# The Sensitivity of Measures of Unwanted and Unintended Pregnancy Using Retrospective and Prospective Reporting: Evidence from Malawi

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## Abstract

A thorough understanding of the health implications of unwanted and unintended pregnancies is constrained by our ability to accurately identify them. Commonly used techniques for measuring such pregnancies are subject to two main sources of error: the *ex post* revision of preferences after a pregnancy and the difficulty of identifying preferences at the time of conception. This study examines the implications of retrospective and prospective measurement approaches, which are vulnerable to different sources of error, on estimates of unwanted and unintended pregnancies. We use eight waves of closely-spaced panel data from young women in southern Malawi to generate estimates of unwanted and unintended pregnancies based on fertility preferences measured at various points in time. We then compare estimates using traditional retrospective and prospective approaches to estimates obtained when fertility preferences are measured prospectively within months of conception. The 1,062 young Malawian women in the sample frequently changed their fertility preferences. The retrospective measures slightly underestimated unwanted and unintended pregnancies compared to the time-varying prospective approach; in contrast the fixed prospective measures overestimated them. Nonetheless, most estimates were similar in aggregate, suggesting that frequent changes in fertility preferences need not lead to dramatically different estimates of unwanted and unintended pregnancy. Greater disagreement among measures emerged when classifying individual pregnancies. Carefully designed retrospective measures are not necessarily more problematic for measuring unintended and unwanted fertility than are more expensive fixed prospective ones.

## Keywords

Unintended pregnancy; Unwanted pregnancy; Fertility preferences; Measurement; Malawi

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## Introduction

The concepts of unwanted and unintended pregnancy are central to the fields of public health and demography where they are used to explain the disconnect between stated fertility intentions and actual fertility [1, 2] and to argue for family planning resources [3–5]. Unwanted pregnancies are pregnancies that occur after a woman wants no more children. Unintended pregnancies, on the other hand, include unwanted pregnancies and pregnancies that were mistimed (i.e., wanted at a later time) [6, 7]. Unwanted and unintended pregnancies are often linked to negative health outcomes for women and children[1] [8–10] and frequently end in abortion [11], which in much of the world remains illegal and unsafe.

Despite the utility of unwanted pregnancy and unintended pregnancy as constructs, their measurement is less than straightforward [1, 4, 12]. Accurate measurement is important at the aggregate level to understand the extent of the issues and to budget resources to address unmet need for family planning. At the individual level, accurate measurement is vital for targeting family planning programs and for carefully assessing the maternal and child health consequences.

In this paper, we use closely-spaced panel data from Malawi to examine how the timing of measures of fertility preferences affects estimates of unwanted and unintended pregnancy.

## Background

Three techniques are commonly used for measuring unwanted and unintended pregnancy (and fertility, which refers specifically to pregnancies that end in births) in survey research. The first, direct retrospective recall, is widely used in a variety of settings [9]. This method uses cross-sectional data on pregnancy (or birth) histories and asks women pregnancy by pregnancy whether or not the pregnancy was wanted at the time of conception. Some variants also ask whether a pregnancy was wanted at that time or at a later time to distinguish between mistimed and unwanted pregnancies.

Direct retrospective recall assumes accurate retrospective reporting of pregnancy desires at the time of conception after the pregnancy in question has occurred, and often after the resulting child has been born. As outlined in Fig. 1, respondents are asked at *time t* about the wantedness of a conception that occurred at *time t–y.* When respondents' reports of wantedness at *time t* are the same as they were at *time t–y*, this method will yield unbiased estimates. A substantial body of literature, however, suggests that this type of retrospective measure is subject to *ex post* rationalization [2, 13–16]. In other words, women are reluctant to label an existing child as unwanted and thus preferences reported at *time t* are not necessarily good indicators of true preferences at *time t–y.* In general, this practice should lead to an underestimation of unintended pregnancies, and explains a shift away from using direct retrospective recall for the measurement of unintended fertility in surveys such as the Demographic and Health Surveys (DHS) [4, 15]. Nonetheless, estimates of unintended pregnancy from the US National Survey for Family Growth (NSFG) and the US Pregnancy

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[1]See Gipson et al. [9] for a detailed review of this literature and its limitations.

Risk Monitoring Assessment System (PRAMS) continue to use this approach [17, 18], as does the DHS in its estimates of unmet need for contraception [19].

A second method for measuring unwanted fertility[2] uses cross-sectional data on respondents' current ideal number of children and compares it to respondents' number of living children at the time of conception for births recorded in a birth history. This method is currently used by the DHS to calculate unwanted fertility [20]. The method assumes an individual's ideal family size is stable: respondents are asked their ideal family size at the time of interview, *time t,* which is inferred to be their ideal family size at the time of conception, *time t−y.* When a respondent's ideal family size changes over time, however, the measure will result in biased estimates of unwanted fertility. Additionally, *ex post* rationalization remains a concern because individuals may revise their ideal family size upwards based on the actual number of children they already have, leading to a possible underestimate of unwanted fertility. Indeed, a study from Malawi found that young women increased their reported ideal family size following the birth of a child that would otherwise have been considered unwanted [21].

The third method for measuring unwanted and unintended pregnancy uses a prospective design. Although generally thought to be more accurate, this method is rarely used because of its substantial data demands. Respondents are asked about their desire to continue childbearing and/or their desired timing of next birth before a pregnancy occurs. For example, suppose the initial interview takes place at *time t−x−y.* Respondents are then followed up $x + y$ years later at *time t.* Pregnancies (or births) are classified as wanted or unwanted (or intended or unintended) at the time of conception ($t−y$) based on reports from the initial interview. Unlike the earlier methods, this design does not suffer from recall bias but does rely on the assumption that preferences are stable. In other words, if a woman reports her preferences at *time t−x−y* but changes them before the conception occurs at *time t −y*, the pregnancy will be misclassified.

Two main sources of error potentially affect measurements of unwanted and unintended pregnancy. The first comes from respondents who may not always report their preferences honestly. Retrospective measures are particularly vulnerable to *ex post* revisions, but prospective measures may also suffer if respondents are unwilling to report socially undesirable preferences. The second source of error is related to survey design and the issue that researchers are measuring preferences at a point in time that never corresponds with the precise time of conception. Certain retrospective measures are less susceptible to this error because they ask specifically about preferences at the time of conception. In contrast, prospective measures ask about preferences before a conception occurred. A growing body of evidence demonstrates that, in response to changes in life circumstances, women change their fertility preferences including ideal family size [13, 21–24], desired timing of next birth [25, 26], and desire for additional children [2, 25]. The risk of misclassifying a pregnancy increases with the length of time between surveys, which is often a period of years [e.g., 13, 15, 16, 27].

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[2]Although it could be used to measure unwanted pregnancy using a pregnancy history, we are not aware of any studies (beside the present one) that have used a pregnancy history in this way.

## Data and Methods

Our data come from Tsogolo la Thanzi (TLT),[3] a panel study designed to investigate how HIV/AIDS affects the family formation strategies of young Malawians. Malawi is a high fertility country in southeastern Africa with a median age of first birth of 19 years and a total fertility rate of 5.7 children per woman [28]. In 2009, TLT drew a simple random sample of 1,505 women between the ages of 15 and 25 living within a seven-km radius of the southern Malawian town of Balaka. This analysis uses eight waves of TLT data, each spaced 4 months apart. The first wave was collected between June and August 2009 and the eighth between October and December 2011. 97 % of contacted and eligible women completed a baseline interview and 80 % of women ever interviewed were reinterviewed at Wave 8. TLT research assistants interviewed respondents in Chichewa, the dominant local language, in private rooms at the TLT research center so that sensitive information could not be overheard.

At each wave TLT interviewers asked respondents a series of questions about their fertility preferences and fertility behavior:

### Ideal Family Size (IFS)

"People often do not have exactly the same number of children they want to have. If you could have exactly the number of children you want, how many children would you want to have?"

### Want More

"Would you like to have a (nother) child?" Respondents who were currently pregnant were asked: "Would you like to have another child after the child you are expecting is born?"

### Desired Timing of Next Birth

"How long would you like to wait before having your first/next child?" Response categories include: as soon as possible, <2, 2–3, 3–4, 4–5, 5+ years, no preference/whenever, don't want a(nother) child, and don't know. Currently pregnant women were asked about the desired timing of their next birth. No preference and "don't know" were set to missing. We combined the first two responses to create a dichotomous variable indicating a desire to get *pregnant* in the near future; all other responses were considered a desire to delay pregnancy.

### Retrospective Preference

Women identified as pregnant during the survey or through post-survey pregnancy testing were given a special pregnancy questionnaire in which they were asked whether the pregnancy was wanted.

We focus on the wantedness and intendedness of *pregnancy* rather than *birth* for three reasons. First, the reported intendedness of a pregnancy can change over the course of the

pregnancy itself [29]. Therefore, we want to capture prospective preferences before conception to avoid measuring preferences that are affected by knowledge of the pregnancy. Second, the TLT study design allows for the measurement of conceptions with reasonable accuracy (see details below). Third, for purposes of family planning programs, particularly in a context where abortion is almost always unsafe, unintended pregnancies are a better marker of the unmet need for contraception than are unintended births.

Following TLT protocol, interviewers offered respondents rapid urine pregnancy tests at each wave after completion of the survey. We consider a respondent to have experienced a new pregnancy between waves if she was not pregnant at the previous wave and either tested pregnant or reported being pregnant and refused the pregnancy test. We investigated and manually confirmed cases where women experienced more than one pregnancy over the two-year period to prevent erroneous double counting of the same pregnancy.

In order to assess the implications of retrospective and prospective measures on estimates, we compare seven methods of measuring unwanted and unintended pregnancies in our sample. Four methods are variants of commonly used measures ("classic") and the other three allow for changes in preferences by capturing preferences within 4 months prior to conception ("new").

## Methods for Measuring Unwanted Pregnancies

**M1**    Retrospective IFS (classic): comparing IFS at Wave 8 with number of living children at time of conception.

**M2**    Time-varying IFS (new): comparing IFS from wave prior to conception with number of living children at time of conception.

**M3**    Fixed prospective wanting more (classic): using desire for more children from Wave 1.

**M4**    Time-varying wanting more (new): using desire for more children from wave prior to conception.

## Methods for Measuring Unintended Pregnancies

**M5**    Retrospective timing[4] (classic): using reported intendedness at wave after conception.

**M6**    Fixed prospective timing (classic): using desired timing of next child from Wave 1 to assess intendedness of subsequent conceptions. On average, women in the sample are followed for approximately 28 months (range 26–31, mean: 28). Therefore, in this measure, we classify a conception as unintended through Wave 5 if a respondent stated at baseline that she would like to wait more than 2 years before her next *birth*. Conceptions that are captured at Waves 6 through 8

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[4]The question in Chichewa, *nanga mimbayi mumayifuna*, translates to "did you want this pregnancy?" Although not explicitly describing timing, responses to the question suggest that respondents interpreted it that way. Nonetheless, the wording remains a limitation of the measure.

are considered unintended if the respondent indicated at baseline that she would like to wait three or more years before her next *birth*.

**M7** Time-varying timing (new): using desired timing of next child from wave prior to conception to assess intendedness.

We assess agreement in aggregate estimates using *t* tests and assess sensitivity, specificity, and positive and negative predictive value of the classic approaches when compared to the new time-varying approaches.

The sample consists of 1,062 women who were interviewed at all eight waves. Women who were pregnant at baseline stayed in the sample if that pregnancy resulted in a live birth; however, the initial pregnancy was not used in estimates. Over the two and a half year period, we captured a total of 590 new conceptions among these women. 44 women had two separate confirmed conceptions and one woman had three. One conception was dropped because of a missing value for ideal family size. An additional 48 conceptions were dropped for estimates of pregnancy intendedness because of missing values on timing preferences.[5]

Tsogolo la Thanzi received ethical approval from the Penn State University Office for Research Protections and the Malawi National Health Sciences Research Committee.

## Results

Table 1 presents the sociodemographic characteristics of the sample at baseline. Respondents' mean age was 19.6 years. 45 % were married and an additional 15 % reported a steady nonmarital partner. Half of the sample had a primary school education or less and 37 % were enrolled in school. 48 % had no living children at baseline and the remainder had between one and five. Ideal family size preferences ranged from one to seven but were heavily clustered between two and four children. The vast majority of women in the sample (92 %) wanted more children. Only 13 % of women wanted a birth within 2 years, and 30 % within 3 years, although 51 % of women would experience a pregnancy within the two and a half year study period (not shown).

Young Malawian women frequently changed their ideal family size preferences and desired timing of next child across each four-month wave (approximately 27 and 14 % at each wave, respectively). The reported desire for a (nother) child was most stable, which is unsurprising given the young age range of the sample. Nonetheless, approximately 6 % of respondents changed their response to this question across sequential waves, mostly in ways not easily explained by a new pregnancy (not shown).

Table 2 presents estimates of the percent of pregnancies classified as unwanted (first two columns) or unintended (last two columns) using the seven different methods of estimation. The first column presents estimates based on variants that compare reported ideal family size and living children. As expected, more conceptions were classified as unwanted using

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[5]Thirty-six of the 48 missing cases were due to women missing pregnancy questionnaires. The additional 12 were due to "don't know" or "no preference/whenever" responses to questions on the desired timing of next child. We conducted a sensitivity analysis in which we classified "don't know" responses as a desire to delay and "no preference/whenever" responses as a desire to have a child soon (<2 years). Neither our estimates nor the differences between estimates changed significantly.

the time-varying method that does not suffer from problems of *ex post* rationalization. The retrospective method [M1], which measures ideal family size after conception, estimated that 2.6 % of pregnancies were unwanted, while the time-varying variant [M2], which measures ideal family size fewer than 4 months before conception, estimated that 3.2 % of pregnancies were unwanted. The differences in aggregate estimates, however, were not statistically different.

The second column compares estimates of unwanted pregnancies using the wanting more measure. The fixed prospective measure of wantedness [M3] based on the respondent's report at baseline classified more than twice as many conceptions as unwanted as did the time-varying method [M4] (5.3 vs. 2.6 %). These estimates were statistically different in aggregate ($p<0.01$). Despite the larger difference in aggregate estimates in this comparison, when compared to the time-varying estimates, the fixed prospective approach had higher sensitivity (i.e., probability of identifying a conception as unwanted if the time-varying approach identified it as such) than did the retrospective IFS measure. Both classic methods of estimating unwanted pregnancies had high specificity and negative predictive value, which is unsurprising given the low prevalence of unwanted conceptions in this young sample.

Lastly, we present and compare estimates of unintended pregnancies—pregnancies that were wanted later or not at all. The estimates of unintendedness ranged from 64 to 69 %. As with measures of unwantedness, the highest estimate was derived from the fixed prospective method [M6]. The most similar estimates occurred among methods that captured preferences in closest proximity to conception (i.e., the wave before [M7] and the wave following [M5]), which differed in their estimates of unintended pregnancy by 2.0 % points. Despite these differences, neither classic method differed statistically in aggregate from the time-varying approach although they were statistically different from one another ($p = 0.026$). At the individual level, the retrospective and fixed prospective methods correctly identified 77 and 81 %, respectively, of unintended pregnancies; however, the former correctly identified more intended pregnancies.

Childbearing during the study period could explain some of the change in fertility preferences observed, and therefore the differences in prospective estimates. In our data, multiple conceptions did not explain any of the inconsistencies in the prospective measures of unwanted pregnancy but did contribute to some for unintended pregnancies. The latter occurred when women reported a baseline desire for a rapid pregnancy, and then revised their timing preference to a desire to delay following a pregnancy. In these circumstances, the fixed prospective method would underestimate unintended pregnancy because the second pregnancy would be classified as wanted based on the preference that actually corresponded with the first. When we limited our sample to respondents' first conceptions during the study period, the estimate of unintended pregnancy using the fixed prospective measure increased from 69.3 to 71.1 %, while the time-varying estimate stayed consistent at 65.6 %.

## Discussion

In this paper, we calculated seven different estimates of unwanted and unintended pregnancy over a two-year period using prospective and retrospective measures of fertility preferences from young Malawian women. Our estimates were generally similar in the aggregate; only the fixed prospective estimate of unwanted pregnancy was statistically different from our time-varying approach. Although prospective measures are generally considered better than retrospective ones, our findings call for some qualification. We found that prospective measures of unwanted and unintended pregnancy overestimated these outcomes. Women in our sample changed their preferences in both directions—from not wanting any more children to wanting more, and from wanting more to not wanting more—but more conceptions occurred after women changed their preferences in a pronatal direction leading to an *overestimation* of unwanted and unintended pregnancy when compared to time-varying estimates. A shift from wanting to not wanting to have another child is likely to occur after a birth, which can be accounted for in estimates of unwanted pregnancy, or as women age or end a relationship, both of which would reduce a woman's risk of pregnancy. In contrast, changes in preferences that are pronatal (e.g., wanting more children, wanting the next child sooner) are more likely to follow changes in life circumstances that make a pregnancy more likely, such as acquiring a new partner. Consequently, estimates of unwanted or unintended pregnancy that are based on prospective measures with long lags between the measurement of pregnancy intention and conception risk overestimating the prevalence of these outcomes.

In contrast, retrospective measures trended towards underestimating unwanted and unintended pregnancy, which is consistent with concerns about *ex post* rationalization of preferences. Nonetheless, the aggregate retrospective estimates did not differ statistically from the time-varying prospective ones. We found the highest aggregate agreement in the measures of unintended pregnancy that were captured in closest proximity to conception [see also 13]. In other words, our time-varying prospective estimate based on desired pregnancy timing measured at the interview before the conception and the retrospective measure captured at the interview immediately after conception yielded the most consistent aggregate estimates of unintended pregnancy.

The similarity in aggregate estimates of unwanted and unintended pregnancy masks disagreement at the individual level. This finding is consistent with that of other researchers [13, 16, 29–32] that aggregate agreement in measures of pregnancy intendedness can occur despite disagreement at the individual level based on how and when questions are asked. To the extent that researchers and policymakers are interested in aggregate estimates of unwanted and unintended pregnancy, the proximity of our estimates should provide comfort. On the other hand, if our interest is in characterizing the women who are most at risk of having an unwanted or unintended pregnancy, then differences at the individual level will matter to the extent that they are systematic rather than stochastic.

Our analyses are subject to important limitations. First, given the small number of women who had achieved their ideal family size in our young sample, our estimates of unwanted fertility are small and not particularly robust. Second, given the complicated timing issues at

play, we limit our analyses to women interviewed at each wave. Sample attrition is a problem with all panel data, and while relatively low in TLT, it introduces bias into our estimates. Women who attrited from the sample or missed interviews, for example, may be different from the analytic sample in ways that are relevant to questions of pregnancy intent. Additionally, while we maintain that our time-varying estimates are more accurate than the alternatives, they too are vulnerable to social desirability and a gap (albeit small)[6] between measurement of preferences and conception.

Careful measurement is essential for understanding the true impact of unwanted and unintended pregnancies on maternal and child health outcomes, and for informing family planning programs. Our objective was not to argue for a proliferation of intensive studies similar to TLT. Such studies are complex and expensive. Rather, we sought to offer insight into the relative size of errors associated with retrospective and prospective approaches to the measurement of unwanted and unintended pregnancies. Our findings support the conclusions of others that retrospective measures of unwanted and unintended pregnancy are likely to be underestimates. Although in our sample, where retrospective estimates are captured close to conception, the underestimates are small. Until now, relatively little attention has been given to the problem that changes in preferences before a conception can have on prospective estimates of unwanted and unintended pregnancies. Our findings that fixed prospective measures overestimated these outcomes should insert a degree of uncertainty into this approach. Even interviews that are 2 years apart may be sufficiently long for fertility preferences to change such that we as researchers no longer know what it is that we are measuring. Prospective studies of fertility intendedness should consider the dynamics and variability of preferences in their design, and it may be that carefully designed retrospective measures are not necessarily more problematic than more expensive fixed prospective ones.

## Acknowledgments

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[6]If we assume conceptions occur midway between survey waves on average, the gap would be 2 months.

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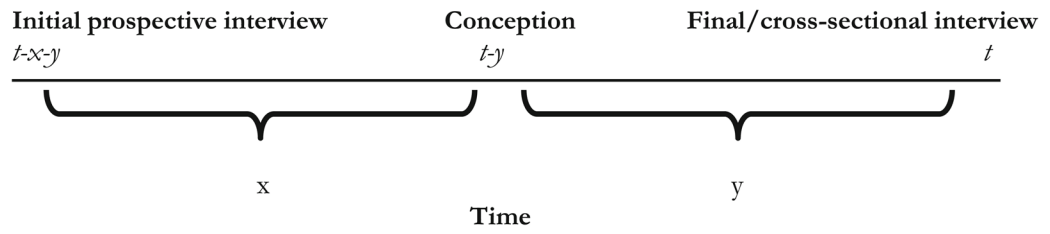
| Initial prospective interview | Conception | Final/cross-sectional interview |
|---|---|---|
| *t-x-y* | *t-y* | *t* |

x

y

**Time**

**Fig. 1.**
Timeline depicting the relationship between data collection and events used to measure unwanted and unintended pregnancies

**Table 1**

Descriptive statistics of analytic sample at baseline, 2009

| Characteristic | % (N = 1062) |
|---|---|
| Age (range 15–25) | |
|   15–19 | 49.5 |
|   20–25 | 50.5 |
| Marital status | |
|   Married | 45.4 |
|   Nonmarital partner | 15.2 |
|   No partner | 39.5 |
| Education | |
|   Primary or less | 51.3 |
|   Some secondary | 41.4 |
|   Finished secondary | 7.3 |
| Enrolled in school | |
|   No | 63.0 |
|   Yes | 37.0 |
| Number of living children (range 0–5) | |
|   0 | 47.7 |
|   1 | 26.7 |
|   2 | 18.6 |
|   >3 | 7.1 |
| Ideal family size (range 1–7) | |
|   1 | 2.3 |
|   2 | 28.1 |
|   3 | 24.3 |
|   4 | 37.1 |
|   5 | 5.8 |
|   6+ | 2.3 |
|   Missing | 0.2 |
| Want a(nother) child | |
|   No | 8.5 |
|   Yes | 91.5 |
| Desired timing of next birth | |
|   <2 years | 13.3 |
|   2–3 years | 16.6 |
|   3+ years | 68.5 |
|   Missing | 1.7 |

**Table 2**

Percent of pregnancies classified as unwanted or unintended using different measurement strategies

| | Unwanted pregnancies (%) | | Unintended pregnancies (%) | |
|---|---|---|---|---|
| | Ideal family size (N = 589) | Want a (nother) (N = 589) | Desired timing (N = 541) | |
| *Classic* | | | | |
| Retrospective | 2.6 [M1][a] | | 63.6 [M5] | |
| Fixed prospective | | 5.3 [M3] | | 69.3 [M6] |
| *New* | | | | |
| Time-varying | 3.2 [M2] | 2.6 [M4] | 65.6 [M7] | |
| Percentage point difference in estimates (new-classic) | 0.6 | −2.7[*] | 2.0 | −3.7 |
| *Diagnostic tests (compared to new)* | | | | |
| Sensitivity | 0.211 | 0.667 | 0.769 | 0.806 |
| Specitivity | 0.981 | 0.963 | 0.618 | 0.522 |
| Positive predictive value | 0.267 | 0.323 | 0.794 | 0.763 |
| Negative predictive value | 0.974 | 0.991 | 0.584 | 0.584 |

[a]Methods: (M1) Retrospective IFS; (M2) Time-varying IFS; (M3) Fixed prospective wanting more; (M4) Time-varying wanting more; (M5) Retrospective timing; (M6) Fixed prospective timing; (M7) Time-varying timing

[*]$p < 0.01$