

TRENDS IN CONTRACEPTIVE USE IN TANZANIA, 1996-2016

BY

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THESIS

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ABSTRACT

Only one in four Sub-Saharan African women have access to contraceptive methods (Tilahun, 2016). Although birth rates are decreasing, and contraceptive use is increasing in much of the developed world, birth rates are classified as high and contraceptive use as very low in much of Sub-Saharan Africa (Larsson & Stanfors, 2014). In twenty years, Tanzania's fertility rate has only slightly decreased - from 5.8 in 1996 to 5.0 in 2016 (The World Bank, 2019). One way to reduce high fertility rates is through contraceptive use to limit unwanted pregnancies (Brown et al., 2015).

The current study uses nationally representative data from Demographic and Health Survey data collected by the United States Agency for International Development in the United Republic of Tanzania. Five cycles of survey data (1996, 1999, 2004-2005, 2010, and 2015-2016) were analyzed to determine trends in contraceptive use among Tanzanian women aged 15-49 years.

Individuals reporting no use of any method of contraception decreased by 18% ($p < 0.001$) from 1996 to 2015-2016. There was an upward trend of long-acting reversible contraception (LARC) use, with the number of women using injections more than doubling from 1996 to 2015-2016. An even more drastic increase was seen among Norplant/Implant users increasing by more than 6% during the same time period. The proportion of women using some form of modern contraception also doubled.

Regardless of these increases, relatively consistent low contraceptive use rates persisted. This, in conjunction with the burden of a high fertility rate, could continue to burden Tanzania. By identifying contraceptive use trends and factors associated with use over time in Tanzania, it

is possible to provide a foundation to better understand of the environments which encourage these low usage rates.

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This work is dedicated to the man who raised me, taught me how to work hard, never quit, and to never stop asking questions. Thank you for sharing the world with me and for teaching me the meaning of selfless love. Nakupenda sana baba.

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CHAPTER 1: INTRODUCTION

Only one in four women in Sub-Saharan have access to contraceptive methods (Tilahun, 2016). Although birth rates are decreasing, and contraceptive use is increasing in much of the developed world, birth rates are classified as high and contraceptive use as very low in much of Sub-Saharan Africa (Larsson & Stanfors, 2014). In twenty years, Tanzania's fertility rate has only slightly decreased - from 5.8 in 1996 to 5.0 in 2016 (The World Bank, 2019).¹ A total fertility rate of 5 or more is considered high by The World Bank (Casterline, J., 2010). High fertility rates bring a number of concerns; one such concern is unplanned pregnancy, as it can drastically alter young women's future prospects in developing countries (Blanc et al., 2009; Chandra-Mouli et al., 2013). Other concerns are related to health risks for mothers, such as maternal health given the higher number of pregnancies per woman, and babies, given the shorter spacing between births and higher mortality risk for higher order-babies (Austin, A., 2015; Rahman et al., 2017). Births by young mothers, for instance, have been shown to have significant health risks for both the mother and the infant (Chandra-Mouli et al., 2013; Austin, A., 2015; Rahman et al., 2017). There are also increased risks for older mothers with high parity and their babies (Ndiaye et al., 2018). In addition, high fertility can also influence how much parents can invest in children's education, which have long-term effects in terms of economic growth (Rusibamayila et al., 2017).

One way to reduce this high fertility is through the use of contraception to limit unwanted pregnancies (Brown et al., 2015). One study looking cross-sectionally at United Nations World Population Prospects data examined contraceptive use impact on fertility in 2003 and 2014

¹ Fertility rate is measured as the total number of births per woman if they were to spend all of their childbearing years giving birth (MEASURE Evaluation, 2019).

(Singh et al., 2018). This study concluded contraceptive use significantly decreased the number of unintended pregnancies and unplanned births (Singh et al., 2018). There are, however, differing effects on high risk births, depending on method use. One study found a positive association between prevalence of modern contraceptive rates and birth intervals of 36 months or more (Perin et al., 2017).

High fertility in Tanzania has been associated with a number of factors, including Tanzania's sociocultural value-system (The Republic of Tanzania, 2006), early age at marriage, lack of fertility regulation, and low rates of modern contraceptive use. The median age of marriage for Tanzanian women is 18 years old, although law allows women over the age of 15 years old to be wed (The Republic of Tanzania, 2006). There is, however, some research that shows parity group may better determine contraceptive use as opposed to marital status (Behrman et al., 2018). This study showed that parous women had greater prevalence rates of modern contraceptive use as compared to their nulliparous counterparts (Behrman et al., 2018).

Contraception is typically distinguished by two categories: modern methods and traditional methods. The World Health Organization provides a division between the two methods, identifying modern methods of contraception, such as: pill, implant, injectable, patch, vaginal ring, intrauterine device (IUD), male and female condoms, male and female sterilization, lactational amenorrhea, and emergency contraception (World Health Organization, 2019). Comparatively, traditional methods include: the calendar method or rhythm method, or withdrawal (World Health Organization, 2019).

Research suggests primary methods most commonly utilized in Sub-Saharan Africa are injections and pills, reflecting higher preference for modern contraceptive methods over traditional ones (Blanc et al., 2009; Cleland et al., 2011). Although condoms are often the most

widely available throughout the continent, there is still a large social stigma placed on women who try to obtain this contraception method (McCleary-Sills et al., 2013). This has resulted in the need for other, more inconspicuous forms of contraception that women can access and use.

Long-acting reversible contraceptive (LARC) methods, like injections, IUDs, and implants are increasing in popularity, perhaps due to their high levels of efficacy, in addition to the privacy they afford and less frequent attention that they require (McCleary-Sills et al., 2013; Simba et al., 2011; Blumenthal et al., 2013).

While there is concern about persisting high fertility rates and the need to prevent unplanned pregnancies, there are still a number of barriers, such as lack of access and misconceptions about contraception and its side effects, which impact contraceptive use (Wang et al., 2012; Shah et al., 2016; Chebet et al., 2015; Simba et al., 2011; Jain et al., 2013; Chandra-Mouli et al., 2014; Atchison et al., 2019; Williamson et al., 2009; Sedgh, G., & Hussain, R., 2014). Demographic and socioeconomic factors, like education, residence, wealth, and age have a significant effect on women's contraceptive decision-making and use (Wang et al., 2012; Shah et al., 2016; Bakinbinga et al., 2016). Education is a significant predictor of contraceptive use with Tanzanian women who lack education having a lower likelihood of using contraception as compared to their educated counterparts (Bakinbinga et al., 2016). Comparative literature from Uganda supports these predictors as well, showing rural women have a lower likelihood of contraception use as compared to their urban counterparts (Andi et al., 2014). Women's desire to have more children also significantly affected contraceptive use, with women who want more children having a higher odds of going without contraception (Bakibinga et al., 2016; Van Lith et al., 2013). Wealth also impacts contraceptive use. While the poor-rich gap has been lessening throughout Sub-Saharan Africa from 1996 to 2009, Tanzania saw an increase in total fertility

rates among its wealthiest residents and a decrease in total fertility rates among its poorest residents (Finlay et al., 2018). In addition to examining the impact of these various factors on contraceptive use, there is also a need to understand the potential impact of interacting factors, like the interaction between age and education on contraceptive use, which was found to be statistically significant in one study in Iringa, Tanzania (Mosha et al., 2017).

One study found a large geographic variation in contraceptive use after examining contraceptive patterns and trends among adolescents in 40 developing countries from 1986 to 2006 (Blanc et al., 2009). While several countries had contraceptive prevalence between 20-35%, only one country, Namibia, had a prevalence of more than 40% (Blanc et al., 2009).² Throughout these countries, however, current contraceptive use was highest among unmarried, sexually active young women, potentially reflecting their desire to prevent pregnancy (Blanc et al., 2009). This could also be reflected in the results of one Sub-Saharan African study which showed trends of decreasing premarital fertility rates (Clark et al., 2017). Although use was higher among unmarried young women, numerous contraceptive use barriers persist among unmarried adolescents. Adolescents often do not know where to get methods of contraception, and even if they are able to obtain them, they may not know how to properly use them (Chandra-Mouli et al., 2013; Baraka et al., 2015). Misconceptions about contraception side effects hinder use as well (Chandra-Mouli et al., 2013; Baraka et al., 2015; Sedgh, G., & Hussain, R., 2014). Additionally, use among older women, and also sometimes younger women, can also be greatly impacted by the number of children they have. Studies have shown that if the women have already reached their desired number of children, additional births may result in a higher proportion of unwanted pregnancies (Van Lith et al., 2013; Susuman et al., 2014).

² Contraceptive prevalence is the percentage of women (or their partners) currently using at least one form of contraception (World Health Organization, 2019).

Many studies have examined contraceptive use from the United States Agency for International Development (USAID) Demographic and Health Survey (DHS) cross-sectional data around the world (Chandra-Mouli et al., 2014; Kalamar et al., 2018; Van Lith et al., 2013). Some have focused specifically on contraceptive use in East Africa (Asiimwe et al., 2014; Bakibinga et al., 2016; Clements, S., & Madise, N., 2004; Stephenson et al., 2008), while other studies have used DHS data to examine trends of contraceptive use over time (Bellizzi et al., 2015; Blanc et al., 2009; Cleland et al., 2011; Jain et al., 2013; Sedgh, G., & Hussain, R., 2014). And while some studies have focused on trends over time in Sub-Saharan Africa (Creanga et al., 2011, Okigbo et al., 2017), fewer still have examined trends in East Africa (Andi et al., 2014; Dennis et al., 2017; Shah et al., 2016) Even among the existing studies situated in East Africa, there is yet to be an analysis of DHS-driven contraceptive trends in Tanzania for the 20-year time period from 1996 to 2016.

Tanzania first implemented a National Family Planning Program in 1992 (The Republic of Tanzania, 2006). This program worked to increase knowledge about and access to family planning, and by 1996 some form of family planning was available in nearly 90% of all Tanzanian health facilities (Richey, 2003). The program was later revised in 2006 in conjunction with the 2003 Zanzibar Population Policy (The Republic of Tanzania, 2006).

These policies, in addition to other interventions, have been attempting to increase modern contraceptive use throughout Tanzania, but without the understanding of the factors that contribute to such low usage rates, it will be improbable to identify and implement sustainable and appropriate solutions to these critical health concerns (Atchinson et al., 2018; The United Republic of Tanzania, 2006; Ngo et al., 2017; Blumenthal et al., 2013). This study will provide a

foundation to better understand trends in contraceptive use and factors associated with use in Tanzania.

CHAPTER 2: METHODS

2.1 Survey

This study is based on nationally representative data from the Demographic and Health Survey (DHS) collected by the United States Agency for International Development (USAID) in the United Republic of Tanzania. Data were obtained through a two-stage cluster sampling, with additional urban/rural stratification. The first stage is based on the selection of clusters from the most recent population census and, in the second stage, there is a systematic selection of households from within the clusters. DHS surveys utilize standardized questionnaires at the household and individual level. Questionnaire data were used in order to analyze women's demographic and socio-economic characteristics with specific trends related to contraceptive methods. Five cycles of survey data are included in these analyses: 1996, 1999, 2004-2005, 2010, and 2015-2016. These data are publicly available with permission from the DHS website (<http://www.dhsprogram.com>).

2.2 Participants

Women aged 15-49 years who did not report being pregnant during the time of the interview were included in these data analyses. Sample size from each cycle includes: 7,322 respondents in 1996, 3,616 respondents in 1999, 9,227 respondents in 2004-2005, 9,154 respondents in 2010, and 12,071 respondents in 2015-2016, for a total of 41,390 female respondents combining all five cycles (1996-2016). There were no other restrictions placed for data inclusion, except for the previously-mentioned exclusion of pregnant women from the analyzed data.

2.3 Measures

Contraceptive Use

All participants were asked if they have ever used a method of contraception. If answered ‘yes,’ additional questions related to contraceptive use followed. For this analysis, contraceptive use is derived from the variable in which respondents informed which type of method was used. This variable categorized the respondent’s current contraceptive method and includes modern methods, traditional methods, folkloric methods, or not using any method. These categories were recoded into a dichotomous variable: one for “not currently using a method”, ‘using traditional methods’ and ‘using folkloric methods coded as “0” versus “using a modern method” coded as “1” following other study protocol (Dennis et al., 2017).

Contraceptive Method

Current contraceptive method was originally categorized with the modern methods: Pill, IUD, Injections, Diaphragm, Condom, Female sterilization, Male sterilization, Implants, Lactational Amenorrhea, Female Condom, Foam and Jelly, Emergency Contraception; traditional methods: Periodic Abstinence (rhythm), Withdrawal, and Abstinence; and folkloric methods: any other traditional method not already included. This variable was used to examine the trends in specific contraceptive methods used. The variable was recoded to include (0) “Not using,” (1) “Pill,” (2) “Injections,” (3) “Condom,” (4) “Female sterilization,” (5) “Periodic abstinence,” (6) “Withdrawal,” (7) “Implant/Norplant,” and (8) “Other”. These were the most common methods currently used by respondents throughout the study period. IUD, Diaphragm, Male Sterilization, Lactational Amenorrhea, Female Condom, Foam and Jelly, Emergency Contraception, and Abstinence were all combined into the category “Other” due to their comparatively low numbers of observations throughout the surveys. Current contraceptive method did not contain any missing data.

Educational Attainment

Educational attainment data were acquired through a question to determine the highest level of education achieved by each participant. This variable was re-categorized to include (0) “No education,” (1) “Incomplete primary,” (2) “Complete primary,” and (3) “Incomplete secondary/higher.” Incomplete secondary, complete secondary, and higher education were all combined due to the small number of observations within these groups across the various survey cycles. The educational attainment variable did not have any missing data.

Age

Current age of the respondent was asked at the time of the interview. This interval data was recoded to encompass 5-year age categories, including: (1) “15-19,” (2) “20-24,” (3) “25-29,” (4) “30-34,” (5) “35-39,” (6) “40-44,” and (7) “45-49.” There were no missing data in the age variable.

Marital Status

Current marital status was self-reported (0) “not married,” (1) “married,” (2) “living together,” (3) “widowed,” (4) “divorced,” and (5) “not living together.” These categories are mutually exclusive, and the only missing data existed in the first cycle, 1996. These data were dropped, as it only related to 1 observation from the entire cycle (<0.01%).

Residence

The residence variable based on the location of the interview, not self-reported by the respondent. This was the *de facto* type of place of residence, specifically (0) “urban” and (1) “rural” depending on whether the cluster or sample point number was defined as urban or rural. There were no missing data for this variable.

Desire

Desire for more children was originally categorized as (1) “wants within 2 years,” (2) “wants after 2+ years,” (3) “wants, unsure timing,” (4) “undecided,” (5) “wants no more,” (6) “sterilized,” (7) “declared infecund,” and (8) “never had sex.” Women who reported never having had sex earlier in their interview were not asked questions relating to desire for future children, and subsequently categorized as “never had sex”. A dichotomous dummy variable was created for this study, combining “wants within 2 years,” “wants after 2+ years,” and “wants, unsure timing” as (0) “wants more children”, while the other five categories were recoded to be (1) “wants no more [children]”. This variable contained less than 0.04% missing data, so those few missing observations were also dropped.

Year

In order to identify trends over time, a time construct was created for each of the survey cycles. Each survey was assigned a numerical value for the Year variable, which allowed for the analysis of time trends of the response and explanatory variables. The survey cycles were categorized as (1) “1996”, (2) “1999”, (3) “2004-2005”, (4) “2010”, and (5) “2015-2016”.

Statistical Analysis

Stata/SE 15.1 statistical software was utilized for data analyses. Descriptive statistics and bivariate analyses based on chi-square tests were used to estimate values and examine associations between contraceptive use, and independent variables: age, educational attainment, marital status, residence, and desire for more children. After, multivariable logistic regressions examined time-trends in contraceptive method use after controlling for covariates. All analyses incorporated standard survey procedures and weights, through the use of the SVY command in Stata. These survey procedures and weights were followed in order to account for complex survey design of the DHS. The statistical significance level was set to 0.05.

CHAPTER 3: RESULTS

Descriptive statistics of the survey respondents

Table 1 presents participant characteristics with the largest proportion of respondents consistently residing in rural areas, although the percentage of participants residing in urban areas has progressively increased over 20 years, from 24.05% in 1996 to 36.88% in the 2015-2016.

The disparity related to educational attainment has decreased over time, with decreasing percentages of women with no education and increasing numbers of women with incomplete secondary, complete secondary, and higher education. In 1996, the percentage of women with no education was 28.40%, with this percentage decreasing progressively reaching 14.36% in 2015-2016. Comparatively, only 5.59% of women had the educational level of incomplete secondary/higher in 1996 but this reached 24.08% in 2015-2016.

Most study participants are married, but the percentage of married people is decreasing while there are an increasing number of cohabitating individuals. In 1996, over half (57.70%) of the study participants were married, but this percentage decreased to 43.70% by 2015-2016. The percentage of individuals living together with their partners increased from 6.60% in 1996 to 16.03% in 2015-2016.

Contraceptive use

Table 2 shows trends in contraceptive use over time, and further describes modern and traditional contraceptive methods usage rates. The proportion of women using some form of modern contraception increased significantly over time ($p < 0.001$), more than doubling from 1996 (13.06%) to 2015-2016 (29.80%). Figure 1 provides a visualization of the percentage of modern contraceptive non-users and users by year.

The current contraceptive method variable included some of the most common modern and traditional methods being utilized by women in the study, while also providing the percentage of women who did not utilize any contraceptive method. Figure 2 includes participants who reported current contraceptive use and further depicts the proportion of women using each method of modern or traditional contraception. Individuals reporting no use of any method of contraception decreased significantly ($p<0.001$) from 1996 (82.13%) to 2015-2016 (64.38%). There was an upward trend in the percentage of women using injections as their method of contraception, with the number more than doubling from 1996 (4.10%) to 2015-2016 (10.90%). An even more drastic increase was seen among Norplant/Implant users during this period. With only 0.05% of the population using Norplant/Implant in 1996, it grew in popularity beginning in 2010 (2.00%) and resulted in a total of 6.11% of use among women using contraception in 2015-2016.

Figure 3 presents the increasing trends among these two long-acting reversible contraceptive (LARC) methods.

Table 3 provides the descriptive statistics of demographic and socioeconomic characteristics based on women's contraceptive use behaviors. All characteristics included, except for desire for more children, were consistently found to be statistically significant associated ($p<0.001$) with contraceptive use throughout the years examined. Desire for more children was only statistically significant ($p=0.030$) during the fifth cycle, in 2015-2016.

With regard to educational attainment, the largest proportion of contraceptive users were consistently those who had completed primary education. There was, however, a significant increase ($p<0.001$) in contraceptive use among those with incomplete primary/higher educational

attainment. In 1996, only 1.91% of participants at this level of educational attainment used a modern method of contraception. This percentage increased to 8.34% by 2015-2016.

Married women were the highest percentage of contraceptive users compared to women with other marital statuses. Among married women 12.16% used contraceptive methods in 1996 and this percentage increased to 19.21% in 2015-2016. Worth noting was the significant increase in contraceptive use among women living together with their partner from 2010 (2.49%) to 2015-2016 (6.87%). The proportion of contraceptive use among women living in urban areas also doubled from 1996 (7.31%) to 2015-2016 (14.86%).

Figure 4 shows contraceptive method use for each age group in each cycle. The highest percentage of contraceptive use varied slightly by year, with women aged 20-24 having the highest percentage of use in 1996 (4.13%) and 1999 (6.61%), but subsequently women aged 25-29 had the highest percentage of use in 2004-2005 (6.28%), 2010 (6.52%), and 2015-2016 (7.28%). Women aged 15-19 were consistently the highest percentage of non-users among all age groups, with a very minimal decrease in non-use from 1996 (20.98%) to 2015-6 (19.59%). Figure 5 focuses on respondents who reported currently using a modern contraceptive method and shows time trends associated with the percentage of women using a modern contraceptive method by age group.

Predictors of modern contraceptive use

Table 4 disaggregates data for each DHS cycle. Through logistic regression, age is significantly associated ($p < 0.001$) with contraceptive use, and in general, older age groups have higher odds of using contraception than younger women aged 15-19 years. However, the oldest age group (45-49 years) did not statistically differ from the reference group (15-19 years) in more recent years.

There were large differences in likelihood of use among women of different educational attainment in 1996, but these differences decreased over time. Women with incomplete secondary educational attainment or higher were over five times as likely (OR=5.15; 95% CI 3.89-6.82; $p<0.001$) to use modern contraception as compared to the reference category of no education. This difference diminished somewhat over time, but still resulted in higher odds (OR=1.95; 95% CI 1.69-2.26; $p<0.001$) of modern contraceptive use as compared to women with no education in 2015-2016. Women were consistently less likely to use modern contraception if they resided in a rural location. Rural-dwelling women were less likely (OR=0.47; 95% CI 0.41-0.54; $p<0.001$) to use contraception compared to women who lived in urban areas in 1996. Residence was still a significant predictor of contraceptive use 20 years later, with rural women still less likely (OR=0.66; 95% CI 0.60-0.72; $p<0.001$) to use contraception than urban women in 2015-2016.

Marital status was also a significant predictor ($p<0.001$) of contraceptive use. Throughout these 20 years, all marital status, except for women who were widowed, had statistically significant increased odds ($p<0.001$) of modern contraceptive use as compared to women who were not married. Being married or living together consistently resulted in statistically significant ($p<0.001$) higher odds of contraceptive use as compared to women who were not married. A married woman in 1991 was more likely (OR=2.45; 95% CI 1.94-3.08; $p<0.001$) to use modern contraception than a woman who was not married and this difference remained over time. Women who were living together were also twice as likely to use modern contraception (OR=2.25; 95% CI 1.68-3.02; $p<0.001$) in 1991, and almost three times (OR=2.93; 95% CI 2.48-3.45; $p<0.001$) as likely in 2015-2016.

In addition to these demographic and socio-economic factors, desire to have more children also significantly determined ($p<0.001$) contraceptive use behaviors. Women who did not want more children had statistically significant ($p<0.001$) higher odds of using a modern method of contraception as compared to women who did want more children in all years except for 2010. The odds that a woman would use a modern method of contraception was nearly double (OR=1.78; 95% CI 1.54-2.05; $p<0.001$, OR=1.98; 95% CI 1.63-2.40; $p<0.001$, OR=2.03; 95% CI 1.79-2.32; $p<0.001$, and OR=1.86; 95% CI 1.67-2.06; $p<0.001$ for 1996, 1999, 2004-2005, and 2015-2016, respectively) for women who did not want any more children as compared to women who did want more children.

Logistic regression models were also used to examine the likelihood of modern contraceptive use (Table 5). Women in 2015-2016 were two times as likely (OR=2.11; 95% CI 1.96-2.28; $p<0.001$) to use a modern method of contraception as compared to women in 1996. A gradient can be seen when looking at the likelihood of contraceptive use among different age groups, with those aged 25-29 years being three and a half times as likely (OR=3.53; 95% CI 3.17-3.93; $p<0.001$) to use a form of modern contraception than women aged 15-19 years. Compared to women aged 15-19 years, all older women had statistically significantly higher odds ($p<0.001$) of using modern contraception.

Women who completed primary education were more than twice as likely (OR=2.50; 95% CI 2.33-2.68; $p<0.001$) to use modern contraception as compared to women with no education. Women who were married or living together were both more than three times more likely (OR=3.11; 95% CI 2.85-3.39; $p<0.001$ and OR=3.52; 95% CI 3.16-3.92; $p<0.001$, respectively) to use modern contraception as compared to women who were not married. Women

of any other marital status had statistically significantly higher odds ($p<0.001$) of using modern contraception when compared with women who were not married.

When considering the impact that desire for more children has on contraceptive use, women who desired no more children had increased odds (OR=1.62; 95% CI 1.53-1.72; $p<0.001$) of using modern contraception in comparison with women who wanted more children. Odds of using contraception, however, were 44% lower (OR=0.56; 95% CI 0.53-0.59; $p<0.001$) among women in rural areas as opposed to women in urban locations.

CHAPTER 4: DISCUSSION

Contraceptive use increased over time in Tanzania, as well as changes in the methods used over time. Modern contraceptive methods, LARCs in particular, are being more widely used among women throughout the country and have been shown to be more appropriate and more effective in some situations (Ngo et al., 2017; Stephenson et al., 2008; Blumenthal et al., 2013; Dennis et al., 2017). This study's results support the growing acceptance and use of LARCs like the injectable and implant (Hubacher et al., 2017). This increased acceptance and use of these methods could be related to the privacy that they allow. Women who may not have partners or family members who are supportive of contraceptive use may be better suited to use these less detectable options. Additionally, these methods have more longevity, with an injectable required only once every three months, and an implant that can be inserted and maintained for up to three years.

Interventions by Non-Governmental Organizations (NGOs), like Marie Stopes International, are demonstrating the viability of using LARCs for diverse female populations from different backgrounds, regardless of their desire to limit or space their births (Ngo et al., 2017; Blumenthal et al., 2017; Blumenthal et al., 2011). During a six-year program, the organization successfully expanded LARC access in 14 different Sub-Saharan African nations by 1037% from 2008-2014. Tanzania is included in this experimental intervention, thus posing the question of the potential impact this large-scale intervention had on the drastic expansion of implants starting in 2010.

These trends depict that overall contraceptive use among Tanzanian women has been increasing for the last 20 years, with some methods gaining popularity quicker than others. Several population health policies, like the National Population Policy, and interventions,

through local and global NGOs, have been investing a lot to contribute to these strides in reproductive and sexual health (Ngo et al., 2017; Atchinson et al., 2018; The United Republic of Tanzania, 2006; Blumenthal et al., 2013). Nonetheless, this study's analyses support the claim that a number of demographic and socio-economic factors still greatly impact women's contraceptive use (Okigbo et al., 2017).

Education

Data from this study have shown that educational disparities have been lessening over time throughout Tanzania. In turn, women with higher education, as compared to women with no education, have higher odds of contraceptive use. Studies in other Sub-Saharan countries, like Nigeria and South Africa, have also shown that education is a significant predictor of contraceptive use (Viswan et al., 2017; Van Stam et al., 2014; Blackstone et al., 2017).

Age

When examining contraceptive use among different age groups, age was seen as a statistically significant predictor for contraceptive use throughout time, except among 45-49-year olds in the more recent years. Compared to women 15-19 years old, all older women had higher odds of using a form of contraception. In 1996, there were large disparities of use among the different age groups, but these have begun to decrease over time as contraceptive use also increased. Age is a predictor of contraceptive use, especially when comparing younger women (aged 15-24 years) and older women (aged 25-49 years) (Dennis et al., 2017). Contraceptive use may also be impacted by a woman's age when considering younger women may wish to delay their first birth, as opposed to older women who may already have their desired number of children (Sedekia et al., 2017).

Marital Status

Compared to women who were not married those who were married, living together, divorced, or not living together were more likely to use contraceptives. Married and cohabitation women had some of the highest rates of use throughout the 20 years studied. What is worth noting, however, is the decrease in odds of use that occurred among women cohabiting between 2010 and 2015-2016.

The fact of the matter, however, was that all of the odds ratios of contraceptive use among women of various marital statuses decreased compared to unmarried women from 2010 to 2015-2016. This finding is a result that increase in contraceptive use among unmarried women was faster than for most of the other marital statuses during that timeframe. One study using DHS data from 1993 to 2001 found that single women were using significantly more condoms over this time period, but that the increase was not reflected in married or cohabitating women (Cleland et al., 2006). This further shows the increasing number of unmarried and sexually active women who may wish to take precautions as to avoid unplanned pregnancies, consistent with existing literature (Sedekia et al., 2017).

Residence

Urban populations in Tanzania grew more than 12% from 1996 to 2015-2016, but odds of contraceptive use remained higher in urban areas. This supports the literature which shows residence as a significant predictor of contraceptive use in Sub-Saharan Africa (Shah et al., 2016). Women living in urban areas may not only have better access to contraception, but they may also have more opportunities for education, which is another statistically significant predictor of contraceptive use (Shah et al., 2016). However, urban-rural differences have been narrowing over time.

Desire

Women who want no more children have higher rates of contraceptive use as compared to women who want more children. A woman's desire for more children is a statistically significant predictor of contraceptive use, but could also reflect interacting factors, such as age, education, marital status, and residence (Asiimwe et al., 2014; Sedekia et al., 2017). A woman's age, whether she is younger or older, wanting to limit or space her births, may influence if she uses a form of contraception.

Limitations

This study does have some limitations. First, data from the 1991 DHS could not be incorporated, as they were missing a significant amount of data necessary for these analyses. Additionally, DHS relies on self-reporting for a number of its indicators. All indicators used in this study, except for residence, were self-reported. Residence was determined based on the location of the interview. Self-reported data has the potential for bias; however, USAID takes a number of precautions to help offset the potential bias of self-reporting (Corsi et al., 2012), including a large representative sample from the surveyed nation while also ensuring high response rates through consistent data collection formats (Corsi et al., 2012).

Another limitation of cross-sectional data, even throughout time, is that it cannot provide any causal relationships. The findings are also limited to the experience of women of Tanzania, so findings cannot be generalized to other regions. The analyses of this study were not adjusted for any other potentially important factors outside the DHS dataset.

Further studies should use a mixed methods approach to consider influencing factors like social and cultural environments, which may foster these low rates of contraceptive use and high fertility rates (Schatz, E., & Williams, Jill, 2012). Mixed methods would allow further development of knowledge about not just *what* affects contraceptive use but also *how*

contraceptive use is affected by the social culture, norms, and relationships of these women. Additionally, further quantitative analyses can be explored to better understand the potential temporal changes in the effects of sociodemographic and preferences factors explored here. Finally, the incorporation of comparative countries within the region would also help to situate Tanzanian women within the larger East African context as well.

Conclusion

Relatively consistent low rates of contraceptive use persisting in conjunction with the burden of a high fertility rate could continue to place a burden on Sub-Saharan nations, like Tanzania. By identifying the trends of contraceptive use and the factors associated with use over time in Tanzania, it is possible to provide a foundation to better understand of the environments which encourage these low rates of use. Only through the identification and understanding of these contexts can appropriate policies and interventions be implemented successfully.

Next steps

This research has established a foundation from which further exploration can be built upon. Additional analyses could be performed to examine the impact of interacting factors on contraceptive use. Ultimately publication will be sought for this paper, in addition to the dissemination of information to the appropriate local Tanzanian authorities and stakeholders. Through the creation of a research brief, the results of this study can be not only shared with the academic community, but also the primary stakeholders who may be directly impact in Tanzania

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APPENDIX A: FIGURES

Figure 1: Percentage of Modern Contraceptive Non-users and Users, 1996-2016, Tanzania

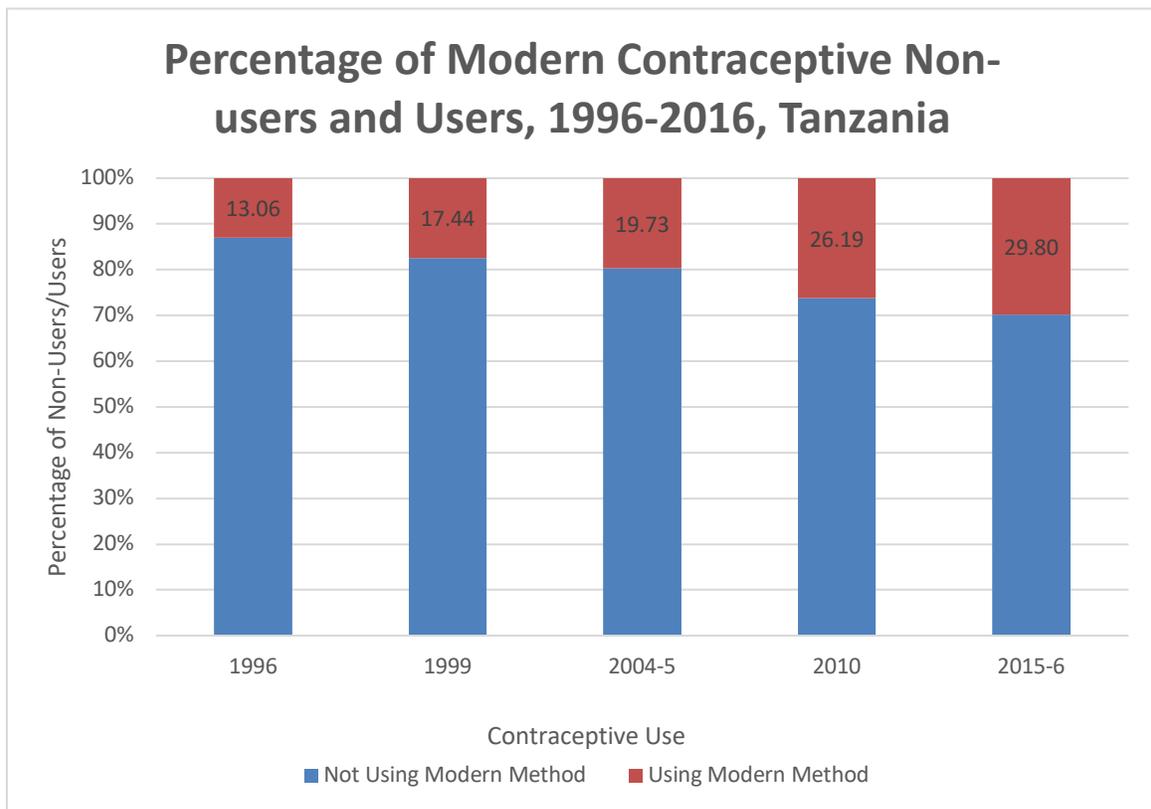


Figure 2: Prevalence Use of Contraceptive Methods, 1996-2016, Tanzania

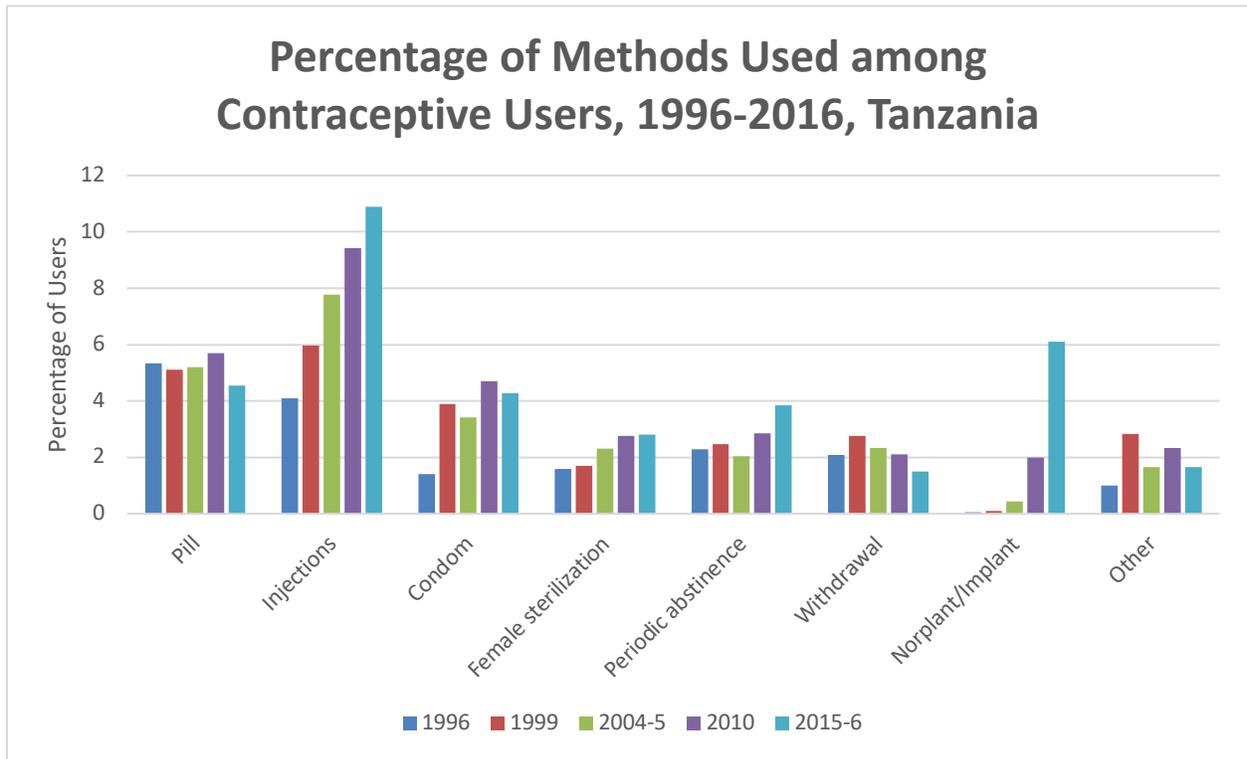


Figure 3: Percentage of Modern Contraceptive Non-users and Users, 1996-2016, Tanzania

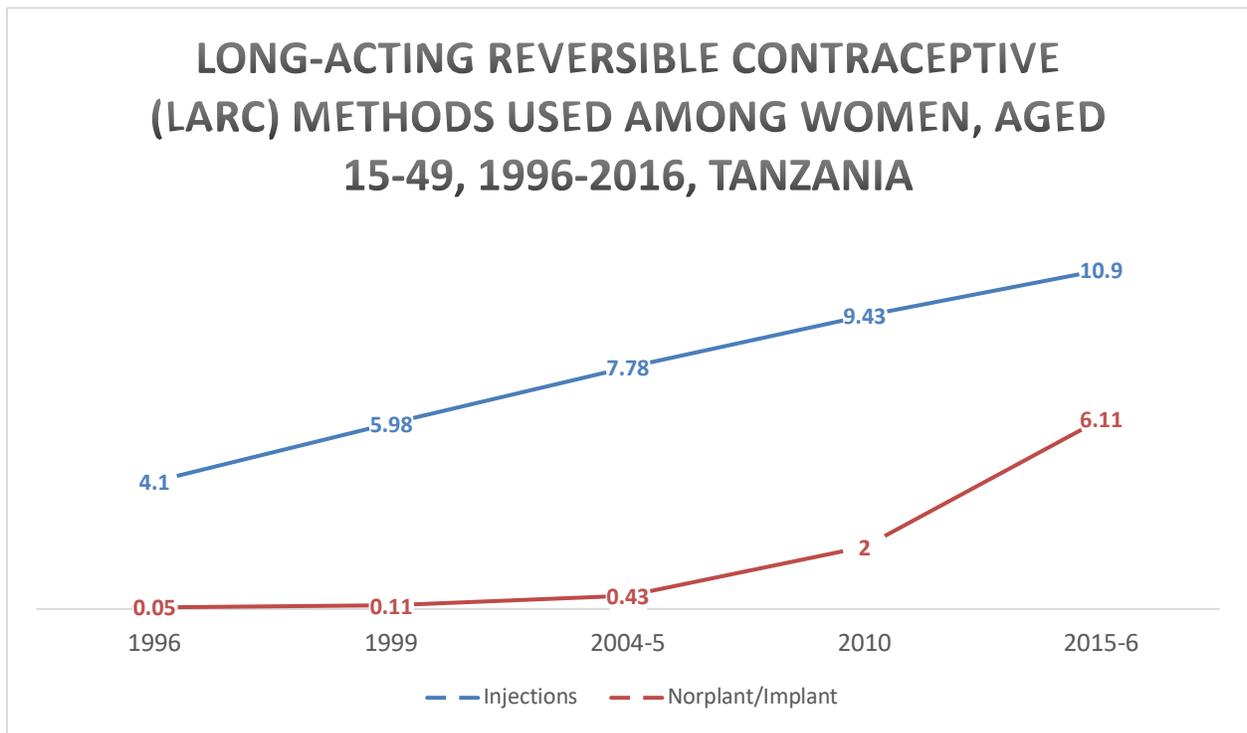


Figure 4: Percentage of Modern Contraceptive Non-users and Users, 1996-2016, Tanzania

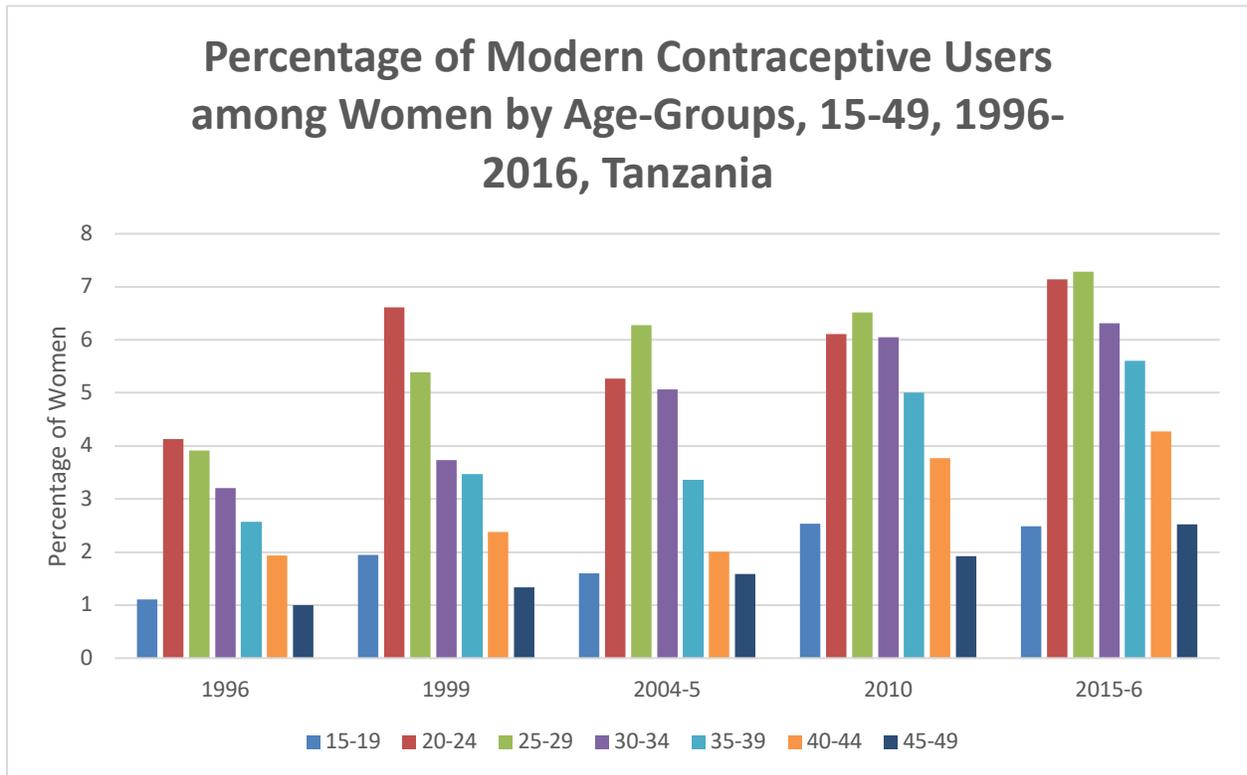
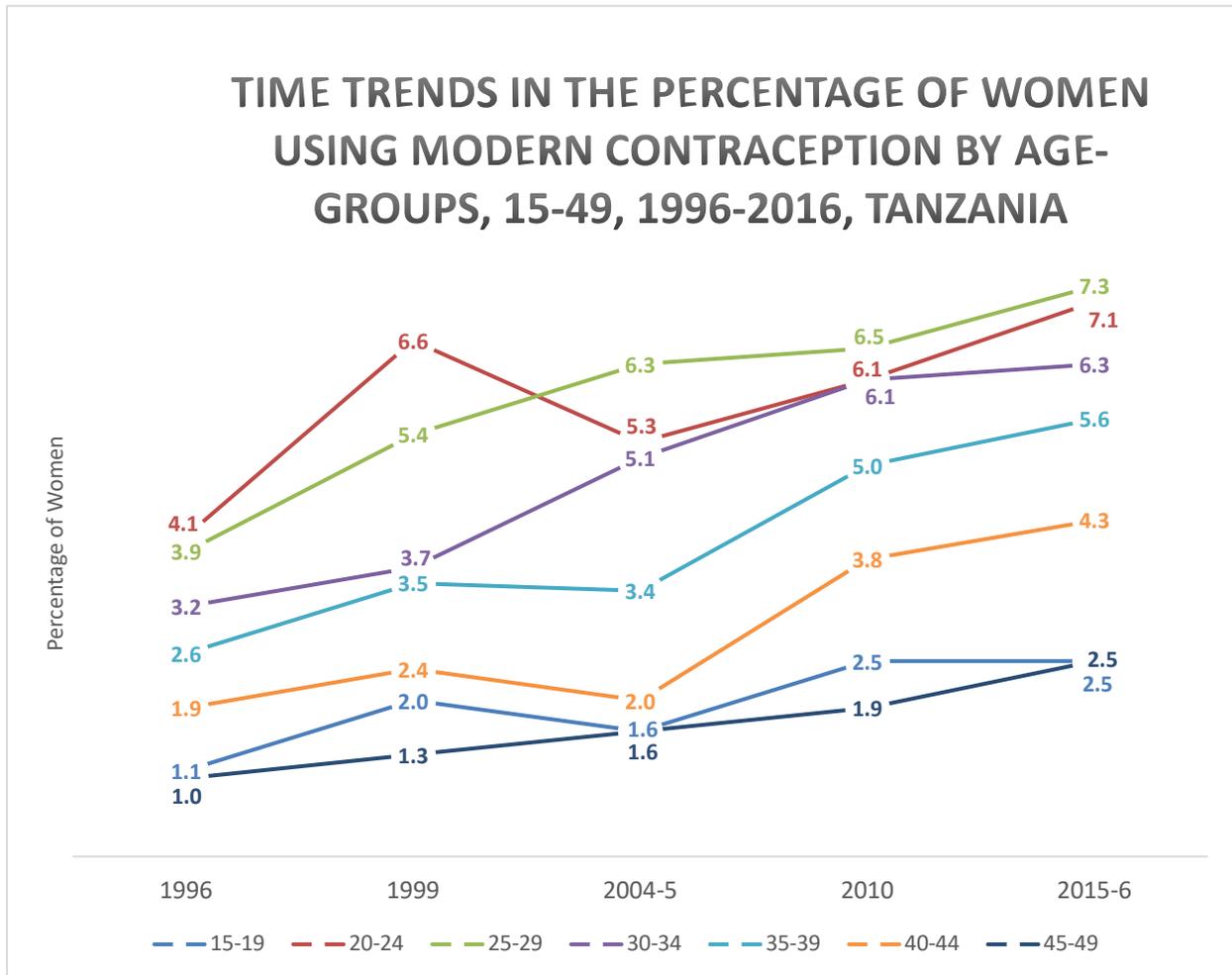


Figure 5: Percentage of Modern Contraceptive Non-users and Users, 1996-2016, Tanzania



APPENDIX B: TABLES

Table 1: Descriptive Statistics for the Included USAID Demographic and Health Survey (DHS) Participants, 1996-2016, Tanzania

<i>Characteristics</i>	<i>1996</i> <i>N=7,322 (%)</i>	<i>1999</i> <i>N=3,616 (%)</i>	<i>2004-5</i> <i>N=9,227 (%)</i>	<i>2010</i> <i>N=9,154 (%)</i>	<i>2015-6</i> <i>N=12,071 (%)</i>
<i>Education</i>					
No education	2010 (28.40)	916 (27.28)	2209 (23.83)	1670 (18.45)	1781 (14.36)
Primary incomplete	1509 (20.61)	738 (21.22)	1739 (18.03)	1364 (14.51)	1450 (11.42)
Completed primary	3291 (45.40)	1469 (45.99)	3950 (48.98)	3891 (49.69)	5454 (50.14)
Incomplete secondary/higher	512 (5.59)	493 (5.50)	1329 (9.16)	2229 (17.34)	3386 (24.08)
<i>Age</i>					
15-19	1610 (22.10)	871 (23.54)	2122 (22.25)	2076 (21.96)	2716 (22.08)
20-24	1473 (19.73)	665 (19.04)	1675 (18.58)	1606 (17.94)	2177 (18.21)
25-29	1234 (17.04)	637 (17.92)	1556 (17.45)	1389 (15.73)	1839 (15.34)
30-34	1007 (13.59)	421 (11.47)	1322 (15.02)	1225 (13.70)	1565 (13.09)
35-39	808 (10.99)	461 (12.12)	978 (10.18)	1135 (13.03)	1496 (12.52)
40-44	634 (8.87)	285 (7.77)	844 (8.49)	927 (9.81)	1276 (10.72)
45-49	556 (7.69)	276 (8.14)	730 (8.03)	796 (7.84)	1002 (8.03)
<i>Marital status</i>					
Never married	1837 (25.00)	956 (25.38)	2461 (24.89)	2648 (26.95)	3393 (26.90)
Married	4164 (57.70)	2015 (55.65)	5157 (56.15)	5109 (55.90)	5405 (43.70)
Living together	544 (6.60)	213 (7.38)	643 (8.58)	351 (4.95)	1758 (16.03)
Widowed	244 (3.33)	123 (3.45)	244 (2.81)	242 (3.06)	336 (3.05)
Divorced	379 (5.20)	179 (3.60)	470 (4.36)	555 (5.55)	620 (4.85)
Not living together	154 (2.16)	130 (4.53)	252 (3.20)	249 (3.59)	559 (5.46)
<i>Residence</i>					
Urban	1923 (24.05)	1304 (28.82)	2319 (29.51)	2424 (29.58)	3836 (36.88)
Rural	5399 (75.95)	2312 (71.18)	6908 (70.49)	6730 (70.42)	8235 (63.12)
<i>Desire</i>					
Wants more children	4457 (60.22)	2269 (59.65)	6404 (66.27)	4926 (55.62)	8443 (68.16)
Wants no more	2865 (39.78)	1347 (40.35)	2823 (33.73)	4228 (44.38)	3628 (31.84)

Table 2: Descriptive Statistics of Contraceptive Behaviors among the USAID Demographic and Health Survey (DHS) Participants, 1996-2016, Tanzania

Characteristics	1996 N=7,322 (%)	1999 N=3,616 (%)	2004-5 N=9,227 (%)	2010 N=9,154 (%)	2015-6 N=12,071 (%)
<i>Current Contraceptive Use</i>					
Not using modern method	6405 (86.94)	2995 (82.56)	7583 (80.27)	7063 (73.81)	8836 (70.20)
Using modern method	1017 (13.06)	621 (17.44)	1644 (19.73)	2091 (26.19)	3235 (29.80)
<i>Current Method</i>					
Not using any method	5958 (82.13)	2769 (75.12)	7146 (74.82)	6620 (68.08)	8216 (64.38)
Pill	425 (5.33)	196 (5.12)	474 (5.20)	505 (5.70)	486 (4.54)
Injections	320 (4.10)	209 (5.98)	651 (7.78)	761 (9.43)	1237 (10.90)
Condom	105 (1.42)	126 (3.89)	257 (3.42)	329 (4.71)	395 (4.28)
Female sterilization	120 (1.60)	57 (1.71)	181 (2.31)	219 (2.77)	297 (2.80)
Periodic abstinence	170 (2.28)	88 (2.46)	176 (2.04)	215 (2.86)	372 (3.84)
Withdrawal	142 (2.08)	74 (2.77)	180 (2.34)	170 (2.11)	187 (1.51)
Norplant/Implant	4 (0.05)	7 (0.11)	32 (0.43)	160 (2.00)	696 (6.11)
Other	78 (1.01)	90 (2.82)	130 (1.66)	175 (2.34)	185 (1.65)

Table 3: Percentage (%) of Contraceptive Non-Users/Users among Female Respondents by Selected Characteristics, 1996-2016, Tanzania

<i>Characteristics</i>	<i>1996</i> <i>N=7,322</i>		<i>1999</i> <i>N=3,616</i>		<i>2004-5</i> <i>N=9,227</i>		<i>2010</i> <i>N=9,154</i>		<i>2015-6</i> <i>N=12,071</i>	
	<i>Not Using</i>	<i>Using</i>	<i>Not Using</i>	<i>Using</i>	<i>Not Using</i>	<i>Using</i>	<i>Not Using</i>	<i>Using</i>	<i>Not Using</i>	<i>Using</i>
<i>Education</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
No education	26.23	2.17	23.05	4.24	20.54	3.29	14.12	4.34	10.31	4.06
Primary incomplete	17.81	2.80	17.00	4.22	14.70	3.33	11.06	3.46	8.18	3.24
Completed primary	34.40	11.00	32.11	13.88	33.48	15.50	30.67	19.02	30.16	19.98
Incomplete secondary/higher	3.68	1.91	2.95	2.55	3.06	3.06	12.24	5.10	15.74	8.34
<i>Age</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
15-19	20.98	1.11	21.59	1.95	20.65	1.60	19.42	2.54	19.59	2.49
20-24	15.60	4.13	12.43	6.61	13.32	5.27	11.83	6.11	11.07	7.14
25-29	13.13	3.91	12.53	5.39	11.17	6.28	9.20	6.52	8.07	7.28
30-34	10.37	3.21	7.73	3.74	9.94	5.07	7.65	6.05	6.79	6.31
35-39	8.41	2.57	8.65	3.47	6.82	3.36	8.03	5.00	6.91	5.61
40-44	6.94	1.93	5.39	2.38	6.48	2.01	6.04	3.77	6.44	4.27
45-49	6.69	1.00	6.80	1.34	6.44	1.59	5.91	1.92	5.51	2.52
<i>Marital status</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Never married	22.85	2.15	22.19	3.18	22.37	2.52	22.85	4.10	22.12	4.78
Married	45.55	12.16	39.62	16.03	38.91	17.25	34.31	21.59	24.49	19.21
Living together	5.07	1.53	4.77	2.61	5.94	2.65	2.45	2.49	9.16	6.87
Widowed	2.69	0.64	2.98	0.48	2.35	0.46	2.28	0.77	2.15	0.91
Divorced	4.21	1.00	2.68	0.92	3.18	1.18	3.76	1.79	3.12	1.73
Not living together	1.76	0.40	2.87	1.66	2.07	1.12	2.43	1.17	3.34	2.11
<i>Residence</i>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Urban	16.74	7.31	18.57	10.25	18.83	10.68	18.36	11.22	22.02	14.86
Rural	65.39	10.55	56.55	14.63	55.99	14.50	49.72	20.70	42.35	20.76
<i>Desire</i>	0.290	0.290	0.103	0.103	0.584	0.584	0.162	0.162	0.030	0.030
Wants more children	50.88	9.33	45.81	13.83	51.65	14.62	36.12	19.50	46.72	21.43
Wants no more	31.25	8.54	29.30	11.05	23.17	10.56	31.96	12.42	17.65	14.19

Note: p-values obtained with chi-square.

Table 4: Multivariable-Adjusted Logistic Regression Examining Contraceptive Use by Year, 1996-2016, Tanzania

Characteristics	1996 N=7,322		1999 N=3,616		2004-2005 N=9,227		2010 N=9,154		2015-2016 N=12,071	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age										
15-19	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20-24	3.46***	2.61-4.58	2.89***	2.07-4.03	3.05***	2.42-3.84	2.40***	1.95-2.96	3.67***	3.10-4.35
25-29	3.39***	2.51-4.58	2.81***	1.97-4.01	3.22***	2.53-4.10	2.82***	2.25-3.53	4.12***	3.43-4.94
30-34	3.76***	2.76-5.12	2.43***	1.66-3.56	2.37***	1.84-3.05	2.85***	2.26-3.60	4.04***	3.34-4.89
35-39	4.16***	3.01-5.77	2.12***	1.43-3.12	2.21***	1.69-2.88	2.38***	1.88-3.02	3.27***	2.69-3.98
40-44	4.22***	2.97-6.00	2.04**	1.32-3.15	1.37*	1.02-1.83	2.04***	1.59-2.62	2.44***	1.98-3.01
45-49	2.65***	1.80-3.91	1.15	0.71-1.87	1.24	0.91-1.70	1.30	0.98-1.71	1.32*	1.05-1.66
Educational attainment										
No education	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incomplete primary	2.54***	2.04-3.17	1.97***	1.49-2.60	1.71***	1.42-2.06	1.25*	1.04-1.50	1.38***	1.17-1.63
Complete primary	4.49***	3.69-5.46	2.34***	1.83-2.99	2.93***	2.51-3.41	2.16***	1.88-2.49	2.10***	1.85-2.38
Incomplete secondary/higher	5.15***	3.89-6.82	3.50***	2.58-4.75	2.56***	2.09-3.13	1.44***	1.21-1.72	1.95***	1.69-2.26
Residence										
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	0.47***	0.41-0.54	0.49***	0.41-0.58	0.46***	0.41-0.52	0.65***	0.58-0.73	0.66***	0.60-0.72
Marital status										
Not married	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Married	2.45***	1.94-3.08	3.08***	2.28-4.16	3.95***	3.22-4.83	3.07***	2.53-3.73	2.77***	2.40-3.20
Living together	2.25***	1.68-3.02	3.71***	2.47-5.59	4.16***	3.21-5.39	5.70***	4.29-7.57	2.93***	2.48-3.45
Widowed	2.02**	1.35-3.01	1.10	0.60-2.02	1.39	0.91-2.13	1.61*	1.11-2.32	1.20	0.89-1.61
Divorced	1.68**	1.19-2.37	2.06**	1.30-3.26	2.72***	2.03-3.65	2.08***	1.59-2.71	1.90***	1.53-2.37
Not living together	1.74*	1.09-2.78	3.84***	2.41-6.11	3.71***	2.66-5.18	2.66***	1.93-3.68	2.06***	1.65-2.57
Desire										
Wants more children	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wants no more	1.78***	1.54-2.05	1.98***	1.63-2.40	2.03***	1.79-2.32	1.07	0.95-1.20	1.86***	1.67-2.06

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5: Multivariable-Adjusted Logistic Regression Examining Contraceptive Use among Tanzanian Women, 1996-2016, Tanzania (N=41,390)

<i>Characteristics</i>	<i>OR</i>	<i>95% CI</i>
<i>Year</i>		
1996	1.00	1.00
1999	1.35***	1.21-1.49
2004-5	1.35***	1.24-1.46
2010	1.75***	1.62-1.90
2015-6	2.11***	1.96-2.28
<i>Age</i>		
15-19	1.00	1.00
20-24	3.22***	2.91-3.56
25-29	3.53***	3.17-3.93
30-34	3.30***	2.96-3.69
35-39	2.91***	2.59-3.27
40-44	2.27***	2.01-2.57
45-49	1.42***	1.24-1.62
<i>Educational attainment</i>		
No education	1.00	1.00
Incomplete primary	1.61***	1.47-1.75
Complete primary	2.50***	2.33-2.68
Incomplete secondary/higher	2.17***	1.98-2.36
<i>Residence</i>		
Urban	1.00	1.00
Rural	0.56***	0.53-0.59
<i>Marital status</i>		
Not married	1.00	1.00
Married	3.11***	2.85-3.39
Living together	3.52***	3.16-3.92
Widowed	1.52***	1.28-1.80
Divorced	2.14***	1.88-2.43
Not living together	2.60***	2.26-3.01
<i>Desire</i>		
Wants more children	1.00	1.00
Want no more	1.62***	1.53-1.72

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$