Life after Loss:
A Prospective Analysis of Mortality Exposure and Unintended Fertility in Malawi[*]

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Abstract
The interplay between mortality and fertility is central to demographer's principal theoretical obsession: demographic transition theory. Current theories posit that high mortality props up fertility by encouraging women to purposefully replace deceased children (replacement effect) and/or to pursue larger families to offset anticipated child deaths based on what they observe among others around them (insurance effect). These hypotheses, however, treat fertility as a volitional outcome even though nearly one-half of births worldwide are unintended, raising questions of whether high-mortality conditions also increase *unintended* fertility. In this paper, we extend theories of mortality and fertility to consider unintended fertility. We analyze panel data on a representative cohort of women in Malawi, which features information on mortality exposure and fertility intentions measured soon before conception, which are confirmed via frequent pregnancy testing. Preliminary results show that exposure to mortality increases women's likelihood of becoming pregnant unintentionally. This study will advance understanding of fertility in high-mortality contexts.

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The interplay between mortality and fertility is central to demographer's principal theoretical obsession: demographic transition theory. The widely documented macro-level links between a population's mortality and fertility profile is theorized to be borne out of two micro-level processes.

The first is commonly referred to as a "replacement" process, which centers on the idea that having one's own child die increases a woman's total fertility by motivating her to have an additional child to replace the deceased child (Grummer-Strawn, Stupp and Mei 1998, Knodel 1978). The second hypothesized process, often referred to as an "insurance" effect, rests on the notion that women's mortality risk perceptions are based on the experiences of those around them. If mortality is high, women will proactively pursue a larger family size than they otherwise would to insure against their perceived risk of some of their children dying (Preston 1978). Studies offer empirical support for both of these micro-level links between mortality and fertility: women's experience with child death increases their total fertility and desired total fertility (Yeatman, Sennott and Culpepper 2013). The size of these effects, however, are dwarfed by the larger influence of the mortality experiences of salient others: women's observations of mortality in their networks and communities strongly pattern their mortality perceptions and fertility outcomes (Nobles, Frankenberg and Thomas 2015, Sandberg 2005, Sandberg 2006, Shapiro and Tenikue 2017).

An assumption underpinning the literature on the micro-level mechanisms linking mortality and fertility is that the former influences the latter as a result of women's purposive behavior. Indeed, replacement and insurance effects are often labeled "volitional" mechanisms, and thus pertain to the impact of mortality on *intended* fertility. Surprisingly, the literature has given no attention to the potential links between mortality and *unintended* fertility—even though an estimated 40% of pregnancies are unintended, either unwanted or coming sooner than desired (Sedgh, Singh and Hussain 2014). Studying the influence of mortality on unintended fertility is important to fully understand fertility in high-mortality contexts.

Drawing on insights from psychology, mortality may work through additional channels than previously hypothesized to influence not only women's fertility outcomes in general terms, but their risk of unintended fertility in particular. One way that mortality salience may influence women's risk of an unintended pregnancy is outlined by the theory of dual-process model of defense, which is an extension of terror management theory (Burke, Martens and Faucher 2010). This perspective suggests that humans use proximal defenses to reduce the conscious impact of mortality. People aim to reduce their anxiety about death by adhering to cultural values—helping them to engage in this sort of symbolic immortality (Greenberg, Solomon and Pyszczynski 1997). That is, when humans are reminded that they are mortal creatures, they tend to want to act in culturally-valued ways. Extending this insight, in pronatal contexts like the Malawian one we study here, mortality exposure may correspond with women avoiding anti-natal behaviors, which could put them at higher risk of a pregnancy that they may not otherwise intend. Other work highlights that mortality salience tends to encourage individuals to invest in intimate relationships. Extending evidence that mortality salience increases people's interest in sex (cite Goldenberg et al 2000), if bereaved couples draw closer in an uncalculated way, this will put them at higher risk of an unintended pregnancy. Indeed, coital frequency is recognized as a powerful predictor of intra-population fertility (Fricke and Teachman 1993, Rindfuss and Morgan 1983). Finally, death is also just disruptive to women's lives. The psychological (grief, trauma) and practical (traveling for funeral) burdens of coping with death could disrupt women's lives, and for example, there consistent contraceptive use, which could in turn put them at risk of unintended pregnancy.

This study will offer new insights into an age-old demographic question by examining how women's exposure to mortality impacts their subsequent risk for unintended pregnancy. To do so, we will use rich data from a rapid-panel study of young women in Balaka, Malawi that features time-varying measures of women's mortality exposure, as well as prospective intentions about when they would like to become pregnant next (if at all) over a two-year period. The dataset features pregnancy test data taken within an average of two months of women's expressed pregnancy intentions, allowing us to accurately classify pregnancies as intended or unintended. Results from preliminary analyses of these rich data show that women's higher exposure to death—specifically measured by the recent deaths of a close relation and funeral attendance—corresponds with a higher risk of not only becoming pregnant, but specifically becoming pregnant within four months of having expressed not intending to be pregnant. Additional results show that these unintended pregnancies

also tend to be ones that women do not feel positively about. This study will substantially advance our theoretical understanding of the potential interplay between mortality and fertility.

Data and Sample

This study will focus on a cohort of young women in a community in Malawi. Data come from Tsogolo la Thanzi-1 (TLT1), an NICHD-funded, longitudinal study of young adults in Balaka (Yeatman et al. 2019), a growing town in southern Malawi where both authors have been involved in data collection since 2009.

TLT1 began in 2009 from a simple random sample of women between the ages of 15 and 25 living within a 7-km radius of the center of Balaka. TLT1 enrolled 1,505 women (95% response rate) who were interviewed 8 times between 2009 and 2011. In our analysis of unintended pregnancy, we use data from wave 2 through wave 8, given that we identify unintended pregnancies based on women's reported intentions during the preceding wave (see below), meaning that we are unable to capture intended or unintended pregnancies at wave 1. We include all women enrolled at wave 2 in our hazard analyses of unintended pregnancy, including those who were pregnant at wave 1. We do so because the same percentage of these women go on to experience unintended pregnancies over the course of the study as women who were not pregnant at wave 1. After excluding women with missing data, we estimate models on 1,394 women, who contribute a total of 6,964 person-waves of observations to the hazard models.

Measures

Unintended pregnancy. We classify pregnancies using women's fertility intentions expressed an average of two months before they became pregnant, which we confirm via a urine pregnancy test at the research center. TLT1 measured women's fertility intentions using the question: "When would you like to have your first/next child?" Women answered this question at each interview, at four month intervals. We classify pregnancies as unintended if, at the wave before a pregnancy is confirmed, women reported wanting no more children or wanting to wait at least two years to have a child. The vast majority of unintended pregnancies in our data occur more than two years earlier than women intended, and in some cases upwards of five years early. Over the study period, a total of 22.6% of women had an unintended pregnancy, whereas 10.8% of women had an intended pregnancy, and 66.6% had no pregnancy. Note that the vast majority of these women who never became pregnant over the study period expressed no intention to become pregnant at one or more waves. However, 26 of the 928 women in this group consistently reported that they did intend to have a child, although they never did. In these analyses, we remove these women, allowing us to have three groups: (1) women who never intended to become pregnant and did not, (2) those who had an unintended pregnancy, and (3) those who had an intended pregnancy. We also conducted sensitivity analyses, however, and confirm that including these women in group 1 does not alter the findings.

Mortality salience. We measure women's recent mortality exposure with two related indicators. At each wave, women report on whether, in the preceding months, they experienced the death of a family member or close friend. We make use of this data to create a time-varying binary indicator of whether a respondent is bereaved due to a recent death of a close relation. Additionally, respondents were asked the number of funerals that they had attended in the past four months, allowing us to create a time-varying indicator of funeral attendance, capturing the number of funerals women recently attended. At the time of the baseline survey, just over 11% of women report having recently experienced the death of a close relation, and on average, had attended 1.12 funerals (ranging from 0 to 11) in the last month.

Additional covariates. In all models, we account for key socioeconomic traits that may pattern women's risk of unintended pregnancy, including a time-varying indicator of women's highest level of education (in years), whether they are enrolled in school, and a household goods index to capture their socioeconomic standing[1]. We also include a standardized indicator for the distance women live from town,

[1] This approach to measuring socioeconomic status has been validated by previous research (cite Filmer and Pritchett 2001, Howe, Hargreaves, and Huttly 2008). The linear asset index comprises nine durable goods (a bed with a mattress, a television, a radio, a landline or mobile phone, a refrigerator, a bicycle, a motorcycle, an animal drawn cart, and an automobile) and one household asset (electricity). The focus on a household's

which approximates their proximity to local institutions and reproductive services. Finally, we include an indicator for the number of siblings women have, their total number of children, and whether they were pregnant at the beginning of the study. We also include time-varying indicators for women's age (in years), and their marital status (including whether they are never married, currently married, or formerly married). Note that the majority (58%) of unintended pregnancies in our data are to married women.

We control for additional factors that could pattern women's risk of pregnancy, and unintended pregnancy specifically. First, we account for a set of time-invariant, psychosocial characteristics. One captures women's future thinking. Interviewers ask women whether and if so, how often, they think about the future. We classify women according to whether they never or only rarely think about the future, sometimes do, think about the future fairly often, or very often. Second, interviewers ask women whether they believe that children "just happen"—along with their beliefs of other, locally-salient statements. Almost one-half of women agree that children "just happen", which may influence their commitment to actively controlling their fertility. Finally, we include a binary indicator of whether women's pregnancy intentions fluctuated over the study period. Specifically, women are coded as having a "flexible" orientation if their fertility intentions fluctuate between intending to have a baby within two years and not intending to do so. When data are missing for these key indicators, we utilize the "carryforward" command in Stata to address missing data. Table 1 offers descriptive statistics to help characterize the cohort of women that we study.

Approach

In order to identify the pre-conception factors that elevate women's risk of unintended pregnancy, we estimate a series of competing risk hazard models. We use cox-proportional hazard models, which allow us to analyze what corresponds with women become pregnant unintentionally and to account for the competing risk of an intended pregnancy. Specifically, we estimate the cumulative incidence of unintended pregnancy (vs no unintended pregnancy) in the presence of a competing risk (intended pregnancy). Our models do not address the potential for recurrent hazards. That is, once a woman has an unintended or intended pregnancy, she exits the study as having failed, and does not re-enter the hazard. Of course, women may go on to have additional unintended or intended pregnancies, however, given variable censoring after becoming pregnant (i.e., carrying the pregnancy to term, postnatal amenorrhea), and a relatively short study period, we opted for a more parsimonious, single failure approach. Models appropriately account for censoring.

Preliminary Results

Table 3 shows results for the cox proportional hazard models. As shown in Model 1, women who recently experienced the death of a close relation experience a 58% increase in the odds of an unintended pregnancy (versus no pregnancy), when accounting for the competing risk of an intended pregnancy. Additionally, Model 2 shows that recent funeral attendance similarly corresponds with an increase in having an unintended pregnancy: each additional funeral a woman attends corresponds with an 11 percent increase in the odds of having an unintended pregnancy.

Additional Analyses

Given increasing recognition that mortality can also increase women's flexibility of fertility preferences, it is possible that the women we code as having had "unintended pregnancies" are those who simply changed their intention during the multiple week window before they became pregnant, and when they were exposed to mortality. If this is the case, it follows that women may feel more positive about these "unintended"

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durable goods better captures economic fluctuation over the relatively short time-span of the study. A principal components analysis calculates weights following the same procedure used to construct the Demographic Health Survey wealth index. The resulting index places households on a continuous scale relative to the sample. To ensure factorial invariance, the weights are consistent across waves.

pregnancies. However, in additional analyses, we made use of data on women's emotional reaction to the unintended pregnancy and confirm that mortality salience not only corresponds with unintended pregnancies, but also tend to be ones that women feel negatively about—suggesting that these are truly unintended and unwelcomed pregnancies.

We pursued additional analyses to also increase our confidence that there is something specific to mortality that influences women's risk of unintended pregnancy, and that the observed association is not spuriously driven by some broader vulnerability. Specifically, we analyzed if women who report a higher burden of morbidity in their family are similarly at elevated risk of unintended pregnancy. The additional analyses offer no indication that this is the case, but instead suggest that there is something specific about exposure to death specifically that corresponds with a heightened risk of unintended pregnancy.

Conclusion

The findings from this study will speak to the vast demographic literature on mortality as a determinant of fertility decline. Even when women very clearly express an intention to not become pregnant over a small time horizon, preliminary results show that mortality exposure corresponds with their higher risk of becoming pregnant. This work will advance the broader demographic literature on the interplay between mortality and fertility, and may contribute new insights into the puzzle of stalled fertility decline in high-mortality settings in Malawi, and potentially other countries in sub-Saharan Africa.

Tables

Table 1. Descriptive Statistics of Key Study Variables ◊

Pregnancy outcome•		
Never pregnant over study period	66.56	
Unintended conception	22.6	
Intended conception	10.84	
Mortality salience		
Recent death of close relative◊	11.60	
Number of funerals attended◊	1.12	(1.25)
Psychosocial characteristics and perceptions		
Impulsive behavior		
Never or rarely	2.83	
Sometimes	11.90	
Fairly often	31.75	
Very often	53.53	
Belief that children "just happen"	45.95	
Fluctuating pregnancy intentions	35.46	
Socioeconomic		
Highest year of education◊	7.79	(2.61)
Currently enrolled in school◊	40.59	
Household wealth◊	0.05	(2.45)
Distance to town	-0.01	(0.97)
Number of siblings	5.23	(2.56)
Demographic		
Total number of children◊	0.82	(0.98)
Pregnant at baseline	9.96	
Age◊	19.41	(3.24)
Marital status◊		
Never married	50.26	
Currently married	42.90	
Formerly married	6.84	

Source: Tsogolo la Thanzi (N=1,394; person-waves=6,964)
•Presented here as time-invariant, cumulative indicator
◊Time-varying indicator, distribution reported at baseline

Table 2. Competing Cox Proportional Hazard Models of Unintended Pregnancy vs. No Pregnancy (Competing Risk of Intended Pregnancy), Among Women 15-25-years-old in Malawi over 3 year study period

	Model 1			Model 2		
Mortality salience						
Recent death of close relative◊	1.63	0.35	*	--		
Number of funerals attended◊	--			1.11	0.05	*
Psychosocial characteristics and perceptions						
Impulsive behavior						
Never or rarely	--			--		
Sometimes	1.21	0.30		1.20	0.30	
Fairly often	1.06	0.25		1.03	0.24	
Very often	0.95	0.22		0.92	0.21	
Belief that children "just happen"	1.27	0.13	*	1.24	0.13	*
Fluctuating pregnancy intentions	0.37	0.05	***	0.37	0.05	***
Socioeconomic						
Highest year of education◊	0.96	0.03	†	0.95	0.03	†
Currently enrolled in school◊	0.32	0.06	***	0.32	0.06	***
Household wealth◊	0.99	0.03		0.99	0.03	
Distance to town	1.16	0.06	**	1.15	0.06	**
Number of siblings	1.04	0.02	*	1.04	0.02	†
Demographic						
Total number of children◊	0.84	0.08	†	0.83	0.08	*
Pregnant at baseline◊	0.58	0.10	**	0.60	0.10	**
Age◊	0.90	0.02	***	0.90	0.02	***
Marital status◊						
Never married	0.54	0.10	**	0.55	0.10	**
Currently married	--			--		
Formerly married	0.70	0.13	†	0.70	0.13	†

◊ time-varying indicator

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