Infertility and Uncertainty: Measurement of Infertility in Sub-Saharan Africa

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Though existing research on infertility in the SSA suggests a conservative demographic measure is ideal for measuring prevalence, the dearth of self-identified infertility measures in survey data in the region has prevented comparisons of measures. Arguably, however, women's perceptions of their own infertility status may have a greater impact for social outcomes such as marital instability and mental health. Using 8 waves of panel data from Ghana, this paper considers the optimal measure of infertility for social research in sub-Saharan Africa. First, correlations are used to examine the relationship within and between measures. Next, the stability of several measures of infertility currently used in the demographic and biomedical literature is assessed through the application of a test-retest statistical method. Finally, random effects models are applied to explore how each measure relates to background demographic characteristics.

I. INTRODUCTION

Involuntary childlessness has been recognized to have detrimental psychological and emotional effects in a variety of contexts (Dyer, Abrahams, Hoffman, and Spuy 2002; Dyer, Abrahams, Mokoena, Lombard, and Spuy 2005). These effects are often attributed to the high value placed on children in Africa (Dyer 2007). In this context, the high rates of infertility commonly found in much of sub-Saharan Africa (Mayaud 2001; Larsen 2000) are troubling. Infertile men and women appear to face a variety of social and economic stressors as a result of their inability to achieve their desired fertility. However, at the crux of this matter is our conceptualization of infertility; without adequate measures, the social and demographic impact of infertility is difficult to pinpoint.

Much of the literature on defining infertility in SSA focuses on the most appropriate measure for estimating prevalence, with emphasis on the utility of demographic measures in particular (see, for example, Larsen 2000; Larsen 2005; Larsen and Raggers 2001). While a clear picture of prevalence is a critical step in understanding infertility, the most conservative and appropriate measure at the aggregate level may not correlate closely to the lived experience of infertility for individual men and women. In other words, biological subfecundity or sterility may or may not overlap with local and personal definitions of fertility status. Little attention has been paid to the utility of self-identified infertility, due in part to the absence of appropriate measures in survey data in the region. Nor is it clear how self-identified infertility and the more objective measures outlined in the biomedical and demographic literatures relate to one another. However, for many outcomes of interest, including treatment seeking, fertility-specific distress, marital satisfaction, and divorce, self-identification may

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be more salient than more objective, externally defined measures. Most infertility research in SSA relies on measures constructed from marriage and pregnancy histories; how these constructed measures correlate with self-identification may prove important for determining the most useful constructed measure in the absence of self-identified measures. Given the dearth of analyses exploring the most apposite definition of infertility for understanding social phenomena at the individual level, in this paper I analyze correlations, test-retest models, and random effects models to examine the relationship between and stability of a variety of infertility measures across eight waves of panel data from Ghana.

A. *Considerations in the Measurement of Infertility*

In the biomedical literature, clinical definitions identify infertility based on conception, with infertility defined as no conception after 12 months of regular, unprotected sex; epidemiological studies rely on a similar definition, extending the requisite length of unprotected intercourse to 24 months (Marchbanks et al. 1989). Demographers, in contrast, consider live births for a sexually active woman not using contraception, rather than focusing on conception (Larsen 2005). Among demographers, the optimal time period without a live birth for identifying infertility is still open to debate, though most measures center on either 5 or 7 years.

Clinical definitions of infertility are often used in medical settings when individuals or couples seek treatment. Thus, the goal is first to make sure that a couple can conceive, and then to address any difficulties carrying the pregnancy, once achieved, to term, as this distinct processes may represent separate facets of infertility (Marchbanks et al. 1989). Short waiting times (the length of time a couple must unsuccessfully try to achieve a pregnancy before classification as infertile) and a focus on conception thus ensure that couples will receive treatment early to address any potential problems. However, where identifying infertility quickly to facilitate a timely response is not the end goal, clinical measures may overestimate infertility; couples who are not infertile may still naturally take longer than twelve months to conceive without an underlying problem (Larsen 2005). While conception may be measured with relative accuracy in a clinical setting, survey responses may not accurately capture conception (Larsen 1994), and may underestimate pregnancy loss. Demographic measures, which tend to be constructed based on survey data thus focus on live births rather than conception. While this could still slightly overestimate subfecundity from a biological standpoint, the long waiting times to birth used for these measures tends to minimize this bias.

Important considerations in measuring infertility also include contraceptive behavior and fertility intentions. In particular, when contraceptives are used, lack of pregnancy may reflect the effectiveness of the contraceptive method rather than an underlying inability to conceive. This is not to say that none of the couples who are using contraceptive are, in fact, subfecund; however, failing to remove successful contraceptors from the pool of women at risk for infertility would result in a substantial overestimate of infertility (Marchbanks et al. 1989; Larsen 1994). The effect of controlling for various types of contraceptives on measurement is also unclear. While western contraceptives may arguably be more effective than traditional methods at preventing pregnancy, research in Tanzania and Nigeria has suggested that some women may believe that western contraceptives cause infertility and, thus, opt for non-western methods instead (Allen 2001; Koster-Oyekan 1999; Mgalla and Boerma 2001).

The role of fertility desires and intentions in shaping fertility behavior is also unclear. While women who express a desire to have no more children may be consciously limiting fertility via methods other than contraceptive use (such as longer periods of breastfeeding or abstinence), women's fertility desires may also have a limited impact on their fertility behavior due, in part, to the strong role of men's desires in shaping fertility behavior–particularly in SSA (DeRose and Ezeh 2005; Ezeh 1993); controlling for desires net of contraceptive use may be important. While intentions arguably do not factor into the underlying biological basis of infertility, Greil and colleagues (Greil and McQuillan 2004; Greil, McQuillan, Johnson, Slauson-Blevins, and Shreffler 2010) have shown that women who are infertile with intent–that is, women who cannot have (additional) children they desire–have poorer health, report distress, and experience other negative consequences to a greater extent than women who are biologically infertile but who are not actively trying to conceive. Therefore, although excluding those who do not wish to conceive from the pool of infertile women may underestimate the underlying biological presence of infertility, including those who are infertile without intent may cause a downward bias in estimates of the social impact of infertility.

In addition, background characteristics may influence the biological and social determinants of infertility. Previous studies have shown that there is a natural decline in fecundability over time, particularly over the age of 35 (Broekmans et al. 2007; Larsen 1994); underlying biological infertility can be expected to increase as cohorts age. Whether this relationship holds when subjective measures are used is unclear. Some research (Frank 1983; White et al. 2001) has suggested that there are racial and ethnic differences in the prevalence of infertility.

Socially determined factors may also influence the prevalence and identification of infertility. Religious affiliation may be associated with differential rates of infertility in SSA, perhaps as a result of differences in sexual and childbearing rites and norms (Anarfi and Owusu 2010; Ericksen and Brunette 1996). Acceptable waiting times to pregnancy, which are shaped by prevailing cultural norms (Allen 2001), may also influence infertility; though unlikely to impact objectively defined measures, waiting times may influence who is identified as infertile by subjective measures. However, the influence of many of these variables may differ substantially across cultural settings.

B. *Measurement of Infertility in SSA*

While desires and family size are on the decline, the total fertility rate (TFR) in SSA remains high at 5.2 children per woman (in Ghana, the TFR is 4.0; Population Reference Bureau 2010). Changes in fertility desires among women in SSA may not correspond to changes in fertility behaviors as a result of couple gender dynamics: where there is not a high premium placed on gender egalitarianism in relationship, partner fertility preferences may asymmetrically influence fertility behaviors (DeRose and Ezeh 2005; Ezeh 1993). Additionally, Bongaarts et al. (1984) note that the proximate determinants of fertility, such as cultural norms regarding postpartum abstinence and breastfeeding, also shape child spacing and timing. Long periods of postpartum abstinence are common, and high rates of breastfeeding give rise to extended lactational amenorrhea. Finally, migration is an increasingly common facet of family life in SSA (Adepoju and Mbugua 1997; Larsen 1994; Larsen 1997; Oppong 1997), resulting in (sometimes long) stints of abstinence. In sum, the childbearing context in SSA is unique, and necessitates and tailored approach to measuring infertility.

Relying on a short waiting time to estimate prevalence of infertility may lead to a substantial upward bias of estimates (Larsen 2005), particularly in light of the aforementioned factors. Thus, Larsen advocates defining infertility as having no live birth for at least 5 (or, for a more conservative estimate, 7) years from either the date of marriage, in the case of primary infertility (childlessness), or the date of last birth, in the case of secondary infertility (infertility subsequent to the birth of a child).

It is unclear which demographic definition will be most suitable for examining the link between infertility and social outcomes. While the definitional requirement of five to seven years without the birth of a child results in a very stable measure of infertility, the deleterious effects of infertility are likely to be driven by local understandings of infertility, which may (and often do) involve a shorter waiting time to conception (Barden-O'Fallon 2005). Furthermore, little is known about the utility of biomedical definitions for examining the social predictors and consequences of infertility.

It may be the case, then, that self-assessed infertility is the most salient indicator of infertility for social outcomes, as the negative effects of infertility will presumably be most likely when a woman perceives herself to be infertile. For example, marital discord will likely arise only when difficulties conceiving have been acknowledged, whether explicitly or not–if not by the couple, then at least by one member of the dyad. However, given that self-defined infertility may vary substantially between groups of women, based partly on variation in social contexts, acceptable waiting times to pregnancy are likely to differ, which will likely reduce the stability of the measure. Leonard (2002) notes that demographic definitions assume that the definition of infertility is the same across time and place, when it likely is not; she contends that self-identified measures may be more appropriate when considering social outcomes.

Thus, obtaining a full, accurate understanding of the implications of infertility in sub-Saharan Africa requires the use of an appropriate, nuanced definition of infertility. This analysis seeks to identify (1) which measure is the most reliable over time (2) which measure is most closely tied to self-identified infertility, and (3) which measures relate to background characteristics in a predictable, expected manner.

II. MATERIALS AND METHODS

A. *Data*

I utilize longitudinal data collected by the Population Council of New York and the University of Cape Coast between 1998 and 2004. Data were collected in six geographically dispersed communities in the Central, Greater Accra, and Western regions of Ghana (Casterline 2007). Sampling maximized ethnic, economic, kinship, and between-community diversity. Women between the ages of 15 and 50 of all marital statuses were sampled. For a full description of sampling methods, see Casterline (2007).

Data were collected in 8 rounds. Respondents were given a main survey containing questions relating to demographic and background characteristics, fertility attitudes and behaviors, contraceptive behavior, and other variables. In addition to completing the main survey, women answered detailed retrospective information regarding factors such as birth control use for each month between the current wave and the previous one. Cases were added between rounds to adjust for attrition: in round one, 1,219 women were sampled; 219 women were added in round two. Twelve cases were dropped due to attrition, resulting in a sample size of 1,373. To restrict the sample to women who are within the demographic age of fecundability (ages 15-49), women over the age of 50 were dropped from the sample. The final sample size for the analysis is 1,350.

Missing data for background and demographic variables was around 3% in most cases, while missing data was more varied among other indicators. At 19.27%, the variable measuring fertility desires had the highest amount of missing data. Missing data were multiply imputed using the ICE procedure in Stata 11; 10 imputed datasets were created, and results shown are averaged across these datasets using the *mim* procedure, which accounts for the uncertainty introduced by imputation by adjusting the standard errors.

B. *Measures*

Four basic objective measures of infertility are considered: clinical, epidemiological, demographic 5 year, and demographic 7 year. Strictly speaking, a clinical definition identifies a woman who has not conceived after 12 months of regular, unprotected sex as infertile. An epidemiological definition is similar, but extends the time span to 24 months of unprotected intercourse without conception. The demographic definitions of infertility identify a woman as infertile if she has not achieved a live birth after 5 or 7 years of unprotected intercourse. Although a strict biomedical definition of the clinical and epidemiological measures would focus on conception while demographic measures focus on live births (Larsen 2005), the focus for all of the objective measures is on live births rather than conception due to difficulties accurately identifying conception (particularly early pregnancy wastage, which may be underestimated by as much as 50% in survey data for developing countries; Casterline 1989) in survey data. Thus, the primary distinguishing factor between these measures is waiting time to infertility.

Additionally, I consider self-assessed infertility, as measured by responses to the question "When you want to become pregnant, do you become pregnant quickly, or does it take a long time?" Women who responded "Takes a long time" or "Can no longer become pregnant" were classified as infertile. Additionally, a small number of women (292 women pooled across 4 waves) responded "Cannot get pregnant" to a second question, "Would you like to have (a/another) child (with your husband/partner) or would you prefer not to have any (more) children (with him)?" were also classified as infertile. Among those classified as infertile, 83.5% responded "Takes a long time", while only 16.5% said that it is impossible (based on either measure) for them to conceive.

One limitation of measuring self-identification as a response of "takes a long time" is that this response could conceivably mean that a woman is subfecund but not infertile, or that she is sterile but reluctant to classify herself as such (or is unaware that she is medically sterile). However, Greil (1991) found that a non-representative sample of U.S. women undergoing treatment were more likely to identify as "not yet pregnant" than "infertile", lending some validity to the use of the response "takes a long time" as a measure of infertility. Based on this subjective measure, waiting times to pregnancy may vary substantially. For instance, a woman who has been trying to become pregnant for one month may say that she cannot get pregnant, while a woman who has not had a child for seven years may not consider herself infertile even if she has been having unprotected intercourse. The self-identified infertility questions were asked only in waves 1, 6, 7, and 8.

A substantial portion (25.5% of the sample) responded "don't know" when asked whether they become pregnant quickly. While women who express uncertainty about their infertility status could conceivably say they don't know because they are not currently sexually active (for instance, due to migration), these women are unlikely to be identified as infertile given that the birth control measure used (see below) includes abstinence. Based on descriptives, correlations, test-retest, and random effects models comparing methods for treating uncertainty (not shown), a measure which combines self-identification and uncertainty was used.

Only women who report being married or in a union were considered at risk for being infertile. Waiting times to birth were calculated based on the time since the most recent birth for women who had given birth to at least one child. For women who had never given birth, waiting times were based on the date of marriage (or the date of the beginning of the union for unmarried women in sexual unions). Due to small cell counts for cases of primary infertility (as few as 7 women were infertile by the end of the 8 waves when using the most conservative measures of primary infertility), primary (childlessness) and secondary infertility (subsequent to the birth of at least one child) were combined into one measure. Infertile women are coded as 1 and women not identified as infertile by the measure coded as 0. These basic measures do not account for birth control use or fertility desires; measures included in the analysis below control for these factors.

Only non-contracepting women who have failed to conceive within the requisite time frame for the definition in question were considered infertile for most of the analyses; following Larsen (2005), contracepting women who have not conceived were considered successful contraceptors, and were coded with a 0 on the infertility measure. Among those contracepting during an earlier wave, the risk period began at the first survey in which no contraceptive use is reported. For example, a woman who had not given birth in six years, but who had been contracepting for the first three years of that period would be considered infertile by clinical (12 month) and epidemiological (24 month) definitions of infertility, but not by either of the demographic measures.

The questions regarding current contraceptive use were drawn from both the calendar data and the main survey, so detailed information are available for each month during the study period. Where birth control use was available from the main survey, these data were used; where data on birth control use was missing (about 40% of cases), birth control use data was drawn from the calendar data.

For each month and each wave, women were asked to recall whether they were using oral contraceptives, injectables, diaphragm, foams or jellies, condoms, intrauterine devices (IUD), sterilization, withdrawal, herbs, Norplant, or any other method (including abstinence). Given the variance in effectiveness of these methods, two sets of measures were constructed for each of the measures of infertility. The first set of measures controlled for any birth control use–that is, if respondents reported using one or more of any of the contraceptive methods in the survey, they were considered successful contraceptors and coded not infertile. The second set considers only western contraceptive methods: IUD, condoms, the pill, sterilization, injectables, diaphragm, foams or jellies, or Norplant.

One limitation of controlling for contraceptive use is that infertile women may use contraceptives; measures accounting for birth control use would inaccurately classify these women as not infertile, resulting in a false negative. However, this limitation may be more problematic for estimating prevalence than understanding social consequences of infertility: while false negatives would create a downward bias in estimates of biological sterility, if contraceptive use stems from the couple (and broader community) being unaware of the underlying sterility, it would be unlikely that this unknown sterility would have serious social consequences.

The objective measures of infertility focus on women who are infertile with intent (Greil and McQuillan 2004)-women who express a desire to have a(nother) child but cannot. Versions of variables with and without removing women who stated that they did not want another child from the population of women at risk of infertility were created. On average, only around 5 to 6 women were moved from infertile to fertile when desires were accounted for. Correlations (not shown) suggested that fertility desires were not particularly stable over time, but there was little variance in the number of women not counted as infertile across waves, perhaps because those who did not desire to have additional children were also using contraception. Given that self-identification is a subjective measure, desires were not accounted for in this measure.

On the whole, birth control use is higher than expected. Among those who say it takes a long time to conceive, 65% report using any form of birth control, while 35% do not. Birth control use is even higher among those who say it is impossible to conceive, but lower among those who say they don't know: a surprising 73% of those who say it is impossible to conceive use contraceptives, while 56% of those who say they don't know use birth control. The highest percentage using birth control are those who say it is impossible to conceive. This may stem from cultural notions about aging and reproductive fatigue (Bledsoe 2002), and may also support the notion that couples use contraceptives for purposes other than preventing pregnancy. For example, Meekers and Calvs (1999) find evidence that condoms are being used for STI prevention.

It may be helpful to identify three classes of measures to ensure clarity of the discussion: basic measures, which do not account for any form of birth control or fertility desires; standard measures, which account for all forms of birth control and fertility desires; and western measures, which account only for western birth control methods and desires. Thus, there are three possible versions of each of the measures (clinical, epidemiological, demographic 5 and 7 year, and self-identification).

C. *Analytic Strategy*

I begin by examining the correlations between 1) basic measures of infertility and birth control use reported at each wave, 2) each measure with itself across waves, accounting for standard and western contraceptive use, and 3) each measure with the other measures. Observations for the third set of correlations are pooled over the eight waves of data.

Next, I employ a tetrachoric test-retest model for dichotomous outcomes to examine the stability of measures across waves (Alwin 2007; Johnson 1995). A graphic display of the basic theoretical model is provided in Figure 1; however, not all arrows are shown in this figure (for example, errors are not drawn in this figure). The assumption of the model is that the measures of infertility outlined above are indicators of the underlying trait of infertility; however, some of these measures may be more effective at capturing the true underlying trait than others. Infertility, then, is a latent variable, with the various measures of infertility serving as observed indicators. The relationship between these latent variables across waves is examined. For the sake of parsimony, and given the high correlation within biomedical measures and within demographic measures (discussed below), only one biomedical measure (clinical) and one demographic (7 year) measure are included in the model, as well as self-identification. Because self-identification measures are not available in waves 2 through 5, the test-retest analysis is limited to waves 6, 7, and 8. Wave 1 is excluded both because trends cannot be continuously assessed throughout waves 2 through 5, and because infertility figures in wave 1 are slightly inflated (discussed in greater detail below).

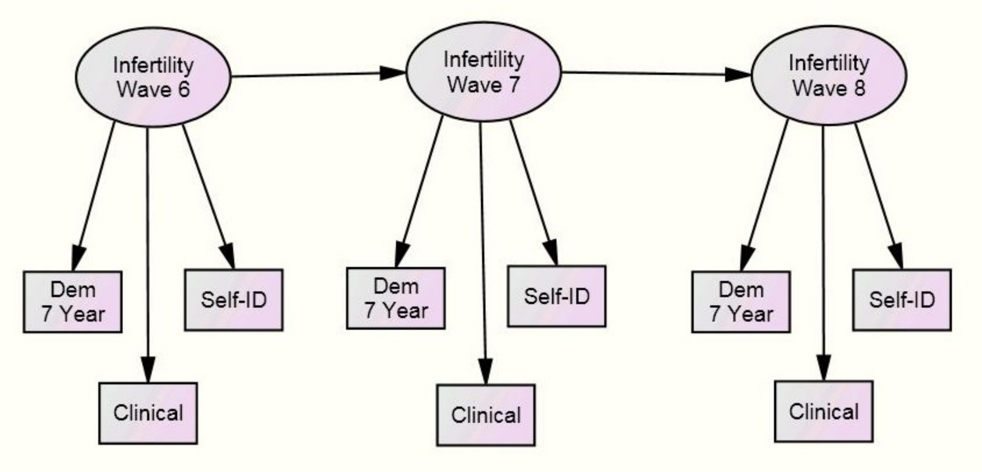

FIG. 1: Test-Retest Model

For the final set of analyses, observations are pooled across waves to maximize the information available; however, pooling the data across waves violated the assumption of independent observations (Johnson 1995). To adjust for the correlation of observations over time, random effects models are used to compare the relationships between the measures of infertility and key background variables: age, ethnicity, and religious identification. Because the outcomes (infertility) are dichotomous, logistic regression is employed.

III. RESULTS

A. *Descriptives*

Table I provides descriptive statistics for the Cape Coast data set. Respondents are aged between 15 and 50, with a mean age of 32.33. Mean age at first marriage (19.47) is on par with national statistics (DHS 2011). In terms of ethnic identification, a majority (51%) of the sample is Fante. An additional 16% are Adangbe, 11% are Ga or Ewe, 13% are Denkyira, and 10% identify as Ahanta or with some other ethnic group. Over 60% of the sample is married, and an additional 15% are involved in a non-marital union. Twelve percent are never-married, while the remaining 10% are either separated, divorced, or widowed. More than a third of the sample (36%) has never attended school, while 18% have attended but never finished primary school and 6% have completed primary school only. Approximately another third (36%) have attended or completed primary school. Only 4% have attended or completed secondary education.

Respondents in the sample do not appear to be very wealthy. A scale indicating ownership of some basic durable household goods (such as a mattress, a bicycle, etc) suggests that, on average, respondents only own three of the nine items in the scale. Most respondents identify with a religious group; only 8% report no religious affiliation at all. Nearly a quarter of the sample identifies as Moslem (22%), and an equal percent identify with a syncretic, traditional, or other religion. Just under 20% identify as Protestant (19%), while 15% are Catholic, and the remaining 13% are Pentecostal or Charismatic.

Table I also provides descriptives for variables relating to fertility preferences and behaviors. Fifty-seven percent of respondents report wanting a(nother) child. However, birth control use is high in the sample–higher than national statistics would suggest should be expected. According to the DHS (2011) for 1998, only 22% of married women were using any form of contraceptives, and 13.3% were using a western method. While the figures for contraceptive use in the Cape Coast data include not only married women, but also unmarried women (who would conceivably have greater motivation to use contraceptives), these figures are still surprisingly high: 65% of women report using any method of birth control, and 57% report using a western method. Parity, however, at an average of 3.53 children, is fairly close to what might be expected based on the TFR for Ghana.

Finally, time to pregnancy, used to determine self-identification in the sample, is provided in Table I. Thirty-six percent of the sample reported that they become pregnancy quickly–in other words, they did not self-identify as infertile. Thirty-two percent, or nearly another third of respondents, said that it takes a long time for them to become pregnant, while only 6% say that it is impossible. An additional 26% responded ”don't know” to this question, and were coded as infertile.

Table II provides the proportion infertile identified by each measure across waves. Basic (not accounting for any form of birth control), standard (controlling for all birth control), and western (controlling for only western birth control use) versions of the clinical, epidemiological, demographic, and self-identified measures are presented. The objective measures follow the pattern expected given definitional differences–that is, more women are identified as infertile by a clinical measure than by the epidemiological and demographic measures. The proportion identified as infertile by the basic measures of infertility are substantially higher than those controlling for the various forms of contraceptive use. Also as expected, proportions infertile are higher for western measures than standard measures, reflecting the fact that the western measures are less stringent.

With some minor exceptions, infertility appears to increase across waves, likely as a result of the aging of the women in the study across waves. The slightly inflated figures observable in wave 1 likely reflect inability to accurately capture contraceptive use prior to the start of the survey–a woman who stopped contracepting two months before the survey but had successfully contracepted for 2 years prior to that would appear to be infertile at the start of the survey. Similarly, the slightly sharper increase in infertility observable in wave 8 as compared to the somewhat more steady rates of increase in previous waves may reflect women who are pregnant but do not yet realize it. In other words, if a woman is four days pregnant at wave 8, she is unlikely to know that she is pregnant, and will thus report that she is not. Had an additional wave of data been collected, a woman who discovered her pregnancy a week after the wave 8 interview would have been able to retrospectively identify herself as pregnant at that time.

There is substantial variation in the estimates of infertility across measures. The highest estimate, given by the basic clinical measure in wave 6, identifies nearly three quarters of the sample (.74) as infertile; meanwhile, the lowest estimate, given by the demographic 7 year measure (either standard or western, in multiple waves), identifies only 1% of the sample as infertile. A large portion of this variation can be accounted for by eliminating successful contraceptors from the pool of at-risk women: when we consider only the measures which exclude women who are using contraceptives, the highest proportion identified as infertile drops from .74 to .20 (western self-identified, waves 1 and 8). The highest proportion estimated infertile by an objective measure accounting for birth control use is .18, which is only slightly lower than the proportion identified by the subjective measure.

This speaks to the importance of removing women who are currently contracepting from the risk pool and, more broadly, to the importance of understanding the reproductive behaviors surrounding times to conception. For a woman who desires to have a child, 1 year of unprotected intercourse without conception may signal underlying fertility barriers; for a woman who does not wish to conceive, a year without a conception is not problematic. Thus, objective measures, which rely primarily on a pregnancy history and contraceptive use, may not adequately account for differences in reproductive desires and behaviors.

The second factor which accounts for the wide variation in estimates of infertility between measures is waiting time to conception. Short waiting times to conception may reflect subfecundity rather than sterility; couples may still conceive naturally beyond the 1 year mark (Larsen 2005). For clinicians, who aim to provide treatment and help subfecund and sterile couples to conceive, early identification of the problem is key. For demographers, however, the emphasis is on identifying the true underlying biological capacity to carry a child to term. Longer waiting times are thus more appropriate for demographers, and the remaining variation between measures once contraceptive use is accounted for is to be expected. For self-identified infertility, personal and local definitions of acceptable waiting times are likely to influence identification as infertile; the amount of variance between subjective and objective measures is partially dependent on these local notions. In sum, both waiting times and contraceptive use strongly influence the proportion of women identified as infertile by various measures of infertility.

B. *Correlations of Measures*

For the sake of parsimony, tables for correlations of measures against themselves across waves are limited to the clinical, demographic 7 year, and self-identified infertility measures. Tables for epidemiological and demographic 5 year infertility are available upon request. Results for epidemiological infertility are very similar to clinical results, while demographic 5 and 7 year results closely approximate one another. Thus, presenting clinical and demographic 7 year results provides both a range of measures (the most and least stringent) and a set of measures that is similar to the excluded tables.

Based on the tables and figures presented in the previous section, it is clear that the infertility figures in wave 1 are slightly inflated when compared to the frequencies across subsequent waves. An examination of the association between the basic measure of infertility and birth control use suggests that this may be a function of the measurement of birth control use. Specifically, while detailed monthly calendar data are available from the first interview through the final interview, birth control use prior to the first wave cannot be accounted for; infertility measures in waves 2 through 8 can control for birth control use more accurately than can be accomplished in wave 1.

For example, if a woman had a child two years before the first interview date and has been contracepting since, she should be classified as a successful contraceptor, and thus not infertile. If she were still contracepting at the first interview, she would accurately be coded 0 on the measures of objective measures of infertility. If, however, she stopped taking contraceptives in the month prior to the first interview, she would be classified as infertile because her birth control use prior to the first wave would be unknown. Table III demonstrates the importance of controlling for birth control use in constructing measures of infertility. The correlation of one of the basic biomedical measures (clinical), a basic demographic measure (7 year), and birth control use are provided across waves. Within waves, infertility and birth control use are positively, significantly associated. This suggests that a significant portion of women who are classified as infertile by the basic measure are, in fact, successful contraceptors.

Table IV provides correlations between the basic measure of self-identification and birth control use for the four waves for which the self-identified infertility measures are available. There is a weak, sometimes significant positive correlation between self-identified infertility and birth control use across waves; some women who self-identify still appear to use contraceptives. Given that this is a subjective measure, it is perhaps surprising that there are not significant negative correlations between self-identification and birth control use, as it might be expected that a woman who believes she is infertile would be less likely to attempt to prevent a pregnancy. It is important to recognize, however, that some forms of contraceptives (particularly condoms) may be used for purposes other than pregnancy prevention–particularly in the context of targeted efforts to increase condom use for the sake of HIV prevention across the sub-continent (Desgrees du Lou 1999). Additionally, some research suggests that women who have suffered difficult pregnancy histories (for example, having a history of miscarriages) may desire to have more children, but may actively use contraceptives in order to allow their bodies to heal in order to sustain a future pregnancy (Bledsoe 2002).

Moreover, though weak and mostly non-significant, the positive correlation between birth control use and self-identification may partially be due to cultural notions which suggest that giving the body breaks from childbearing in the short-term may have positive effects for long-term childbearing trajectories (Bledsoe 2002). In addition, this relationship may be a function of the imprecision of the self-identification variable in the Cape Coast data. Specifically, rather than explicitly asking whether women believe they are infertile, the question asks whether they become pregnant quickly, or whether it takes a long time. Thus, even if a woman believes that it takes her a long time to become pregnant, this may not be problematic for her if she is not in a rush to conceive.

In sum, some women may believe that childbearing is difficult for them, but timing is also an important consideration which influences fertility decisions. Women may take contraceptives to prevent a mistimed birth even if they believe there is an underlying physical problem increasing the difficulty of conception. Identification as infertile, then, does not necessarily imply that one must currently be trying to conceive. Taken together, the positive correlations between birth control use and infertility seen in Tables III and IV suggest that it is important to account for birth control use to avoid false positives in the case of successful contraceptors.

Table V shows the correlation of clinical infertility across waves. Below the diagonal are correlations of standard clinical infertility with itself; correlations for western clinical infertility are provided above the diagonal. Correlations range from weak to moderate, with correlations between proximate waves being greater than those between waves which are further apart. In other words, as time between measures increases, the magnitude of the correlations decreases. Associations between infertility in wave 1 and subsequent waves are the weakest correlations, likely due to the inflated frequencies discussed above. The highest correlation across waves is .47, which is weaker than might be expected given that the measures should be tapping the same underlying infertility factor. There appears to be fairly substantial variation in in who is identified as infertile from wave to wave, then, likely as a result of the short waiting times involved in this measure of infertility. While there are some very slight fluctuations between correlations from the western birth control measure and the standard infertility measure, type of contraceptives controlled for does not appear to make a large difference in the association across waves.

Table VI provides correlations within measures across waves for the 7 year measures. Standard measures are provided below the diagonal, while western measures are shown above the diagonal. As with the other measures, correlations with wave 1 are the lowest across waves, while correlations are higher between waves that are closer together in time than among waves which are more distant. Correlations are generally positive and statistically significant, with strength ranging from weak to moderate. The correlations fluctuate based on the forms of contraception accounted for, but not in a systematic way.

The final set of correlations within measures is provided in Table VII. Correlations between self-identified infertility across waves 1, 6, 7, and 8 (the four waves for which the measures are available) are provided, with standard measures shown below the diagonal and western measures above the diagonal. The correlations are positive and significant across waves. Correlations are substantially higher among measures in waves 6 through 8 than with wave 1, though the correlations are generally fairly low compared to those observed among other measures. For instance, while the highest correlation among clinical measures is .47, the highest correlation among self-identification is .30. As with the other measures, controlling for more or less stringent measures of birth control use does have an impact on the magnitude of correlations, but not in a systematic way.

The final set of correlations is provided in Tables VIII. The table provides correlations between all of the measures of infertility, with data pooled across the 8 waves (or in the case of self-identification measures, 4). Correlations are moderate to strong, positive, and generally highly statistically significant. Unsurprisingly, the highest correlations are between measures controlling for all forms of birth control and their less stringent western method counterparts. Among objective measures, correlations are highest among measures which are more similar in terms of waiting times. For example, the correlation between clinical and epidemiological infertility, accounting for all birth control, is .86–nearly as high as the correlation between clinical infertility and its western contraceptive counterpart.

Meanwhile, the correlation between clinical infertility and the demographic 5 and 7 year measures are much lower, at .52 and .38 respectively. Between the demographic measures, the correlation is lower than between the biomedical measures, but still high at .75. This may result from the fact that the difference in waiting times between clinical and epidemiological measures is only 12 months, whereas the difference between demographic measures is 24 months. Type of birth control accounted for appears to make little difference in the relationship between measures; the trends across western measures closely resemble the trends across the more stringent measures. Self-identification appears to be most closely aligned with the clinical measure of infertility, followed by epidemiological, demographic 5 year, and, finally, demographic 7 year measures; self-identification is positively associated with the objective measures, though the association with the demographic 7 year measure is non-significant.

C. *Test-Retest Models*

Table IX provides results for the test-retest model. This model assumes that subfecundity is an underlying trait captured to a varying extent by each of the measures of infertility outlined above. Based on the logic that the least stringent biomedical model, most stringent demographic measure, and the subjective measure will approximately capture the range of subfecundity (discussed in greater detail above), the test-retest models include measures of latent infertility in waves 6, 7, and 8 as a function of clinical, demographic, and self-identified infertility. The model examines waves 6, 7, and 8 only due to data availability for self-identification measures.

Model fit statistics were obtained for a series of test-retest models involving a variety of theoretically motivated constraints. Specifically, model fit, measured by the Root Mean Square Error of Approximation (RMSEA), was examined for the following models: a) All errors were uncorrelated, and no paths were constrained to be equal across waves, b) errors for each measure between waves 6 and 7, and waves 7 and 8 are correlated, c) errors for each measure between waves 6 and 7, 6 and 8, and 7 and 8 are all correlated, d) errors were uncorrelated, but paths for each measure were constrained to be equal across waves, e) paths were constrained to be equal and errors were correlated between waves 6 and 7 and waves 7 and 8, and, finally, f) within measures across waves, all errors were correlated, and all paths were constrained to be equal. Based on the model fit statistics, model f was selected (RMSEA=.027). Results presented are from the standardized models.

Table IX provides the results of the test-retest model. Coefficients within measures across waves have been constrained to equal, and thus do not vary across waves. The coefficients for clinical, demographic 7 year, and self-identified infertility represent the reliability of the measures. Recall, these paths have been constrained to be equal in this model (though there is some very slight variation in the coefficients due to standardization). Perhaps surprisingly, clinical infertility appears to be the most reliable measure of the latent construct, as indicated by the large coefficients for this measure across waves, though the coefficient is not significant. Clinical infertility is followed by the demographic 7 year measure, which is a highly significant indicator of underlying infertility. Reliability is lowest for self-identified infertility, though also significant and only slightly less reliable than the demographic measure.

The paths for the relationship between latent infertility in waves 6 and 7 and waves 7 and 8 represent the stability of the measures across waves. Although these paths were not constrained to be equal, they are remarkably similar, suggesting that the stability between waves 6 and 7 is only marginally lower than the stability between waves 7 and 8. This suggests that the stability of the measures fluctuates very little across time. However, given that these coefficients are only moderate in strength (B=.57 and .58 respectively), this suggests that stability of the measures is not particularly high across waves. This is somewhat surprising given that once an individual is truly subfecund, it would be unusual to for her to once again be fecund in later waves–that is, within person variation in subfecundity could reasonably be expected to be fairly low. The moderate stability of the infertility measures across waves, then, suggests that perhaps current measures of infertility are imperfect indicators of true underlying subfecundity.

Finally, Table IX includes the correlations of errors to capture associations among unmeasured characteristics. While these correlations do not provide information about the reliability or stability of the measures, they do suggest that there is a significant association between the unmeasured characteristics of respondents who are identified as infertile by the demographic measure and, to some extent, by the self-identified infertility, but not those who are clinically infertile. This stands to reason because the information used to identify demographic infertility overlaps substantially for demographic infertility as a result of the long waiting time; this is less true of self-identified infertility, which does not specify a waiting time, and especially of clinical infertility, which designates a very short waiting time, causing substantial change in identification across time.

D. *Random Effects Models*

The final analysis examines the relationship between the infertility measures and background characteristics–age, ethnicity, and religious affiliation. Data were pooled across 8 waves, and random effects models were used to account for the non-independence of observations across waves. Zero-order and full models are provided for the basic, standard, and western versions of clinical and demographic 7 year measures, as well as self-identification, uncertainty, and combined self-identity. The logistic regression random effects results are presented as odds ratios (OR's). Based on exploratory analyses, curvilinear terms for age were included in the models when suggested by lowess curves and found to be statistically significant.

Table X shows the relationship between clinical infertility and background characteristics. Looking first at the zero-order model for basic clinical infertility, there is a statistically significant relationship between age and infertility: for every one year increase in age, there is 9% increase in the odds of identification as infertile. Likewise, ethnicity is significantly associated with infertility. Specifically, Denkyira respondents have greater odds (OR=1.55) of identification as infertile than the reference group (Ahanta or other ethnicity). Though the remaining ethnic groups are not significantly associated with basic clinical infertility compared to the reference group, most have greater odds of identification (Adangbe, with a non-significant negative association, are the exception to this pattern). Religion is also a significant predictor: compared to those who report no religious affiliation, those identifying as Moslem (OR=.72), Syncretic, Traditional, or some other religious affiliation (OR=.77) have lower odds of being infertile. Respondents identifying as Catholic, Protestant, Pentecostal, or Charismatic also had lower odds of infertility, but these findings were non-significant.

The next two columns in Table X show the coefficients for the full model predicting basic clinical infertility–that is, the model in which age, ethnicity, and religious affiliation are all included in the model. The patterns are quite similar to those observed in the zero-order models, though the magnitude of most of the coefficients is somewhat reduced and religious affiliation becomes non-significant, suggesting that some of the effect of religious affiliation is due to the association with ethnicity and age.

The next set of models in Table X are the zero-order and full models for standard clinical infertility. The magnitude of the association between age and infertility (OR=1.17) is highly significant and greater than the association for basic clinical infertility, but the relationship is curvilinear: contrary to what might be expected, infertility actually increases until around age 30, then begins to decline (discussed further below). The relationship between infertility and ethnicity is not significant in either model, and the coefficients have, in fact, changed directions, suggesting that at least some of the effect of ethnicity was related to birth control practices. Likewise, religion is a non-significant predictor in these models, and the coefficients change direction between the zero-order and full models. The final models in Table X show the relationship between western clinical infertility and background characteristics.

As with standard infertility, the relationship between the western measure and age is highly significant, positive (OR=1.17), and curvilinear. Also as with the standard models, ethnicity and religious affiliation are non-significant in both the zero-order and full western models.

As discussed briefly above, there is a curvilinear relationship between standard and western infertility and age. This relationship speaks to the importance of accounting for birth control use in measures of infertility: the expected strong, positive relationship can be observed between basic infertility and age. Once birth control is accounted for, the relationship between age and infertility becomes more complex. Lowess curves (not shown) show that the relationship between infertility and standard clinical infertility is strong and positive only until around age 30, at which point it becomes a negative relationship. Thus, while the natural biological increase in subfecundity over time suggested by the literature appears to be supported by the data, this relationship only holds before accounting for birth control. Birth control use, it seems, increases as women age–behavior which could be logically expected: as women age, they are more likely to have achieved their desired family size (or at least to be closer to goal), and will thus have greater motivation to use contraceptives.

Table XI shows the results for the demographic 7 year measures. First, zero-order and full models are provided for the basic demographic measure. Age is positively, significantly associated with infertility in both models: for every year increase in age, the odds of identification as infertile by the demographic 7 year measure increase by 18%. In terms of ethnicity, the zero-order model shows that Denkyira and Fante respondents are significantly more likely (OR=1.86 and 1.33 respectively) to be demographically infertile than those identifying as Ahanta or another ethnic group. The magnitude of the relationship is reduced in the full model, but the coefficient for Denkyira remains significant. Religion is not significant in the zero-order model, but when it is included in the full model it becomes significant. Specifically, the odds of infertility are 52% higher for Protestant respondents than those who don't identify with any religion.

The models for the standard measures are provided next in Table XI. As with the clinical measure, the relationship between age and standard demographic infertility is significant and curvilinear, with infertility increasing until around age 40, then declining slightly thereafter. Ethnicity is no longer significant (as compared to the models with basic demographic infertility), and religion is significant only in the zero-order model, which shows that the odds of Pentecostal or Charismatic respondents being infertile are 39% lower than the odds for those with no religious affiliation. The last models in Table XI show the models for the western demographic 7 year measure. Patterns in these models are largely the same as those observed in the models for the standard measure, although the magnitude varies (reduced in some cases, increased in others, perhaps reflecting religious and ethnic differences in type of birth control used).

Turning next to the subjective measures, Table XII provides the random effects models for the combined measure of self-identification. In contrast to the other measures, there is a statistically significant curvilinear relationship between the basic combined measure, but not the standard or western combined measures. For the basic measure, infertility declines until around age 30, then begins to rise steadily thereafter. Additionally, ethnicity and religious affiliation are significantly associated with basic combined self-identification in the zero-order model. Specifically, Adangbe respondents have lower odds (OR=.77) of identifying as infertile than Ahanta or those identifying with some other ethnic group, while Moslem respondents have lower odds of identifying than those with no religious affiliation. With a few exceptions, the patterns between the zero-order and full model are quite similar.

However, the relationship between self-identification and ethnicity is no longer significant. Meanwhile, though the odds ratio for Moslem respondents is no longer significant, Catholic respondents have 36% lower odds of self-identification than those with no religious affiliation.

The next models in XII show the zero-order and full models for standard combined self-identification. The relationship between age and infertility is no longer significant once birth control is accounted for, suggesting that much of the drop in infertility until around age 30 is due to increasing use of birth control during this time period. Additionally, accounting for birth control use reduces the effects of ethnicity and religious affiliation to non-significance, suggesting that much of the relationship between self-identified infertility, ethnicity, and religious affiliation is due contraceptive behavior. Nearly identical results can be observed between the standard and western models.

IV. DISCUSSION

A. *Conclusions*

In this paper, I explored the utility of a variety of biomedical, demographic, and subjective measures of infertility for social research in SSA. While prior studies (Larsen 2000; Larsen 2005; Larsen and Raggers 2001) have examined measurement issues associated with estimating the prevalence of infertility, less is known about which of the plethora of measures available in the literature is most suitable for studying the relationship between infertility and social outcomes. Employing correlation analyses, test-retest models, and random effects models, this paper attempts to answer that question. I examine clinical (12 month), epidemiological (24 month), demographic 5 and 7 year measures, and self-identified infertility (measured both separately from and together with uncertainty). These analyses seek to answer the following: (1) which measure is the most reliable measure of infertility across time, (2) which measure is most closely related to self-identification, and (3) which measures relate to background characteristics in expected ways?

Taken together, the correlation analyses suggest that, while the trends in infertility across time (as women age; Larsen 1994) are fairly similar across the objective measures, longer waiting periods to identification as infertile result in more stringent and, thus, more stable measures, as indicated by the higher correlations among the demographic than biomedical literatures. Moreover, the test-retest model showed that the demographic 7 year measure was the most reliable statistically significant indicator of latent infertility. This provides some support for Larsen's (2005) assertion that biomedical definitions of infertility are not stringent enough to be useful. It is reasonable expect that infertility would increase somewhat across across time as cohorts in the study age and natural fertility declined. Conceptualizing subfecundity as an underlying continuum of the biological capacity to conceive and carry a child to term, we could also expect some fluctuations as women who are somewhat subfecund but not sterile have children, but at a slower than expected rate due to biological factors. These expectations account for the low to moderate correlations observed within measures.

Associations between objective measures with themselves across waves were fairly similar, while those among self-identification were noticeably lower, suggesting that there is greater fluctuation in self-identified measures across time. Across measures, those which involve the most similar waiting times are most highly correlated. In other words, the biomedical measures are very similar to one another, but less similar to the demographic measures, which are highly correlated. Meanwhile, self-identification was most closely aligned with clinical infertility, suggesting that the long waiting times required by demographic measures of infertility may be too conservative to fit with women's own assessments of their infertility.

In terms of the relationship between measures and background characteristics, the random effects models showed that the demographic 7 year measure related to infertility in the most predictable way–that is, rising steadily across time. However, all of the measures were, in fact, related to age, though the majority of these relationships appear to be curvilinear. Additionally, though there is a relationship between infertility and background characteristics (age, ethnicity, and religious affiliation), only age is consistently related to infertility. The random effects models provided some evidence that the effects of ethnicity and religious affiliation are tied to one another, as well as being closely tied to birth control use. This finding is in keeping with research which suggests that a relationship may exist between infertility and background characteristics as a result of differences in sexual practices associated with ethnicity and religious beliefs (Frank 1983).

The results from this paper also provided an opportunity to examine the effects of controlling for all forms of contraceptives versus controlling for western methods. The proportions identified as infertile suggest that the western birth control measures are less stringent than the the broader measures. However, the correlations revealed little systematic difference between measures controlling for all birth control compared to western methods. Comparing basic measures and measures controlling for contraceptive use reveals that a large proportion of those identified as infertile based purely on waiting times are, in fact, successful contraceptors; accounting for birth control use, then, is important to avoid false positives. Moreover, many of the relationships between basic infertility, ethnicity, and religious affiliation changed magnitude or were reduced to non-significance when birth control use was accounted for, suggesting that much of the relationship between these factors acts through contraceptive use.

Taken as a whole, the results herein suggest that, though useful for estimating the prevalence of biological infertility in a population (Larsen 2005), demographic measures of infertility are too conservative to match with cultural and individual notions of infertility. Arguably, these local notions of infertility may be far more salient for understanding the social implications of infertility. Thus, the clinical measure appears to be the most appropriate objective measure for social research on infertility. However, given the similarities between the clinical and epidemiological (24 month) measures of infertility, epidemiological infertility may serve as a suitable substitute for researchers seeking a more conservative measure. Additionally, the results herein speak to the importance not only of selecting the appropriate waiting time, but also of controlling for contraceptive use. However, the distinction between controlling for western versus all contraceptives made little difference; controlling for all methods is advisable for a stringent measure.

B. *Limitations and Directions for Future Research*

While this paper has provided an extensive exploration of measurement and infertility, there are some limitations to the findings presented herein. First, because the data are based solely on Ghana, the findings cannot be generalized to sub-Saharan Africa more broadly. Future research should focus on extending these findings to other countries and regions in the sub-continent.

It is also worth noting that contraceptive use among women in the Cape Coast sample is higher than might be expected based on demographic estimates for the country. Contraceptive use among married women was only 23.5% according to the 2008 Demographic Health Surveys (DHS 2011), while 65% of the Cape Coast sample reports using any contraceptive method. Similarly, while the 2008 DHS shows that 16.6% were using western contraceptives in 2008, 57% report using contraceptives in the Cape Coast data. One might conclude that much of this disparity is due to the fact that the Cape Coast data is not restricted to married women. However, when the sample is restricted to married women, birth control use is still at 65% in the Cape Coast data. Meanwhile, contraceptive use among unmarried women in sexual unions (58.3%) is actually somewhat lower than among married women.

Although the sample was collected in geographically dispersed communities, Casterline (2007) notes that the the sampling frame was purposive in nature–specifically, it was designed to maximize ethnic, economic, kinship, and between-community diversity. This emphasis on diversity of the sample may thus have resulted in selection bias, as evidenced by the inflated birth control use figures. Future research should attempt to replicate the findings from this study using a nationally representative sample.

Additionally, recall that, although a strict definition of clinical and epidemiological infertility focuses on conception rather than live births, the analyses herein focused on births due to the difficulties inherent in measuring conception in survey data. However, a focus on conception rather than birth may produce different results, and is an area that should be explored in future research.

Finally, though this study provided some evidence of the utility of the self-identification measure used in the Cape Coast data, it is unclear how this measure of infertility might compare to other potential subjective measures. A respondent's understanding of the survey item assessing self-identification will impact her response; though she may believe that it takes a long for her to conceive a child, she may not believe that she is currently infertile. Because it is unclear from this survey item *why* women believe it takes a long time or is impossible for them to conceive (i.e. whether their difficulties are due to underlying biological subfecundity or some other cause), it is difficult to assess whether this measure is, in fact, capturing women's own views of whether they are infertile. A different measure may be more appropriate for capturing women's beliefs about their infertility. For instance, the U.S. based National Study of Fertility Barriers includes two questions which assess self-identified infertility: "Do you think you have/have had/might have trouble getting pregnant" and "Do you think you have/have had a fertility problem" (Johnson and White N.D.). Respondents who answered yes to either of these questions were asked to provide additional details as to why they believed they were infertile. Future research should consider a variety of measures of self-identified infertility to assess which is the most valid measure.

V. REFERENCES

Adepoju, Aderanti and Wariara Mbugua. 1997. "The African Family: An Overview of Changing Forms." in *Family, Population and Development in Africa*, edited by A. Adepoju. London: Zed Books Ltd.

Allen, Denise M. Roth. 2001. "Mchango, Menses and the Quality of Eggs: Women's Perceptions of Fertility Risks." Pp. 223-240 in *Women and Infertility in Sub-Saharan Africa: A Multi-Disciplinary Perspective*, edited by J. T. Boerma and Z. Mgalla. Amsterdam: KIT Publishers.

Alwin, Duane. 2007. *Margins of Error.* Hoboken, NJ: John Wiley & Sons, Inc.

Anarfi, John Kwasi and Adobea Yaa Owusu. 2010. "The Making of a Sexual Being in Ghana: The State, Religion and the Influence of Society as Agents of Sexual Socialization." *Sexuality & Culture* 15(1):1-18.

Barden-O'Fallon, Janine. 2005. "Unmet Fertility Expectations and Perception of Fertility Problems in a Malawian Village." *African Journal of Reproductive Health* 9:14-25.

Bledsoe, Caroline. 2002. *Contingent Lives: Fertility, Time, and Aging in West Africa.* Chicago: University of Chicago Press.

Bongaarts, John, Odile Frank, and Ron Lesthaeghe. 1984. "The Proximate Determinants of Fertility in Sub-Saharan Africa." *Population and Development Review* 10: 511-537.

Broekmans, F., E. Knauff, E. te Velde, N. Macklon, and B. Fauser. 2007. "Female Reproductive Ageing: Current Knowledge and Future Trends." *Trends in Endocrinology & Metabolism* 18(2): 58-65.

Casterline, John. 1989. "Collecting Data on Pregnancy Loss: A Review of Evidence from the World Fertility Survey." *Studies in Family Planning* 20(2): 81-95

Casterline, John. 2007. "Social Learning, Social Influence, and Fertility Control." *Project Description.* Population Council and University of Cape Coast.

Demographic and Health Surveys. 2011. Retrieved on February 25, 2011 from: $http : //www.statcompiler.com/country.cfm?ctry_i d = 14\&Ctry_n ame = Ghana\#$

DeRose, Laurie F. and Alez C. Ezeh. 2005. "Men's Influence on the Onset and Progress of Fertility Decline in Ghana, 1988-98." *Population Studies* 59(2): 197-210.

Desgrees du Lou, Annabel. 1999. "Reproductive Health and AIDS in Sub-Saharan Africa. Problems and Prospects." *Population: An English Selection* 11:61-87.

Dyer, S. J. 2007. "The Value of Children in African Countries: Insights from Studies on Infertility." *Journal of Psychosomatic Obstetrics & Gynecology* 28(2): 69-77.

Dyer, S.J., N. Abrahams, M. Hoffman, and Z.M. van der Spuy. 2002. "'Men Leave Me as I Cannot Have Children': Women's Experiences with Involuntary Childlessness." *Human Reproduction* 17:1663-1668.

Dyer, S.J., N. Abrahams, N.E. Mokoena, C.J. Lombard, and Z.M. van der Spuy. 2005. "Psychological Distress among Women Suffering from Couple Infertility in South Africa: A Quantitative Assessment." *Human Reproduction* 20:1938-1943.

Ericksen, K. and Tracy Brunette. 1996. "Patterns and Predictors of Infertility among African Women: A Cross-National Survey Of Twenty-Seven Nations." *Social Science & Medicine* 42(2):209-220.

Ezeh, Alex Chika. 1993. "The Influence of Spouses over Each Other's Contraceptive Attitudes in Ghana." *Studies in Family Planning* 24:163-174.

Frank, Odile. 1983. "Infertility in Sub-Saharan Africa: Estimates and Implications." *Population and Development Review* 9:137-144.

Greil, A.L. 1991. *Not Yet Pregnant: Infertile Couples in Contemporary America.* New Brunswick: Rutgers University Press.

Greil, Arthur L., Julia McQuillan, Katherine Johnson, Katherine Slauson-Blevins, and Karina M. Shreffler. 2010. "The Hidden Infertile: Infertile Women without Pregnancy Intent in the United States." *Fertility and Sterility* 93(6): 2080-2083.

Greil, A.L. and J. McQuillan. 2004. "Help-Seeking Patterns among Subfecund Women." *Journal of Reprodroductive and Infantant Psychology* 22:305-319.

Johnson, David. 1995. "Assessing Marital Quality in Longitudinal and Life Course Studies." in *Family Assessment*, edited by Jane Conoley and Elaine Buterick Werth. Buros Institute of Mental Measurements: Lincoln, NE.

Johnson, David. 1995. "Alternative Methods for the Quantitative Analysis of Panel

Data in Family Research: Pooled Time-Series Models." *Journal of Marriage and the Family* 57:1065-1077.

Johnson, David R. and White, Lynn K. No Date. National Survey of Fertilty Barriers [Computer File]. Population Research Institute [distributor]. The Pennsylvania State University. University Park, PA.

Koster-Oyekan, Winny. 1999. "Infertility among Yoruba Women: Perceptions on Causes, Treatments and Consequences." *African Journal of Reproductive Health* 3:13-26.

Larsen, Ulla. 1994. "Sterility in Sub-Saharan Africa." *Population Studies* 48:459-474.

Larsen, Ulla. 1997. "Fertility in Tanzania: Do Contraception and Sub-Fertility Matter?" *Population Studies* 51:213-220.

Larsen, Ulla. 2000. "Primary and Secondary Infertility in Sub-Saharan Africa." *International Journal of Epidemiology* 29:285-291.

Larsen, Ulla. 2005. "Research on Infertility: Which Definition Should We Use." *Fertility and Sterility* 83:846-852.

Larsen, Ulla and Han Raggers. 2001. "Levels and Trends in Infertility in Sub-Saharan Africa." Pp. 25-70 in *Women and Infertility in Sub-Saharan Africa: A Multi-Disciplinary Perspective*, edited by J. T. Boerma and Z. Mgalla. Amsterdam: KIT Publishers.

Leonard, Lori. 2002. "Problematizing Fertility: "Scientific" Accounts and Chadian Women's Narratives." Pp. 193-214 in *Infertility Around the Globe: New Thinking on Childlessness, Gender, and Reproductive Technologies*, edited by M. Inhorn and F. v. Balen. Berkeley: University of California Press.

Marchbanks, Polly A., Herbert B. Peterson, George L. Rubin, Phyllis A. Wingo, and the Cancer and Steroid Homormone Study Group. 1989. "Research on Infertility: Definition Makes a Difference." *American Journal of Epidemiology* 130(2): 259-268.

Mayaud, Philippe. 2001. "The Role of Reproductive Tract Infections." Pp. 71-108 in *Women and Infertility in Sub-Saharan Africa: A Multi-Disciplinary Perspective*, edited by J. T. Boerma and Z. Mgalla. Amsterdam: KIT Publishers.

Meekers, Dominique and Anne-Emmanule Calvs. 1999. "Gender Differentials in Adolescent Sexual Activity and Reproductive Health Risks in Cameroon " *African Journal* *of Reproductive Health* 3:51-67.

Mgalla, Zaida and J. Ties Boerma. 2001. "The Discourse of Infertility in Tanzania." Pp. 189-202 in *Women and Infertility in Sub-Saharan Africa: A Multi-Disciplinary Perspective*, edited by J. T. Boerma and Z. Mgalla. Amsterdam: KIT Publishers.

Oppong, Christine. 1997. "African Family Systems and Socio-Economic Crisis." in *Family, Population and Development in Africa*, edited by A. Adepoju. London: Zed Books Ltd.

Population Reference Bureau. 2010. *World Population Data Sheet.* Retrieved on February 25, 2011 from: $http://www.prb.org/pdf10/10wpds_eng.pdf$

White, Richard G., Basia Zaba, J. Ties Boerma, and John Blacker. 2001. "Modeling the Dramatic Decline of Primary Infertility in Sub-Saharan Africa." Pp. 117-150 in *Women and Infertility in Sub-Saharan Africa: A Multi-Disciplinary Perspective*, edited by J. T. Boerma and Z. Mgalla. Amsterdam: KIT Publishers.

TABLE I: Descriptive Statistics for Cape Coast Data

	Mean	St. Dev	Min	Max
Age	32.33	8.63	15	50
Age at First Marriage	19.47	3.33	10	31
Ethnicity				
Adangbe	0.16	0.37	0	1
Ga or Ewe	0.11	0.31	0	1
Denkyira	0.13	0.33	0	1
Fante	0.51	0.50	0	1
Ahanta or Other	0.10	0.30	0	1
Marital Status				
Married	0.62	0.48	0	1
Single	0.12	0.33	0	1
In a Union	0.15	0.35	0	1
Separated	0.03	0.18	0	1
Divorced	0.05	0.22	0	1
Widowed	0.02	0.15	0	1
Education Level				
No Education	0.36	0.48	0	1
Some Primary School	0.18	0.39	0	1
Finished Primary School	0.06	0.24	0	1
Attended Middle School	0.36	0.48	0	1
Attended Secondary School	0.04	0.19	0	1
Scale of Household Goods	2.95	2.13	0	9
Religious Affiliation				
Catholic	0.15	0.36	0	1
Protestant	0.19	0.39	0	1
Moslem	0.22	0.42	0	1
Pentecostal or Charismatic	0.13	0.34	0	1
Syncretic, Traditional, or Other	0.22	0.41	0	1
None	0.08	0.27	0	1
Desire Additional Children	0.57	0.50	0	1
Using Any Birth Control	0.65	0.48	0	1
Using Western Birth Control	0.57	0.50	0	1
Parity	3.53	2.90	0	14
Time to Pregnancy				
Quick	0.36	0.48	0	1
Takes a Long Time	0.32	0.47	0	1
Impossible	0.06	0.24	0	1
Don't Know	0.26	0.44	0	1

N=1,350; pooled N=10,800

TABLE II: Proportion Infertile Across Waves (N=1,350)

	W 1	W 2	W 3	W 4	W 5	W 6	W 7	W 8
Basic Clinical	0.63	0.67	0.67	0.65	0.73	0.74	0.73	0.69
Standard Clinical	0.12	0.10	0.11	0.11	0.13	0.14	0.13	0.14
Western Clinical	0.16	0.12	0.13	0.14	0.16	0.17	0.18	0.17
Basic Epidemiological	0.52	0.52	0.52	0.47	0.54	0.54	0.60	0.64
Standard Epidemiological	0.09	0.06	0.07	0.06	0.08	0.10	0.10	0.13
Western Epidemiological	0.12	0.08	0.08	0.08	0.11	0.12	0.13	0.15
Basic Demographic 5 Year	0.27	0.27	0.27	0.26	0.29	0.27	0.29	0.35
Standard Demographic 5 Year	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.06
Western Demographic 5 Year	0.05	0.02	0.03	0.03	0.04	0.04	0.04	0.07
Basic Demographic 7 Year	0.19	0.19	0.20	0.19	0.20	0.19	0.21	0.24
Standard Demographic 7 Year	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.03
Western Demographic 7 Year	0.03	0.01	0.01	0.02	0.02	0.02	0.03	0.04
Basic Self-Identified	0.66	–	–	–	–	0.66	0.60	0.65
Standard Self-Identified	0.17	–	–	–	–	0.15	0.11	0.18
Western Self-Identified	0.20	–	–	–	–	0.18	0.15	0.20

TABLE III: Correlation of Basic Clinical Infertility and Basic Demographic 7 Year Infertility with Birth Control Use

	BC Use W1	BC Use W2	BC Use W3	BC Use W4	BC Use W5	BC Use W6	BC Use W7	BC Use W8
Clinical Infert. W1	0.21 ***	0.12 ***	0.06	0.02	0.04	0.03	0.04	-0.01
Clinical Infert. W2	0.18 ***	0.27 ***	0.13 ***	0.07 **	0.07	0.03	0.04	0.02
Clinical Infert. W3	0.05	0.24 ***	0.20 ***	0.16 ***	0.12 **	0.04	-0.01	0.05
Clinical Infert. W4	0.03	0.20 ***	0.18 ***	0.21 ***	0.15 ***	0.05	-0.01	0.05
Clinical Infert. W5	0.08 *	0.07 *	0.10 **	0.18 ***	0.21 ***	0.12 **	0.06	0.05
Clinical Infert. W6	0.08 *	0.05	0.03	0.06	0.13 **	0.17 ***	0.13 **	0.05
Clinical Infert. W7	0.05	0.06	0.04	0.01	0.05	0.11 *	0.17 ***	0.07
Clinical Infert. W8	0.06	0.10	0.09	0.05	0.09	0.04	0.06	0.18 ***
7 Year Infert. W1	0.14 *	0.19 ***	0.16 ***	0.14 **	0.12 **	0.11 **	0.08	0.05
7 Year Infert. W2	0.17 **	0.21 ***	0.18 ***	0.16 ***	0.14 ***	0.12 **	0.09	0.06
7 Year Infert. W3	0.19 ***	0.23 ***	0.20 ***	0.18 ***	0.16 ***	0.13 ***	0.09 *	0.07
7 Year Infert. W4	0.19 ***	0.23 ***	0.20 ***	0.18 ***	0.16 ***	0.13 ***	0.09 *	0.07
7 Year Infert. W5	0.21 ***	0.24 ***	0.21 ***	0.18 ***	0.18 ***	0.13 ***	0.08	0.07
7 Year Infert. W6	0.20 ***	0.24 ***	0.21 ***	0.18 ***	0.18 ***	0.15 ***	0.10 *	0.08
7 Year Infert. W7	0.19 ***	0.24 ***	0.22 ***	0.17 ***	0.19 ***	0.14 ***	0.11 *	0.10
7 Year Infert. W8	0.21 ***	0.27 ***	0.23 ***	0.19 ***	0.21 ***	0.15 ***	0.13 **	0.12

Notes: *p < .05; **p <.01; ***p < .001

TABLE IV: Correlation of Basic Self-Identified Infertility and Birth Control Use

	Infert. W 1	Infert. W 6	Infert. W 7	Infert. W 8	BC Use W 1	BC Use W 6	BC Use W 7	BC Use W 8
Infert. W1	1.00	–	–	–	–	–	–	–
Infert. W6	0.27 ***	1.00	–	–	–	–	–	–
Infert. W7	0.28 ***	0.50 ***	1.00	–	–	–	–	–
Infert. W8	0.23 ***	0.49 ***	0.48 ***	1.00	–	–	–	–
BC Use W1	0.01	0.14 ***	0.12 ***	0.14 ***	1.00	–	–	–
BC Use W6	0.06	0.02	0.06	0.08 *	0.18 **	1.00	–	–
BC Use W7	0.04	0.01	0.03	-0.01	0.15 **	0.44 ***	1.00 –	
BC Use W8	0.04	0.05	0.01	-0.04	0.08	0.25 ***	0.29 ***	1.00

Notes: *p < .05; **p <.01; ***p < .001

TABLE V: Correlation of Standard Clinical Infertility Below the Diagonal, Western Clinical Infertility Above the Diagonal

	Infert. W 1		Infert. W 2		Infert. W 3		Infert. W 4		Infert. W 5		Infert. W 6		Infert. W 7		Infert. W 8	
Infert. W 1	–		0.21	***	0.17	***	0.14	***	0.15	***	0.11	*	0.12	**	0.06	
Infert. W 2	0.15	***	–		0.31	***	0.22	***	0.16	***	0.14	**	0.10	**	0.12	
Infert. W 3	0.13	***	0.31	***	–		0.47	***	0.28	***	0.19	***	0.20	***	0.16	**
Infert. W 4	0.13	***	0.20	***	0.46	***	–		0.41	***	0.21	***	0.22	***	0.21	***
Infert. W 5	0.13	***	0.17	***	0.27	***	0.41	***	–		0.35	***	0.19	***	0.16	***
Infert. W 6	0.11	**	0.14	***	0.20	***	0.21	***	0.37	***	–		0.31	***	0.21	***
Infert. W 7	0.09	**	0.11	**	0.20	***	0.20	***	0.18	***	0.34	***	–		0.30	***
Infert. W 8	0.06		0.11	*	0.14	***	0.20	***	0.16	***	0.20	***	0.30	***	–	

Notes: *p < .05; **p <.01; ***p < .001

TABLE VI: Correlation of Standard Demographic 7 Year Infertility Below the Diagonal, Western Demographic 7 Year Infertility Above the Diagonal

	Infert. W 1		Infert. W 2		Infert. W 3		Infert. W 4		Infert. W 5		Infert. W 6		Infert. W 7		Infert. W 8	
Infert. W 1	–		0.23	*	0.16	*	0.18	***	0.14	*	0.13	*	0.14	*	0.08	
Infert. W 2	0.24	*	–		0.26	**	0.21	*	0.14		0.14	*	0.13	**	0.10	
Infert. W 3	0.16	*	0.29	**	–		0.45	**	0.32	***	0.24	**	0.19	***	0.16	**
Infert. W 4	0.19	**	0.25	**	0.43	**	–		0.31	**	0.24	***	0.19	**	0.18	**
Infert. W 5	0.11		0.16	**	0.28	***	0.31	***	–		0.39	*	0.27	***	0.19	**
Infert. W 6	0.16	*	0.18	**	0.26	**	0.22	*	0.33	***	–		0.38	***	0.28	**
Infert. W 7	0.15	*	0.16	*	0.19	**	0.17		0.20	**	0.35	***	–		0.37	***
Infert. W 8	0.07		0.12		0.14	*	0.17		0.17	*	0.26	**	0.38	***	–	

Notes: *p < .05; **p <.01; ***p < .001

TABLE VII: Correlation of Standard Self-Identified Infertility Above the Diagonal, Western Self-Identified Infertility Below the Diagonal

	Infert. W 1		Infert. W 6		Infert. W 7		Infert. W 8	
Infert. W1	–		0.14	***	0.18	***	0.11	**
Infert. W6	0.14	**	–		0.28	***	0.25	***
Infert. W7	0.16	***	0.30	***	–		0.28	***
Infert. W8	0.10	*	0.25	***	0.28	***	–	

Notes: *p < .05; **p <.01; ***p < .001

TABLE VIII: Correlation Of All Measures of Infertility Across All Waves

	Clinical	West. Clinical	Epi	West. Epi	Dem 5 Year	Dem 5 Year	Dem 7 Year	West. Dem 7 Year	Self ID	West. Self ID
Clinical	1.00	–	–	–	–	–	–	–	–	–
West. Clinical	0.87 ***	1.00	–	–	–	–	–	–	–	–
Epi	0.86 ***	0.75 ***	1.00	–	–	–	–	–	–	–
West. Epi	0.75 ***	0.86 ***	0.88 ***	1.00	–	–	–	–	–	–
Demographic 5 Year	0.52 ***	0.45 ***	0.60 ***	0.52 ***	1.00	–	–	–	–	–
West. Demographic 5 Year	0.44 ***	0.51 ***	0.51 ***	0.59 ***	0.88 ***	1.00	–	–	–	–
Demographic 7 Year	0.38 ***	0.33 ***	0.45 ***	0.39 ***	0.75 ***	0.66 ***	1.00	–	–	–
West. Demographic 7 Year	0.32 **	0.38 ***	0.37 **	0.45 ***	0.64 **	0.76 ***	0.87 **	1.00	–	–
Self-Identified	0.61 *	0.51 *	0.55 *	0.46 *	0.36 *	0.30	0.28	0.23	1.00	–
West. Self-Identified	0.53 *	0.60 *	0.48 *	0.54 *	0.32	0.35	0.25	0.28	0.89 ***	1.00

Notes: *p < .05; **p <.01; ***p < .001

TABLE IX: Test-Retest Model for Clinical, Demographic 7 Year, and Self-Identified Infertility

	B		St. Error
Latent Infertility W6	–		–
Clinical	1.01		0.03
Demographic	0.88	***	0.03
Self-Identified	0.86	***	0.03
Latent Infertility W7	–		–
Clinical	1.01		0.04
Demographic	0.88	***	0.04
Self-Identified	0.86	***	0.04
Latent Infertility W8	–		–
Clinical	1.02		0.03
Demographic	0.90	***	0.03
Self-Identified	0.88	***	0.04
Latent Infertility W6 on W7	0.57	***	0.06
Latent Infertility W7 on W8	0.58	***	0.06
Correlation of Errors of Clinical W6 and W7	0.01		0.06
Correlation of Errors of Clinical W6 and W8	0.05		0.06
Correlation of Errors of Clinical W7 and W8	-0.06		0.06
Correlation of Errors of Demographic W6 and W7	0.32	***	0.08
Correlation of Errors of Demographic W6 and W8	0.41	***	0.11
Correlation of Errors of Demographic W7 and W8	0.36	***	0.06
Correlation of Errors of Self-ID W6 and W7	0.10		0.07
Correlation of Errors of Self-ID W6 and W8	0.19	***	0.06
Correlation of Errors of Self-ID W7 and W8	0.06		0.07

Notes: $^*p < .05$; $^{**}p < .01$; $^{***}p < .001$; RMSEA=.027

TABLE X: Random Effects Model of Clinical Infertility and Background Characteristics

	Basic Zero Order			Basic Full Model			Standard Zero Order			Standard Full Model			Western Zero Order			Western Full Model		
	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error
Age	1.09	***	0.00	1.09	***	0.00	1.17	***	0.05	1.18	***	0.05	1.17	***	0.05	1.17	***	0.05
Age Squared	–		–	–		–	.02	***	0.02	.02	***	0.01	.02	***	0.02	.02	***	.02
Ethnicity	–		–	–		–	–		–	–		–	–		–	–		–
Adangbe	0.85		0.09	0.96		0.13	1.26		0.17	1.23		0.23	1.22		0.18	1.21		0.20
Ga or Ewe	1.17		0.12	1.20		0.14	0.97		0.15	0.95		0.15	1.06		0.17	1.04		0.18
Denkyira	1.55	***	0.19	1.45	***	0.18	0.97		0.13	1.03		0.15	1.01		0.13	1.07		0.15
Fante	1.15		0.10	1.06		0.11	0.80		0.10	0.85		0.11	0.88		0.10	0.92		0.11
Ahanta or Other (reference)	–		–	–		–	–		–	–		–	–		–	–		–
Religious Affiliation	–		–	–		–	–		–	–		–	–		–	–		–
Catholic	0.95		0.13	1.07		0.17	1.16		0.23	0.97		0.19	1.14		0.19	0.97		0.18
Protestant	0.90		0.12	1.05		0.15	1.04		0.21	0.94		0.18	1.05		0.19	0.95		0.18
Moslem	0.72	*	0.09	1.03		0.18	1.29		0.25	0.85		0.18	1.18		0.21	0.82		0.16
Pentecostal or Charismatic	0.89		0.12	0.98		0.16	1.27		0.21	1.03		0.17	1.21		0.18	0.98		0.15
Syncretic, Traditional, or Other	0.77	*	0.09	0.89		0.12	0.95		0.16	0.90		0.15	0.95		0.14	0.89		0.14
None (reference)	–		–	–		–	–		–	–		–	–		–	–		–
/lnsig2u				0.62		0.01				0.04		0.03				0.05		0.03

Notes: *p < .05; **p <.01; ***p < .001; Age squared divided by 1,000

TABLE XI: Random Effects Model of Demographic 7 Year Infertility and Background Characteristics

	Basic Zero Order			Basic Full Model			Standard Zero Order			Standard Full Model			Western Zero Order			Western Full Model		
	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error
Age	1.18	***	0.01	1.18	***	0.01	1.36	*	0.13	1.40	*	0.13	1.38	**	0.11	1.40	**	0.11
Age Squared	–		–	–		–	.01	*	0.02	.01	*	.02	.01	**	0.02	.01	**	.01
Ethnicity	–		–	–		–	–		–	–		–	–		–	–		–
Adangbe	0.95		0.12	1.20		0.25	2.17		0.94	2.92		1.65	1.67		0.62	2.16		1.03
Ga or Ewe	1.22		0.17	1.32		0.23	1.21		0.53	1.15		0.50	1.20		0.45	1.17		0.43
Denkyira	1.86	***	0.32	1.75	*	0.37	1.29		0.62	1.32		0.67	1.29		0.57	1.29		0.58
Fante	1.33	*	0.15	1.28		0.20	0.86		0.39	0.81		0.39	0.96		0.34	0.91		0.33
Ahanta or Other (reference)	–		–	–		–	–		–	–		–	–		–	–		–
Religious Affiliation	–		–	–		–	–		–	–		–	–		–	–		–
Catholic	0.97		0.14	1.25		0.22	0.44		0.21	0.43		0.20	0.60		0.24	0.59		0.25
Protestant	1.14		0.15	1.52	**	0.23	0.67		0.23	0.71		0.24	0.85		0.25	0.90		0.28
Moslem	0.81		0.13	1.38		0.33	0.81		0.29	0.41		0.25	0.79		0.24	0.53		0.24
Pentecostal or Charismatic	0.87		0.13	1.26		0.23	0.61	*	0.24	0.53		0.22	0.68	*	0.21	0.63		0.21
Syncretic, Traditional, or Other	0.91		0.15	1.01		0.19	0.36		0.17	0.38		0.19	0.44		0.16	0.46		0.18
None (reference)	–		–	–		–	–		–	–		–	–		–	–		–

Notes: *p $<$ .05; **p $<$.01; ***p $<$ .001; Age squared divided by 1,000

TABLE XII: Random Effects Model of Self-Identified Infertility and Background Characteristics

	Basic Zero Order			Basic Full Model			Standard Zero Order			Standard Full Model			Western Zero Order			Western Full Model		
	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error	OR		St. Error
Age	0.74	***	0.02	0.74	***	0.02	0.91	***	0.01	0.91	***	0.01	0.91	***	0.01	0.91	***	0.01
Age Squared	83.53	***	37.95	88.14	***	40.20	–		–	–		–						
Ethnicity	–		–	–		–	–		–	–		–	–		–	–		–
Adangbe	0.77	*	0.10	0.79		0.12	1.01		0.21	0.89		0.22	1.02		0.22	0.93		0.23
Ga or Ewe	0.89		0.12	0.88		0.13	0.98		0.18	0.98		0.19	0.97		0.17	0.97		0.18
Denkyira	1.14		0.16	1.16		0.18	0.99		0.20	1.03		0.22	0.97		0.17	1.03		0.20
Fante	1.02		0.11	0.99		0.11	0.75		0.12	0.79		0.13	0.82		0.12	0.86		0.13
Ahanta or Other (reference)	–		–	–		–	–		–	–		–	–		–	–		–
Religious Affiliation	–		–	–		–	–		–	–		–	–		–	–		–
Catholic	0.77		0.11	0.74	*	0.11	1.39		0.42	1.10		0.34	1.37		0.35	1.10		0.29
Protestant	1.00		0.14	0.99		0.14	1.25		0.36	1.09		0.33	1.34		0.33	1.17		0.30
Moslem	0.71	*	0.10	0.80		0.14	1.34		0.42	0.97		0.33	1.33		0.36	0.97		0.28
Pentecostal or Charismatic	0.84		0.12	0.88		0.12	1.42		0.36	1.13		0.30	1.42		0.31	1.16		0.26
Syncretic, Traditional, or Other	0.95		0.15	0.96		0.15	1.12		0.29	1.04		0.27	1.18		0.27	1.10		0.25
None (reference)	–		–	–		–	–		–	–		–	–		–	–		–

Notes: *p $<$ .05; **p $<$.01; ***p $<$ .001; Age squared divided by 1,000