice versa.

There is reason to anticipate that the influence of sibling death on ideal family size could differ between women and men. On the one hand, even though sibling mortality can be consequential for women's fertility preferences and ideals (Pebley et al. 1979; Broussard and Weitzman 2020), men's fertility preferences often exceed women's, especially in African countries such as those we study here (Dodoo and Van Landewijk 1996). Men's typically higher fertility preferences and ideals could be indicative of a greater sensitivity to experiences, such as bereavement. That is, if sibling mortality decreases individuals' confidence in their (future) children's survival, as past work has suggested (Montgomery 1998), men may be particularly apt to respond to this perceived threat by desiring more children. In fact, there is some indication that sibling deaths affect women's ideals only at the highest parities (Pebley et al. 1979), further implying that men's (generally higher) ideals could be particularly sensitive.

On the other hand, it is possible that women's ideal family sizes are sensitive to sibling mortality but that men's are not. Women tend to have stronger, more evident reactions in the wake of a family member's death, including that of a sibling (Fletcher et al. 2018). As such, it is possible that sibling mortality leaves a greater impression on women's than men's life course trajectories, worldviews, and desires. If that is the case, past research that focused only on women may have overstated the relevance of sibling mortality for adults' fertility preferences more generally.

Although past research has focused on the salience of individuals' own kin mortality exposures for their fertility preferences, sibling deaths could also have cross-spousal influence. Many 'couple studies' have examined how marital dynamics affect spouses' fertility preferences and behaviours; some studies have also outlined cross-spousal influence on adults' preferences (DeRose and Ezeh 2005; Snow et al. 2013). Extending this evidence suggests that even if an adult is not from a family burdened by excess mortality, marrying a spouse who is could also inform their ideal family size. As such, accounting for a spouse's sibling bereavement will clarify the full reach of sibling mortality on both women's and men's fertility preferences.

Current study

Recognizing that mortality exposures may affect fertility outcomes through various pathways, here we examine one possible route: by informing adults' fertility preferences (Van de Kaa 2001). We study fertility preferences specifically using a measure of ideal family size—an indicator known to align with achieved family size (Pritchett and Summers 1994; Günther and Harttgen 2016) yet imperfectly so (Cleland et al. 2020). Although nationally representative data sources, including the Demographic and Health Survey (DHS) Program data that we use here, often include information on men's fertility histories, the data are minimal and their quality

contested (Velema et al. 1991; Fikree et al. 1993; Coughlin et al. 1998; Rendall et al. 1999; Ratcliffe et al. 2002; Joyner et al. 2012). Thus, because of the challenges associated with collecting detailed and accurate fertility history data from men (Schoumaker 2017), we continue the tradition of studying ideal family size—one of the most widely used measures of fertility preferences—as an optimal way to understand how people think about fertility (Behrman 2015; Thiede et al. 2020; Kebede et al. 2022), even though we recognize its limitations (Casterline and El-Zeini 2007; Johnson-Hanks 2007; Müller et al. 2022).

The DHS Program is a valuable source of cross-nationally comparative surveys that are well suited to studying the salience of sibling mortality for adults' own ideal family sizes and those of their spouses; the data feature representative samples of men and women, as well as a subsample of couples, collected over a 20-year period. Here, we analyse DHS Program data from three African countries—Zimbabwe, Zambia, and Nigeria—which share historically high fertility and mortality rates but have experienced distinct fertility transitions. Zimbabwe has experienced dramatic fertility decline, whereas Zambia has seen a more subtle, yet sustained, decline in fertility and Nigeria continues to boast one of the highest fertility rates in the region (United Nations, Department of Economic and Social Affairs, Population Division 2019). Our multi-country analysis allows us to clarify cross-contextual variation in the documented associations between sex, sibling death, and ideal family size, and our use of two rounds of survey data for each country enables us to provide initial insights into temporal variation in the observed patterns.

Approach

Data and sample

The DHS Program uses a stratified random sampling design to produce representative samples of 15–49-year-old women and men (with select surveys interviewing men up to age 59). From this framework, the DHS Program interviews a subsample of co-residing spouses. DHS Program surveys have collected women's sibling mortality data in more than 150 surveys; however, in only 10 countries, almost all in Africa, has the DHS Program collected information on men's experiences of sibling mortality. For this study, we focused on the three countries with multiple and more recent survey data available: Zimbabwe (1994, 2005–06), Zambia (2007, 2013–14), and Nigeria (2008, 2013). We excluded Malawi (1992), Uganda (1995), Brazil (1996), Tanzania (1996), Cameroon (2004), Congo (2005), and Indonesia (2007). All DHS Program data are publicly available (https://dhsprogram.com/data/).

Table S1 in the supplementary material offers information on the samples from the three focal countries. Note that among polygynous men, we randomly selected one interviewed wife to ensure independence of cases. In supplementary analyses, we kept every polygynous wife interviewed in our sample and found comparable results.

Key measures

Ideal family size. The DHS Program collects multiple indicators of respondents' fertility preferences. As already noted, we focused our analyses on ideal family size, which references the exact number of children the respondent would choose to have. Across the three countries, between <1 and 13 per cent of respondents gave a non-numeric response, suggesting that fertility is 'up to God', when asked their ideal number of children; we excluded these cases. Although research has shown that mortality conditions can influence women's tendency to provide non-numeric responses (Sandberg 2005; Hayford and Agadjanian 2011), in supplementary analyses, we found limited evidence of this. Only in Zambia did sibling loss increase the likelihood that a woman provided a non-numeric response (significant at $p < 0.05$), implying that any bias would yield conservative estimates.

As shown in Table S2 (supplementary material), there is considerable between-country variation in men's average ideal family sizes, aligning with their country's distinct fertility profiles; yet in all settings, the average ideal family size is relatively high and persistently so. Women's ideal family sizes are, on average, lower than men's ideal family sizes (at $p < 0.05$).

Sibling mortality. DHS interviewers administered a sibling history module to respondents, collecting information on each sibling's birth year, vital status, and year of death if deceased. The sibling data are collected principally to track adult mortality in countries lacking vital statistics (Obermeyer et al. 2010; Masquelier et al. 2014; Masquelier and Dutreuilh 2014) but have also facilitated research on sibling bereavement (Smith-Greenaway and Weitzman 2020). We created a continuous measure

of the number of sibling deaths each adult had experienced.

Table S2 (supplementary material) shows that between one-third and two-thirds of adults have experienced a sibling death, with adults on average having experienced about one sibling death. Even in recent years, sibling mortality has remained exceptionally common. On average, men (and husbands) have experienced more sibling deaths than women (and wives), likely due to their older age.

Modelling strategy

We estimated a series of weighted ordinary least squares (OLS) regression models to study the associations between sibling mortality and ideal family size. We included controls for adults' experience of their own children's deaths and numbers of (surviving) children and siblings. Due to the potential for a mechanistic link between birth order and exposure to sibling mortality, we also included a variable on respondents' birth order. In terms of socio-demographic covariates, we included respondents' age, education, marital status, practice of polygyny, and residence in a rural vs urban area. We also included the pre-constructed DHS wealth index, which categorizes households into five quintiles based on a principal component factor analysis of household assets and characteristics (Filmer and Pritchett 2001). Note that the Zimbabwe (1994) survey did not include all measures in the pre-constructed wealth index; thus, in these models, we controlled for household access to piped water and electricity instead. Additionally, for models testing cross-spousal effects, we included spouse's age, education, and number of (surviving) siblings. See Tables S3–S5 (supplementary material) for descriptive statistics for each analytic sample.

Results

Figure 1 plots regression coefficients of the associations between sibling mortality exposure and adults' ideal family size (see Tables S6–S8 (supplementary material) for full model results; to facilitate comparisons, we report standardized coefficients).

In Zimbabwe, the linkages between sibling mortality and adults' fertility preferences are highly gendered. Sibling mortality is associated with women's higher fertility preferences in 1994, but the association is non-significant among men (Figure 1(a)). Among the subsample of couples, however, there is no evidence that either wives' or their husbands' sibling mortality exposures significantly pattern wives' fertility preferences (Figure 2(a)). More recently, however, the reverse pattern is visible: men's, not women's, sibling mortality is associated with own higher fertility preferences in 2005–06 (Figure 1(a))—a finding also observed among couples (Figure 3(a)). Overall, the more recent significance of sibling mortality for men's (including husbands') higher fertility preferences eclipses that documented for women, implying that a focus on women will underestimate the salience of sibling mortality exposure to adults' ideal family size in Zimbabwe.

As distinct from Zimbabwe, the results for Zambia offer no indication that men's sibling mortality is associated with their ideal family size: neither among the full representative sample (Figure 1(b)) nor among coupled men (Figure 3(b)). Further, the results show the emergence of sibling mortality as significantly associated with women's higher ideal family size, a finding also documented among the subsample of married women (Figures 1(b) and 2(b)). This relevance extends even to their husbands' higher ideal family sizes (Figure 3(b)).

In contrast to the stark sex-specific nature of the associations in Zambia and Zimbabwe, the results for Nigeria are largely gender neutral. As shown in Figure 1(c), both women's and men's experiences of sibling mortality are associated with own higher ideal family size. Importantly, however, the salience of sibling mortality exposure extends to spouses' ideals (Figures 2(c) and 3(c)). That is, net of women's own sibling mortality, husbands' experiences of sibling mortality correspond with their wives' higher ideal family size in 2008 (Figure 2(c)); hence, not accounting for husbands' sibling mortality will underestimate the relevance of mortality exposures to women's ideal family size. As documented in Zambia, there is also evidence that wives' sibling mortality corresponds with their spouses' higher ideal family size (Figure 3(c)).

In additional analyses, we assessed if child, adolescent, or adult sibling deaths were driving these results, yet we found no indication that the loss of younger vs older siblings is disproportionately influential. We also found no evidence that the results are sensitive to our coding of sibling mortality exposure (i.e. as a binary indicator of any death vs the continuous measure of number of deaths).

We can summarize three key findings. First, sibling mortality is frequently associated with adults' higher ideal family size. Second, these associations are gendered, yet in different ways across country contexts, emphasizing the need to study women *and* men to understand the total influence of sibling mortality

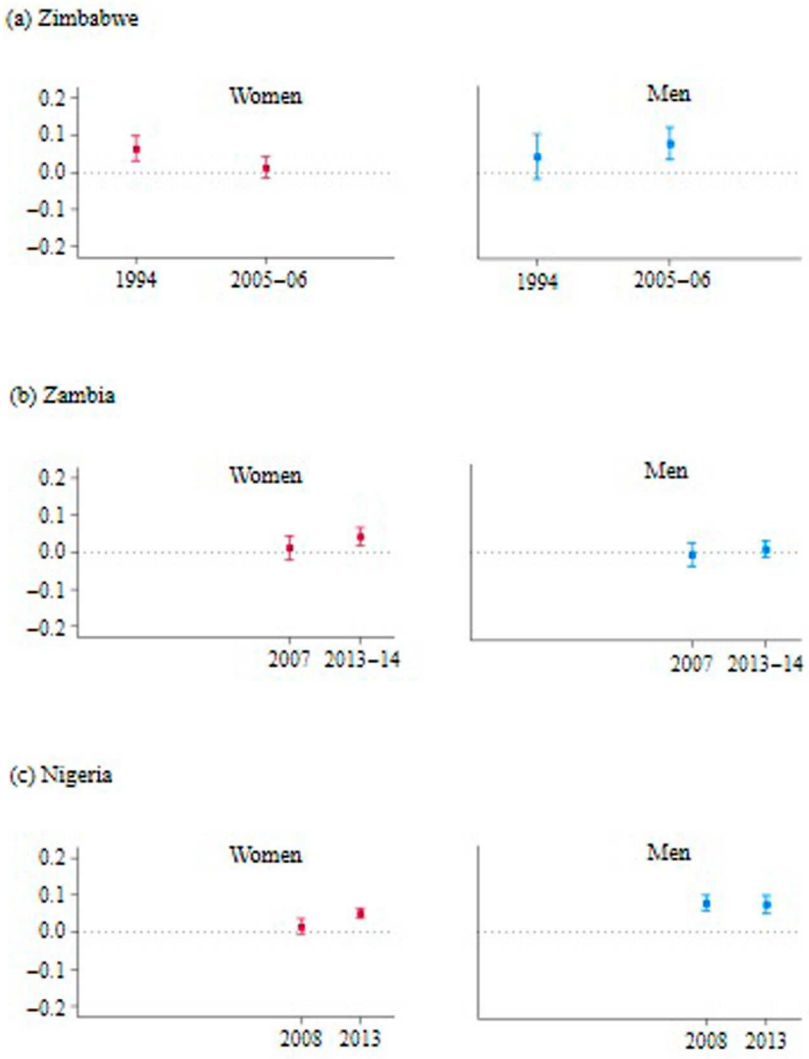

Figure 1 Regression model results of the association between own sibling mortality exposure and ideal family size for women (left panels) and men (right panels)
Notes: Plots show standardized OLS regression coefficients and 95 per cent confidence intervals. Model is based on sample of individuals. Full model results are available in supplementary Tables S6–S8 ('Women' and 'Men' columns).
Source: Demographic and Health Surveys.

on adults' ideal family sizes in any particular context. Third, the cross-spousal findings clarify that sibling deaths can have a lasting influence, not only on adults themselves but also on their spouses, attesting to the value of a relational framework.

In addition to these key findings, three additional features of our results (not shown here) merit acknowledgement. First, sibling mortality exposure is not the only experience that has a gendered influence on ideal family size. We found that significant correlates of women's higher ideal family size are often unobservable among men, or operate in the opposite direction, further reinforcing the need to incorporate men fully into research on fertility preferences. Second, the results demonstrate that sibling mortality is not the only way that siblings (or mortality exposures) inform adults' ideal family sizes. In most instances, having more siblings corresponds with higher ideal family size (although the results show the reverse pattern in Zambia, a surprising finding that merits further investigation), emphasizing another way in which siblings can have a lingering influence on individuals. Moreover, in every country, having lost an own child corresponds with higher ideal family size, further attesting to the salience of other mortality events. Third, and finally, the correlates of fertility preferences shift when studying adults vs the subsample of spouses. In some cases, the significance of sibling mortality exposure for adults' fertility preferences dissipates when studying only coupled adults: a pattern that we also observe for other socio-demographic determinants (i.e.

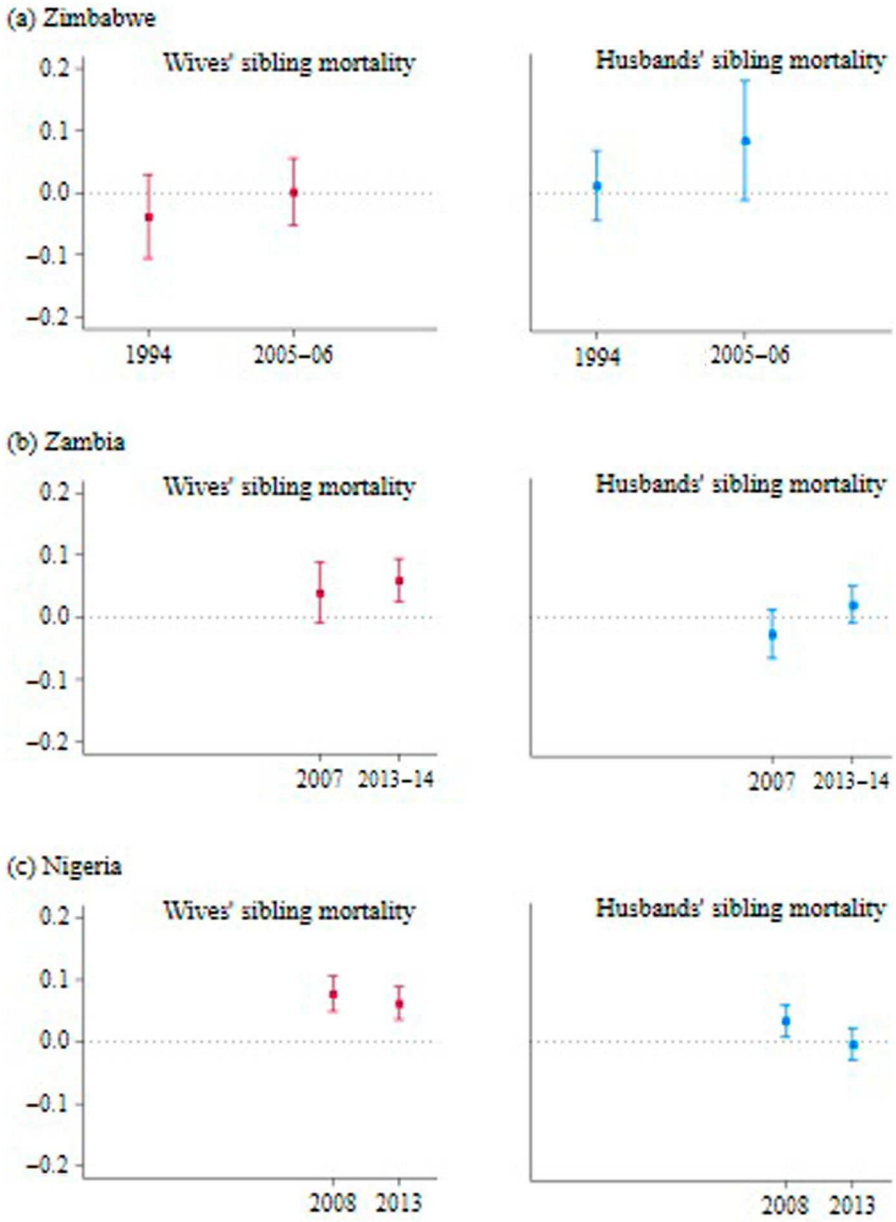

Figure 2 Regression model results of the association between wives' own and husbands' (left and right panels, respectively) sibling mortality exposure and wives' ideal family size

Notes: Plots show standardized OLS regression coefficients and 95 per cent confidence intervals. Model is based on subsample of couples. Full model results are available in supplementary Tables S6–S8 ('Wives' column).

Source: As for Figure 1.

education and urban residence). This emphasizes the importance of incorporating men, not only within the context of their role as spouses but also as independent adults whose experiences can distinctly influence their fertility preferences.

Discussion

By studying the associations between sibling mortality and ideal family size among adults and couples, this research note provides a first analysis of sex differences in the linkage between sibling mortality exposure and fertility preferences. The results emphasize that studying only women can produce an incomplete, and in some cases misleading, understanding of the relationships at hand. We find no uniform gendered pattern in the links between sibling mortality and ideal family size across the three countries. Yet, the sex-specific nature of the findings in each country supports the shared conclusion that incorporating men into research is essential.

From our study of just three countries, the results outline the theoretical gains of considering the

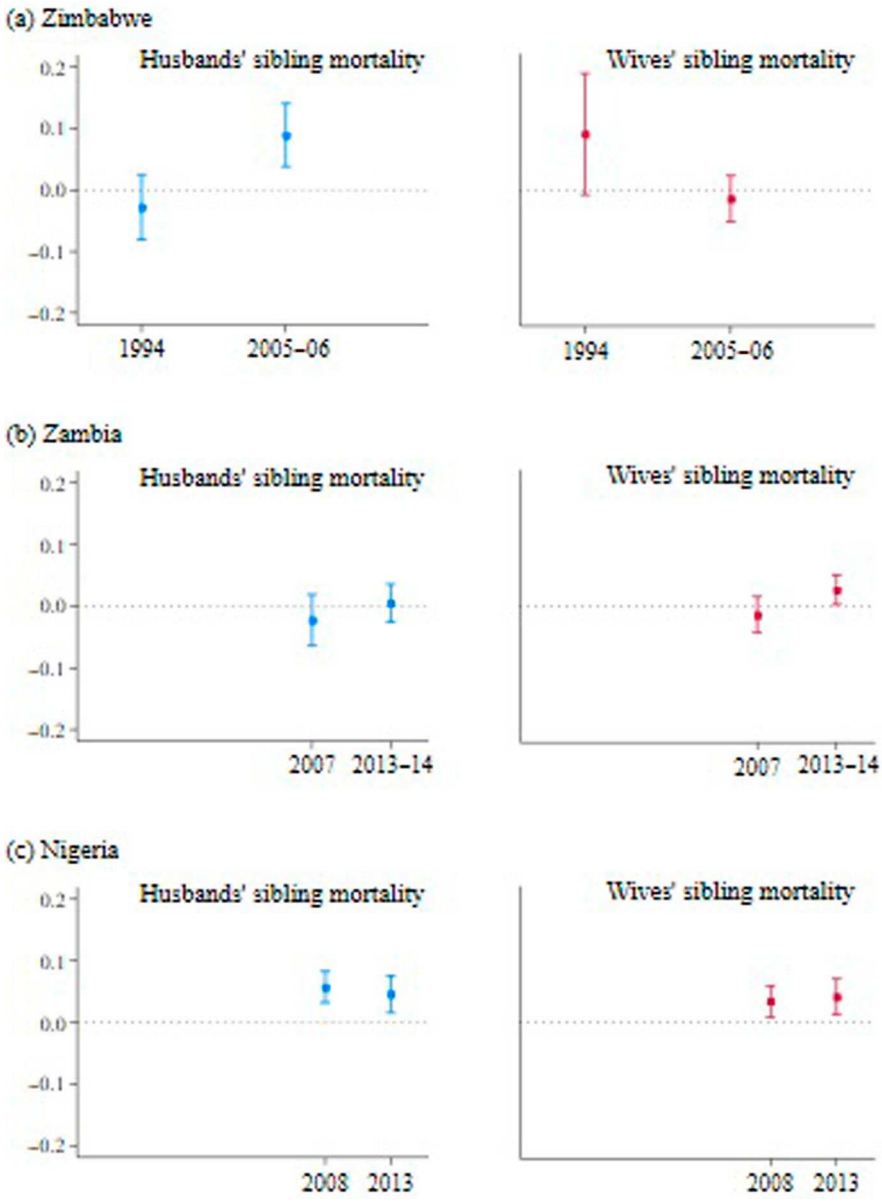

Figure 3 Regression model results of the association between husbands' own and wives' (left and right panels, respectively) sibling mortality exposures and husbands' ideal family size

Notes: Plots show standardized OLS regression coefficients and 95 per cent confidence intervals. Model is based on subsample of couples. Full model results are available in supplementary Tables S6–S8 ('Husbands' column).

Source: As for Figure 1.

gendered implications of mortality events for adults' fertility preferences. For Zimbabwe, the results suggest that incorporating men is essential to avoid underestimating the salience of sibling mortality for adults' ideal family size in recent years. That is, the evidence that men's ideal family size is sensitive to sibling deaths, but women's is not, suggests that focusing on women only will underestimate the true potential for sibling mortality exposures to elevate adults' ideal family size and, by extension, potentially their fertility (Van de Kaa 2001). Conversely, in Zambia, where the significance of sibling mortality for ideal family size is concentrated among women, a sole focus on women will facilitate a false confidence in extrapolating the micro-level associations between sibling mortality and ideal family size to the population level, given their non-significance among the other half of the adult population. Finally, although the results for Nigeria differ notably from the former two countries in that the associations among women and men are generally comparable, the cross-spousal findings further attest to the need to incorporate men, specifically

husbands, into research to inform the potential for these individual-level manifestations to be reflected in couple-level behaviours and to identify the pathways through which mortality exposures inform couples' fertility.

Even though this brief note offers a valuable first look at the salience of sibling mortality for adults' fertility preferences, the very omission that this research seeks to illuminate is the cause of its limitations. First, there are very few countries where the DHS Program data feature sibling and fertility-related data on men, resulting in our focusing on merely three countries. Future investment in collecting demographic data from men will be essential to facilitate a clearer sense of whether what we know about women's experiences and corresponding fertility preferences is universal or is sex specific. Second, due to further data limitations, we cannot test if the links between sibling mortality and adults' higher ideal family sizes are manifested in adults' higher achieved fertility. Although fertility preferences are strongly associated with achieved fertility (Cleland et al. 2020), there are often discrepancies between what people say is ideal and their eventual fertility outcomes (Kebede et al. 2022). Thus, future work must assess whether sibling mortality exposures differentially affect men's and women's fertility outcomes, in addition to their preferences. Third, and related, the study does not entertain, neither empirically nor theoretically, the potential for sibling mortality to influence adults' experiences of unwanted fertility. Mortality exposures can affect women's fertility even in the absence of an influence on preferences (Smith-Greenaway et al. 2022). Fourth, and finally, we are unable to account comprehensively for other mortality exposures that these adults have experienced (e.g. deaths of other relations or community members), which may also affect their fertility desires and outcomes (Dahlberg 2020). Of note, however, the results are net of the strong influence of having experienced the death of an own child, emphasizing the simultaneous influence of mortality in adults' natal and conjugal families on their fertility preferences.

Even with the limitations of the study, this research note highlights the gendered nature of an age-old determinant of fertility. By considering the salience of mortality exposures to men's fertility preferences, the study emphasizes that the historical focus on women's responses to mortality exposures has provided at best a partial and at worst a biased sense of the salience of mortality for adults and has overlooked the relevance of their spouses' experience.

Notes and acknowledgements

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