CAPTURING COMPLEXITIES: A SEQUENCE ANALYSIS TO INVESTIGATE PATTERNS OF FAMILY PLANNING FOR YOUNG COUPLES IN MALAWI

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by
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ABSTRACT

Key Words: Family Planning; Life Course; Malawi; Couples; Sequence Analysis

Decisions surrounding family planning are complex, influenced by social and relational contexts and life course events. For young adults in the Southeastern African country of Malawi, these decisions are further shaped by a persistent AIDS epidemic, shifting family planning preferences, and a fertility climate characterized by nearly universal marriage and childbearing. I use unique couple-level data and the tools of sequence analysis to answer two questions: (1) what are the typical patterns of family planning as couples transition through a relationship; and (2) how are family planning trajectories related to couple-level characteristics, particularly couple-level alignment and transitions in fertility preferences, family planning intentions, and relationship stage, as well as more stable characteristics such as age and education? I find that the patterning of family planning behaviors is very diverse both across and within couples; yet, despite this variability, similarities do exist, in the form of six distinct clusters of family planning trajectories. These clusters are identified largely by their relationship stage, levels of discordance, and fertility preferences and behaviors, suggesting that both the life course and couple-level characteristics play an important role in determining trajectories of family planning.
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INTRODUCTION

Family planning decision-making in Malawi is situated within a complex milieu that is shaped by a number of factors, including a persistent AIDS epidemic, economic insecurity, and evolving contraceptive semiotics. Decisions to pursue or prevent pregnancy are shaped by social ideals surrounding family formation that influence each individual, but these are also joint-decisions navigated by two actors in the context of a relationship. Whether explicitly discussed by both parties involved or not, the personal preferences, uncertainties, and ideals of each partner reciprocally influence the family planning behaviors the couple engages in. In this study, I address three aspects of family planning (i.e. behavioral, attitudinal, and biological) at the couple-level with the intention of identifying salient patterns and inconsistencies in use both within the couple and across couples.

Decisions surrounding family planning are contextualized in two ways: one being the societal context that the couple engages within and the second being the context of the life course that the individuals and couples are navigating. The social context of this study centers in rural Malawi, where young adults hold a range of attitudes towards family planning as well as differing amounts of accessibility and acceptability of specific methods. Additionally, the life course plays an important role in these decisions, as the life stages of young Malawians tend to be marked in distinct ways, with the transition into marriage and starting a family traditionally beginning at an early age and progressing quite rapidly. These contexts help to fill the gap in fertility-related life course studies, allowing for the conceptualization of variation within life course trajectories. Prior literature has tended to measure family planning behaviors in such a way that suggests they are individual-level, static decisions. The use of couple-level data and a unique longitudinal data reduction method provides the foundation for my project to (a) look at family planning at the couple level and (b) approach these behaviors with a life course perspective. Family planning is not a stable decision made alone, but rather is – I argue here – a dynamic process consisting of the couple-level navigation of preferences and behaviors that change over the course of a relationship. To contextualize these dynamic decisions, I turn to a life course centered approach, focusing on an important facet of the life course: events, transitions, and trajectories (Alwin 2012).

My life-course, couple-centered approach brings together important findings in the literature on family planning and fertility behaviors. Becker (1996), Dodoo (1998), and others pioneered the inclusion of men in studies of reproductive health, suggesting that both men and women actively participate in family planning decision-making. Other studies have continued to confirm that men's family planning preferences matter, finding that men often desire larger families (Bankole and Singh 1998), identifying important cross-couple effects (i.e. related to symmetries and asymmetries) on method change and use (Miller, Severy, and Pasta 2004), and the importance of societal-level gender discrepancies (i.e. age-specific sex-ratios) on bargaining power for fertility-related decisions within a relationship (Bauer and Kneip 2013). A number of studies on husbands’ and wives’ fertility preferences necessitate looking at family planning at the couple-level. Additionally, attitudes towards and use of contraception have been found to change as relationships change and transition (Adetunji 2000; Anglewicz and Clark 2013). Notable studies have also found that women's fertility preferences are flexible and dynamic over time (Sennott and
Yeatman 2012; Yeatman, Sennott, and Culpepper 2013). These transitions in relationships, contraceptive use, and fertility preferences indicate that family planning behaviors change over time and call for a longitudinal approach to questions of family planning behaviors.

Notable studies in Malawi have shown that cultural scripts and attitudinal aversions are at play when it comes to certain family planning behaviors (Tavory and Swidler 2009), but less is known about the corresponding family planning behaviors that couples actually engage in throughout the course of their relationship. In this paper, I follow couples through a particular stage of the life course, young adulthood, and identify (1) complexities within couples’ family planning trajectories, and (2) differences between couples’ family planning trajectories. Using unique, couple-level data from the southern region of Malawi, I leverage sequence analysis as a tool for visualizing and clustering couples’ family planning behaviors across the course of their relationship. The resulting trajectories illuminate the complexity of family planning behaviors, but also show that similarities exist, in the form of six distinct clusters of family planning behaviors for young adults in Malawi. My current study fills the gap in the literature by modeling the family planning behaviors of young couples in Malawi, using a life-course, couple-level approach, and finds a considerable amount of variation in family planning behaviors both within and across couples, suggesting that family planning decisions are largely contingent on the stage of the life course and varied across couples and time.

BACKGROUND

Family Planning in sub-Saharan Africa (SSA)

Researchers note a steady rise in contraceptive use and a transition in the methods used over the past few decades, with individuals in SSA replacing traditional methods with more modern contraceptive methods (e.g. hormonal contraception and condoms) (Seiber, Bertrand, and Sullivan 2007). Although this change in “method mix” has been well-documented at the aggregate level (Seiber et al. 2007), less is known about how couples choose a specific type of contraceptive over the course of their relationships. In SSA, the increase in modern contraceptive use is largely due to two factors: 1) the increased response to the concept of “unmet need” by the global health community (Casterline and Sinding 2000); and, 2) the onset of the HIV/AIDS epidemic in 1980s and subsequent prevention strategies (Allen et al. 1992).

The concept of “unmet need” (formerly the KAP-gap) has been defined as “the condition of wanting to avoid or postpone childbearing but not using any method of contraception” (Casterline and Sinding 2000, 691). Since the coining of this term in the 1960s, the international reproductive health field has adopted the goal of minimizing unmet need in developing regions. In SSA, this has meant expanding family planning services to increase the availability of modern contraceptive methods. However, increased availability does not always equate to increased use. Couple-level dynamics are one of several predictors of use, as partners negotiate use or nonuse of certain methods; thus, a couple-specific understanding of the motivation for using or not using contraception is necessary. In fact, Wolff, Blanc, and Ssekamatte-Ssebuliba (2000) found that partner opposition to contraceptive use accounts for about 15 percent of unmet need experienced
by women. Additionally, they found that disagreement towards family planning can lead to an increased use of traditional methods over more modern methods of contraception.

The global health community has responded to the HIV/AIDS epidemic by focusing their efforts on prevention, in particular, the ABCs (abstinence, be faithful, and condom use) (Green 2003). The onset of the AIDS epidemic generated a condom-centric body of research that focuses on how and why couples use the male condom, as this is the only form of contraception that prevents against HIV. The male condom is a dual-protector, meaning that it can protect against both HIV and pregnancy (Maharaj 2001); however, this dualism is not reflected in much of the research. For example, many scholars are perplexed by the persistently low rates of condom use in SSA (particularly in marriage), despite widespread knowledge that the condom can prevent HIV transmission (Adetunji 2000) and that over one half of HIV infections occur within marriage (Dunkle et al. 2008); yet, these studies often do not look at fertility preferences in accord with condom use. How couples perceive condoms, whether as a method of contraception or for HIV prevention, and their ensuing likelihood to use them, began to enter the conversation only in the last decade or so (see Akwara, Madise, and Hinde 2003; Ali, Cleland, and Shah 2004; Anglewicz and Clark 2013; Maharaj and Cleland 2004; Maharaj 2001; Tavory and Swidler 2009; Westercamp et al. 2010). Notable studies have asked why rates of condom use in marriage are so low (see for example Anglewicz and Clark 2013), but few have contextualized condom use within a range of family planning behaviors and preferences.

In SSA, the HIV/AIDS epidemic permeates innumerable aspects of an individual’s life and consciousness, including relationship decision-making that is broader than the solitary goal of trying to avoid AIDS (Watkins 2004). HIV prevention is, in fact, intricately linked to child-bearing preferences and behaviors. Researchers in Malawi have found that one’s uncertainty of their HIV status matters for childbearing behaviors, particularly spacing of births, with more uncertain individuals reporting a desire to accelerate childbearing (Trinitapoli and Yeatman 2011). The importance of contraceptive choice is further exemplified by the current research on the relationship between hormonal contraceptives and increased HIV risk. Recent clinical studies suggest an association between hormonal contraception use and increased HIV acquisition, infectivity, and multi-drug interaction (Morrison and Nanda 2012; Phillips, Curtis, and Polis 2013; Polis, Phillips, and Curtis 2013; Polis et al. 2014, 2013; World Health Organization 2010). Thus, family planning researchers in SSA need to look at use of both the male condom and hormonal contraception in accordance with fertility preferences that are shaped by the experience of a persistent AIDS epidemic.

Research on contraceptive use and family planning has undergone two recent transitions from (1) the individual-level to the couple-level and (2) cross-sectional to longitudinal. These shifts allow researchers to ask more relationally-oriented research questions and to contextualize family planning behaviors within the life course. The previous absence of couple-level data in SSA has

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1 The possible increase in infectivity due to hormonal contraceptive use is unlikely to be visible at the individual level because respondents are unlikely to be aware of its possibility; however, hormonal contraceptive use trajectories can be potentially informative for future studies interested in understanding the levels of HIV infectivity across stages of relationships.
precluded supra-individual analyses of how family planning is negotiated within relationships. Many researchers agree that decision-making about family planning should be studied at the couple-level (Becker 1996; Miller et al. 2004), but very few have actually done so and even fewer have done so longitudinally. Studies of family planning in SSA need to be repositioned into a time-oriented social context that accounts for couple-level negotiations amid an ever-changing milieu shaped largely by the AIDS epidemic and the subsequent transitions in contraception availability and accessibility.

**Life Course and Fertility**

Despite the known connections between fertility behaviors and life course transitions, very little research has looked at family planning from a life course perspective. Pointing to the interdependent, dynamic nature of fertility decision-making, a recent study (i.e. Huinink and Kohli 2014) urges fertility researchers to move deliberately towards a life-course centered approach. The interdisciplinary Theory of Conjunctural Action (TCA) acknowledges that decisions surrounding contraception and conception are “embedded in an individual life course, which is further embedded in the macro-structures of time and place” (Johnson-Hanks et al. 2011). The life course can be considered a “multilevel phenomenon, ranging from structured pathways through social institutions and organizations to the social trajectories of individuals and their developmental pathways” (Elder 1994: 5). Though a complex perspective, Alwin (2012:217) outlines a five-part typology of life course in research; this project focuses on the third use: “the life course as events, transitions, and trajectories.”

Most of the research on family planning and fertility addresses questions in a cross-sectional, individual-level context. Only recently is family planning beginning to be conceptualized as phenomena that are unique to couples and sensitive to relationship transitions. A few key methodological developments provided the opportunity for fertility researchers to engage in studies of the life course. Approaching fertility expectations in the US from a life course perspective, Hayford (2009) finds that, indeed, women’s fertility expectations change over their life course and that four distinct fertility expectation trajectories emerge according to a life course framework. The shift towards a life course perspective is crucial, as “social forces, both structural and cultural, are articulated in the life-course dimension, and the individuals who act under their influence conceive of their actions in –more or less explicit and extended- life-course terms. Thus, theories of fertility need to be set in these terms as well” (Huinink and Kohli 2014: 1295). However, the life course approach is underrepresented in fertility studies, particularly in sub-Saharan Africa. A life course perspective on family planning is needed, as this approach acknowledges that preferences and behaviors are firmly embedded within relationship trajectories.

Approaching fertility from the life course perspective not only calls for the analysis of “events, transitions, and trajectories” (Alwin 2012, 217) but also necessitates doing so dyadically. Decisions surrounding family planning rarely involve one person alone but tend to be joint decisions influenced by gender, relationship status, alignment of preferences, and (I argue) relationship transitions which are embedded in relationship trajectories that give them meaning and form (Alwin 2012: 212; Bauer and Kneip 2013; Miller et al. 2004; Dodoo 1998). Each couple follows a trajectory comprised of family planning transitions and events – some unique and some
shared — that define their fertility trajectories. These trajectories shift and transition as relationships progress or regress.

Couples’ family planning trajectories are also situated within a broader social context, shaped by cultural and community-level influences. Social forces, operating externally to the couples, produce similarities and dissimilarities across couples over time. Aisenbrey and Fasang (2010) outline a typology of life course patterns, emphasizing (1) variation, or complexity, within a life course and (2) variation, or distances, between life courses. In other words, a life course approach to family planning requires examining the complexity of family planning behaviors for couples across time and comparing these couple-level trajectories across couples, identifying systematic differences and similarities in the navigation of family planning behaviors and intentions throughout a relationship.

My current project applies the life course perspective, broadly, to a particular stage in the life course, focusing on family planning patterns during young adulthood. In Malawi, individuals experience family planning transitions quite rapidly. Young women, on average, first have sex at age 17, experience their first marriage a year later, at age 18, and tend to birth their first child within a year, around age 19 (National Statistical Office and ICF Macro 2011). Many of the decisions surrounding family planning and formation occur in these condensed years of young adulthood, so analyzing family planning behaviors in Malawi using one stage in the life course, young adulthood, is quite appropriate. Additionally, many young adults are expected to follow this normative life course pattern. As suggested by TCA, “many people, particularly in high-fertility countries, conflate female and adult identity with motherhood and parenthood. Specifically, in such contexts, teenage girls desire to become adult women, a status that entails having children” (Johnson-Hanks et al. 2011:64). Conceptualizing family planning behaviors within the context of the relationship and the life course allows for the contextualization of family planning behaviors within a setting shaped by the normative patterns and behaviors that are expected and experienced by young Malawian couples.

In this project I ask two questions, both of which fit neatly into a couple-centered, life course approach. First, what are the typical patterns of family planning as couples transition through a relationship? And second, how are family planning trajectories related to couple-level characteristics, particularly couple-level alignment and transitions in fertility preferences, family planning intentions, and relationship stage, as well as more stable characteristics such as age and education? I use unique, intensively-longitudinal, couple-level data from Malawi to explore these research questions.

**STUDY CONTEXT**

The Southeastern African country of Malawi offers a distinct study context for exploring the question of family planning transitions. Malawi is characterized by a fertility climate that is different from the well-known Western context. Marriage and childbearing are nearly universal and fertility remains high in Malawi, though some researchers note that a slow fertility transition is underway (Bongaarts 2008; National Statistical Office and ICF Macro 2011). On average, women have six children, with about three years between each birth (National Statistical Office and ICF Macro 2011). As mentioned before, transitions between life course events occur rapidly for young
adults in Malawi with women, on average, experiencing their first sex, first marriage, and first child within a period of three years and, generally, before the age of 20 (National Statistical Office and ICF Macro 2011).

In Malawi, knowledge of contraceptive use for family planning is universal with 98 percent of women and 99 percent of men reporting knowledge of modern methods of contraception (National Statistical Office and ICF Macro 2011). However, knowledge does not equate to use as rates of use across the different types of contraceptive method vary greatly. For example, almost 50 percent of women report ever using injectables while only 18 percent report ever using a male condom (National Statistical Office and ICF Macro 2011). Researchers have found that there are also strong attitudinal aversions to certain types of contraception, such as the male condom, with a suggestion of condom use in marriage indicating distrust and use being associated with decreased sensuality (Tavory and Swidler 2009).

Malawi has been especially hard hit by the AIDS epidemic and researchers have noted that Malawi’s AIDS crisis is one of the world’s most severe (National Statistical Office and ORC Macro 2005). In 2010, around 10 percent of Malawi’s adult population was HIV positive, with women showing higher rates of seropositivity than men (National Statistical Office and ICF Macro 2011). For married men and women, the percentage of HIV positivity is almost triple that of never married individuals (National Statistical Office and ICF Macro 2011), an important indicator of the potential linkages between HIV/AIDS, fertility behaviors, and relationship status. Due in large part to this epidemic, the life expectancy at birth is only is only 48.3 years for men and 51.4 years (National Statistical Office 2008). Morbidity and mortality are high for those who contract HIV leading to a shortened stage of life where family planning and childrearing take place.

Overall, Malawi provides an exceptional context for answering the research questions above. Relationship transitions occur at a rapid pace and many Malawians are planning for marriage and children by the time they enter young adulthood. While contraceptive education is extensive and many methods are easily obtained, the use of contraception varies enormously. The data used in this study provide the opportunity to look at these processes, not only within the unique context of Malawi, but also in a longitudinal and dyadic fashion.

DATA & METHODS

Tsogolo la Thanzi (TLT)

The data for this study come from the research project Tsogolo la Thanzi (TLT), which means “healthy futures” in Chichewa. TLT aims to examine the ways in which young adults navigate reproduction and the transition to adulthood amidst an AIDS epidemic. At baseline, female respondents (ages 15-25) were randomly selected based on a complete household listing in census enumeration areas within 7 kilometers of the district capital, Balaka. The randomly selected sample of 1,505 women were interviewed at wave one and then followed at four-month intervals between 2009 and 2012 (8 waves). TLT successfully recruited over 96 percent of female respondents for the baseline interviews; interviews were conducted in private rooms at TLT’s centrally-located research center.
At each of the eight waves, female respondents were asked to report on their sexual and romantic partners. For each of the romantic partners they reported in their interview, female respondents were given tokens, which they then gave to their male partners. The male partners brought these tokens to the TLT research center, enrolled in the study, and completed a full interview at that wave and at each subsequent wave. Staff at the TLT center then matched the female interview with her partner’s interview to create the unique couple-level dataset I leverage here. This method of partner recruitment generated a dataset of 792 couples that contribute 6,324 couple-waves (defined as the number of waves contributed by the couples) over the course of the study. There are two important points to make regarding this sample of couples. Due to the fact that females could recruit their partner at any wave of the study, some males enter the study at later waves and some relationships dissolve before the study is complete. Additionally, women were not restricted to reporting one partner, either concurrently or subsequently, so about 8 percent of women in my study are linked to more than one partner during the observational period.

**Sequence Analysis**

My research questions are explored using sequence analysis as a tool to visually map patterns of family planning for couples across time. What originally began as a method of DNA analysis in the natural sciences has evolved into a distinguished data reduction technique for longitudinal data, which is particularly well-suited for life course analysis (Aisenbrey and Fasang 2010). Abbott spearheaded SA for the social sciences in the early 1990s, stating that the discipline is “turning from units to context, from attributes to connections, from causes to events”, pointing to a shifting paradigm leaning towards life course focused analyses that looks at whole sequences rather than single events at discrete points in time (Abbott 1995:93). This aspect of my study is highly valuable due to the understudied nature of my research questions and the lack of life course perspective in fertility studies; the visualized sequences will help establish the importance of studying family planning as a dynamic process, operating within and between couples.

My particular use of sequence analysis is ideal for conceptualizing, visualizing, and analyzing life course patterns. Aisenbrey and Fasang (2010) describe sequence analysis as both theoretically and methodologically appropriate for life course research:

> Theoretically, sequence analysis is a suitable approach for the analysis of one of the core concepts in the life course, the trajectory […] Methodologically, sequence analysis provides the possibility to approach data without any distributional assumptions, and its exploratory potential is particularly well suited to analyzing nonstandard and “outlier” life courses. (p. 450)

My application of sequence analysis represents an important step in bringing a life course approach to fertility studies, as urged by Huinink and Kohli (2014), and displays both the complexity within and differences between trajectories.

I leverage sequence analysis tools in service of a set of analyses that proceed in four parts: (1) description, (2) visualization, (3) comparison, and (4) grouping (Brzinsky-Fay, Kohler, and Luniak 2006:436). The first step entails identifying six, mutually-exclusive states of family planning:
antinatal nonuse, pronatal nonuse, hormonal only, condoms only, hormonal and condoms, and pregnant. These states make up what is called, in sequence analysis, an “element variable,” described in more detail below. I sequence these states for all 792 couples across the course of their relationship, creating what I refer to as “family planning trajectories,” which can be visualized using sequence index plots. Shifting from descriptive to analytical, I use optimal matching, a technique to measures the distance between sequences based on the weighted number of insertions, deletions, and substitutions it would take to make one sequence look like another. I set the insertion-deletion costs to 1.75 and the substitution costs to 2, as to not penalize sequences for their length or ordering (Brzinsky-Fay et al. 2006). Lastly, I use the output from the optimal matching (i.e. a dissimilarity matrix) to cluster the sequences and identify underlying groups of trajectories. Importantly, I use substantive meaning and theoretical guidance to name and analyze the six clusters identified in this study.

In this study, I employ these tools of sequence analysis to examine how couples navigate family planning across their relationships. I use sequence analysis plots and clustering to visualize the complexities in family planning behaviors and intentions. Using the tools of sequence analysis allows me to search for similarities in family planning trajectories, while contextualizing family planning behaviors within relationships and the life course.

MEASURES

The element variable in my analysis is made up of six states of family planning. I measure family planning by identifying family planning states that factor in contraceptive use behaviors, the biological state of pregnancy, and preferences about childbearing. All six states are based on the female’s report. The first two states capture contraceptive nonuse (about a third of couple-waves are spent in this state) but differ according to stated fertility intentions. The antinatal nonuse state includes couples who are not using any contraception and who do not want another child in the next two years or sooner. Couples who are not using contraception and do want another child in the next two years or sooner fall under the second state: pronatal nonuse.

The next three states relate to contraceptive use and make up about half of all couple-waves. Condoms only refers to couples who report having used condoms at least once during their last three instances of sexual intercourse but are not using another form of contraception. Hormonal only refers to couples using hormonal contraception (mainly injectables) and who are not using condoms. Couples who are using condoms while also using hormonal contraception fall under the condoms and hormonal state. I treat pregnancy as its own state, classified by pregnancy biomarker data TLT collected at each wave. Around 20 percent of couple-waves are spent pregnant.

The cluster analysis portion of my study considers individual and couple-level characteristics to distinguish between the clusters. These variables are displayed in Table 4 (see page 20), with asterisks indicating the variables that are allowed to vary across the relationship and are thus measured as percent or mean of couple-waves; all other variables measure the mean value at baseline. In regards to general demographics, I look at female’s age (ranging from 15 to 28 years; \( \bar{x} = 20.70 \)) and years of education (ranging from 0 to 14; \( \bar{x} = 7.05 \)). In order to identify relationship-level dissimilarities, I include couple-level measures of these two variables, which are calculated by
subtracting the female’s value from the male’s. I include a measure of the normed distance (in kilometers) from the town center, which proxies as a measure of rurality, with greater values indicating residence in a more rural village. In an attempt to get at poverty versus affluence, I include a measure that indicates the percent of couples who have an iron or cement roof, which are considered the more expensive and nicer roofs, generally available only to people who can afford them.

Descriptive variables of the relationship include the percent of couples who experience a relationship status change throughout the course of the study, the percent of couples who enter the study with a relationship duration of one or more years, and the percent of couple waves spent in a specific relationship status (i.e. married, cohabiting, steady boyfriend/girlfriend, new boyfriend/girlfriend, infrequent partner, and one-night stand). Additionally, I identify the percent of couples that entered the study already married and the percent that become married over the course of the study.

I examine a number of variables related to fertility preferences and behaviors. In order to address a woman’s attitude towards pregnancy, I use a variable that asks, “If you found out you were pregnant next month, would that news be: Very bad, fairly bad, neither good nor bad, fairly good, or very good?” The responses range from 1 (very bad) to 5 (very good). I also include a measure that identifies the percent of couple-waves with a 2 or more unit difference in scores on the pregnancy variable between the two partners. I include measures of the female’s ideal family size (IFS). Non-numeric and don’t know responses make up only 1 percent of responses and are coded as missing. Additionally, I report the percent of couple-waves in which there is a 2 or more child difference in male’s and female’s IFS. I suspect parenthood plays an important role here, so I include a measure indicating the percent of couples who enter the study with at least one child.

RESULTS

The first part of my analysis is largely descriptive and provides insight into the patterns of family planning most commonly utilized by young couples in Malawi. Sequence analysis, the second part of this study, allows for descriptions and visualizations of the types of patterns, as well as the frequency and distribution of these patterns across couples. I use cluster analysis to group together similar trajectories of family planning. I proceed to describe these clusters and the types of couples that tend to follow certain patterns of family planning.

Descriptives

Figure 1 serves as an introduction, providing a snapshot of family planning behaviors for all women at baseline, some of whom do not appear in the couple-level data, as they may not have recruited their partner, may not have had a partner at the time, or their partner may not have completed the interview. It is crucial to emphasize that Figure 1 is a representation of a single point in time. We see in Figure 1 that 60 percent of women report being sexually active at baseline and about three-fourths of these women are married or cohabiting with their partner. In comparison, about 80 percent of the couples in my analytic sample are married at baseline and this proportion varies slightly by wave. For all sexually active women at baseline, rates of contraceptive use vary by type of contraception and relationship status, with about the same proportion of married and
unmarried women reporting using contraception (about two-thirds), but the rates of condom use and hormonal contraceptive use differ between these two groups. The lower rate of condom use and higher rate of hormonal contraception use in marriage is consistent with my sample of couples.

The contraceptive use tree seen in this figure only shows family planning behavior for women at baseline. It does not account for any couple-level characteristics or relationship status changes and, as I argue here, it is missing important changes in family planning behaviors over time. In order to identify these changes and to address them at the couple-level, I begin by looking at the family planning states across the eight waves for all matched couples in the study.
**Figure 1. Contraceptive Use Tree, All Women at Wave 1**

All Wave 1 Women

- **Currently sexually active**
  - Married/Cohab: 681 (74.6%)
  - Using Contraception: 451 (66.23%)
    - Pronatal: 54 (23.58%)
    - Antinatal: 175 (76.42%)
  - Not Using Contraception: 230 (33.77%)
    - Pronatal: 9 (10.59%)
    - Antinatal: 76 (89.41%)

- **Not sexually active**
  - Married/Cohab: 232 (25.4%)
  - Using Contraception: 147 (63.36%)
    - Pronatal: 9 (6.2%)
    - Antinatal: 76 (83.8%)
  - Not Using Contraception: 85 (36.64%)
    - Pronatal: 9 (8.6%)
    - Antinatal: 76 (91.4%)

- **Ever Use Condoms**
  - Yes: 313 (69.40%)
    - Using other method: 136 (45.95%)
      - Injectables: 108
      - Pill: 7
    - Not using other method: 160 (54.05%)
      - Pill: 7
      - Injectables: 108
      - Other: 21
  - No: 138 (30.60%)
    - Other: 15
    - Pill: 3
    - Injectables: 120

- **Never had sex**
  - 426 (28.3%)

- **Missing**
  - 18 (0.02%)

- **Never Use Condoms**
  - 9 (6.12%)
    - Other: 4
    - Injectables: 5
    - Pill: 2

- **Consistent Condom Use**
  - 48 (32.65%)
    - Using other method: 7 (16.67%)
      - Injectables: 5
      - Other: 2
    - Not using other method: 35 (83.33%)
      - Injectables: 5
      - Other: 21

- **Inconsistent Condom Use**
  - 90 (61.22%)
    - Using other method: 7 (11.84%)
      - Injectables: 5
      - Other: 2
    - Not using other method: 83 (88.16%)
      - Injectables: 5
      - Other: 21

- **Not using other method**
  - 35 (83.33%)
    - Pill: 7
    - Injectables: 108
    - Other: 21
The distribution of the family planning states across all waves can be seen in Table 1, below. Table 1 shows us that the smallest state of family planning is the condoms and hormonal use state, with only 3 percent of couple-waves, at most, spent in this state, suggesting that very few couples are utilizing dual-protection consistently. The second smallest group is condom-only users. At any given wave, less than 10 percent of couple-waves are identified as condom only use. While this is larger than the condoms and hormonal state, the size of the condoms only state is still quite small, with only 1 in 10 couple-waves spent using condoms alone.

More than a third of couple-waves are spent in the hormonal-only state. Additionally, about a third of the couple-waves are identified as "nonuse", or not using any contraception. A majority of the waves spent not using contraception are also identified as antinatal – suggesting that these couples do not want a child in the near future. Pregnancy accounts for around 20 percent of couple-waves and this number decreases across time. Table 1 shows that the proportion of couples within each state remains relatively consistent across the eight waves. This could suggest two things: (a) that couples are not changing their family planning behaviors; or, (b) that couples are moving in and out of different categories of family planning over time. I use the tools of sequence analysis to parse out the answer to these questions by modeling couples’ family planning behaviors across the course of their relationships, allowing variation at each wave.

<table>
<thead>
<tr>
<th>Table 1. Family Planning State by Wave, Percents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave (%)</td>
</tr>
<tr>
<td>1   2   3   4   5   6   7   8</td>
</tr>
<tr>
<td>Antinatal nonuse</td>
</tr>
<tr>
<td>Pronatal nonuse</td>
</tr>
<tr>
<td>Condoms Only</td>
</tr>
<tr>
<td>Condoms and Hormonal</td>
</tr>
<tr>
<td>Pregnant</td>
</tr>
<tr>
<td>N    403 521 577 587 585 629 603 616</td>
</tr>
</tbody>
</table>

**Sequence Analysis**

A simple breakdown of the sequences shows that most of the sequences are unique, meaning that most of the sequences are only observed once in the data. A minority of the sequences are shared, with about 5 percent of the sequences (n=44 sequences) shared by two couples and around 2 percent of the sequences (n=20 sequences) shared by three couples. A majority of the couples in this study have unique patterns of family planning, meaning that for a majority of the couples, no two couples’ trajectories are alike. It is important to note that comparisons across sequences take into account both the states of family planning and the length of the sequence. Four specific examples of these family planning sequences can be seen in Figure 3, below.

The left hand side of Figure 2 displays the color-coded family planning states. The colors used for these states remain consistent throughout the rest of this paper. The first partnership, Couple #1, lasts throughout all eight waves of the study. This couple provides an example of a family planning trajectory that is quite varied with multiple transitions occurring. Couple #1 begins by using both condoms and hormonal contraception, transitions into hormonal contraception in
wave 2, and does not use contraception for the remainder of the study (waves 3 through 8) with most of these waves identified by a pronatal attitude, with the exception of wave 7, in which the couple does not want a baby in the next two years. Couple #2's consistency of use juxtaposes the variation in Couple #1's trajectory. Couple #2 exhibits quite consistent family planning behaviors throughout the duration of their relationship. This couple’s relationship ends in wave 6, but up until that point they are using hormonal contraception at each of the waves.

The last two examples, Couples #3 and #4 are unique and important to this study. The same woman is the female partner in both of these couples. She is partnered with one male in waves 3 and 4, but their relationship ends and she transitions into another partnership at wave 5 with a different male partner. Importantly, we see that this woman displays different family planning behaviors in each of the partnerships. In her first partnership she is using hormonal contraception consistently. Yet, in her next partnership she begins the partnership not using contraception but not wanting a child. At wave 6, they exhibit condom use, yet at wave 7 she tests positive for pregnancy. Patterns of family planning behavior are dependent upon both the couple and the individuals who make up the couple, with this woman showing drastically different behaviors in two subsequent couplings. These last two couples are an interesting example of not only variation within couples, but also variation across couples for the same woman, showing that family planning is largely couple-based, not woman-based.

Figure 2, above, serves as an introduction to Figure 3, below, which aggregates the trajectories for all 792 couples. Again, the six colors represent the different states of family planning, as seen in the key to the right of the sequence index plot. The y-axis counts the number of couples represented in the graph and the x-axis shows the TLT waves. Essentially, these are the family planning trajectories for every couple in the study.

At first glance, the hormonal only category (light blue) overwhelms the graph, with many of the couples appearing in this stage at all waves or moving in and out of hormonal contraceptive use. It is also clear that many couples practice other forms of use or nonuse. Almost half of the couples enter the study at later waves; hence, the large white area at the bottom of the graph. Also, couples have sequences (i.e. relationships) of varying lengths. Despite the apparent heterogeneity in
patterns of family planning, sequence analysis allows us to look for similarities and match couples on these similarities in use through cluster analysis which will be explored in the next section.

Figure 3. Sequence Index Plot for All Couples

Figure 3 illustrates two points: first, that very few couples follow the same family planning trajectories as other couples; second, that few couples spend their entire trajectory in a single family planning state. Below, Table 2, shows us that, indeed, less than one in five couples (~16 percent) display consistent family planning behavior across the duration of their relationship in the study, a maximum of three years. The vast majority of couples (71.3 percent) are inconsistent in their family planning behaviors across the duration of the study. The remaining 12.6 percent of couples only contribute one wave and, thus, cannot be considered consistent or inconsistent.

Only about 4 percent of couples remain consistently in a state of nonuse throughout their time in the study, and this is split evenly between antinatal and pronatal nonuse. The state that sees the most consistent use is hormonal contraception, with almost 8 percent of couples using hormonal contraception at every wave that they appear in the study. Additionally, these are longer relationships, on average, with about 5 couple-waves contributed by these consistent hormonal users. The state with the least amount of consistent use across relationships is the dual protection state, condoms and hormonal, with less than 1 percent of couples spending the duration of their relationship using both condoms and hormonal. Those who do use dual protection consistently tend to be represented in this dataset by shorter relationships, lasting on average only 2 waves.
Looking at all 792 couples using sequence analysis helps visualize two things: (1) very few couples are alike in their family planning behaviors, with less than 10 percent of couples sharing sequences with other couples, and (2) couples exhibit a lot of complexity in their family planning behaviors across the duration of their relationship, as only 16 percent of couples exhibit consistent family planning behaviors across their contributed waves.

The next step in my analysis helps expand on these two points to find six underlying groups of young adult couples who are engaging in family planning in similar ways.

### Content of Clusters

Using Ward's hierarchical clustering, I classify couples into six distinct clusters that share similar family planning patterns. Figure 4, below, displays the sequence index plots for each of the six clusters. After close examination of the clusters, I labeled them as following: (1) Childbearing Consistent Users, (2) Married Spacing, (3) Transitory, (4) Pursuing Conception, (5) Unmet Need, and (6) In Transition. Some of the clusters display more consistent use of contraception, while others display more erratic patterns of use. The sequence analysis confirms and helps visualize that very few couples exhibit strictly consistent use across all of their couple-waves, but that broad similarities in family planning behaviors do exist.

<table>
<thead>
<tr>
<th></th>
<th>% of Couples</th>
<th>N</th>
<th>Average # waves contributed by these couples</th>
<th>Range of waves contributed by these couples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inconsistent Family Planning States</td>
<td>71.3</td>
<td>577</td>
<td>6.0</td>
<td>2 8</td>
</tr>
<tr>
<td>Consistent Family Planning States</td>
<td>16.1</td>
<td>115</td>
<td>4.0</td>
<td>2 8</td>
</tr>
<tr>
<td>Antinatal Nonuse</td>
<td>1.9</td>
<td>14</td>
<td>2.9</td>
<td>2 6</td>
</tr>
<tr>
<td>Pronatal Nonuse</td>
<td>1.9</td>
<td>13</td>
<td>3.4</td>
<td>2 8</td>
</tr>
<tr>
<td>Condoms Only</td>
<td>2.7</td>
<td>20</td>
<td>3.5</td>
<td>2 8</td>
</tr>
<tr>
<td>Hormonal Only</td>
<td>7.8</td>
<td>55</td>
<td>5.1</td>
<td>2 8</td>
</tr>
<tr>
<td>Condoms &amp; Hormonal</td>
<td>0.3</td>
<td>2</td>
<td>2.0</td>
<td>2 2</td>
</tr>
<tr>
<td>Pregnant</td>
<td>1.4</td>
<td>11</td>
<td>2.1</td>
<td>2 3</td>
</tr>
<tr>
<td>Contribute 1 Wave Only</td>
<td>12.6</td>
<td>100</td>
<td>1.0</td>
<td>1 1</td>
</tr>
</tbody>
</table>

| N | 100.0 | 792 |

Looking at all 792 couples using sequence analysis helps visualize two things: (1) very few couples are alike in their family planning behaviors, with less than 10 percent of couples sharing sequences with other couples, and (2) couples exhibit a lot of complexity in their family planning behaviors across the duration of their relationship, as only 16 percent of couples exhibit consistent family planning behaviors across their contributed waves. The next step in my analysis helps expand on these two points to find six underlying groups of young adult couples who are engaging in family planning in similar ways.

### Content of Clusters

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---

2 See Appendix A for larger and clearer sequence index plots for each individual cluster.
Table 3. Distribution of Clusters

<table>
<thead>
<tr>
<th>Clusters</th>
<th>Couple-Waves</th>
<th>Couples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Childbearing Consistent Users</td>
<td>800</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>12.7%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Married Spacing</td>
<td>1,096</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>17.3%</td>
<td>17.3%</td>
</tr>
<tr>
<td>Transitory</td>
<td>1,224</td>
<td>153</td>
</tr>
<tr>
<td></td>
<td>19.4%</td>
<td>19.3%</td>
</tr>
<tr>
<td>Pursuing Conception</td>
<td>328</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>5.2%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Unmet Need</td>
<td>1,104</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>17.5%</td>
<td>17.4%</td>
</tr>
<tr>
<td>In Transition</td>
<td>1,772</td>
<td>223</td>
</tr>
<tr>
<td></td>
<td>28.0%</td>
<td>28.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,324</strong></td>
<td><strong>792</strong></td>
</tr>
</tbody>
</table>

Table 3 displays the distribution of couples across these clusters. The values are expressed in couple-waves (i.e. the number of waves each couple spent in each cluster) and in the total number of couples that fall into each cluster. The smallest cluster is the Pursuing Conception cluster with only about 5 percent of the couple-waves in this cluster. The largest cluster, the In Transition cluster, contains 28 percent of the couple-waves. These are couples that experience many shifts in use of contraception, as can be seen from the colorful variation in the sequence index plot for this cluster. Additionally, most of these relationships last only a few waves, as seen from the large amount of white space in the sequence index plot.

The remaining four clusters fall in between the size of the above mentioned clusters. The Transitory cluster contains almost 20 percent of couple-waves, the Childbearing Consistent Users make up about 13 percent of couple-waves, the Unmet Need are around 18 percent of couple-waves, and the Married Spacing contain about 17 percent of the couple-waves.

The sequence index plots, in Figure 4, are visual representations of sequences contained in the six clusters. Most of the Childbearing Consistent Users start out pregnant (the grey blocks on the left side of the index plot) and then transition into relatively consistent hormonal contraceptive use after their pregnancy. Many of the dark purple blocks (antinatal nonuse) appear to follow a pregnancy. These couples can be expected to be experiencing lactational amenorrhea after their recent pregnancy and, hence, are not using contraception.
The Married Spacing sequence index plot is made up of couples who use hormonal contraception a majority of the time, as seen by the heavy presence of light blue in the plot. While these couples do show some variation in use, they remain relatively stable in their use of hormonal contraception across time and seem to be doing so as a spacing technique, as the vast majority of women in this cluster have at least one child at baseline. These also appear to be more stable and longer relationships, as suggested by the lack of white space in rows of the sequence index plot.

Most of the couples who are using condoms (identified by yellow lines) appear in the third cluster: the Transitory cluster. Couples that appear in this cluster tend to have shorter relationships and more variable contraceptive use. Of the couples not using contraception in this group, many of them do not want more children in the near future, as indicated by the presence of the dark purple in the sequences. The Pursuing Conception cluster is the smallest cluster. The sequence index plot shows that these couples spend a majority of their relationship wanting a child in the next two years and not using contraception; however, very few of these couples actually become pregnant during the study, as identified by the lack of light grey in this plot.

The couples in the Unmet Need cluster spend a lot of their couple-waves pregnant. When not pregnant these couples shift a lot between use and nonuse of contraception, as well as shifting between types of contraception. The relatively large presence of the antinatal nonuse state could
suggest that many of these pregnancies were unexpected or unplanned. Looking at this state within the couples’ trajectories allows for the identification of two unique forms of unmet need. By sequencing the states, we can see that antinatal nonuse both precedes and follows pregnancy in this cluster. When antinatal nonuse precedes pregnancy, it can be clearly identified as unmet need, as this nonuse resulted in an unwanted pregnancy. Antinatal nonuse that follows a pregnancy may, in fact, be better characterized as lactational amenorrhea. The tools of sequence analysis that allow for the ordering of states help to see these important distinctions.

Lastly, the In Transition cluster are a group of couples with many transitions between use, nonuse, and types of contraception used, as well as being identified by shorter relationship duration. This cluster does not have one identifying family planning pattern that stands out – yet, this very fact is the identifying feature: these couples experience a lot of contraceptive use change and, arguably, a lot of relationship transitions, as many of their relationship durations are quite short.

Although the clustering of these groups is based solely on the family planning variable, we see that they generally form around life stage as related to marriage and family formation. Four of the six clusters consist mainly of couples that enter the study already married (see Figure 5, below). These four clusters represent four general family planning trajectory patterns for married couples in this study. While these four clusters do not vary much in relationship status, there are other defining characteristics that I will discuss in the subsections below. Less than half of the remaining two clusters (i.e., Transitory and In Transition) consist of couples that begin the study already married; many of these couples have not yet transitioned into marriage or family formation, many of them being in the early stages of dating and not engaging in consistent family planning behaviors. These two clusters experience more relationship transitions and generally tend to capture more couples at the beginning of their relationships that tend to be dating and do not enter marriage during the duration of the study. These two unique clusters are described in more detail following the married clusters, below.
Composition of Clusters

The Childbearing Consistent Users Cluster

The Childbearing Consistent Users cluster is a cluster of 100 couples who largely start out pregnant but then transition into hormonal contraception use. The vast majority of these couple waves are spent married, so there is very little variation in relationship status for these couples. Over half of the couple-waves are spent using hormonal contraception and a quarter of the couple-waves are spent pregnant. In terms of the general demographics shown in Table 4 (see page 20), the couples in the Childbearing Consistent Users cluster are about average. They do not stand out from other couples in regards to age or education. The average age for male partners is 26 years old and for females, 21. On average, the male and female in these couples are about 6 years apart in age. Females in these couples have almost 7 years of education and their male partners, on average, have almost two more years of education.

A vast majority of these couples identify as married, with 96 percent of the couple-waves spent in a married state and 72 percent of the couples entering the study with a relationship duration of more than a year. The remaining relationship stages are shared between steady boyfriend/girlfriend (3 percent of couple-waves) and infrequent partner (1 percent of couple waves). On average, each of the couples in this cluster contribute almost 7 waves to the study. Over half of the couple-waves are spent using some form of contraception (57 percent). A vast majority of these waves are spent using hormonal contraception, as condoms are used in only 4 percent of the couple-waves. This cluster has the third highest occurrence of pregnancy with 21 percent of the couple-waves spent pregnant; however, this cluster scores the lowest on the pregnancy attitude scale (i.e. 1.6 on a scale ranging from 1 (very bad) to 5 (very good)), suggesting that many of these couples may desire to delay their next pregnancy. Only 69 percent of the couples entered the study with at least one child, suggesting that this cluster captures some first births. Overall, this cluster is characterized by married couples with higher rates of pregnancy transitioning into high rates of hormonal contraception use.
Table 4. Descriptives of the 6 Clusters, means at baseline wave

<table>
<thead>
<tr>
<th>Clusters</th>
<th>CC Users</th>
<th>M Spacers</th>
<th>Pursuing C</th>
<th>Unmeet Need</th>
<th>In Tran</th>
<th>Transitory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norm Distance from research center (kilometers)</td>
<td>0.34</td>
<td>0.07</td>
<td>0.14</td>
<td>0.36</td>
<td>-0.01</td>
<td>-0.05</td>
</tr>
<tr>
<td>Percent with iron sheets or cement roof</td>
<td>0.32</td>
<td>0.44</td>
<td>0.63</td>
<td>0.36</td>
<td>0.77</td>
<td>0.81</td>
</tr>
<tr>
<td>Female’s years of education</td>
<td>6.70</td>
<td>6.70</td>
<td>6.87</td>
<td>6.41</td>
<td>7.25</td>
<td>7.96</td>
</tr>
<tr>
<td>Difference in years of education (male-female)</td>
<td>1.47</td>
<td>1.51</td>
<td>1.53</td>
<td>1.06</td>
<td>1.63</td>
<td>0.90</td>
</tr>
<tr>
<td>Female’s age</td>
<td>20.69</td>
<td>21.78</td>
<td>21.68</td>
<td>20.68</td>
<td>20.36</td>
<td>20.37</td>
</tr>
<tr>
<td>Age difference (male-female)</td>
<td>5.66</td>
<td>5.57</td>
<td>6.74</td>
<td>4.71</td>
<td>3.98</td>
<td>4.84</td>
</tr>
<tr>
<td>Average # of waves contributed per couple</td>
<td>6.88</td>
<td>7.52</td>
<td>7.19</td>
<td>6.85</td>
<td>3.00</td>
<td>2.68</td>
</tr>
<tr>
<td><strong>Relationship Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience at least one relationship status change</td>
<td>0.14</td>
<td>0.05</td>
<td>0.07</td>
<td>0.12</td>
<td>0.61</td>
<td>0.28</td>
</tr>
<tr>
<td>Rel. duration more than 1 year at baseline</td>
<td>0.72</td>
<td>0.90</td>
<td>0.85</td>
<td>0.80</td>
<td>0.54</td>
<td>0.66</td>
</tr>
<tr>
<td>Married/Cohabit*</td>
<td>0.96</td>
<td>0.99</td>
<td>0.95</td>
<td>0.92</td>
<td>0.63</td>
<td>0.54</td>
</tr>
<tr>
<td>Steady Boyfriend/Girlfriend*</td>
<td>0.03</td>
<td>0.01</td>
<td>0.05</td>
<td>0.08</td>
<td>0.32</td>
<td>0.39</td>
</tr>
<tr>
<td>New Boyfriend/Girlfriend*</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Infrequent partner*</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>One-night Stand*</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.001</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Family Planning States</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antinatal Nonuse*</td>
<td>0.17</td>
<td>0.13</td>
<td>0.19</td>
<td>0.39</td>
<td>0.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Pronatal Nonuse*</td>
<td>0.05</td>
<td>0.03</td>
<td>0.64</td>
<td>0.09</td>
<td>0.13</td>
<td>0.06</td>
</tr>
<tr>
<td>Condoms Only*</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.07</td>
<td>0.10</td>
<td>0.36</td>
</tr>
<tr>
<td>Hormonal Only*</td>
<td>0.53</td>
<td>0.73</td>
<td>0.05</td>
<td>0.17</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>Condoms and Hormonal*</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Pregnant*</td>
<td>0.21</td>
<td>0.09</td>
<td>0.11</td>
<td>0.28</td>
<td>0.23</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Fertility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy attitude: If found out pregnant - very bad (1)-very good (5)*</td>
<td>1.60</td>
<td>1.80</td>
<td>4.14</td>
<td>1.95</td>
<td>2.05</td>
<td>1.59</td>
</tr>
<tr>
<td>Percent of couple-waves with 2+ unit disagreement on pregnancy attitude variable (above)*</td>
<td>0.51</td>
<td>0.44</td>
<td>0.45</td>
<td>0.59</td>
<td>0.82</td>
<td>0.81</td>
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<tr>
<td>Female’s ideal family size*</td>
<td>3.60</td>
<td>3.55</td>
<td>3.61</td>
<td>3.63</td>
<td>3.26</td>
<td>3.31</td>
</tr>
<tr>
<td>Percent of couple-waves with 2+ child disagreement in ideal family size*</td>
<td>0.32</td>
<td>0.23</td>
<td>0.25</td>
<td>0.36</td>
<td>0.69</td>
<td>0.73</td>
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<tr>
<td>Have at least one child at baseline</td>
<td>0.69</td>
<td>0.96</td>
<td>0.66</td>
<td>0.71</td>
<td>0.43</td>
<td>0.54</td>
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<tr>
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<td>1.11</td>
<td>1.76</td>
<td>1.00</td>
<td>1.02</td>
<td>0.65</td>
<td>0.86</td>
</tr>
</tbody>
</table>

| N (Couple-waves) | 800 | 1096 | 328 | 1104 | 1772 | 1224 |
| N(Couples) | 100 | 137 | 41 | 138 | 223 | 153 |

* Indicates Percent/ Mean of couple-waves

**CC Users** = Childbearing Consistent Users; **M Spacers** = Married Spacers; **Pursuing** = Pursing Conception; **In Tran** = In Transition
The Married Spacing Cluster

The Married Spacing cluster is made up of 137 couples who spend a majority of their time using hormonal contraception, likely in order to space their births, as can be seen in the sequence index plot that is mostly light blue, the color of the hormonal only state. The vast majority (96 percent) of these couples starts out married and has at least one child, suggesting that they are using hormonal contraception to delay their next pregnancy. On average, these females are the oldest of all the clusters and their partners tend to be about 6 years older than them.

Demographically, this cluster is quite similar to the Childbearing Consistent Users, although a bit older (see Table 4, above). In fact, the mean age of females in this cluster is the highest for all clusters. With an even higher proportion of the couple-waves spent in marriage (99 percent), only 5 percent of these couples experience a relationship status change throughout their relationship – this is largely due to the fact that most of these couples enter the study already married.

Compared with the above cluster, these couples are using contraception more regularly, with 75 percent of the couple-waves spent using some form of contraception. Most of the contraception used is hormonal, as very few couple-waves are spent using condoms. This cluster spends only 12 percent of couple-waves pregnant, and the males in these couples have, on average, the smallest proportion of females wanting more children than their male partner. This is a cluster of couples who are relatively stable in their family planning behaviors, aligned in their fertility desires, using hormonal contraception quite consistently, and entering the study already married and remaining married, thus experiencing few relationship status changes.

The Pursuing Conception Cluster

The Pursuing Conception cluster is a unique and small cluster, containing only 41 couples. These are couples who, despite their pronatal intentions and behaviors, are generally not becoming pregnant. They are generally not using contraception and they score the highest on the pregnancy attitude scale, suggesting they would welcome a pregnancy, however only 10 percent of couple-waves are actually spent pregnant. These couples have one of the largest age differences. On average, about 1 in 4 of the females in this cluster desire 2 or more children than their male partners and almost half of the male partners score 2 or more points higher or lower on the pregnancy attitude scale, raising the question on whether this discordance in preference that may be linked to their inability to actually become pregnant.

The defining characteristic of this cluster is their strong desire to become pregnant. On average, the females in these couples score a 4.2 on the pregnancy attitude scale, suggesting that they would greet the announcement of a pregnancy with a positive response. To confirm, the males in these couples also score very high on the pregnancy attitude scale – a 3.8 on average. These couples exhibit contraceptive use behaviors that are in line with their family planning goals. Less than 10 percent of the couple-waves are spent using any form of contraception and almost a third of those waves are spent using condoms, a less-permanent form of contraception as compared to other hormonal types.

On average, the coupling within this cluster is fairly unequal showing the largest difference in age (~7 years) between the male and female. It is important to note, once again, that this is the
smallest cluster. Part of the exclusivity of this cluster is possibly due to the fact that, despite their pronatal intentions and practices, a small amount of the couple-waves are actually spent in a pregnant state. These appear to be couples who are having trouble achieving the pregnancy they desire.

**The Unmet Need Cluster**

The Unmet Need cluster contains 138 couples whose transition into and out of pregnancy is surrounded by inconsistent contraceptive use and lots of antinatal nonuse, as seen from the large presence of dark purple in the sequence index plot. Antinatal nonuse can be considered unmet need, since these couples do not want a child but are not using contraception. This unmet need is leading to a lot of pregnancy for this cluster, as they have the highest proportion of couple-waves spent pregnant. Most of these couples are married, yet only 10 percent of couple-waves are spent using contraception. The females in this cluster have the fewest years of education on average. These couples also live the farthest, on average, from the Balaka town center, suggesting that they live in rural, more disconnected locations. Additionally, these couples appear relatively poorer than most of the other clusters, with only 36 percent of these couples having a roof made of modern materials (iron sheets or cement). These couples show a lot of variation in their family planning behaviors despite their relatively stable relationship status.

Again, a clear majority of the couples in the Unmet Need cluster are married, with 92 percent of the couple-waves identifying the couple as married. This cluster contains the largest proportion of couple-waves spent pregnant (28 percent) and 71 percent of the couples entered the study with at least one child. Only a quarter of the couple-waves are spent using contraception. In almost 10 percent of the couple-waves, these couples are using condoms. Overall, this cluster is characterized by married couples who appear to be less-educated and economically disadvantaged, using contraception inconsistently with transitions between types of use and explicit unmet need, in addition to experiencing a very high proportion of pregnancies.

**The In Transition Cluster**

The In Transition cluster is the largest cluster, containing 223 couples. Less than half of the couple-waves are identified as married. These couples exhibit the most relationship status changes, with 61 percent of the couples experiencing a relationship status change, and they are, on average, the youngest. On average, the couples in this cluster only contribute 3 waves to the study, suggesting short-term, high transition relationships. Not only do these couples transition across relationship type, but they also transition a lot across various types of family planning behaviors and 15 percent of the couple-waves are spent pregnant.

Despite their young age, the females in this cluster have the second highest level of education (7.3 years). Consistent with their young age, these couples have a relatively low parity (0.6 children) and a majority of these couples entered the study without any children. Overall, this cluster is characterized by young couples, many who are in the beginning stages of their relationship, experiencing many transitions in relationship type and family planning behaviors and intentions, as can be seen from the sequence index plot.
**The Transitory Cluster**

I call this cluster the Transitory cluster, as the 153 couples in this cluster are either in a short-lived relationship or using temporary forms of contraception, or both. These couples, on average, contribute the fewest number of waves to the study: only 2.7 waves each, emphasizing the short-term nature of these relationships. Thirty-six percent of the couple-waves are spent using condoms only; this is by far the highest for any cluster. About forty percent of the couple-waves are identified as being in a steady dating relationship, though less than a third of the couples experience a relationship status change throughout the duration of their relationship in the study.

The females in this cluster exhibit the highest educational attainment (~8 years) and the couples, on average, exhibit less than a 1 year gap in education attainment between partners. As with the In Transition cluster, above, the Transitory cluster contains couples that live relatively close to the town center, on average only 0.05 kilometers from Balaka town. This cluster exhibits the lowest amount of pregnancy during their relationship duration; only 7 percent of couple-waves are spent pregnant. Overall, these seem to be less-stable relationships where many of the couples are using a less-permanent form of contraception: the male condom.

**DISCUSSION**

These findings represent a shift from looking at a snapshot of family planning as woman-based of behaviors, to understanding family planning in the context of the life course with an emphasis on partner characteristics and relationship transitions. The above analysis shows how couples transition from use to nonuse, into and out of pregnancy, and across different types of use. Through sequencing their family planning behavior, we can see that very few couples actually adhere to a single form of contraception throughout the duration of their relationship and that over half of couples follow unique sequences of family planning. Additionally, we see that many women change family planning trajectories as they change partners. However, these varying trajectories are not completely independent of one another, which is exemplified by the fact that almost 10 percent of the sequences are shared by couples and, by clustering the sequences, six distinct patterns of family planning emerge. These trajectories of family planning help illuminate some important points, below.

**Contextualizing Family Planning Behaviors**

The primary benefit of applying sequence analysis to the case of family planning is to be able to place patterns of behavioral and attitudinal shifts within the context of a relationship. This offers two advantages. First, we can see (in Figure 2 on page 13) that some females behave differently across relationships, for example a woman may use contraception within one relationship but the same woman may not use contraception or use contraception inconsistently within another relationship. We need to make sure that inconsistent use and consistent use are not treated as mutually exclusive categories that individuals fall into, as people often transition from inconsistent to consistent use across their relationship trajectories.

Second, we can look at the differences between these relationships trajectories to identify why a woman might use contraception with one partner but not another. While sequence analysis can show us the broad differences between these types of couples, future research should look
specifically at individuals who move from inconsistent to consistent use between their relationships, and the reasons behind doing so. Additionally, I situate these family planning trajectories within a couple’s attitudes towards pregnancy and the life course expectations associated with childbearing at a young age. Identifying trajectories associated with certain stages of the life course can help us understand the variation in method used, particularly in regards to condoms versus hormonal contraception.

The concept of dual-protection has been discussed to some extent in recent literature on contraceptive use and HIV. Dual-protection can refer to either the condom as a dual-protector against both HIV and pregnancy or using two methods of contraception to experience this dual-protection (i.e. a barrier and hormonal method). This is an important concept, as it provides a conceptual and behavioral link between the concepts of family planning and HIV prevention. However, in all of the clusters, no more than 5 percent of the couple-waves in each are spent using condoms and hormonal contraception concurrently. Similarly, only one of the clusters, the Transitory cluster, spends a substantial amount of time using condoms consistently. These findings confirm that a vast majority of couples are not using two methods simultaneously and very few are utilizing condoms as a method of protection, but also allow these behaviors to be situated within the broader context of the relationship.

**Patterns of Family Planning by Relationship Status and Life Course Stage**

At any given wave, only 11 to 21 percent of the couples in this study identify as not married. While this means that a majority of the couples consist of spouses, there is still a noteworthy number of dating partners. Interestingly, the clusters of family planning trajectories generally form around relationship status, despite relationship status not being included in the clustering algorithm. A vast majority of the couples in four of the six clusters identify as married. These clusters are described in detail above, but a few interesting details emerge specifically in regards to the married status of these clusters.

A majority of the pregnancies occur in the married clusters, suggesting that the young adults in my study are still bearing children mostly within the confines of marriage. Is it the case then that the unmarried couples are successfully using contraception to prevent pregnancy? Or, is the duration of dating so short that the risk of pregnancy is decreased? Whether the answer to these questions is largely an age or duration effect cannot be completely parsed out with the sequence analysis above, but should be examined further by modeling relationship transitions around the pregnancy, as many couples may be marrying because of an unplanned pregnancy. A more detailed look at where the relationship transitions occur in accord with family planning transitions may shed light on the role pregnancy plays in these relationships.

Condom use is very low in all four of the married clusters; this is consistent with current reports of condom use in marriage. Patterns of hormonal contraceptive use between the majority married and majority unmarried clusters are less clear. While the clusters with the highest proportion of hormonal contraceptive use mostly consist of married couples, the two clusters containing the unmarried respondents do spend around 20 percent of their couple-waves using hormonal contraception. The key difference when it comes to hormonal contraception use appears to be the consistency of use between stable, married couples and couples experiencing more
transitions in their relationship status. Certainly, there is inconsistent use in both married and non-married couples; however, the non-married clusters do not show many substantial patterns of consistent use. These patterns may be explained, in part, by varying levels of accessibility/acceptability of hormonal contraception for unmarried couples or couples without any children, as they may be turned away from family planning clinics or encouraged by health care providers to use condoms rather than hormonal contraception.

**Relationship Discordance and Patterns of Family Planning**

Existing literature acknowledges the influence of discordance within a couple on their use of contraception. The current study looks mainly at differences in age, education, and fertility preferences. In general, the most discordant cluster is the Transitory cluster, with 81 percent of the couples-waves spent in pregnancy attitude discordance and 73 percent of couple-waves spent in IFS discordance. The other majority non-married cluster, the In Transition cluster, exhibits similarly high levels of fertility preference discordance, as well as the highest level of educational discordance.

On the other hand, the least discordant group in terms of fertility preferences is the Married Spacing Cluster. This cluster is only experiences IFS discordance, as defined by the female wanting to or more children than her male partner, in 14 percent of the couple-waves and less than half of the couple-waves are spent in pregnancy attitude discordance. This raises questions as to homophily (defined as “a contact between similar people [that] occurs at a higher rate than among dissimilar people” (McPherson, Smith-Lovin, and Cook 2001)) in marriage partnering or a post-marriage adjustment of preferences. Although the answer to this question is beyond the reach of the current project, it begs further investigation, particularly in regards to family planning behaviors in married couples.

Although most of the couples are relatively similar in educational attainment, there is quite a bit more variation in age difference. Differences in age, defined as the male’s age minus the female’s age, ranges from about 4 years to almost 7 years, on average. Surprisingly, the cluster with the smallest age difference is the cluster that exhibits the most discordance in fertility preferences, the In Transition Cluster. On the other hand, the Pursuing Conception Cluster has the largest age difference, on average, with the men being almost 7 years older than their female partners in this cluster. As stated previously, the Pursuing Conception Cluster is quite unique, though also a rather small cluster. Future research would be wise to look at infertility or difficulty conceiving in couples with large age discordance to help understand the underlying processes at work here.

**Pregnancy as a Stepping Stone or an Obstacle to Use?**

The state of pregnancy helps to illuminate the importance of sequencing family planning behaviors and contextualizing the states within a relationship trajectory. Two of the clusters are marked by their high levels of pregnancy: the Childbearing Consistent Users and the Unmet Need. While both of these clusters score relatively low on the pregnancy attitude question, indicating that they would not be happy to find out they are pregnant, their proportion of couple-waves spent in antinatal nonuse differs drastically. The Childbearing Consistent Users spend less than a fifth of their couple-waves in a state of antinatal nonuse, while the Unmet Need spend almost 40 percent of theirs in antinatal nonuse. Most of this is due to the fact that the Childbearing Consistent Users tend
to transition into hormonal contraceptive use after their pregnancy. On the other hand, the couples in the Unmet Need cluster generally are not consistently using any form of contraception before or after their pregnancies. These differences in antenatal nonuse could also suggest that the Unmet Need may be experiencing more unintended pregnancies. An intended or unintended pregnancy may be associated with consistent or inconsistent family planning, accordingly.

Remarkably though, these couples share most of the same characteristics in terms of relationship status, age, education, ideal family size, and parity. So, the question arises – does pregnancy itself serve as a stepping stone or an obstacle to contraceptive use? Further research is needed to deconstruct the relationship between pregnancy and contraceptive use. A sequence analysis focusing on use before and after pregnancy could shed some light on these patterns. For example, couples who use inconsistently before pregnancy may be more likely to use inconsistently after pregnancy – this does appear to be the case in the current study, as seen in the Unmet Need sequence index plot. However, the current study does not allow for us to see the patterns of use for the Childbearing Consistent Users prior to their pregnancy, as most of them begin the study in a state of pregnancy or quickly become pregnant.

The State of Unmet Need

Many researchers would call the state of antenatal nonuse “unmet need.” Asking some of these couples about their contraceptive use behavior in a cross-sectional setting could place many of them within the category of “unmet need”; however, when looking at their sequences of family planning we see that, in reality, some of these couples use contraception a majority of the time and are largely successful in doing so. For example, the Married Spacing cluster and Transitory cluster spend 13 and 25 percent of their couple-waves in the state of antenatal nonuse, respectively; however, both of these clusters spend less than 10 percent of the couple-waves in a state of pregnancy. This identifies a possible issue with classifying unmet need in a cross-sectional framework: measuring unmet need at a single point in time may artificially inflate its incidence. Sequence analysis draws out trajectories and allows us to classify couples based on their patterns of use rather than on individual points in time or retroactive reports. Arguably, the entire trajectory, as opposed to one point in time, would have more influence on a multitude of couple-related outcomes.

By clustering these sequences, I am able to pull out a group of couples who are experiencing persistent unmet need across the duration of their relationship: the Unmet Need cluster. Rather than looking at these couples at one point in time, we see that across the waves contributed by these couples over a third of the waves are spent in antenatal nonuse. These couples also experience a high rate of pregnancy. This cluster exhibits characteristics that previous researchers have found to be associated with unmet need, particularly rural residence, poverty, and low levels of education, suggesting that these couples may be underserved or not have adequate knowledge of where to obtain contraception or how to use certain methods. Of all the couples in my study, almost one-fifth of them fall into the Unmet Need cluster, suggesting that a portion of young adult couples in Malawi, many of whom are married, are experiencing persistent unmet need.

The longitudinal nature of my study raises the question of how to define unmet. Using the tools of sequence analysis, I am able to order the family planning states and identify what state
precedes or follows the state of antinatal nonuse. For example, in the Childbearing Consistent Users Cluster, much of the antinatal nonuse follows a pregnancy and may indeed be the experience of lactational amenorrhea in combination with wanting to postpone one’s next pregnancy. However, in the Unmet Need cluster, a lot of the antinatal nonuse precedes a pregnancy, suggesting that, in these cases, these couples are experiencing unmet need that is leading to undesired outcomes. On the other hand, the Married Spacing cluster provides further insight into the state of antinatal nonuse. While 13 percent of couple waves are spent in the state of antinatal nonuse, we can see by ordering these states for each couple that many couples consistently use hormonal contraception across the course of their relationship with only one or two waves spent in antinatal nonuse. For some of these couples, they may indeed be experiencing unmet need, maybe they are unable to make it to the clinic for their injectables that month, but the experience of antinatal nonuse for someone who consistently uses contraception might mean something completely different than for a couple who is not using any form of contraception consistently. The analysis above allows for better insight into the experiences of each family planning state, by sequencing them for couples and contextualizing them within the relationship trajectory.

CONCLUSION

Examining family planning longitudinally and at the couple-level allows us to see important nuances between and within couples’ trajectories in new ways. This study looks at young adult couples in Malawi and finds that their patterns of family planning are both varied and similar. At the individual level, I show that women often have different family planning trajectories depending on the relationship they are in. At the couple-level, very few couples consistently use the same method of contraception across their relationships. Within the context of the life course, we see that for young adults in Malawi, family planning behaviors tend to cluster around relationship status and stage of family formation. It is important to look at sequences of family planning in order to get at these different ways individuals and couples are navigating family planning as they move through the transitions associated with young adulthood in Malawi.

At the aggregate level, I detect six clusters that identify similarities and dissimilarities in family planning between couples. Four of the clusters (i.e. the Childbearing Consistent Users, Married Spacing, Pursuing Conception, and Unmet Need) are similar in their relationship status, but vary by pregnancy and consistency of use. The remaining two clusters (i.e. the Transitory and the In Transition) have more variation in relationship status and show the highest level of condom use. Each cluster represents a “big picture” of family planning for those couples. Had these couples been asked about their family planning at one point in time their categorization into clusters would have likely been very different. Sequences of family planning are important for recognizing transitions in and out of use, as well as the presence of pregnancy as a game-changer.

The large amount of variation in family planning across time and across couples may appear discouraging to policy makers that hope to implement contraceptive use policies or family planning programs as, at first glance, there appears to be little similarity between couples. However, I display these important differences not to discourage, but to show the complexity in use. Complex sequences of family planning suggest a need for multidimensional strategies from policy-makers, as
simple resolutions will not achieve the desired result. Additionally, sequence analysis allows for clustering on similarities to see that there are, in fact, some distinct groups of users. Policy and community groups should place their focus on these subpopulations of contracepting couples.

Another important note to policy-makers and AIDS researchers alike is that only one of the six clusters uses condoms more than 10 percent of the time: the Transitory cluster. All other clusters, throughout their entire family planning sequences, display very low levels of condom use. Arguably, if condom use were particularly sensitive to specific attitudinal or behavioral changes in relationships, one would expect clearer patterns of fluctuation in condom use. This is not the case. The Transitory Cluster tends to use condoms for a large proportion of their family planning trajectories and many of them are in a dating relationship. It does appear that a specific type of relationship facilitates consistent condom use.

Though these findings are informative to research and policy alike, the current study is not without its limitations. First, and importantly, the sequence analysis conducted here does not allow for a causal explanation for these family planning behaviors nor should it be misinterpreted in a causal framework. However, the contribution of this study lies largely in its descriptive and exploratory finding that very few couples are alike in their family planning behaviors and that family planning decisions fluctuate enormously over time. This point can easily become lost in statistical models that aggregate couples’ family planning motivations and behaviors. Sequence analysis allows for the detailed presentation of the complex family planning behaviors experienced by young couples in a variety of settings, not limited to the current non-Western context. Second, while the importance of looking at family planning at the couple-level is undisputed, the actual process of doing so is extremely complex. In this study I use couple-level data to follow couples across time and address a number of couple-level discrepancies; however, I am aware that my use of the female’s reports of contraceptive use has its limitations. In future projects I hope to use this ability to link partners to further explore the issue of discrepant reports of contraceptive use and reciprocal transitions in fertility preferences between partners across time, but in the current analysis, modeling discrepant reports was neither probable nor valuable.

The young couples in the current study demonstrate the importance of looking at family planning both at the couple-level and across time. These couples exhibit an enormous amount of variation in their family planning behaviors, with about 9 out of 10 couples exhibiting a completely unique trajectory of family planning – meaning that for a vast majority of the couples, no two trajectories are the same. Additionally, only 1 out of 6 couples are consistently in a single family planning state across the duration of their relationship in the study – meaning that most of the couples in the study experience transitions between use, nonuse, and pregnancy as they move throughout their relationship. The implications of these findings are vast and span across family planning policy and research, suggesting that both policy and research need to be more couple-focused, allowing for and understanding the amount of change that occurs within and across couples over time.

This study points to the importance of looking at family planning as a process that is unique to couples. It is crucial to understand the amount of heterogeneity in order to address the questions surrounding contraceptive use, family planning, and prevention behaviors. A longitudinal approach
allows us to see how couples move in and out of use and vary their types of contraception, both across and within relationships. Clustering on these trajectories shows that, despite the individual and couple-level variation, distinct groups emerge. Some of these groups tend to use contraception more consistently and successfully, as indicated by rates of and attitudes towards pregnancy. We see that relationship status tends to be associated with certain trends in family planning, including the fact that condoms are rarely used in marriage. In conclusion, family planning is a dynamic process that manifests at the couple-level and transitions over time as Malawian couples navigate family planning amid a unique fertility climate shaped by the AIDS epidemic and transitioning attitudes and fertility goals.
REFERENCES


APPENDIX. Individual Sequence Index Plots for Six Clusters

Figure A.1 Sequence Index Plot, Childbearing Consistent Users

- 1. Antinatal nonuse
- 2. Pronatal nonuse
- 3. Condoms Only
- 4. Hormonal Only
- 5. Condoms & Hormonal
- 6. Pregnant
Figure A.2 Sequence Index Plot, Married Spacing

- Wave
- Antinatal nonuse
- Pronatal nonuse
- Condoms Only
- Hormonal Only
- Condoms & Hormonal
- Pregnant

Couples
Figure A.3 Sequence Index Plot, Transitory

Wave
1. Antinatal nonuse
2. Pronatal nonuse
3. Condoms Only
4. Hormonal Only
5. Condoms & Hormonal
6. Pregnant
Figure A.4 Sequence Index Plot, Pursuing Conception
Figure A.5 Sequence Index Plot, Unmet Need
Figure A.6 Sequence Index Plot, In Transition

- Antinatal nonuse
- Pronatal nonuse
- Condoms Only
- Hormonal Only
- Condoms & Hormonal
- Pregnant