

ABSTRACT

Title of Dissertation: DETERMINANTS OF UNINTENDED PREGNANCY AND MODERN FAMILY PLANNING USE

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Unintended pregnancy, defined as a pregnancy that is mistimed or unwanted, is one of the world's most common negative health outcomes. Furthermore, the United Nations Population Fund has found that 225 million women wish to delay or avoid pregnancy yet do not engage in modern family planning method use. Unintended pregnancy affects both maternal health (by way of nutrient deficiency, reproductive organ deficiency, and mental health) and child health (low birth weight, reduced gestational age, and nursing difficulties). The most life-saving and cost-saving means to prevent unintended pregnancy is to encourage modern family planning use. This dissertation examines family planning and unintended pregnancy in three different national contexts. In these studies, I:

1. Decompose the differences in unintended pregnancy rates for black and Hispanic women compared to white women in the United States;
2. Examine the relationship among indicators of health literacy, health system access, and utilization of modern family planning in Senegal;
3. Evaluate an intervention in Benin designed to increase modern family planning use.

My research found that black and Hispanic women had a greater likelihood of unintended pregnancy compared to white women. However, psychosocial and socioeconomic factors contributed to the greater likelihoods of unintended pregnancy among racial and ethnic minorities. Among indicators of health literacy, oral and visual messages were the strongest predictors of health system access and modern family planning use in Senegal. The conclusion of the intervention in Benin found that social diffusion behaviors increased among people in the treatment group, and furthermore, the intervention did reduce unmet need for modern family planning use. These research results, though from different research studies, can imply that increasing access as much as possible to modern family planning use can ultimately prevent unintended pregnancy.

DETERMINANTS OF UNINTENDED PREGNANCY AND MODERN FAMILY
PLANNING USE

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2017

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Dedication

I dedicate this research to the birth-mother of my son, Jayu. I am thankful every day that you made a choice that was right for you and right for our family. May all find bodily autonomy as well.

Acknowledgements

I wish to thank the University of Maryland Graduate School. The opportunity to show UMD that I was capable and successful was an enormous honor. I was proud to have received the Graduate Dean's Dissertation Fellowship for the 2016-2017 academic year. I am also proud to have been awarded a Fulbright Fellowship and a Doctoral Dean's Scholar Award.

To my professors at the University of Maryland, thank you for bestowing your public health scholarship. The three and a half years with the Health Services Administration Department flew by very quickly. Thank you for making it so much fun and so intellectually stimulating and supportive. Thanks to my original Cash & Counseling colleague, Dr. Lori Simon-Rusinowitz. You first knew me as a neophyte public health research assistant at Mathematica Policy Research, and now I have completed the doctoral program here. Thank you for convincing me to apply five years ago and for being a confidante through my struggles with invisible illnesses. Thank you, Dr. Muhiuddin Haider, for serving as a surrogate parent. With your support, I am your first PhD student at College Park who has now completed the Global Health Certificate. I took four semester courses with you, more than anyone else here at UMD. You helped me to springboard my global health career. Thank you to Dr. Jie Chen for providing unconditional support for pursuing my quantitative data research career. I am very pleased to have added more number crunching skills into my toolbox. Lastly, thank you to my research advisor, Dr. Michel Boudreaux. Last year was a scary time and period of transitioning in my doctoral studies. Your

support, recovery plan, and bringing me back in as a working parent made my life much less daunting. I have made it this far with your encouragement and insight.

To my colleagues at Georgetown, Rebecka Lundgren, Kim Ashburn, Mariam Diakit , and Susan Igras it has been an absolute pleasure to develop a working partnership. Thanks so much for teaching me about social network diffusion theory. I am excited that we will likely present our findings later this year in Baltimore. I am so glad we all spoke with each other last year with members of CARE to further change dialogue about gender norms.

To my son, Jayu, you are one amazing and inquisitive child. I want to know that what I am doing will create a better world as you grow. I worry about the current affairs, but when I look at your face and hear your questions, I recognize your curiosity will keep humanity alive. I cannot wait to see what you do as you continue to become your own person. I will work endlessly to make this world better for you.

To my cats, Gink and Schr dinger, I cannot imagine any better furry companions who have helped me with my research. You kept the office warm and the house quiet, except when you wanted to be fed. I could not have asked for any better office-mates.

To my parents, Dr. B. Sung Kim and Kyung-mi Min Kim, thank you for always pressuring me to pursue the most challenging paths. It has taught me that life is much more satisfying when we cannot always solve problems immediately. We must always think.

Lastly to my husband, Dr. Nathan H. Parrish, I am so honored to call you my husband. We have been on this journey for 10 years (yours and now mine). It has not

been easy, but it always seemed more achievable because we had each other. You were always so happy whenever I earned awards and went to conferences. I hope you feel that I was there for you, too. We have made it this far, and now we dream of our future endeavors.

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List of Abbreviations

ACA	Affordable Care Act
AOR	Adjusted Odds Ratio
CDC	Centers for Disease Control
CPR	Contraceptive Prevalence Rate
DHS	Demographic and Health Surveys
DID	Difference in Difference
FP	Family Planning
HLS	Health Literacy Skills
MDG	Millennium Development Goals
NCHS	National Center for Health Statistics
NSFG	National Survey of Family Growth
PPACA	Patient Protection and Affordable Care Act
SDG	Sustainable Development Goals
SEM	Social Ecological Model
SEM	Structural Equation Model
UN	United Nations
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
USD	United States Dollars
WHO	World Health Organization

Chapter 1: Introduction

Background

Unintended pregnancy is one of the world's most common negative health outcomes. As of 2016, nearly 225 million women worldwide, or 1 out of every X women of child bearing age, wanted to delay or avoid pregnancy, yet did not use safe or effective methods to do so (UNFPA, 2016). This unmet need has far reaching consequences for individual women, their families, and their communities.

This dissertation examines unintended pregnancy and contraceptive method use in the United States and in two countries of West Africa. In the United States, unintended pregnancy is still a common negative public health outcome among women, even though the US has the most prosperous economy in the world. In West Africa, which includes the United States Agency for International Development (USAID) funded nations of Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Guinea, Mali, Niger, Nigeria, Senegal, and Togo, the unintended pregnancy rate has hovered around 40% for approximately the last 15 years (Malarcher, Olson, & Hearst, 2010; Sedgh, Singh, & Hussain, 2014).

In this introductory chapter I review evidence on the consequences of unintended pregnancy and introduce the theoretical frameworks that serve as the foundations that guide the later chapters. I provide a political background that describes the history of family planning programs that have been supported by the United States. I also discuss main findings of each of the chapters. The introduction concludes with a review of each chapter in the dissertation and the common themes.

Negative Health Consequences of Unintended Pregnancy

Unintended pregnancy is associated with negative health outcomes for women and infants. Unintended pregnancy is associated with increased levels of stress and depression (Maxson & Miranda, 2011), shorter maternity leaves (R. K. Dagher, Hofferth, & Lee, 2014), and delay of antenatal care (Mayer, 1997). There is also concern for women's safety regarding their personal lives and their overall reproductive safety. Women who have unintended pregnancy are more likely to report household dysfunction and abuse (Thapa, Shyam, 2011), unsafe abortion (Gipson, Koenig, & Hindin, 2008; Grimes et al., 2006), and unsafe birth spacing by WHO standards, two births occurring within two years of each other (Conde-Agudelo, Rosas-Bermudez, Castaño, & Norton, 2012; DaVanzo et al., 2004; Exavery et al., 2012; Leonard, Gee, Zhu, Crespi, & Whaley, 2014).

Preventing Unintended Pregnancy

The most life-saving and cost-effective means to prevent unintended pregnancy is to encourage modern family planning use. Globally, for every 1 USD invested in family planning, the cost of pregnancy-related care reduces by 1.47 USD (S. Singh, Darroch, & Ashford, 2014). However, there remain many barriers to modern family planning use. Reproductive health, which includes family planning, has been one of the largest projects for USAID since 1965 ("Family Planning and Reproductive Health," 2015). Between 1994 and 1996, USAID closed 23 country missions, eight in Sub-Saharan Africa, and created a regional program dedicated to family planning, mostly through African managers and organizations as a cost-saving measure (Shepard, Bail, & Merritt, 2003). The closing of USAID missions does not represent a serious obstacle since one reason for this transition was to promote long-term capacity building where nations' own organizations would become leaders in communities. More Sub-Saharan African

and South Asian countries now provide oral contraceptives and injectables through community-based distribution programs (FHI 360, 2013; Hossain, Khan, & Begum, 1999).

Political Climate of Reproductive Health

Since one goal of closing USAID missions was to shift outside aid to nations' internal aid, there have been unintended consequences with internal leadership. Local level political leaders in developing nations have often created barriers to accessing modern family planning methods. In urban Senegal, even where there are not legal restrictions to provide contraception to unmarried young women, young women have claimed that their physicians would not give them access (Sidze et al., 2014). More recently, in the United States and in developing nations, lawmakers and politicians have pressed for abstinence-only education instead of comprehensive sexual education that includes family planning education (Boonstra, 2011). The shift in comprehensive sexual education to abstinence-only sexual education mostly began under the Bush (43) administration. However, the change in support from the United States regarding family planning programs began as early as the 1980s.

Support for family planning programs in developing nations changed in the 1980s during the era of China's well-known population control program, "Wan Xi Shao," (later, fewer, longer). This major population control effort became known as the one-child policy. The policy was not voluntary family planning; the United States Department of State declared the one-child policy as coercive in law and practice (Dewey, 2004). One of the greatest consequences of Wan Xi Shao program was sex-selection abortions (Ebenstein & Sharygin, 2009). In 1984, the Reagan Administration issued a policy statement to the International Assembly on Population and Development that the United States would refuse support to any non-governmental organizations (NGOs) performing abortions (Holden, 1984). This policy existed under the Bush (41) and (43)

Administrations, was rescinded by Presidents Clinton and Obama, and was re-instated again under Trump (Aizenman, 2017; Obama, 2009). United States' aid development for family planning programs has varied depending on the political party of the current president.

While the United States and certain West African nations (Senegal and Benin, in particular) have progressed in reducing unintended pregnancy and increasing access to family planning, within the United States, racial and ethnic minorities experience some of the greatest burden of unintended pregnancy and births (Kost & Forrest, 1995; William Mosher, Jones, & Abma, 2012; Williams, 1991). Approximately 25% of the world's women live in nations that either ban abortion or permit abortion in life-saving circumstances only (Gipson et al., 2008). In Western Africa, particularly in Senegal and Benin, it is legal to terminate a pregnancy in life-saving instances only, so abortion requires medical team approval ("Abortion in Senegal," 2015, "Benin," 2003). West Africa experiences 44% of the world's maternal deaths from unsafe abortions, and there are an estimated 24 unsafe abortions per 1,000 women, aged 15-44 (Grimes et al., 2006).

Dissertation Foci

This dissertation applies health behavior theories to ascertain the determinants of unintended pregnancy and family planning use. Specifically, the aims of the dissertation are to:

1. Decompose the differences in unintended pregnancy rates for black and Hispanic women compared to white women in the United States;
2. Examine the relationship between health literacy indicators and modern family planning use in Senegal;
3. Examine how social network diffusion and exposure to a family planning intervention program in Benin influenced modern family planning use, intentioned use of modern

family planning, and meeting family planning needs and understand how exposure to family planning intervention methods through radio and social network diffusion was

associated with these outcomes after the intervention had concluded.

While I describe each of the different conceptual frameworks I employ in detail in the second, third, and fourth chapters, below I provide a general overview. The three separate aims do consider three different populations.

However, the process of researching

the populations reveals that unintended pregnancy is a worldwide occurrence with consequences that harms all women, children, and nations. Furthermore, even though Benin and Senegal are nations receiving aid from the United States, this dissertation forces us to witness that even in the wealthiest nation, reproductive health must be taken more seriously. The final section of this chapter provides a roadmap to the rest of the dissertation.

Conceptual Frameworks

Given the distinct nature of the research questions and populations I consider, I draw on related, but distinct conceptual models to guide hypothesis generation and my empirical approach. However, the dissertation is guided by a conceptualized causal chain that connects women to reproductive outcomes.

Figure 1.1 displays the Social Ecological Model (SEM) (McLeroy, Bibeau, Steckler, & Glanz, 1988), which guides my analysis of racial disparities in US unintended pregnancy rates

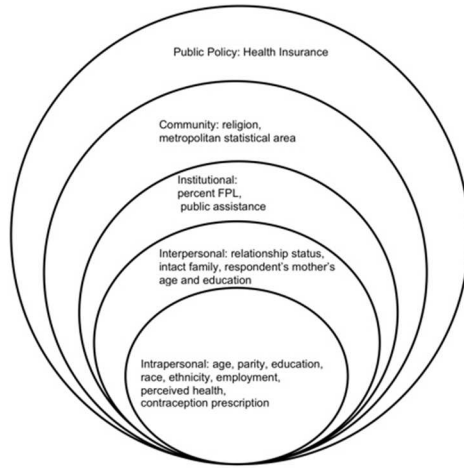


Figure 1.1 The Social Ecological Model of McLeroy et al. (1988) and its adapted application to unintended pregnancy.

(Chapter 2). I apply the SEM to research the determinants of unintended pregnancy because the causes of unintended pregnancy are not just at the individual level or dyadic level, but also depend on the institutional, community, and policy context. McLeroy et al. consider the intrapersonal, interpersonal, organizational, community, and public policy factors that shape women's fertility intentions. A fuller description of this theory and the racial and ethnic disparities surrounding unintended pregnancy are defined further in Chapter 2. The SEM has a long history in public health and provides a framework for synthesizing a large body of evidence on the multi-dimensional and multi-level causal determinants of population health and health care utilization.

Figure 1.2, below, shows the Health Literacy Skills Framework that guides my analysis of Senegal women (Chapter 3) (Squiers, Peinado, Berkman, Boudewyns, & McCormack, 2012). The HLS provides a conceptual underpinning for understanding the relationship between health literacy and health-related outcomes. I consider the relationship between health literacy and using family planning because the existing literature has found that lack of health literacy about family planning prevent its use. A common barrier to using family planning in developing nations is the perceived fear that it causes infertility, damages the fallopian tubes, uterus, and male sex organs (Hindin, McGough, & Adanu, 2014; Katz & Naré, 2002; Nalwadda, Mirembe, Byamugisha, & Faxelid, 2010). Focus groups in India, Nepal, and Nigeria have revealed that women had heard that family planning causes mental deficiency in children, increased risk for Cesarean-section deliveries, breast cancer, and death, and that the health information they receive from their other family members and friends influences their health decisions (Diamond-Smith, Campbell, & Madan, 2012). Despite growing knowledge of condoms and oral contraceptives, other focus groups research has found that few Senegalese women can name

more than two family planning methods. These women also have incorrect knowledge about intrauterine device implantation, its mechanism to prevent pregnancy, and its myth of causing damage to a fetus if a woman becomes pregnant (Naré, Katz, & Tolley, 1997). There is also not always comprehensive knowledge about effective family planning use. For example, discontinuation rates of injectable family planning remain high in multiple Sub-Saharan nations because many users who do not wish to become pregnancy still do not arrive for the next injection (Ross & Agwanda, 2012). As education and comprehensive sex education are strongly predictive of modern family planning use and continuation, more interventions to improve health literacy of family planning are necessary to reduce the fears and misperceptions regarding its effective use. Further details of health literacy are defined in Chapter 3.

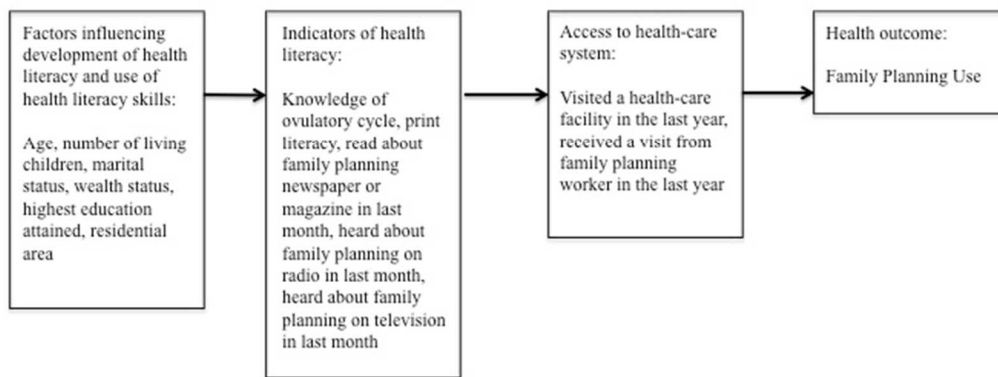


Figure 1.2: Conceptual Framework for Family Planning Use, adapted from Squiers et al. (2012)

Figure 1.3 displays the Social Network Diffusion Framework (Igras, Diakit , & Lundgren, 2016) when applied to current modern family planning use, intention to use modern

family planning, actual need met for modern family planning, and perceived need met for family planning. This theory guides my study of Benin in Chapter 4. I consider the relationship of social networks because they strongly guide women of what reproductive and maternal health decisions to make (Lowe & Moore, 2014). In a qualitative study of family planning fears and misperceptions in India, Nepal, and Nigeria, female friends and family members would tell a woman that contraception had negative health consequences based on their experience, and as a result, a woman would then not use family planning (Diamond-Smith et al., 2012).



Women’s influence on other women’s health behaviors (seeking skilled antenatal care, using family planning, or deciding to get pregnant) was consistent in other studies as well. The influence of other Malian women’s maternal and reproductive health behaviors have even greater influence on younger women compared than older women, and younger women are more at risk of unintended pregnancy because of higher fecundity (Madhavan, Adams, & Simon, 2003). A very specific gatekeeper in the social networks who has heavily governed a woman’s family planning use in India, Nepal, or Nigeria is any maternal figure, especially a mother or mother-in-law who lives in the family’s home (Diamond-Smith et al., 2012; Madhavan et al., 2003).

A Preview of Chapters 2, 3, and 4

In Chapter 2, Racial/Ethnic Differences in Unintended Pregnancy: Evidence from a National Sample of U.S. Women, I use a national sample of women to conduct the first study that decomposes what factors contribute to the greater proportions of unintended pregnancy for

Black and Latina American Women between 2006 and 2010 using a Fairlie Decomposition Model, an extension of the Blinder-Oaxaca Decomposition Technique (Fairlie, 2005).

Decomposition techniques' purposes are such that we may quantify separate contributions of group difference in measurable characteristics such as education levels, marital status, or racial or gender gaps for outcomes such as salaries or Federal Poverty Level (Oaxaca, 1973). When we consider a categorical outcome, such as having an unintended pregnancy (yes or no), it is necessary to modify the decomposition analysis, and thus I considered the Fairlie Decomposition Method, which uses estimates from a logit or probit model (Fairlie, 2005). My results are such that when adjusted for other factors discussed in the social ecological model, race and ethnicity were not significant predictors of unintended pregnancy despite an existing significant difference in unintended pregnancy between white and black women and white and Hispanic women. When decomposing our model by race and ethnicity, more psychosocial and socioeconomic factors such as age, education, relationship status, poverty, public assistance, and insurance status contributed to the differences in unintended pregnancy rates between racial and ethnic minorities compared to white women.

Chapter 3, *The Role of Health Literacy in Family Planning Use Among Senegalese Women*, addresses knowledge of reproductive health and indicators of health literacy. Particularly, I study mass media broadcasting of family planning messages as determinants of family planning use and family planning health services in addition to the other more frequently cited factors: wealth, education, age, marital status, and parity. I also describe how mass media and knowledge serve as indicators of health literacy. I apply structural equation modeling to Senegalese Demographic Health Survey (DHS) Data from 2014. This chapter is only the second paper to my knowledge that considers health literacy indicators from DHS data, and the first that

considers it in a family planning context. Our results suggest that certain indicators of health literacy, particularly radio and television broadcasting family planning messages, were strong determinants of modern family planning use.

Chapter 4, *Social Network Influence on Family Planning in Benin*, examines the impact of a social network diffusion intervention on current modern family planning use, intention to use modern family planning, actual met need for family planning, and perceived need met for family planning in three Beninese villages. This research uses difference-in-difference analysis to determine the treatment effect of the intervention on women's and men's family planning behaviors. The results suggest that there were significant treatment effects of the family planning intervention on women than there were for men. However, the intervention was effective at increasing social network diffusion about modern family planning for both men and women. Additionally, exposure to the family planning intervention through radio was particularly associated with increased odds modern family planning use, increased odds of intention to use modern family planning methods, increased odds of actual need met for modern family planning, and reduced odds of perceived family planning needs met.

The common themes I found in each of the chapters is that unintended pregnancy is not only a wealthy nation's public health concern. This is a public health priority that even the United States has not yet solved. However, the solution to preventing unintended pregnancy is the same for every chapter. If we increase health literacy and increase access surrounding modern family planning use, then preventing unintended pregnancy is a public health priority that all nations can solve together.

Conclusion

In the concluding chapter I discuss and integrate empirical findings of how research results confirm and inform health services and behavior theories. This discussion includes implications for policy in the United States, implications worldwide under the Millennium Development and Sustainable Development Goals Eras, and further research implications to continue family planning programs sustainably.

Chapter 2: Racial/Ethnic Differences in Unintended Pregnancy: Evidence from a National Sample of U.S. Women

Introduction

Unintended pregnancy is defined as any mistimed, unplanned, or unwanted pregnancy at the time of conception (Brown & Eisenberg, 1995). Preventing unintended pregnancy is a public health priority and human rights concern in the U.S. and worldwide (Gipson et al., 2008; “Healthy People 2020: Family Planning,” 2014). In 2008, 51% of pregnancies in the U.S. were unintended for women aged 15–44 years (Finer & Zolna, 2013). Women with unintended pregnancies report increased levels of stress and depression (Maxson & Miranda, 2011), delayed prenatal care, shorter maternity leaves (R. K. Dagher et al., 2014), and increased likelihood of smoking and drinking during pregnancy (Keeton & Hayward, 2007; Mayer, 1997). Women with unintended pregnancies are also more likely to experience household dysfunction and psychological and physical abuse (Thapa, Shyam, 2011). In 2010, the nation’s total public costs for births, abortions, and miscarriages resulting from unintended pregnancies were approximately \$21 billion (Sonfield & Kost, 2015).

Racial and ethnic minorities experience the greater proportion of unintended pregnancies and births (Kost & Forrest, 1995; William Mosher et al., 2012; Williams, 1991). In 2008, the percentages of unintended pregnancy were 69% among black women, 56% among Hispanic women, and 40% among white women (Finer & Zolna, 2013). Among women at risk for unintended pregnancy, 16% of black women, compared with 9% each of Hispanic, Asian, and white women, were not using contraception (Dehlendorf et al., 2014; WD Mosher & Jones,

2010). Other studies have documented lower contraceptive use among black and Hispanic women compared with white women (Craig, Dehlendorf, Borrero, Harper, & Rocca, 2014; Dehlendorf et al., 2014; Kost & Forrest, 1995; Williams, 1991). In addition, black and Hispanic women were less likely than white women to use and have correct information about hormonal and longer-acting contraceptive methods (WD Mosher & Jones, 2010).

Healthy People 2020 proposes eliminating health disparities and preventing unintended pregnancy (“Healthy People 2020: Disparities,” 2014, “Healthy People 2020: Family Planning,” 2014). Although studies have documented the prevalence of these racial/ethnic disparities, there is scarce research investigating factors associated with racial and ethnic differences in unintended pregnancy. Given the numerous health and economic consequences of unintended pregnancy, this study addresses an important gap in the literature by examining the factors that explain racial and ethnic disparities in unintended pregnancy among a nationally representative sample of U.S. women.

Methods

Conceptual Framework

This study used the social ecologic model (SEM) adapted from McLeroy and colleagues’ (McLeroy et al., 1988) original model of promoting health programs to research the determinants of unintended pregnancy. The SEM recognizes multiple levels of influencing health behavior: intrapersonal factors, interpersonal factors, organizational factors, community factors, and public policy (Figure 2.1). The literature review revealed the following intrapersonal factors to be associated with higher likelihood of unintended pregnancy: black race (Kost & Forrest, 1995; Williams, 1991), younger age (Brown & Eisenberg, 1995; Jones et al., 1985; Kost & Forrest, 1995; Martínez-García, Carter-Pokras, Atkinson, Portnoy, & Lee, 2014, p.; William Mosher et

al., 2012), greater parity (Koren & Mawn, 2010; Kost & Forrest, 1995; Maxson & Miranda, 2011; Williams, 1994), and below high school education (Finer & Henshaw, 2006; Finer & Zolna, 2013). Interpersonal factors associated with higher likelihood of unintended pregnancy have included single and cohabitating relationship status (Finer & Henshaw, 2006; Finer & Zolna, 2013; Kost & Forrest, 1995). Specifically, among Latina adolescents, having an intact family during childhood and a college-educated mother reduced unwanted pregnancy (Martínez-García et al., 2014). Institutional factors such as having incomes at the lower federal poverty levels (FPLs) (Williams, 1991, 1994), receiving public assistance (Rank, 1989), and not having comprehensive sex education (Brown & Eisenberg, 1995; Jones et al., 1985) were associated with increased unintended pregnancy. For community factors, the literature has found that non-religious and Roman Catholic adolescent women were less likely to have repeated unintended pregnancy within 2 years compared with Protestant adolescent women (Boardman, Allsworth, Phipps, & Lapane, 2006). Moreover, women in urban residences with low FPL had increased likelihood of unintended pregnancy compared with women of the same FPL in suburban and rural areas (Koren & Mawn, 2010). Research has shown that public policy factors such as health insurance status predict unintended pregnancy. Women with private insurance or Medicaid were more likely than uninsured women to obtain contraception prescriptions (Nearn, 2009). Uninsured women were more likely to not use contraception and be at risk for unintended pregnancy compared with women with private insurance (Foster et al., 2004). The present analyses incorporated variables at each level of the SEM, especially those found to be associated with unintended pregnancy in the literature.

Data and Sample

This study used the 2006–2010 National Survey of Family Growth (NSFG) data, which are publically available through the National Center for Health Statistics at CDC. The 2006–2010 NSFG data are based on a national population-based sample, and unlike previous versions, it now has a continuous design where interviews continue through each year (Lepkowski, Mosher, Davis, Groves, & Van Hoewyk, 2010). Between June 2006 and June 2010, the NSFG interviewed 12,279 women aged 15–44 years (William Mosher et al., 2012).

The NSFG data are self-reported. The questions consist of family life, marriage and divorce, pregnancy, fertility, contraception use, and women’s health. The Trained female interviews used laptop computers to interview all subjects, women who were 15-44 years of age living in US households. To aid women with recalling dates and detailed events, the interviewers would provide respondents with life history calendars. The interviews were conducted in only English or Spanish (“About the NSFG,” 2017).

Our outcome of interest was pregnancy intention *at the time of conception*. To decrease recall error of pregnancy intention status, I restricted the sample to pregnancies that were conceived up to 36 months prior to interview. Sensitivity analyses also tested different timeframes (2 and 5 years). The analytic sample included 3,557 pregnancies, where a mother may have had more than one pregnancy during the 36-month period.

Measures

Unintended pregnancies are defined as those that are mistimed or unwanted at the time of conception (Brown & Eisenberg, 1995). Within the NSFG data, this study used a binary term for pregnancy intention status. Mistimed or unwanted pregnancies were unintended pregnancies

whereas overdue, properly timed, and indifference were categorized as intended pregnancies to keep the unambiguity with only the unintended status (Finer & Zolna, 2011, 2013).

This study focused on racial and ethnic differences in unintended pregnancy using a limited sample of only white non-Hispanic (white) ($n=1,593$, 45%), black non-Hispanic (black) ($n=1,017$, 28%), and Hispanic women ($n=967$, 27%). The covariates for intrapersonal factors were respondent's age category at conception (<20 , 20–24, 25–29, and ≥ 30 years), if a respondent was born in the U.S., the respondent's highest completed education level (no high school diploma, at most a high school diploma, or Bachelor's degree or more), her participation in the labor force (currently working or not working), parity (total number of live births), perceived health status (excellent or very good, good, or fair or poor), and if she received a contraception prescription within the last 12 months. The interpersonal factors were the respondent's relationship status (married, divorced/widowed/separated, cohabiting, or never married and not cohabiting), whether the respondent's family remained intact during childhood, the respondent's mother's age at first birth (<20 , 20–24, or ≥ 25 years), and the respondent's mother's education level (no high school diploma, high school diploma only, or Bachelor's degree or more). The institutional factors included the %FPL ($<100\%$, 100%–199%, or $\geq 200\%$) and if the respondent had received public assistance within the last calendar year. The community factors included metropolitan statistical area residence (urban, suburban, or rural) and religion (none, Catholic, Protestant, or some other religion). Public policy factors included current health insurance status (private or Medi-Gap, Medicaid/Children's Health Insurance Program/other state-sponsored plan, Medicare/military/other government health care, or single-service/Indian Health/uninsured). The insurance status of a respondent was an individual level factor. However, previous research applying the SEM considered a respondent's insurance status

as a public policy factor (Koren & Mawn, 2010). Furthermore, we treated insurance status as a public policy factor because insurance status can be a result of public policy. For example, a previously uninsured woman may have become a Medicaid recipient upon becoming pregnant, which was a qualifying event based on previous legislation about Medicaid (The Henry J. Kaiser Family Foundation, 2013).

Statistical Analysis

The variables chosen for the multivariable logistic regression analysis were selected based on a priori causal assumptions about potential confounding factors as suggested by the SEM and literature on determinants of unintended pregnancy (Table 2.1). We tested and ascertained the assumptions of no multicollinearity, no outliers, and additivity of the covariates to ensure model fit for logistic regression.

Next, we applied the Fairlie Decomposition method to examine the factors contributing to racial and ethnic disparities in unintended pregnancy (Table 2.2). The Fairlie Decomposition is an extension of the Blinder-Oaxana Decomposition Technique (Fairlie, 2005). Our outcome of unintended pregnancy is nonlinear. The Fairlie Decomposition uses estimates from our logit model to provide estimates of the contribution of racial and ethnic differences in unintended pregnancy (Table 2.2). The contribution of each variable to the gap in unintended pregnancy is equal to the change in the average predicted probability of from replace the black distribution or Hispanic distribution with the white distribution of that variable while holding the distributions of the other variables constant. The sum of the contributions from the individual variables are equal to the total contribution from all variables included in the full sample (Fairlie, 2005). The Fairlie Decomposition also presents the statistically significant factors contributing to the racial

and ethnic differences (Table 2.3) (Fairlie, 2005; King, Chen, Dagher, Holt, & Thomas, 2014; Pagán, Su, Li, Armstrong, & Asch, 2009).

We kept the same variables as the logistic regression except for race and ethnicity, which became the basis for comparison for our decomposition analysis. Decomposition analysis has been used to ascertain the contributions of underlying factors in health disparities and inequalities in economics (Fairlie, 2005; King et al., 2014; Pagán et al., 2009). The Fairlie decomposition decomposes the mean differential of unintended pregnancy between black women and white women (the reference group), and Hispanic women and white women.

To obtain robust SEs, the analysis used 100 decomposition replications (King et al., 2014). To adjust for complex sampling design and to have a nationally representative sample, the authors used the sampling weights provided by the NSFG data set. All analyses were performed with Stata, version 14.0. Analyses occurred in Autumn 2014 and Winter 2015.

Sensitivity Analysis

As a sensitivity analysis, the authors conducted hierarchical regressions for each of the different levels of the SEM: intrapersonal, interpersonal, institutional, community, and public policy (Appendix Table 2.1). This analysis examined whether adding more covariates at the next level creates or removes statistical significance (R. Dagher & Shenassa, 2012). The results of the explanatory variables did not change significantly at each level of the SEM. We performed another sensitivity analysis by excluding cases where women were aged <20 years at the time of conception, as this population of women may not have completed high school or may not have been working at the time of conception due to their younger ages. The results of the explanatory variables were similar to the results in Table 2.1, and are included in Appendix Table 2.2.

Results

Within the sample of women, there were 1,593 pregnancies among white women (45%), 1,017 pregnancies among black women (28%), and 967 pregnancies among Hispanic women (27%). Of all 3,577 pregnancies, 1,765 (50%) were unintended. The mean age at conception was 26 (SD=0.62) years. The results of bivariate analyses are included in the Appendix. Overall, there were significant differences in unintended pregnancy rates for white (42%), black (63%), and Hispanic (48%) women. Further details about differences in other factors are in Appendix Table 2.3.

Table 2.1 provides ORs and AORs and their 95% CIs of the logistic regression measuring the association between respondent characteristics and unintended pregnancy. The adjusted odds of having an unintended pregnancy were not statistically significant by race and ethnicity (Black aOR=1.17, Hispanic aOR=1.02), in contrast to the unadjusted odds (Black OR=2.54, Hispanic OR=1.71), which showed that black and Hispanic women had largely significant higher odds of unintended pregnancy than whites. The factors most associated with increased odds of unintended pregnancy in the adjusted model were being aged <20 years at conception; not having a high school diploma; increased parity; receiving a contraception prescription within the last year; and being divorced, widowed, separated, cohabitating, and single and not cohabiting at conception. Factors associated with reduced odds of unintended pregnancy included having the respondent's mother complete high school as opposed to not completing high school, living in suburban or rural neighborhoods as opposed to urban neighborhoods, and being Catholic or Protestant as opposed to non-religious.

Tables 2 and 3 present the results of the Fairlie decomposition analysis. Table 2.2 shows the percentages of the racial and ethnic disparities in unintended pregnancy explained by the

Fairlie decomposition model. The model explained 51% of the 23-percentage point difference in unintended pregnancy between black and white women, and 73% of the 13-percentage point difference between Hispanic and white women. In other words, the observed factors in the model could explain 11.7-percentage points of the total 23-percentage point difference between blacks and whites and 9.2-percentage points of the total 13-percentage point difference for Hispanics and whites. The Fairlie decomposition explained much more of the difference between Hispanic and white woman than the difference between black and white women with regards to unintended pregnancy. Additionally, the Fairlie decomposition found more factors contributing to the differences in unintended pregnancy rates between black and white women than between Hispanic and white women.

As shown in Table 2.3, being aged <20 years contributed to about 16% of the difference between black and white women and 14% between Hispanic and white women. Similarly, single and non-cohabitation status contributed to unintended pregnancy differences between black and white women (20%) and Hispanic and white women (10%). FPL of $\geq 200\%$ negatively contributed to 15% of the difference in unintended pregnancy between black and white women. The respondent's mother's being aged ≥ 25 years at first birth negatively contributed to 10% of the difference in unintended pregnancy between black and white women. Medicaid positively contributed to 12% of the difference in unintended pregnancy between black and white women. Though these contributions to the differences in unintended pregnancy between black and white women were Hispanic, these were much smaller contributions compared to the contributions towards the difference between Hispanic and white women's unintended pregnancy rates, but this may have been because more factors contributed to the differences between black and white women. Between Hispanic and white women, not being U.S.-born substantially contributed to

differences in unintended pregnancy between Hispanic and white women (−48%) while having a college degree contributed to 60% of the difference. Socioeconomic factors contributed more to the differences in unintended pregnancy rates for black and white women than for Hispanic and white women.

Discussion

The purpose of this research was to decompose the differences in unintended pregnancy for black and Hispanic women compared with white women in the U.S. There were significant differences in unintended pregnancy between racial and ethnic minority women and white women in unadjusted logistic regression analyses. Compared with white women, black women had the highest proportion of unintended pregnancies, followed by Hispanic women. However, in the adjusted logistic regression model, these racial and ethnic differences became statistically non-significant. By contrast, previous research had found that black race and Hispanic ethnicity were associated with increased odds of unintended pregnancy (Craig et al., 2014; Kost & Forrest, 1995). It is possible that those racial and ethnic differences in unintended pregnancy are driven more by psychosocial and socioeconomic differences, such as age (Brown & Eisenberg, 1995; Jones et al., 1985; Martínez-García et al., 2014), education level (Brown & Eisenberg, 1995; Finer & Zolna, 2013), relationship status (Finer & Henshaw, 2006; Finer & Zolna, 2013; Kost & Forrest, 1995), and poverty level or public assistance (Finer & Zolna, 2013; Rank, 1989; Williams, 1994). This was confirmed in the decomposition model, which explained the different rates of unintended pregnancy between different groups. Being younger than age 20 years and single and non-cohabitating contributed to differences in unintended pregnancy between black and white women and Hispanic and white women. In addition, Medicaid status and lower FPL contributed to the difference in unintended pregnancy between black and white women. U.S.-

born status and education level contributed to unintended pregnancy differences between Hispanic and white women. These findings are consistent with those of the general literature on determinants of unintended pregnancy (Finer & Henshaw, 2006; Finer & Zolna, 2013; Foster et al., 2004; Kost & Forrest, 1995; William Mosher et al., 2012; Nearn, 2009). The present findings also support that multiple levels of influence, defined in the SEM in Figure 2.1, contribute to unintended pregnancy (Koren & Mawn, 2010; McLeroy et al., 1988).

Interestingly, community factors such as metropolitan residence and religion did not explain racial and ethnic disparities in unintended pregnancy. However, as seen in the logistic regression, they contribute to unintended pregnancy. Women living in suburban or rural neighborhoods were less likely to have unintended pregnancy compared with women in urban neighborhoods. Previous research has hypothesized that rural women would have greater unintended pregnancy rates compared with suburban or urban women based on access to family planning services, yet there was little difference in these rates by residential area (Koren & Mawn, 2010; Kost & Forrest, 1995). Other studies have found increased unintended pregnancy rates in urban youth populations who had experienced other negative health behaviors such as smoking, eating poorly, and being victims of sexual violence (Eaton et al., 2012; Rutman, Taulii, Ned, & Tetrick, 2012). It is possible that the increased odds of unintended pregnancy among urban women are more attributed to their age, poverty, or risky experiences and behaviors. In terms of religion, the current findings are in line with previous research that found that non-religious adolescent women had increased odds of unintended pregnancy compared with Catholic and Protestant adolescent women (Smid, Martins, Whitaker, & Gilliam, 2014).

This study is the first to apply the Fairlie decomposition analysis to determine how intrapersonal, interpersonal, institutional, community, and public policy factors explain the racial

and ethnic disparities in unintended pregnancy. The significance and contribution of this decomposition analysis is that it reveals which factors contribute to higher rates of unintended pregnancy for black and Hispanic women compared with white women, and the percentages of the racial and ethnic differences explained by these factors, 51% and 73%, respectively. These findings, which were consistent with the SEM model, suggest that interventions to reduce racial and ethnic differences in unintended pregnancy have to take into account multiple factors at multiple levels of influence. For example, interventions could target at-risk groups of women such as younger, unmarried, lower-income, less-educated, non-U.S. born women, and those with public insurance.

One potential policy intervention relates to women's health insurance coverage. Under the Patient Protection and Affordable Care Act (PPACA), Medicaid has expanded in 32 states including Washington, DC ("Status of State Action on the Medicaid Expansion Decision," 2016). Health plans must cover women's preventative health care, including contraceptives, without cost sharing ("Women's Preventative Services Guidelines," n.d.). These changes can offer opportunities for preventing unintended pregnancy for racial and ethnic minorities whose rates of unintended pregnancy are greater than white women and who are more likely to be uninsured or underinsured (Mehta, 2014; The Henry J. Kaiser Family Foundation, 2013). Between Autumn 2012 and Spring 2014, the proportion of privately insured women paying \$0 out of pocket for prescription contraceptives increased from 15% to 67% (Sonfield, Tapales, Jones, & Finer, 2014). Unfortunately, these rates are applicable to women with private insurance only; the rates of contraception use for publically insured and uninsured women remain unchanged (Finer, Sonfield, & Jones, 2014). Lower-income women are more likely to be uninsured or publically insured, but still 18 states have not expanded Medicaid ("Status of State

Action on the Medicaid Expansion Decision,” 2016, The Henry J. Kaiser Family Foundation, 2013). In many cases, these states also experience high unintended pregnancy rates, costs, and negative health outcomes (Finer & Kost, 2011; Gee, Levy, & Reyes, 2014; Sonfield, Kost, Gold, & Finer, 2011). Future research should consider examining the effects of the PPACA on unintended pregnancy rates in states that have expanded Medicaid and have implemented state exchanges compared with states that have not. The expectation is that Medicaid expansion under the PPACA may relieve some of the financial burden for lower-income women in states that expanded Medicaid (Garfield, Damico, Stephens, & Rouhani, 2015).

Limitations

The NSFG data are cross-sectional, thus the present analyses cannot determine temporal sequences or causality. This was evident with variables such as receiving a contraception prescription within the last 12 months and receiving public assistance in the last calendar year. The answers to those questions may not have impacted a pregnancy that occurred in the years prior to that. In addition, this study captures respondents’ current insurance status but not before or during the pregnancy. Furthermore, the current insurance status combines uninsured and Indian Health together. The authors cannot determine the exact number of people who are uninsured. With any interview period about a past event, recall bias is always possible. To limit this as much as possible, the sample included only pregnancies where conception occurred within 36 months of the interview. Still, there is always the possibility that recall bias exists, especially as the NSFG variables are self-reported through interviews. Also, some of the questions may have created social desirability bias, such as questions about sexual behavior and contraception use.

Conclusions

This research contributes a unique methodologic approach to understanding the underlying factors of racial and ethnic disparities in unintended pregnancy. Consistent with the SEM, the results showed that different levels of SEM influenced unintended pregnancy. The decomposition analysis showed that age, education, U.S. nativity status, relationship and marital status, poverty, and health insurance status contributed to racial and ethnic disparities in unintended pregnancy. Thus, interventions could target at-risk groups of women such as younger, unmarried, lower-income, less-educated, non-U.S. women, and uninsured or publicly insured women. Although this study could not separate the populations who were uninsured or had public health insurance, the authors expect that the provisions of the PPACA may have the potential to reduce racial and ethnic disparities in unintended pregnancy. Under the PPACA, the majority of the proposed target population would be previously uninsured populations who can now benefit from Medicaid expansion or insurance access through state marketplaces. Future research should investigate the impact of PPACA provisions on disparities in unintended pregnancy, especially by comparing states that have expanded Medicaid with states that have not.

FIGURE 2.1-The Social Ecological Model of McLeroy et al. (1988) and its adapted application to unintended pregnancy: National Survey of Family Growth, 2006-2010.

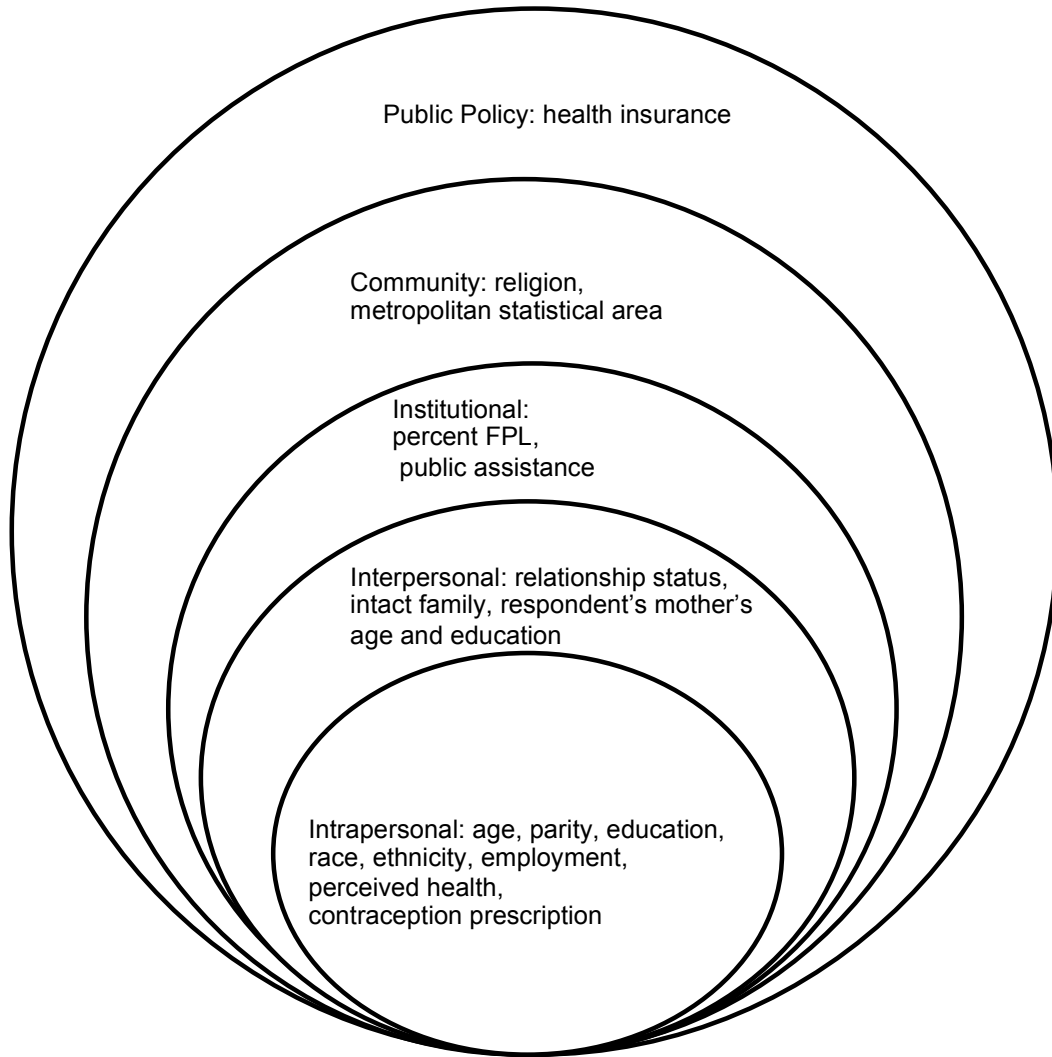


Table 2.1. Logistic regression models measuring the association between respondent characteristics and unintended pregnancy.

Respondent Characteristic	Unadjusted OR	95% CI	Adjusted OR	95% CI
Race/Ethnicity				
White (Ref)	1.00		1.00	
Black	2.54	(2.00,3.22)***	1.17	(0.85,1.65)
Hispanic	1.71	(1.35,2.16)***	1.02	(0.72,1.46)
Age at conception (in years)				
30+ (Ref)	1.00		1.00	
25 to 29	1.25	(0.94,1.65)	1.20	(0.87,1.65)
20 to 24	2.46	(1.88,3.21)***	1.58	(1.14,2.18)**
<20	6.87	(4.87,9.68)***	3.28	(2.10,5.12)***
Born in U.S. (No, Ref/Yes)	1.02	(0.79,1.34)	1.31	(0.87,1.97)
Education (Highest attained)				
No HS diploma (Ref)	1.00		1.00	
HS diploma	0.60	(0.48,0.75)***	0.95	(0.71,1.28)
BA/BS or more	0.14	(0.10,0.19)***	0.44	(0.28,0.70)**
Employment (No, Ref/Yes)	0.85	(0.69,1.03)	1.20	(0.94,1.54)
Parity	1.06	(0.99,1.14)	1.19	(1.07,1.32)**
Perceived health status				
Excellent/Very good (Ref)	1.00		1.00	
Good	1.25	(0.99,1.56)	0.96	(0.74,1.24)
Fair/poor	1.66	(1.15,2.39)**	0.81	(0.52,1.27)
Contraception prescription within last 12 months (No, Ref/Yes)	1.48	(1.22,1.81)***	1.28	(1.02,1.61)*
Relationship status at time of conception				
Married (Ref)	1.00		1.00	
Divorced/Widowed/Separated	5.76	(3.72,8.85)***	4.10	(2.51,6.69)***
Cohabiting	3.80	(2.93,4.92)***	2.34	(1.69,3.24)***
Never married, not cohabiting	8.77	(6.66,11.54)** *	5.06	(3.56,7.19)***
Intact family during childhood (No, Ref/Yes)	0.46	(0.37,0.56)***	0.83	(0.65,1.05)
Respondent's Mother's age at first birth				

<20 (Ref)	1.00		1.00	
20 to 24	0.70	(0.56,0.87)**	1.03	(0.79,1.34)
25+	0.65	(0.48,0.86)**	1.36	(0.95,1.94)
Respondent's Mother's education level				
No HS diploma (Ref)	1.00		1.00	
HS/GED only	0.77	(0.62,0.96)*	0.70	(0.52, 0.95)*
BA/BS or more	0.50	(0.36,0.70)***	0.72	(0.46, 1.11)
Poverty Level				
0 to 99 FPL (Ref)	1.00		1.00	
100 to 199	0.76	(0.59,0.98)*	1.25	(0.92, 1.70)
200+	0.35	(0.28,0.44)***	1.08	(0.76, 1.54)
Receipt of public assistance in last calendar year (No, Ref/Yes)	2.85	(2.32,3.50)***	0.99	(0.72, 1.35)
Residence				
Urban (Ref)	1.00		1.00	
Suburban	0.56	(0.46,0.70)***	0.74	(0.57, 0.95)*
Rural	0.57	(0.43,0.76)***	0.67	(0.47, 0.96)*
Religion				
No religion (Ref)	1.00		1.00	
Catholic	0.49	(0.36,0.67)***	0.67	(0.46, 0.97)*
Protestant	0.58	(0.44,0.76)***	0.65	(0.46, 0.90)*
Other religion	0.59	(0.38,0.91)*	1.24	(0.75, 2.06)
Current insurance status				
Currently Private insurance or Medi-Gap (Ref)	1.00		1.00	
Medicaid, CHIP, or a state-sponsored plan	2.97	(2.35,3.75)***	1.12	(0.78, 1.59)
Medicare, military, other government health care	1.85	(1.17,2.94)**	0.79	(0.46, 1.37)
Single-service, Indian Health, uninsured	2.94	(2.24,3.86)***	1.46	(1.00, 2.13)

Source: Estimates based on National Survey of Family Growth (NSFG) 2006-2010 (N=3,577).

Note: Boldface indicates statistical significance (P<0.05).

*P<0.05; **P<0.01; ***P<0.001.

a. Sample is restricted so that pregnancies occurred before a 36-month time-lapse between conception month and interview month.

b. Sampling weights applied.

c. Unadjusted ORs are results from the bivariate analysis while Adjusted ORs control for all listed covariates in the table (i.e., all respondents' characteristics).

Table 2.2. Decomposition of racial and ethnic differences in unintended pregnancy

	Black Compared With White	Hispanic Compared With White
Difference (0-1), %	22.93	12.57
Total explained difference, %	11.62	9.18
Explained, %	50.70	73.03
Unexplained, %	49.30	26.97

Source: Estimates based on National Survey of Family Growth (NSFG) 2006-2010 (N=3,577).

- a. Sample is restricted so that pregnancies occurred before a 36-month time-lapse between conception month and interview month.
- b. Sampling weights applied.
- c. Numbers may not add up to 100% due to rounding.

Table 2.3. Factors contributing to racial and ethnic differences in unintended pregnancy

Characteristic	Black Compared with White		Hispanic Compared With White	
	Coefficient (SE)	Contribution (%)	Coefficient (SE)	Contribution (%)
Being younger than 20 year at age at conception	0.03** (0.01)	16.03	0.02** (0.01)	14.39
Born in U.S. (No, Ref/Yes)	-0.001 (0.002)	-0.36	-0.06* (0.02)	-48.05
Having BA/BS or more	0.03 (0.02)	11.52	0.08** (0.02)	60.62
Never being married or cohabitating at time of conception	0.05* (0.02)	19.55	0.01*** (0.003)	9.69
Respondent's mother being 25 years or older at time of first birth	-0.02* (0.01)	-10.46	0.01 (0.01)	4.01
% FPL 200+	-0.04* (0.01)	-15.49	0.02 (0.02)	18.01
Current insurance is Medicaid, CHIP, or state-sponsored plan	0.03* (0.01)	12.34	0.002 (0.01)	1.55

Source: Estimates based on National Survey of Family Growth (NSFG) 2006-2010 (N=3,577).

Note: Boldface indicates statistical significance (P<0.05).

*P<0.05; **P<0.01; ***P<0.001.

a. Sample is restricted so that pregnancies occurred before a 36-month time-lapse between conception month and interview month.

b. Sampling weights applied.

c. Percentages may differ slightly due to rounding.

Chapter 3: The Role of Health Literacy in Family Planning Use among Senegalese Women

Introduction

Background

For the first time in 2014, the Senegalese, family planning rate use reached 20% (Agence Nationale de la Statistique et de la Démographie (ANSD) and ICF International, 2015). This is similar to other Sub-Sahara African yet much lower compared to United States Agency for International Development (USAID) assisted nations in North Africa and Asia (Khan, Mishra, Arnold, & Abderrahim, 2007). The Senegalese Ministry of Health wishes the CPR to reach 27% over the next few years (*CSIS: Family Planning in Senegal*, 2015; Stratton, 2015). The unmet need for contraception, defined as the percentage of women who do not want to become pregnant but are not using contraception (S. E. K. Bradley, Croft, Fishel, & Westoff, 2012), remains highest in rural areas and for unmarried and adolescent women (*CSIS: Family Planning in Senegal*, 2015; Sidze et al., 2014).

By not meeting the need for family planning, women and children will continue experiencing the negative health outcomes from low, ineffective, and non-use including unsafe abortion which was 32% of all abortions in 2012 for Senegal (Sedgh, Sylla, Philbin, Keogh, & Ndiaye, 2015) and unsafe birth spacing (DaVanzo et al., 2004). The risks associated with unsafe birth spacing, defined as two births within two years of each other (World Health Organization, 2005), may include maternal outcomes such as nutritional depletion, folate depletion, cervical insufficiency, vertical infection transmission, incomplete healing of uterine scars from previous Cesarean births, abnormal process of remodeling endometrial blood vessels, and physiological

regression (Conde-Agudelo et al., 2012; K. G. Dewey & Cohen, 2007; Rezk, Marawan, Dawood, Masood, & Abo-Elnasr, 2015). Unsafe birth spacing also carries infant risks such as decreased gestational ages at birth (DeFranco, Seske, Greenberg, & Muglia, 2015), lower chances of survival (Kayode et al., 2014), and lower birth weight (Merklinger-Gruchala, Jasienska, & Kapiszewska, 2015).

The consequences to unintended pregnancy are not only health related. There are severe economic consequences of unintended pregnancy. Attempts to induce abortion can result in imprisonment up to five years and fines up to 100,000 CFA francs (Clarke, Sall, Mané, Diop, & Daff, 2014). There are economic benefits to family planning. Every additional dollar invested into family planning services saves \$1.47 in pregnancy-related and newborn health-care worldwide (Barot, 2015).

Previous research has found that among lower Gross Domestic Product Nations, there are factors associated with increased family planning use. An urban Senegalese study found that having completed secondary school (Katz & Naré, 2002) was associated with increased family planning use. A rural Tanzanian study found that having reached desired family size or more living children increased family planning use (Marchant et al., 2004). An intervention for Nigerian and Ghanaian youth groups found that receiving comprehensive sexual education was effective and increasing family planning use (Brieger, Delano, Lane, Oladepo, & Oyediran, 2001). Multiple nationally representative family surveys in developing nations found that living in urban areas with a husband who agrees with a woman about family planning use increased family planning use (Faye, Faye, Bâ, Ndiaye, & Tal-Dia, 2010; Speizer, Fotso, Davis, Saad, & Otai, 2013). Misperceptions research of urban areas, specifically Dakar, Guediawaye, Pikine, Mbao, Mbour, and Kaolack, in Senegal using representative urban samples found that agreement

with myths at the individual and community levels was negatively associated with family planning use among women in unions (Gueye, Speizer, Corroon, & Okigbo, 2015).

Wealth has a substantial relationship with total fertility rates and contraceptive prevalence rates (Rutsein & Johnson, 2004). There is limited research thus far about how a couple's wealth index predicts their family planning use. However, studies have examined wealth index and its prediction of using antenatal care services where families with increased wealth are more likely to seek such maternal care services in Bangladesh and Ethiopia (Kamal, Hassan, & Islam, 2013; Tarekegn, Lieberman, & Giedraitis, 2014). While affordability of family planning is not always dependent on increased wealth index, USAID supports family planning accessibility by keeping it available at low-cost. However, one of the unintended consequences has been maintaining sufficient stock of contraceptive products at health clinics and pharmacies. Meeting supply chain needs has become a USAID priority for family planning (USAID, 2015). Yet still there is evidence that health facilities cannot always meet the demands of women seeking family planning services, and thus low supply chain is associated with low contraceptive prevalence rates in Senegal (Cavallaro et al., 2016). Besides the demographic and economic factors associated with family planning use, attitudes and knowledge towards family planning are also strong predictors of family planning use.

Health Literacy

The World Health Organization (WHO) defines health literacy as the cognitive and social skills determining the motivation and ability for people to access, understand, and use information to promote and maintain good health ("WHO: Health literacy and health behaviour," 2015). Another definition implies that health literacy is the achievement of a level of knowledge, person skills, and confidence to take action to improve personal and community health by

changing personal lifestyles and living conditions (Kickbusch, 1997). Health literacy can also be the degree to which an individual can interpret, obtain, process, and understand the basic health information and services they need to make appropriate health decisions (Nielsen-Bohlman, Panzer, & Kindig, 2004). Health literacy differs from literacy since health literacy requires different skills such as those necessary for finding, evaluating, and integrating health information from a variety of contexts. Health literacy also goes beyond individual since it depends on skills, preferences, and expectations of health-care providers, the media, and social networks (Nielsen-Bohlman et al., 2004). Health literacy also requires knowledge of health-related vocabulary and knowledge of the healthcare system (Rootman, 2009).

For this study, knowledge about family planning and knowledge of reproductive health represent indicators of health literacy. There is evidence in the literature that there are knowledge gaps and wide misperceptions about family planning. A common barrier to using family planning discussed in focus group research is the perceived fear that it causes infertility and damages the fallopian tubes, uterus, and male sex organs (Hindin et al., 2014; Katz & Naré, 2002; Nalwadda et al., 2010). Focus groups in India, Nepal, and Nigeria revealed that women believed family planning causes mental deficiency in children, increased risk for Cesarean-section deliveries, breast cancer, and death, and that the health information they receive from their other family members and friends influences their health decisions (Diamond-Smith et al., 2012). Despite growing knowledge of condoms and oral contraceptives, other focus group research discussed that few Senegalese women could name more than two family planning methods. Women also had incorrect knowledge about intrauterine device (IUD) implantation, its mechanism to prevent pregnancy, and its myth of causing damage to a fetus if a woman becomes pregnant (Naré et al., 1997). There is also not always comprehensive knowledge about effective

family planning use. Discontinuation rates of injectable family planning have remained high in multiple Sub-Saharan nations because many users would not arrive for the next injection (Ross & Agwanda, 2012). As education and comprehensive sex education predict modern family planning use, more interventions to improve health literacy are necessary to reduce the fears and misperceptions regarding effective family planning use. A solution to increase health literacy of family planning can be providing more free information and education about how to properly use family planning as some nations have done (Brieger et al., 2001; Hossain et al., 1999; Wilder, Masilamani, & Daniel, 2005).

Health literacy is an important component of family planning use at the individual and at the population levels. Fewer people will spread misinformation when communities increase their health literacy. There is a substantial knowledge gap about family planning, which must be narrowed if Senegal is to reach its family planning goals. To educate the Senegalese population about the benefits and risks of the full range of contraceptive options requires that the population have sufficient skills to seek out, comprehend, and act on family planning messages.

Furthermore, not all childbearing-age women are familiar with the types of contraceptive methods, their benefits and side-effects, or how to pay or access them in the first place (Chandra-Mouli, McCarraher, Phillips, Williamson, & Hainsworth, 2014; Diamond-Smith et al., 2012, p.; Jammeh, Liu, Cheng, & Lee-Hsieh, 2014; Katz & Naré, 2002; Küçük, Aksu, & Sezer, 2012). There also remains a continued barrier to accessing comprehensive sexual education (CSE), reproductive health education (RHE), and family life education (FLE). Only 18% of girls and 24% of boys attend secondary schools in Senegal, and the Ministry of Education has been responsible for disseminating health and education programs to adolescents (Chau, Seck, Chandra-Mouli, & Svanemyr, 2016; Haapasolo, 2016). Such educational programs are a means

to increase health literacy, and the inability to access these programs is problematic for Senegalese people who do not attend secondary schools.

In previous research, public health experts defined the interventions to influence health behavior change as health communication (Rimal, 2009). Such interventions can include social marketing through media campaigns in print, over television, or over radio. Health communication and health literacy are not identical, but health communication interventions have the purpose to inform people and to encourage behavior change (Rimal, 2009). To attain health literacy, effective health communication channels are necessary, but they are not sufficient (Ratzan, 2001). In this study, we treat the event of receiving health communication through print, radio, and television as indicators of health literacy. We assume that receiving media communication about family planning would be similar to having been exposed to increased wealth. Radio, television, and print media exposure can determine whether a person receives mass media health messages (Rutsein & Johnson, 2004; Schrauben & Wiebe, 2015). Previous DHS research in Nigeria and cross-sectional urban representative data in Senegal also found that exposure to media promotion of family planning through television and radio is positively associated with ever-use of contraception (Bankole, 1994; Okigbo, Speizer, Corroon, & Gueye, 2015). Furthermore, owning a radio or television are household items collected for purposes of determining wealth, and increased wealth has been associated with more positive health outcomes (Rutsein & Johnson, 2004). The purpose of this study was to identify the relationship between indicators of health literacy and using modern family planning in Senegal. A sub-purpose of this study was to examine the relationship among indicators of health literacy, accessing health services, and using modern family planning in Senegal.

Theoretical Framework

The objective of this study was to determine how indicators of health literacy via mass media, knowledge about reproductive health, and literacy skills influence family planning use. We applied the Health Literacy Skills (HLS) Conceptual Framework (Figure 1). The HLS model hypothesizes the relationship between health literacy and health-related outcomes (Squiers et al., 2012). The HLS model also illustrates how health literacy functions at the individual level and recognizes that external factors such as personal relationships, societal norms, and mass media presence can also influence health behaviors (Squiers et al., 2012).

Methods

Health-Related Behavior and Outcome

The health-related behavior was using a modern family planning method as defined by the WHO. These included oral contraception, implants, rings, patches, IUDs, condoms, sterilization, emergency contraception, lactation amenorrhea, standard days, basal body temperature tracking, and ovulation tracking (“WHO | Family planning/Contraception,” 2015). The inclusion criteria were women who were using contraception and women who were not using contraception. We do not include women who were pregnant, infertile, or menopausal at the time of interview. We have described the HLS Model components of this study in Figure. The framework considered four sections: (1) factors influencing development and use of health literacy skills such as demographics and individual resources (2) indicators of health literacy via print, oral communication, or information seeking (3) mediators that may influence the relationship between health literacy and health-related outcomes, and (4) health-related behaviors and health outcomes (Aldoory, 2016; Squiers et al., 2012; Sun et al., 2014).

Data and Sample

This study used cross-sectional and publicly available data from the 2014 Senegalese Demographic Health Survey (DHS), a survey sponsored by USAID and conducted by ICF International. The DHS surveys collect information on characteristics of households and of women and men. The Senegalese Women's DHS is a nationally representative sample of 22,365 women who were between 15 to 49 years old at the time of the interview. For the 2014 Senegalese DHS, households were selected at random. Respondents met with a matched gender field team member to take the survey in the language of her choice. The survey was conducted in at least six different languages ("DHS Model Questionnaires," 2016). The response rate among eligible women between 15 and 49 years between 2012-2014 was 95.8%. Women in urban settings responded at 96.3% while women in rural regions responded at 95.5% (ICF International, 2015). DHS Surveys are conducted over about 18 months. The samples are generally representative at the national, residence, and regional levels. The samples are usually based on stratified two-stage cluster designs: (1) Enumeration Areas drawn from Census files and (2) in each Enumeration Area, the DHS draws samples of households ("DHS Model Questionnaires," 2016).

The 2014 Senegalese DHS asked respondents questions regarding background characteristics (age, marital status, education, employment, media exposure, religion, ethnicity, and place of residence), economic resources, reproductive behavior and intentions, knowledge about contraceptive methods, status of women (decision making, autonomy, ownership of houses and land, barriers to medical care, and attitudes towards domestic violence) and health-care access (L'Agence Nationale de la Statistique et de la Démographie, 2012, "DHS Model Questionnaires," 2016). We do not include religion in the analysis as 96% of the sample were

Muslim, which is consistent with Senegalese religion statistics (Bop, 2005). There is research that supports religion's role in fertility behaviors, particularly that religion may serve as a barrier towards family planning use (Greenwell, 2012; Shiffman & Quissell, 2012). However, there are different branches of Islam, and in parts of South Asian and the Middle East where religious leaders have emphasized maternal and child health as supporting the Qur'an's message (Mahmood, 2012; Roudi-Fahimi, 2004; Underwood, Kamhawi, & Nofal, 2013). Thus, we excluded religion from this research for its lack of variability and for acknowledging that Islam is not synonymous with anti-family-planning messages. We also excluded ethnicity as there is not yet detailed literature discussing its relationship with fertility outcomes for Senegal. For this study, we treated modern family planning use as a binary variable: when a woman reported using one of the WHO's specified methods, the variable was 1; the variable was equal to 0 when she reported not using any of the methods and did not intend to use one in the future. We removed cases where women were pregnant, infertile, or menopausal at the time of the interview. Our final sample consisted of 19,671 women.

Thirteen variables were included in the present analyses. The individual resources and demographics consisted of age (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, or 45-49), number of living children (none, one-five, or six or more), marital status (never, married, living with partner, widowed, divorced, or no longer living together/separated collapsed to married or unmarried because of the limited sample who were not married or who had never been married), wealth status (poorest, poorer, middle, richer, or richest), highest education attained (none, primary, secondary, or more than secondary, which we collapsed to none, primary, or secondary or more because of the limited sample with more than secondary education), and residential area (urban or rural). To measure health literacy, the indicators included literacy (none, some words,

or full sentence), having read about family planning information in the last month (yes or no), hearing about family planning information on the radio or on television in the last month (yes or no), and knowledge of one's ovulatory cycle (during her period, after period ended, middle of the cycle, before period begins, at any time, or don't know which we collapsed to no, parts of it, or any time). We chose these variables as indicators of health literacy because of their representation of the domains of definitions of health literacy from the WHO, Nielson-Bohlman et al. (2004), and Kickbusch (1997). Furthermore the variables included were consistent with a study assessing health literacy in Zambia, another USAID and DHS-served nation (Schrauben & Wiebe, 2015). The mediators that Squiers and colleagues (2012) considered are mostly related to self-efficacy, attitudes, and motivation. For this research, we modify the HLS Framework and do not include such mediating factors but instead consider accessing the health-care system. These include visiting a health facility in the last year (yes or no) and receiving a visit from a family planning health care worker within the last year (yes or no). We include accessing the health care system in our model is because access in the form of availability, accessibility, accommodation, affordability, and acceptability can determine whether women use family planning health services (Penchansky & Thomas, 1981). Furthermore, since the Senegalese Ministry of Health wishes to increase the total CPR with financial investments, health-care workers, both those in health-care facilities and those who visit people at home, are stakeholders in Senegal's desire to increase the total CPR.

Statistical Analyses

The HLS model and literature on determinants of family planning use suggested which variables would be most appropriate for a structural equation model (SEM). We chose to apply SEM because of the ability to examine direct and indirect effects of health literacy indicators,

access to the health care system, and modern family planning use (Hancock & Mueller, 2013; Kline, 2015). Our path diagram, Figure 2, with the measured variables (represented with rectangles) displays directional arrows that point from causes to effects. The strength of SEM is that it can also test the HLS theory applied to family planning use (Kline, 2015; Mueller & Hancock, 2010). Another strength of the SEM is that with multiple indicators representing health literacy, we reduce the risk of multicollinearity.

Within the 2014 Senegalese DHS, there were very few missing data on the individual variables in our model. The only variable for which there were missing values was literacy, and its missingness proportion was only 0.001 (inconsequential). To adjust for sampling design, we used the individual sampling weights provided by the DHS data set in all analyses (“DHS Model Questionnaires,” 2016). We assumed the errors were independent and identically distributed over observations. Given the categorical nature of all variables in the model and the multiple levels, we applied a multilevel generalized structural equation model to confirm the HLS theory (StataCorp LP, 2013). Furthermore, we estimated our model with multinomial families and logit links (Huber, 2013). All analyses were performed in Stata Version 14.2 and R Version 3.3.1 with maximum likelihood estimation.

Results

Descriptive Statistics

Table 3.1 presents the proportions and p-values of chi-square tests used in the bivariate comparison between modern family planning use and the 13 variables in the study. Within the sample of 19,671 eligible women who were using or were not using modern family planning, 4,395 (22%) were modern family planning users while 115,276 (78%) did not use modern family

planning. The majority (N=18,217, 93%) were married, had one to five living children (N=11,991, 61%), lived in rural settings (N=13,391, 68%), had no formal education (N=15,092, 77%), could not read (N=16,180, 82%), knew parts of their ovulatory cycle (N=13,031, 67%), did not hear of family planning on the radio in the last few months (N=12,794, 65%), did not hear of family planning on television (N=14,197, 72%), were not visited by a family planning worker in the last year (N=16,908, 86%), and visited a health facility in the last year (N=13,622, 69%). There were significant differences in family planning use for all covariates.

Structural Equation Model

The survey item, “Knowledge of ovulatory cycle,” had not previously been included in other health literacy literature using DHS data (Schrauben & Wiebe, 2015). However, we argue for its presence in the model based on the HLS conceptual framework (Squiers et al., 2012) and based on previous literature identifying reproductive health knowledge as a determinant of modern family planning use, even when controlling for education (Brieger et al., 2001).

Table 3.2 provides the results of the structural equation model of all eligible women. The direct effect of marital status in isolation on family planning use was estimated to be 0.93 (95% CI: 0.66-1.19) and highly statistically significant. This can be interpreted as an expected married woman with the same attributes as an unmarried woman being 0.93 increase log-odds more likely or rather $\exp(0.93)=2.53$ times more likely to use family planning. Table 3.1 shows that 22% of women in the sample engaged in modern family planning use. Regarding health literacy indicators and family planning use, knowing parts (coef=0.29, 95% CI: 0.13–0.45) and all of one’s ovulatory cycle (coef=0.30, 95% CI: 0.12–0.48) were significantly associated 1.34 and 1.35 times increased family planning use, respectively, in isolation when compared to not having any knowledge of one’s ovulatory cycle. Hearing about family planning on television

(coef=0.23, 95% CI 0.10–0.37) in the last few months was also associated with increased modern family planning use; women who had heard family planning messages on television were 1.29 times more likely to use modern family planning compared to women who did not hear such messages when holding other factors constant. Hearing radio and reading print messages about family planning use did not significantly increase modern family planning use compared to women who did not hear family planning messages on the radio or who did not read family planning messages in print. Increased literacy levels also were not significantly associated with increased family planning use.

Having access with the health-care system was associated with family planning use. Visiting a health-care facility within the last year (coef=0.87, 95% CI: 0.74–1.00) and receiving a visit from a family planning worker in the last year (coef=0.58, 95% CI: 0.45–0.72) were significantly associated with family planning use. Women who visited a health-care facility within the last year were 2.39 times more likely to use modern family planning compared to women who did not when holding other factors constant. Women who had received a family planning health-care visit at their home were 1.79 times more likely to use modern family planning compared to women who did not receive a family planning health-care worker in their home.

We further considered the indicators of health literacy and its relationship with health-care access as endogenous variables. Reading about family planning was positively associated with 2.83 times increase in visiting a health care facility within the last year (coef=1.04, 95% CI: 0.54–1.53). This can be attributed to urban residencies among women who can read an entire sentence. Furthermore, health-care facilities are more accessible in urban areas, and thus urban women likely do not require health-care workers to visit their homes. As a result, urban women

1.32 times more likely compared to rural women to have visited a health-care facility in the last year when holding other factors constant (coef=0.28, 95% CI: 0.18–0.39). Hearing of family planning on television (coef=0.40, 95% CI: 0.27–0.53) and radio (coef=0.48, 95% CI: 0.35–0.61) were significantly associated with a 1.49 and 1.62 respective increase in having a family planning worker visit one's home. Hearing of family planning on television (coef=0.29, 95% CI: 0.17–0.41) and radio (coef=0.39, 95% CI: 0.28–0.50) were also significantly associated with a 1.34 and 1.48 respective increase in visiting a health-care facility in the last year.

Lastly, we calculated the indirect and total effects of health literacy indicators (mass media and skills) on modern family planning use. The results are included in Table 3.3. Education, specifically completing secondary school, had multiple avenues to increased modern family planning use. On its own, completing secondary school was associated with a highly significant 3.00 increase in family planning use compared to women without any formal education (coef=1.10, 95% CI: 0.79–1.41). The direct path via primary school was also associated with a 2.05 significant increase in family planning use compared to women without any formal education (coef=0.72, 95% ci: 0.55–0.89). In addition to the direct path, based on Figure 2's application of the HLS, education influenced modern family planning use through literacy and knowing one's ovulatory cycle. Completing secondary school had a significant indirect effect on a 1.46 increase of modern family planning use through knowing part of one's ovulatory cycle (coef=0.38, 95% CI: 0.10–0.66). The total effect of completing secondary school through knowing part of the ovulatory cycle was also associated with a much more significant 3.97 increase in modern family planning use (coef=1.38, 95% CI: 0.97–1.79). The indirect effect of completing secondary school on modern family planning use was not significant via knowledge of all parts of the ovulatory cycle and the ability to read a complete sentence or, but

their total effects were. The total effect of secondary school completion through knowing all of one's ovulatory cycle was 1.16 (95% CI: 0.81–1.51) and associated with a significant 3.19 increase of modern family planning use. The total effect of secondary school completion on family planning use through the ability to read a complete sentence was a highly significant 9.78 (95% CI: 1.03–18.54).

Since we considered the indicators of health literacy and their relationship with accessing the health-care system, we also wanted to determine the indirect and total effects of modern family planning use through health-care access. The direct effect of hearing family planning messages on the radio was not significant (coef=-0.07, 95% CI: -0.18–0.05). However, hearing family planning messages on the radio had significant avenues to modern family planning use through receiving a visit from a family planning health-care worker and visiting a health-care facility. The indirect effect of hearing family planning on the radio through visiting a health-care facility was 0.90 (95% CI: 0.19–0.37) and was associated with a significant 2.46 increase on modern family planning use. The total effect of hearing family planning messages on the radio through visiting a health-care facility was 0.27 (95% CI: 0.12–0.43) and was associated with a significant 1.31 increase on modern family planning use. The indirect effect of hearing family planning messages on the radio through receiving a family planning worker at home was 0.28 (95% CI: 0.19–0.37) and was associated with a 1.32 increase of modern family planning use. Its total effect was 0.47 (95% CI: 0.31–0.63) and was associated with a 1.60 increase of modern family planning use.

Reading about family planning also had paths to modern family planning use through visits to the health facility and receiving visits from family planning workers. The paths through receiving visits from family planning workers were insignificant. However, the indirect path of

reading family planning in the newspaper through visiting a health-care facility was significant (coef=0.90, 95% CI: 0.46–1.35) and was associated with a 2.46 increase of modern family planning use. Its total effect through visiting a health-care facility was 0.88 (95% CI: 0.29–1.47) and was associated with a 2.41 significant increase of modern family planning use.

The indirect and total effects of hearing about family planning on television on family planning use through visits to health-care facilities and visits by family planning health-care workers remained significant, similar to the direct effects. The indirect effect of hearing family planning messages on television through receiving a visit from a family planning health-care worker was 0.23 (95% CI: 0.14–0.33) and associated with a 1.26 significant increase of modern family planning use. Its respective total effect was 0.47 (95% CI: 0.31–0.63) and was associated with a 1.60 increase of modern family planning use. The indirect effect of hearing family planning messages on television through visiting a health-care facility was 0.26 (95% CI: 0.14–0.37) and associated with a 1.30 increase of modern family planning use. Its respective total effect was 0.49 (95% CI: 0.31–0.67) and was associated with a 1.63 increase of modern family planning use.

Sensitivity Analysis

To ascertain whether print exposure to family planning use in the last few months would be significant for women who could read, we performed a sensitivity analysis for only women who could read an entire sentence, included in Table 3.4. The SEM was applied again as well without dummy variable indicators. Reading about family planning in the last few months was still not significantly associated with increased modern family planning use (coef=-0.01, 95% CI: -0.09–0.08). This further indicates that media such as television or videos would be more successful at reaching audiences about health behavior change as opposed to magazines,

pamphlets, and newspapers in Senegal. Since the literacy rate among Senegalese adults is only 50% (“UNICEF,” 2013), audio and visual media would likely reach more people than print media.

We also considered the region where respondents lived. Since previous research had discussed certain urban regions of Senegal accepting more misperceptions about contraception, we applied another structural equation model where region is included, in addition to the previously aforementioned variables. The results were that most regions, when compared to Dakar, had received significantly less exposure to family planning messages through mass media, had less likely visited a health facility in the last year, and had less likely been visited by a family planning worker in the last year. These results are included in Appendix Tables 3.1 and 3.2.

Discussion

The purpose of this study was to examine the relationship between indicators of health literacy and modern family planning use among Senegalese women. This study also explored relationships among indicators of health literacy, using with the health-care system within the last year, and modern family planning use. We applied structural equation modeling to an easily available, large national health survey in Senegal as previous researchers had with Zambia’s DHS data (Schrauben & Wiebe, 2015). In addition to structural equation modeling, this research applied a skill-based conceptual framework of health literacy (Squiers et al., 2012) to a public health priority outcome. Research that addresses health literacy, interaction with the health-care system, and health behaviors while applying theories and methods that can measure the relationships among each other are needed. To the best of our knowledge, this is the first

research using the HLS Framework model and structural equation modeling to identify direct and indirect effects of health literacy indicators on modern family planning use.

Our results found that health literacy indicators in the form of audio and visual messages about family planning use were the biggest predictors of modern family planning use. Radio family planning messages were not significantly associated with increased family planning use, but its indirect effect through visiting a health-care facility or receiving a family planning worker in one's home had a significant impact on family planning use. Knowledge of the ovulatory cycle, both parts of it and any part of it, were also associated with increased family planning use. Thus, increased health literacy, in the form of knowledge about and exposure to reproductive health messages was a big predictor modern family planning use.

The effect of reading messages about family planning was not even small; it was virtually non-existent in its association with modern family planning use. Most women surveyed did not exhibit high health literacy, largely because 83% surveyed could not read. This would prevent women from reading any material about family planning. Not surprising, women who had completed primary or secondary education were much more likely to be able to read. Since literacy is a necessary component to reading about family planning, health literacy measured through hearing about family planning over television (41%) or radio (35%) produced much higher percentages compared to reading about family planning in newspapers (2%). There was a positive relationship between knowledge of parts of the ovulatory cycle and completion of primary and secondary school. This is consistent with the literature that people have the opportunity to learn about reproductive health and comprehensive sexual education from their schools (Brieger et al., 2001).

Regarding the factors influencing development and use of health literacy skills such as demographics and individual resources, education and wealth status were factors that predicted increased health literacy indicators. Having completed primary or secondary school was positively associated with the ability to read some words and full sentences, knowledge parts of ovulatory cycle, and reading about family planning in the newspaper compared to not having any formal education. Increased wealth index was also positively associated with hearing about family planning through mass media, potentially because more wealth would increase access to newspapers, televisions, and radios. Increased wealth index, however, was not a strong indicator of literacy or of knowledge about the ovulatory cycle. Likely education was a stronger determinant of knowledge regarding ovulation and literacy. This is consistent with the existing literature where education is cited as one of the largest determinants of modern family planning use (Katz & Naré, 2002).

There were other factors that were associated with certain indicators of health literacy such as age and having more living children. Being older and having more than six living children were positively associated with knowing parts or all the ovulatory cycle. This can be a result of becoming more knowledgeable about reproductive health over time and over multiple births. Furthermore, by having more children and having reached desired family size, a woman is likely older and has had the time to learn about ovulation. Once having reached a desired family size, the desire to limit births is greater and thus a determinant of using modern family planning. This is consistent with previous findings where increased parity was associated with modern family planning use (Marchant et al., 2004).

Limitations

There were multiple limitations to this research. The structural equation model in this dissertation does not produce a goodness-of-fit measurement. Future modeling and results will include this information.

Our measurement of health literacy by using indicators may not be precise. Part of the difficulty of understanding which indicators to include was that only one previous study used a Demographic Healthy Survey (Schrauben & Wiebe, 2015). Our indicators differed from Schrauben and Wiebe (2015) in that they considered HIV/AIDS information while our study did not since our outcome was about family planning use. However, the indicators similarities were that they included information through mass media channels. Contrary to Schrauben and Wiebe's (2015) research, our indicators of health literacy did not produce high internal consistency. However, previous literature and the HLS Framework justified including all elements of health literacy we had found in the DHS to be applicable.

The DHS is a cross-sectional design in which respondents answer questions about reproductive behaviors and intentions that cover dates and survival of all births, pregnancies that did not end in a live birth, current pregnancy status, fertility preferences, and future childbearing intentions of each woman. Questions also ask about knowledge and use of family planning methods, source of contraception methods, exposure to family planning messages, informed choice, and unmet need ("DHS Model Questionnaires," 2016). Since questions cover births and reproductive behaviors with past dates, the results of the current study need to be interpreted with the possibility of recall bias. There was also a limited sample of adolescent women, unmarried women, literate women, women who had completed secondary school, and nulliparous women. Since previous literature has cited the significance of age, marital status, education, and parity in

terms of using family planning (Katz & Naré, 2002; Naré et al., 1997; Sidze et al., 2014; Speizer et al., 2013), it would have provided more information had the survey oversampled women with these characteristics. Additionally, the DHS provide only limited information regarding attitudes, self-efficacy, and motivation surrounding family planning use. Since attitudes and misperceptions are a determinant of family planning use (Hindin et al., 2014; Nalwadda et al., 2010) and a mediating factor between health literacy and health behaviors within the HLS Framework (Aldoory, 2016; Squiers et al., 2012), these mechanisms link the relationship between health literacy and health behavior. Further research can consider the capacity of attitudes and misperceptions in health literacy and health behaviors.

Research Implications

This research finds that only certain indicators of health literacy, particularly hearing about family planning through television and perhaps indirectly via radio, were strong determinants of using modern family planning. We would have expected all media channels to be effective at encouraging family planning use. Hearing about family planning on the radio was not directly significantly associated with modern family planning use. However, hearing about family planning on the radio was associated with visiting a health-care facility within the last year and receiving a visit from a family planning health-care worker within the last year. This can be a result of regions outside of Dakar not having as many health-care workers or facilities and having fewer accessible mass media options. Additionally, hearing about family planning on the radio had significant indirect and total effects with family planning use through both interactions with the health-care system. Reading about family planning in the newspaper did not produce the same results, even when we restrict the sample to the fully literate population. This implies that audio and visual media channels are likely more effective means to communicate

public health priorities. Further research is necessary to assess the impact of health outreach programs on global health outcomes, particularly among population who cannot read. There is growing research on mobile health applications to promote health behaviors (Gurman, Rubin, & Roess, 2012). However, not all people can read or communicate via short messaging services or through print information. With the continued success of radio and television, mobile health applications may include audio and visual communications to promote health behaviors.

Conclusion

By applying the Health Literacy Skills Framework to the Senegalese Demographic Health Survey, we find indicators of health literacy can predict family planning use both directly and indirectly. Educating childbearing-age women about the benefits of contraception with pamphlets and teaching them how to make healthcare appointments are not sufficient to increase family planning use in the long-term because sometimes there are other barriers such as cost or inability to access a health-care facility. Comprehensive reproductive and sexual health education are means to both teach people about family planning and to break society norms discouraging its use. Additionally, information about family planning must be made available through multiple media channels.

Figure 3.1. Conceptual Framework for Family Planning use, adapted from Squiers et al. (2012).

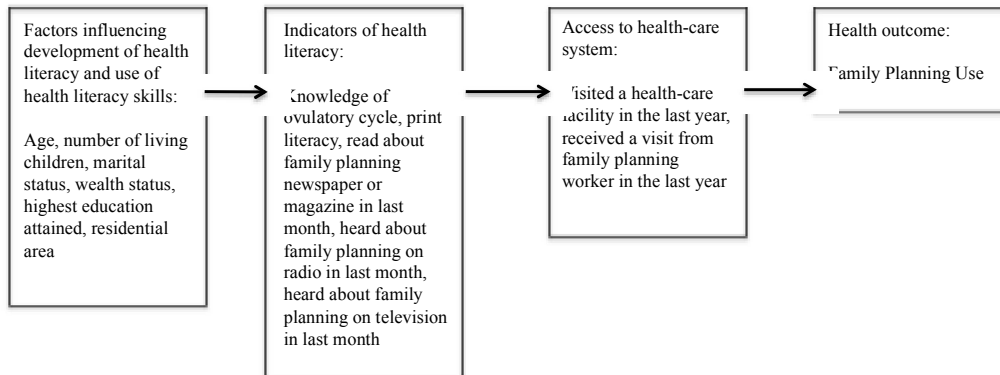


Figure 1: Conceptual Framework for Family Planning Use, adapted from Squiers et al. (2012)

Figure 3.2 Path Analysis of Family Planning Use

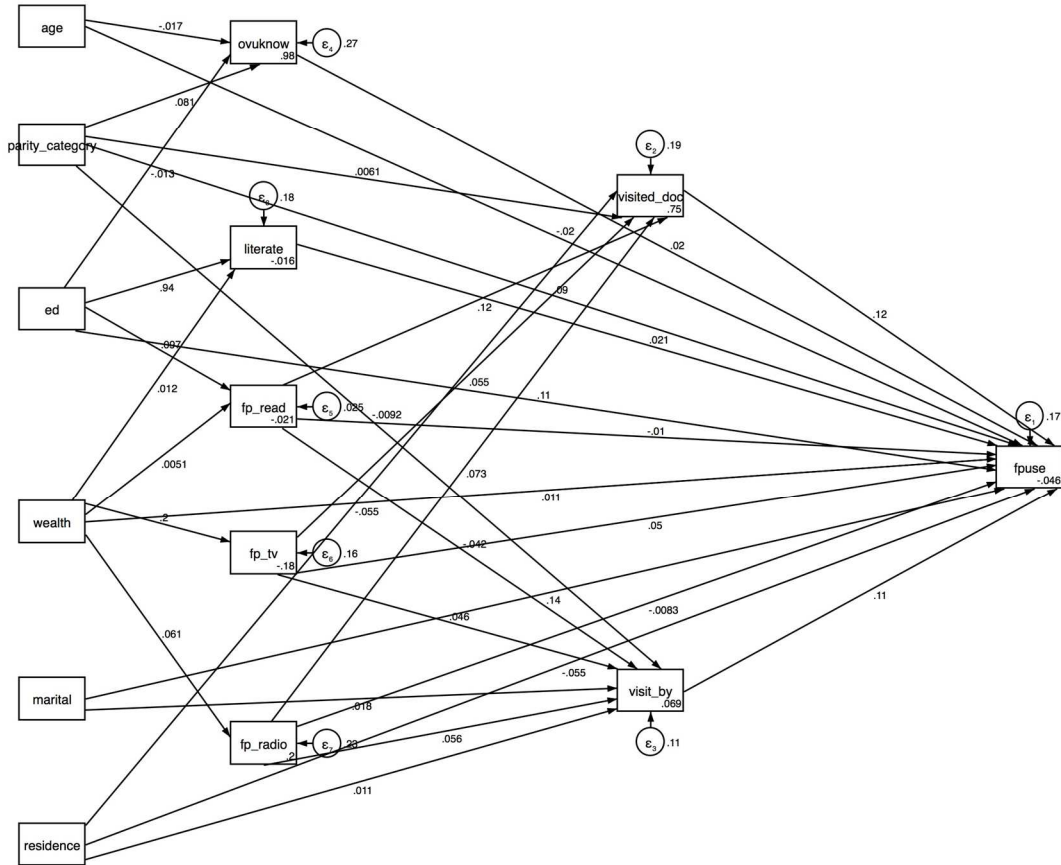


Table 3.1. Comparison of current modern family planning users to non-users.

Covariate	Not currently using modern FP (N=15,276, 78%)	Currently using modern family planning (N=4,395, 22%)	P-value
Marital status			<0.001***
No	1,232 (84.73)	222 (15.27)	
Yes	14,044 (77.09)	4,173 (22.91)	
Age			<0.001***
15-19	272 (84.21)	51 (15.79)	
20-24	1,323 (82.89)	273 (17.11)	
25-29	2,377 (76.55)	728 (23.45)	
30-34	2,908 (74.56)	992 (25.44)	
35-39	2,831 (73.61)	1,015 (26.39)	
40-44	3,083 (78.03)	868 (21.97)	
45-49	2,482 (84.14)	4568 (15.86)	
Living children			<0.001***
None	45 (91.84)	4 (8.16)	
1-5 children	9,467 (78.95)	2,524 (21.05)	
6+ children	5,764 (75.53)	1,867 (24.47)	
Residence			<0.001***
Urban	4,256 (67.77)	2,024 (32.23)	
Rural	11,020 (82.29)	2,371 (17.71)	
Highest education level attained			<0.001***
None	12,305 (81.53)	2,787 (18.47)	
Primary	2,237 (66.92)	1,106 (33.08)	
Secondary or more	734 (59.39)	502 (40.61)	
Wealth index			<0.001***
Poorest	5,433 (84.10)	1,027 (15.90)	
Poorer	4,192 (79.33)	1,092 (20.67)	
Middle	2,894 (74.70)	980 (25.30)	
Richer	1,680 (67.36)	814 (32.64)	
Richest	1,077 (69.08)	482 (30.92)	
Literacy			
None	13,005 (80.38)	3,175 (19.62)	
Some words	782 (73.91)	276 (26.09)	
Full sentence	1,485 (61.39)	934 (38.61)	
Read of family planning in newspaper in last few months			<0.001***
No	15,075 (77.97)	4,260 (22.03)	
Yes	201 (59.82)	135 (40.18)	

Heard of family planning on radio in last few months			<0.001***
No	10,288 (80.21)	2,539 (19.79)	
Yes	4,988 (72.88)	1,856 (27.12)	
Heard of family planning on TV in last few months			<0.001***
No	11,514 (81.10)	2,683 (18.90)	
Yes	3,762 (68.72)	1,712 (31.28)	
Knowledge of ovulatory cycle			<0.001***
No	2,460 (82.11)	536 (17.89)	
Parts of it	9,803 (75.23)	3,228 (24.77)	
Any time	3,013 (82.68)	631 (17.32)	
Visited by a family planning worker in last 12 months			<0.001***
No	13,506 (79.88)	3,402 (20.12)	
Yes	1,770 (64.06)	993 (35.94)	
Visited health facility in last 12 months			<0.001***
No	5,427 (89.72)	622 (10.28)	
Yes	9,849 (72.30)	3,773 (27.70)	

Source: Senegalese Demographic Health Survey, 2014.

Note. Removal of women for pregnancy, infertility, or menopause.

Table 3.2. Results of the Structural Equation Model, Direct Effects Only.

Covariate	Outcome	Coefficient	95% CI
Marital status			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	0.93	[0.66, 1.19]***
Age			
15-19 (Ref)	Use Family Planning	Ref	Ref
20-24	Use Family Planning	-0.69	[-1.15, -0.24]***
25-29	Use Family Planning	-0.24	[-0.67, 0.20]
30-34	Use Family Planning	-0.35	[-0.79, 0.08]
35-39	Use Family Planning	-0.22	[-0.65, 0.21]
40-44	Use Family Planning	-0.62	[-1.05, -0.18]*
45-49	Use Family Planning	-1.11	[-1.56, -0.65]***
Living children			
None (Ref)	Use Family Planning	Ref	Ref
1-5 children	Use Family Planning	0.33	[-0.93, 1.59]
6+ children	Use Family Planning	0.89	[-0.37, 2.16]
Residence			
Rural (Ref)	Use Family Planning	Ref	Ref
Urban	Use Family Planning	0.27	[0.15, 0.39]***
Highest education level attained			
None (Ref)	Use Family Planning	Ref	Ref
Primary	Use Family Planning	0.72	[0.55, 0.89]***
Secondary or more	Use Family Planning	1.10	[0.79, 1.41]***
Wealth index			
Poorest (Ref)	Use Family Planning	Ref	Ref

Poorer	Use Family Planning	0.16	[0.05, 0.28]*
Middle	Use Family Planning	0.24	[0.09, 0.38]***
Richer	Use Family Planning	0.55	[0.37, 0.72]***
Richest	Use Family Planning	0.18	[-0.03, 0.39]
Knowledge of ovulatory cycle			
No (Ref)	Use Family Planning	Ref	Ref
Parts of it	Use Family Planning	0.29	[0.13, 0.45]***
Any time	Use Family Planning	0.30	[0.12, 0.48]***
Read of family planning in newspaper in last few months			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	-0.02	[-0.35, 0.31]
Heard of family planning on TV in last few months			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	0.23	[0.10, 0.37]***
Heard of family planning on radio in last few months			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	-0.07	[-0.18, 0.05]
Literacy			
None (Ref)	Use Family Planning	Ref	Ref
Some words	Use Family Planning	0.22	[-0.01, 0.46]
Full sentence	Use Family Planning	0.23	[-0.01, 0.46]
Visited health			

facility in last 12 months			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	0.87	[0.74, 1.00]***
Visited by a family planning worker in last 12 months			
No (Ref)	Use Family Planning	Ref	Ref
Yes	Use Family Planning	0.58	[0.45, 0.72]***
Marital status			
No (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
Yes	Visited by family planning health-care worker in last year	0.16	[-0.10, 0.43]
Living children			
None (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
1-5 children	Visited by family planning health-care worker in last year	0.99	[-0.35, 2.32]
6+ children	Visited by family planning health-care worker in last year	0.89	[-0.45, 2.23]
Residence			
Rural (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
Urban	Visited by family planning health-care worker in last year	-0.10	[-0.22, 0.02]
Read of family			

planning in newspaper in last few months			
No (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
Yes	Visited by family planning health-care worker in last year	-0.35	[-0.76, 0.07]
Heard of family planning on TV in last few months			
No (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
Yes	Visited by family planning health-care worker in last year	0.40	[0.27, 0.53]***
Heard of family planning on radio in last few months			
No (Ref)	Visited by family planning health-care worker in last year	Ref	Ref
Yes	Visited by family planning health-care worker in last year	0.48	[0.35, 0.61]***
Living children			
None (Ref)	Visited health-care facility in last year	Ref	Ref
1-5 children	Visited health-care facility in last year	1.10	[0.22, 1.99]*
6+ children	Visited health-care facility in last year	1.12	[0.23, 2.00]*
Residence			
Rural (Ref)	Visited health-care facility in last	Ref	Ref

	year		
Urban	Visited health-care facility in last year	0.28	[0.18, 0.39]***
Read of family planning in newspaper in last few months			
No (Ref)	Visited health-care facility in last year	Ref	Ref
Yes	Visited health-care facility in last year	1.04	[0.54, 1.53]***
Heard of family planning on TV in last few months			
No (Ref)	Visited health-care facility in last year	Ref	Ref
Yes	Visited health-care facility in last year	0.29	[0.17, 0.41]***
Heard of family planning on radio in last few months			
No (Ref)	Visited health-care facility in last year	Ref	Ref
Yes	Visited health-care facility in last year	0.39	[0.28, 0.50]***
Age			
15-19 (Ref)	Knowing part of ovulatory cycle	Ref	Ref
20-24	Knowing part of ovulatory cycle	0.57	[0.13, 1.02]*
25-29	Knowing part of ovulatory cycle	0.93	[0.50, 1.37]***
30-34	Knowing part of ovulatory cycle	1.06	[0.63, 1.49]***
35-39	Knowing part of ovulatory cycle	1.06	[0.63, 1.49]***
40-44	Knowing part of ovulatory cycle	0.99	[0.56, 1.42]***
45-49	Knowing part of	1.41	[0.97, 1.86]***

	ovulatory cycle		
Living children			
None (Ref)	Knowing part of ovulatory cycle	Ref	Ref
1-5 children	Knowing part of ovulatory cycle	1.04	[-0.05, 2.13]
6+ children	Knowing part of ovulatory cycle	1.35	[0.26, 2.44]*
Highest education level attained			
None (Ref)	Knowing part of ovulatory cycle	Ref	Ref
Primary	Knowing part of ovulatory cycle	0.57	[0.41, 0.73]***
Secondary or more	Knowing part of ovulatory cycle	1.55	[1.22, 1.88]***
Age			
15-19 (Ref)	Knowing all parts of ovulatory cycle	Ref	Ref
20-24	Knowing all parts of ovulatory cycle	0.43	[-0.02, 0.89]
25-29	Knowing all parts of ovulatory cycle	0.25	[-0.19, 0.69]
30-34	Knowing all parts of ovulatory cycle	0.22	[-0.22, 0.66]
35-39	Knowing all parts of ovulatory cycle	-0.15	[-0.59, 0.29]
40-44	Knowing all parts of ovulatory cycle	-0.27	[-0.71, 0.17]
45-49	Knowing all parts of ovulatory cycle	-0.21	[-0.67, 0.26]
Living children			
None (Ref)	Knowing all parts of ovulatory cycle	Ref	Ref
1-5 children	Knowing all parts of ovulatory cycle	0.85	[-0.22, 1.92]
6+ children	Knowing all parts of ovulatory cycle	1.50	[0.42, 2.57]*
Highest education level attained			
None (Ref)	Knowing all parts of ovulatory cycle	Ref	Ref
Primary	Knowing all parts of ovulatory cycle	-0.58	[-0.78, -0.38]***
Secondary or more	Knowing all parts of ovulatory cycle	0.20	[-0.27, 0.68]

Highest education level attained			
None (Ref)	Can read some words	Ref	Ref
Primary	Can read some words	3.61	[3.38, 3.85]***
Secondary or more	Can read some words	1.29	[1.03, 1.55]***
Wealth index			
Poorest (Ref)	Can read some words	Ref	Ref
Poorer	Can read some words	0.24	[0.01, 0.47]*
Middle	Can read some words	0.06	[-0.21, 0.32]
Richer	Can read some words	-0.14	[-0.46, 0.17]
Richest	Can read some words	1.03	[0.69, 1.37]***
Highest education level attained			
None (Ref)	Can read full sentence	Ref	Ref
Primary	Can read full sentence	4.62	[4.35, 4.89]***
Secondary or more	Can read full sentence	38.08	[37.81, 38.35]***
Wealth index			
Poorest (Ref)	Can read full sentence	Ref	Ref
Poorer	Can read full sentence	-0.08	[-0.35, 0.18]
Middle	Can read full sentence	0.26	[-0.04, 0.56]
Richer	Can read full sentence	-0.05	[-0.33, 0.23]
Richest	Can read full sentence	0.74	[0.42, 1.07]
Highest education level attained			
None (Ref)	Read of family planning in newspaper in last few months	Ref	Ref
Primary	Read of family planning in	2.09	[1.53, 2.65]***

	newspaper in last few months		
Secondary or more	Read of family planning in newspaper in last few months	4.67	[4.16, 5.18]***
Wealth index			
Poorest (Ref)	Read of family planning in newspaper in last few months	Ref	Ref
Poorer	Read of family planning in newspaper in last few months	2.44	[1.19, 3.70]***
Middle	Read of family planning in newspaper in last few months	3.06	[1.79, 4.32]***
Richer	Read of family planning in newspaper in last few months	3.50	[2.28, 4.72]***
Richest	Read of family planning in newspaper in last few months	3.66	[2.44, 4.88]***
Wealth index			
Poorest (Ref)	Heard of family planning on TV in last few months	Ref	Ref
Poorer	Heard of family planning on TV in last few months	1.26	[2.44, 4.88]***
Middle	Heard of family planning on TV in last few months	2.86	[2.71, 3.01]***
Richer	Heard of family planning on TV in last few months	3.84	[3.68, 4.00]***
Richest	Heard of family planning on TV in last few months	4.27	[4.07, 4.46]***
Wealth index			
Poorest (Ref)	Heard of family planning on radio	Ref	Ref

	in last few months		
Poorer	Heard of family planning on radio in last few months	0.33	[0.24, 0.42]***
Middle	Heard of family planning on radio in last few months	0.53	[0.42, 0.64]***
Richer	Heard of family planning on radio in last few months	0.82	[0.69, 0.95]***
Richest	Heard of family planning on radio in last few months	1.08	[0.93, 1.23]***

Source: Senegalese Demographic Health Survey, 2014.

Note. Removal of women for pregnancy, infertility, or menopause. N=19,671, AIC=1.34e+11, BIC=1.34e+11, *P<0.05, **P<0.01, ***P<0.001

Table 3.3. Indirect and Total Effects of Mass Media and Skill Indicators of Health Literacy with Family Planning Use.

Health Literacy Indicator	Effect	Coefficient	95% CI
Finishing secondary school	Indirect through knowledge of ovulatory cycle (anytime)	0.06	[-0.09, 0.21]
Finishing secondary school	Indirect through knowledge of ovulatory cycle (parts of it)	0.38	[0.10, 0.66]**
Finishing secondary school	Indirect through ability to read complete sentence	8.68	[-0.29, 17.67]
Read of family planning in newspaper in last few months	Indirect through visit by family planning health-care worker in last year	-0.20	[-0.45, 0.04]
Heard of family planning on TV in last few months	Indirect through visit by family planning health-care worker in last year	0.23	[0.14, 0.33]***
Heard of family planning on radio in last few months	Indirect through visit by family planning health-care worker in last year	0.28	[0.19, 0.37]***
Read of family planning in newspaper in last few months	Indirect through visiting health-care facility in last year	0.90	[0.46, 1.35]***
Heard of family planning on TV in last few months	Indirect through visiting health-care facility in last year	0.26	[0.14, 0.37]***
Heard of family planning on radio in last few months	Indirect through visiting health-care facility in last year	0.34	[0.24, 0.45]***
Finishing secondary school	Total through knowledge of ovulatory cycle (anytime)	1.16	[0.81, 1.51]***
Finishing secondary school	Total through knowledge of ovulatory cycle (parts of it)	1.38	[0.97, 1.79]***
Finishing secondary	Total through ability	9.78	[1.03, 18.54]*

school	to read complete sentence		
Read of family planning in newspaper in last few months	Total through visit by family planning health-care worker in last year	-0.22	[-0.60, 0.15]
Heard of family planning on TV in last few months	Total through visit by family planning health-care worker in last year	0.47	[0.31, 0.63]***
Heard of family planning on radio in last few months	Total through visit by family planning health-care worker in last year	0.21	[0.07, 0.35]**
Read of family planning in newspaper in last few months	Total through visiting health-care facility in last year	0.88	[0.29, 1.47]**
Heard of family planning on TV in last few months	Total through visiting health-care facility in last year	0.49	[0.31, 0.67]***
Heard of family planning on radio in last few months	Total through visiting health-care facility in last year	0.27	[0.12, 0.43]**

Source: Senegalese Demographic Health Survey, 2014.

Note. Removal of cases who were non-users currently because of pregnancy, infertility, or menopause. N=19,671, *P<0.05, **P<0.01, ***P<0.001.

Table 3.4. Structural equation model results based on women who could read full sentence only, direct effects.

Covariate	Outcome	Coefficient	95% CI
Married	Use Family Planning	0.28	[0.21, 0.36]***
Age	Use Family Planning	-0.02	[-0.04, -0.01]*
Number of living children	Use Family Planning	0.22	[0.15, 0.28]***
Urban residence	Use Family Planning	-0.12	[-0.19, -0.06]***
Education	Use Family Planning	0.07	[0.02, 0.12]***
Wealth index	Use Family Planning	-0.01	[-0.04, 0.02]
Knowledge of ovulatory cycle	Use Family Planning	0.07	[0.01, 0.13]*
Read of family planning in newspaper in last few months	Use Family Planning	-0.01	[-0.09, 0.08]
Heard of family planning on TV in last few months	Use Family Planning	0.18	[0.11, 0.25]***
Heard of family planning on radio in last few months	Use Family Planning	-0.02	[-0.08, 0.04]
Visited by family planning health-care worker in last year	Use Family Planning	0.09	[0.02, 0.16]*
Visited health-care facility in last year	Use Family Planning	0.10	[0.04, 0.17]***
Married	Visited by family planning health-care worker in last year	-0.04	[-0.10, 0.02]
Number of living children	Visited by family planning health-care worker in last year	-0.01	[-0.04, 0.04]
Urban residence	Visited by family planning health-care worker in last year	0.02	[-0.01, 0.06]
Read of family planning in newspaper in last few months	Visited by family planning health-care worker in last year	0.02	[-0.03, 0.07]
Heard of family	Visited by family	-0.02	[-0.07, 0.02]

planning on TV in last few months	planning health-care worker in last year		
Heard of family planning on radio in last few months	Visited by family planning health-care worker in last year	0.07	[0.03, 0.10]***
Number of living children	Visited health-care facility in last year	0.06	[0.01, 0.11]*
Urban residence	Visited health-care facility in last year	-0.04	[-0.08, 0.01]
Read of family planning in newspaper in last few months	Visited health-care facility in last year	0.08	[0.03, 0.13]***
Heard of family planning on TV in last few months	Visited health-care facility in last year	-0.02	[-0.08, 0.03]
Heard of family planning on radio in last few months	Visited health-care facility in last year	0.09	[0.04, 0.14]***
Age	Knowledge of ovulatory cycle	0.00	[-0.01, 0.01]
Number of living children	Knowledge of ovulatory cycle	-0.02	[-0.07, 0.02]
Education	Knowledge of ovulatory cycle	0.02	[-0.02, 0.05]
Education	Read of family planning in newspaper in last few months	0.15	[0.11, 0.19]***
Wealth index	Read of family planning in newspaper in last few months	0.04	[0.02, 0.06]***
Wealth index	Heard of family planning on TV in last few months	0.17	[0.11, 0.19]***
Wealth index	Heard of family planning on radio in last few months	0.17	[0.15, 0.18]***

Source: Senegalese Demographic Health Survey, 2014.

Note. Removal of cases who were non-users currently because of pregnancy, infertility, or menopause. Model includes non-dummy variables due to lack of convergence. N=2,419, AIC=1.95e+10, BIC=1.95e+10, *P<0.05, **P<0.01, ***P<0.001.

Chapter 4: Social Network Influence on Family Planning in Benin

Introduction

Background

Trends over more than a decade show that the total contraceptive prevalence rates (CPR) in Benin are rising, but remain low. Among women in a union aged 15 to 49 years, the total CPR was 3% in 1996, 7% in 2001, 6% in 2006, and 9% in 2012 (Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF International, 2013). Among sexually active women, aged 15 to 49, only 14% used any contraceptive method in 2011 and 2012 (Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF International, 2013). The negative health outcomes associated with low, ineffective, and non-use of modern contraception include but are not limited to unsafe abortion, which was 28 per 1,000 West African women ages 15-44 in 2008 (World Health Organization, 2011), and unsafe birth spacing, birth intervals that are shorter than 24 months apart from each other (World Health Organization, 2005), which can then lead to increased maternal mortality where Benin's rate is 340 deaths per 100,000 live births in 2012, infant mortality where Benin's rate was 42 deaths per 1,000 live births in 2012 (Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF International, 2013).

Theoretical Framework

Since the 1990s, research has emerged regarding the significance of social interaction and social context in increasing contraception utilization. This has evolved into social network diffusion theory as a theoretical underpinning for promoting contraception use as a health

behavior (Kohler, Behrman, & Watkins, 2001). Social network diffusion theory and related intervention approaches have leveraged social networks to diffuse health behaviors. Within social networks, key people, such as religious leaders, village chiefs, or others with social influence and connections, influence other peoples' behaviors (Igras et al., 2016). Research has found that such influential community members and positive social relationships are associated with better health outcomes and engaging in positive health behavior changes (Mackenbach et al., 2016; L. Singh, Singh, & Arokiasamy, 2016). Social network theory has achieved success in its applications to health behaviors such as tobacco cessation (Valente, 2003), narcotic cessation (Curtis & Edwards, 1995), exercise interventions (Forthofer et al., 2016), and HIV/AIDS prevention (de Voux et al., 2016). Abundant research of social network influence on contraception use has also emerged in the last decade (Alvergne, Gurmu, Gibson, & Mace, 2011; Behrman, Kohler, & Watkins, 2002; Colleran & Mace, 2015; Kendal, Ihara, & Feldman, 2005; Madhavan et al., 2003).

In rural Malawi, a qualitative study of social network diffusion of contraception using in-depth interviews found that men and women had different responses to family planning attitudes and its use (Paz Soldan, 2004). Men spoke of the benefits and disadvantages of limiting family size. Men also discussed more sexual behaviors taking place outside of marriage. The interviews with women found that they spoke of different methods, accessing methods, and side effects. A rural Ethiopian community-based social network diffusion study found that person-to-person contact through friendships and spatial networks only marginally influenced modern family planning use while socio-demographic characteristics such as parity and education more strongly predicted it (Alvergne et al., 2011). Our research of societal norms, community communication,

and mass media information adds to the body of research of social diffusion and modern family planning use.

Statement of the Problem

Bradley et al. (2012) have defined unmet need for contraception as the percentage of women who do not want to become pregnant but do not use contraception (S. E. K. Bradley et al., 2012). The literature of unmet need for contraception has affirmed the need to recognize that social networks, social norms, cultural norms, power relations, and gender norms determine reproductive health behavior (Adjamagbo & Bakass, 2009; Alvergne et al., 2011; J. Bongaarts & Bruce, 1995; Colleran & Mace, 2015; Kendal et al., 2005; Madhavan et al., 2003; Mosha & Ruben, 2013; Wegs, Creanga, Galavotti, & Wamalwa, 2016). In addition to the low contraceptive prevalence rate in Benin, Benin's total unmet need for family planning was 33% in 2012 (Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF International, 2013). Beninese culture has discouraged and limited public dialogue and couple decision making about contraception and instead has emphasized fertility decisions with household members, kin, and peer networks, (Buessler & Diakité, 2013; Igras et al., 2016).

There is also growing research that has addressed including men in family planning interventions (Hartmann, Gilles, Shattuck, Kerner, & Guest, 2012; Hossain et al., 1999; Islam, Padmadas, & Smith, 2006; Raj et al., 2016; Yore et al., 2016). More recently, the United Nations has begun prioritizing men's involvement to improve reproductive health (UNFPA and Engender Health, 2017). By not including men in reproductive health interventions, public health fails to teach men that couple communication is an integral part of family planning use (Daniel, Masilamani, & Rahman, 2008; Shah, 1974) and that men must also be part of the solution to reducing unmet need for family planning.

Description of Tékponon Jikuagou Intervention and Goals

To increase dialogue about contraception between couples, Tékponon Jikuagou (TJ) applied social network diffusion theory to identify and train influential community actors, whom we call “Influentials” for this study, who then encouraged community dialogue about fertility desires and contraception. Influentials included village savings and loan groups, religious groups, farmers, merchants, and other people in more formal positions. TJ packaged five different social network interventions, which we present in Figure 4.1. (1) Community mapping identified influential for community health and wellbeing. The TJ staff oriented these Influentials on unmet need for contraception and community engagement and discussion surrounding contraceptive unmet needs. (2) TJ materials provided Influentials with 15 cards consisting critical thinking stories and activities. The cards facilitated discussion about fertility, contraception, and gender norms, which would then bring forth discussion and debate. (3) TJ provided Influentials with infographics that displayed data on indicators such as women’s intention to use contraception, women’s desire to space births further apart from each other, or women’s intention to talk with husbands about contraception. An influential merchant, for example, could engage regular customers in dialogue surrounding contraception unmet need. (4) Group discussions recorded conversations and then broadcasted these shows on their radio stations to reach wider audiences. (5) To increase trust and knowledge, TJ encouraged health-care providers to attend groups meetings. Group attendees could then ask health-care providers questions about contraception. Health-care providers then diffused accurate medical information about the safety and benefits of contraception.

Methods

Study Design

TJ evaluation used a pre-post study design. Before the intervention, the TJ research team conducted a baseline household survey of men and women. Eighteen months later, the TJ research team followed up with the men and women with the endline survey. The surveys consisted of roughly 50 questions at baseline and 100 questions at endline. The questions addressed family planning and its current and intentioned use, couple communications, self-efficacy, access, gender norms, and social network diffusion. The objective of this study was to examine how social network diffusion and exposure to the TJ program influenced modern family planning use, intentioned use of modern family planning, and meeting family planning needs (the actual need met and the perceived need met). A sub-purpose of this study was to understand how exposure to TJ methods (radio, leaders, and information cards) was associated with these same outcomes at endline.

Data and Sample

The TJ research team based its sampling strategy on the 2012 Beninese Demographic and Health Survey (DHS), a nationally representative survey conducted by Benin's Ministry of Health and ICF (Institut National de la Statistique et de l'Analyse Économique (INSAE) et ICF International, 2013). The TJ project selected Ouémé Department as the intervention because CARE already had ongoing public health activities surrounding maternal and child health programs, and thus it was feasible to allow technical support to new user organizations as well as the interest of local health authorities. Atlantique Department served as the control site because of its similar levels of unmet need for family planning, its CPR, and other sociodemographic

characteristics (Ashburn, Lundgren, Igras, Gado, & Diakité, 2016). The TJ research team intentionally selected Ouémé and Atlantique for study activities where at Stage 1, they drew 32 villages (16 of 44 targeted for scale up in each region) with a probability proportional to the size estimated of the adult population (15-59 years) according to 2015 Benin census data. At second stage, TJ developed a list of all households and sampled systematically to select households. With a list of household occupants, they determined one eligible woman and one eligible man to interview.

The TJ research team stratified the sample by region and village size. In Ouémé, there were 650 households sampled and 627 sampled in Atlantique where they then selected 1,080 women and 1,080 men at baseline. The response rates were 97% at baseline for women and men, 96% at endline for women, and 95% at endline for men, leaving the total sample to be 1,046 women and 1,045 men. The Institutional Review Board of Georgetown University and le Comité d’Ethique de la Recherche, Institut des Science Biomédicales Appliquées en Santé in Bénin approved all research studies in 2012.

Outcomes of Interest

This study examined four different outcomes: (1) modern method family planning use, (2) the intention to use a modern family planning method, (3) the met need rate (which we call actual need met) for family planning use, and (4) the perceived met rate (which we call perceived need met) for family planning use. TJ defined modern family planning use consistently with the WHO’s definition of modern family planning (“WHO | Family planning/Contraception,” 2015). These included female sterilization, male sterilization, oral contraception, intrauterine devices, implants, condoms, diaphragms/foam/jelly, standard days method, and lactation amenorrhea. TJ surveyed women as well about traditional methods such as periodic abstinence, withdrawal,

herbal teas, traditional rings, and traditional belts. The met need rate or the actual need met consisted of women who were using a modern method at the time of interview who also did not wish to become pregnant within the next year. The perceived met need rate or perceived need met included women who were also not wishing to become pregnant within the next year but who were using a traditional family planning method. All four outcomes were binary.

Key Indicators' Impact on Outcomes

We examined the effect of self-efficacy, access, attitudes and gender norms, couple communications, and social diffusion behaviors on the four outcomes. There were many challenges that TJ faced in its inception. Lack of access to family planning services was and remains a barrier to contraceptive use. Contraception was not always available in women's village health centers, and women occasional needed to go to zonal health centers in order to obtain them (Buesseler & Diakité, 2013). Furthermore, not every respondent at baseline had high self-efficacy to use contraception in the event of challenges such as lack of support from friends and family.

Gender and societal norms, specifically that a wife must always obey her husband, was one of the largest obstacles women face when accessing family planning. Culturally, family planning use must include a husband's approval (Buesseler & Diakité, 2013; Oheneba-Sakyi & Takyi, 1997; Shah, 1974). Beninese health providers have frequently asked for women's husbands' consent before prescribing women with long-term methods. This is because there is a societal belief that this is a law. Furthermore, some health-care providers have informed husbands that wives were using contraception, even without women's permission (Diakité, 2013). Previous TJ research found that among men who participated in TJ, they believed wives needed to inform husbands about contraception use (Buesseler & Diakité, 2013).

The opinions of social networks and community norms also led to using or not using family planning. Discussions about family planning use have been rare between couples and among community members in Benin. Social factors such as having support from your friends and family have also influenced whether couples with unmet need actually have chosen to use family planning (Igras et al., 2016). Beninese women have feared being criticized by the community as being promiscuous while men have feared the community will view them as less masculine for having fewer children (Diakit , 2013). The reason TJ considered self-efficacy, gender norms, access, and couple communications in its intervention was because previous literature had found such indicators were associated with contraception use (Barden-O’Fallon & Speizer, 2010; Chandra-Mouli et al., 2014; Daniel et al., 2008; Izugbara, Ibisomi, Ezeh, & Mandara, 2010; Oheneba-Sakyi & Takyi, 1997; Shah, 1974).

Statistical Analyses

We assessed covariate balance across the intervention and control groups using chi-square measures of association. We then performed bivariate tests of association and assessed the rate of change in key indicators: self-efficacy, access, gender norms, couple communication, social network diffusion behavior, and family planning outcomes: current use, intention to use, actual need met, and perceived need met via OLS regression and difference-in-difference (DID) strategy. Our DID strategy estimated the effect of TJ by comparing the change in outcomes from baseline to follow-up in the intervention site compared to the change over time in the control group (Wooldridge, 2007). This approach controlled for observed and unobserved time-invariant factors that were spuriously correlated with the treatment. The assumption of the model is that, conditional on model covariates, the change observed in the comparison sites represents what would have occurred in the treatment sites had the intervention never occurred.

To examine the effect of TJ on the probability of using a modern method of family planning, intention to use modern family planning methods, meeting needs, and perceived need, we modeled the four binary outcomes as:

$$Y_{it} = a + b_1 * X_1 + b_2 * X_2 + \dots + b_{(n-2)} * t + b_{(n-1)} * g + d * b_n * t * g + e_i \quad (1)$$

where i indexed an individual, $g = 0/1$ represented the treatment status (intervention or control), and $t = 0/1$ marked baseline or endline time periods, respectively, and $t * g$, defined the interaction between treatment condition and time period (Wooldridge, 2007). The coefficient, b_n , in equation (1) for the TJ project evaluation, was the difference in the average outcome in the treatment group before and after treatment subtracted by the difference in the average outcome in the control group before and after treatment.

We applied multivariable models for all DID analyses. We chose a DID analysis within a logistic regression framework because it could estimate the average treatment effect of TJ easily without biases in the endline between the intervention and control groups, which may have been a result of existing inherent differences between the treatment condition groups (Wooldridge, 2007). To further interpret our interaction terms, we also determine the marginal effects, as our models were nonlinear. Likely a one-unit difference in an interaction that consists of two continuous variables such as age and body mass index would pose little difference on a conditional probability. However, since our interaction consists of two binary variables, each one-unit difference in either time period or treatment condition would yield a larger difference on conditional probability than an interaction term that consisted of continuous variables (Karaca-Mandic, Norton, & Dowd, 2012).

The covariates included respondent background characteristics and key indicators of family planning use. The background characteristics comprised of age (18-24, 25-34, or 35 and

older years), education (none, primary, or secondary), religion (Christian, Traditional, Muslim, or None), ethnicity (Adja, Yoruba, or Fon or other), number of living children (none, one, two, three, four, or five or more), and having cowives (no or yes). The key indicators of family planning use consisted of self-efficacy to use family planning (confidence to use, confidence to use even with spousal disapproval, and family/in-laws/entourage support to use), access to family planning (information to make decision, knowing where to obtain, ability to reach place, and the means to purchase), couple communications (knowing how many children spouse wants, comfort talking about family planning with partner, spouse approval of family planning, discussing opinions of having children with spouse, discussing methods of family planning with spouse, and discussing how to obtain method with spouse), gender norms (men should make final decisions, men earn more respect with more children, women must always obey, women should be responsible for discussing family planning, and men should use family planning if women don't), social network diffusion (discussing family planning with family, discussing family planning with friends, and correct others about misinformation surrounding family planning), time period (baseline and endline), treatment condition (intervention or control groups), and the interaction between time and treatment condition.

We did not include exposures of the intervention such as the information cards, interactions with leaders, or TJ radio because those exposures would not have been available for baseline in the DID analysis. These outcomes were analyzed with only the respondents' characteristics (ethnicity, education, religion, ethnicity, number of living children, and having cowives) and did not include the key indicators (self-efficacy, gender roles, couple communication, and social diffusion) regarding family planning use. This was because (1) the changes in key indicators at endline would have largely been attributed to the treatment condition

and (2) the interactions with leaders, radio, and information cards depended heavily on the treatment condition, thus the results would have not been reliable given collinearity. We perform separate OLS regressions for these exposures of TJ intervention with outcomes of using a modern method, the intention to use a modern method, needs met for family planning, and perceived needs met for family planning in further analyses in Appendix Tables 4.1 and 4.2.

Results

Characteristics of Men and Women (Table 4.1)

All people in the sample were between the ages of 18 and 44 years. Most women did not have any formal education. Few men also had formal education, however, there were more men who had completed primary and secondary education. More women were between 25 and 34 years old while men were more likely to be 35 years and older. More than 80% of men and women identified ethnically as Fon or other. Fertility was also high; most people in the sample had multiple living children.

Indicators of Family Planning Use (Table 4.2)

The overall rate of current modern family planning use was low for women at baseline. At baseline, 102 women in the control group (28.33%) and 164 in treatment (45.81%) were using a modern method. These numbers increased to 135 (35.59%) for controls and 243 (65.85%) for women in treatment. The intentions to use modern family planning produced higher numbers. At baseline, 271 (51.72%) in control and 279 (53.76%) intended to use a modern method in the future. These also increased at endline to 277 (52.96%) for controls and 339 (64.82%) for treatment.

Among women, there was not a significant increase of current modern method use at endline between the treatment and control groups (12.78% difference, $p=0.18$). However, the intention to use a modern method produced a significant difference between the two treatment conditions and time lines (9.82% difference, $p=0.02$). For men, the opposite was true. The percent difference of intention to use family planning in the future between the control and treatment groups was only -2.36% at endline ($p=0.52$). However, the percent difference for current use was -19.29% ($p<0.001$). This change between groups though may have been attributed to the large uptake among the controls, which happened to be absent among the treatment group for men. There was a highly significant increase for meeting contraceptive needs among women. At endline, the treatment group had increased actual need met by 17% while the controls had decreased actual need by 3% ($p<0.001$). The perceived need met decreased among the treatment group by 2% yet increased 10% among controls ($p<0.001$). Men reported consistent results. The actual need met increased by 19% among treatment but only 5% for controls ($p=0.004$). The perceived need met decreased for controls by 5% and for treatment by 18% ($p<0.001$).

Many indicators also produced significantly different changes between treatment and control at the different timelines. We calculated these differences as well via DID analysis. There were significant gains in self-efficacy indicators for the women's treatment group. Particularly, women in the treatment group were much more likely to express confidence in always using family planning and its subsequent correct use. There were also positive gains in couple communications among women in the treatment group. At endline, more women in the treatment group compared to the control group said that they had discussed with their husbands about using a modern method. The changes in gender norms were not as strong as we had hoped.

Women at endline in both groups still had negative views of men who had fewer children, and this actually increased at endline for women in the treatment group (DID=-17.49%, p=0.004). Despite TJ's promoting family planning use, women still believed that using modern family planning was associated with promiscuity. The DID for men viewing it "shameful to be associated with women using modern family planning" was 6.22% (p=0.03). The good change in societal and gender norms though was that there was an increase of acceptability to talk about family planning within the village (DID=20.09%, p<0.001).

Men's results in changes for family planning indicators had similar changes between the time periods and treatment conditions. Similar to the women, there were increases in self-efficacy, couple communications, and access. However, the gender norms were more pronounced in the negative direction compared to the women's responses. The DID estimator of "being shameful to be associated with a woman using family planning" was -6.89% (p=0.02) where more men answered yes at endline compared to baseline despite encouragement to engage in modern family planning use. Furthermore, more men in treatment viewed that women needed to obey husbands than in the control group and then at endline (DID=56.56%, p<0.001). Lastly, there was still the belief that men earned more respect with more children, even at endline in the treatment group (DID=46.18%, p<0.001).

Social Network Diffusion Behaviors (Table 4.2)

The social network diffusion DID analysis found that women in the treatment group were significantly more likely at endline compared to the controls to talk about family planning with family and friends (DID=41.95%, p<0.001), share positive knowledge about family planning with family and friends (DID=28.53%, p<0.001), and correct someone whenever they said something incorrect about family planning (DID=19.05%, p<0.001). There were also positive

changes for social diffusion behavior among men. At endline, more men had said that they had asked friends and family about family planning (3.04% increase, $p=0.001$) and had shared positively knowledge of family planning with family and friends (5.83% increase, $p=0.035$). Further results from the key indicators of family planning are included in Table 4.2.

Treatment Effect and Time Period (Table 4.3 and Appendix Table 4.3)

The DID analysis showed the treatment effects of TJ existed on current family planning use (not significant), intention to use a modern family planning method (significant), meeting actual need for modern family planning (not significant), and meeting perceived needs for family planning for women (significant). Table 4.3 presents the DID analysis results. We found that the odds of current modern family planning use for women in the treatment group when isolating all other factors was nearly three times that of women in the control group. The DID estimate, $b_n=1.471$ ($p=0.218$), was the difference in odds for current family planning use in the treatment group before and after evaluation minus the difference in odds for current modern family planning use in the control group before and after treatment when holding all other variables constant.

The result for intention to use a modern family planning method were more striking compared to current modern family planning use among women. This could have been that current use was lower because of a current pregnancy or current desire to become pregnant at the time of interview. The treatment group's odds of intention to use modern family planning were 1.59 times that of the control group's when isolating all other factors ($p=0.009$). The difference in odds of intention to use modern family planning in the treatment group (endline and baseline) minus the difference in odds for controls (endline and baseline) was 0.39 ($p<0.001$) when holding all other factors constant.

At endline, there was a significant increase in odds at meeting actual need for modern family planning. Women in the treatment group had a 2.5 increased odds ($p < 0.001$) at having their actual needs met compared to women in the control group when holding other factors constant. However, the DID for meeting actual need was not significant. The treatment group did have a significant reduction in perceived needs met compared to the control. Endline had significant increased odds of perceived needs met (aOR=2.65, $p < 0.001$) and a significant DID (0.23, $p < 0.001$)

The results of treatment effect did not produce the same positive effects for men as they had for women. Men in the treatment group did not have increased odds of current use of a modern method compared to those in the control group. Men in the treatment group also had significantly reduced odds of intention to use a modern method compared to controls (aOR=0.56, $p = 0.005$) when controlling for other factors. The DID of intention to use a modern method was 0.38 ($p = 0.002$) between the treatment and control groups. However, the odds of actually meeting a man's need for a modern family planning method were significantly higher for the treatment group compared to the control group (aOR=1.83, $p = 0.01$). The endline odds of actual needs met were also significantly higher compared to baseline (aOR =2.2, $p = 0.004$). Lastly there was an increased odds of perceived needs met for the treatment group compared to control group (aOR=3.18, $p < 0.001$) with DID=0.05 ($p < 0.001$). The factors that most strongly predicted men's family planning outcomes were greater number of living children – men with five or more living children had an 8.10 increased odds ($p < 0.001$) of current modern family planning use compared to no living children, – and having family planning dialogue with their wives.

When we examined the marginal effects, the results were not consistent with the logistic DID results. In fact, several of the effects were opposite in sign form. However, this is possible

where the interaction effect varies widely and may have different signs for different observations (Ai & Norton, 2003). In our study, the marginal effects of time over treatment condition for women was significant for current modern family planning use, intentions of modern family planning use, and actual met need for modern family planning. The marginal effect was insignificant for perceived needs of family planning. The marginal effects of time over treatment condition for men were also different from the DID analysis. They were insignificant for current modern family planning use. The difference in marginal effects between treatment and control for intention to use modern family planning was 0.555 ($p=0.005$). This is not a positive change in family planning behavior we would have expected. However, there was a significant increasing in meeting modern family planning method needs between treatment and control (aOR=1.824, $p=0.011$). We also plotted the average marginal effects of time with 95% confidence intervals for each of the four outcomes over the treatment conditions (Figures 4.2 and 4.3).

For women, the marginal effect of meeting actual needs for current modern family planning use for those in the treatment group was 0.026 ($p=0.38$). Among women in treatment, the predicted probability of meeting actual needs for modern methods at endline was 0.026 greater. For women in the control group, the predicted probability of actually meeting needs for modern methods at endline was -0.021 less ($p=0.227$). The difference of meeting women's needs for modern family planning was very significant between the treatment and control groups (aOR=2.491, $p<0.001$). Women in treatment had significant greater odds of actual needs met for modern methods compared to controls over time, which is evident in Figure 4.2c, where the average marginal effect of meeting modern method needs had increased for women in treatment. We include the results of the marginal effects and DID analysis with adjusted odds ratios of time and exposure are in Table 4.3 while the entire covariate list is in Appendix Table 4.3.

Endline Measures and Supplementary Tables

We considered the social network diffusion behaviors and their associations with the four outcomes in our multivariable analyses. The results of all the other factors aORs in the model are in the Appendix. Women who had asked their friends and family recently about their experiences with family planning had a 1.976 increased odds in intentions to use family planning ($p < 0.001$) compared to women who had not asked such questions. Women who had shared positive knowledge and experiences about modern family planning had a 2.402 increased odds ($p < 0.001$) in current modern family planning use and 2.402 increased odds ($p < 0.001$) in actual need met compared to women who had not shared knowledge or positive experiences. Women who had corrected others for diffusing incorrect information about modern family planning had a significant reduction in perceived needs met (aOR=0.442, $p=0.029$) compared to women who had not corrected someone for diffusing incorrect information about modern family planning. Men also had significant associations with positive social network diffusion behaviors and their four outcomes. Men who had shared knowledge or positive experiences with modern family planning with family and friends had a 1.663 increased odds of intentions to use modern family planning ($p=0.039$) compared to men who had not shared knowledge or positive experiences.

The exposure to TJ programming through radio, infographics, leaders, and story cards was limited. At endline, only 35% of women and 24% of men surveyed had heard a TJ radio broadcast in the past three months, 30% of women and 31% of men had interacted with an influential or infographic, and 25% of women and 22% of men had exposure to TJ groups, activity cards, and story cards. Furthermore, the exposures to TJ programming were mostly limited to the treatment groups. However, among women who had been exposed to such TJ programming, there were significant increased odds in their current use of modern family

planning, intention to use modern family planning, actual needs met for modern family planning, and reduced odds of perceived needs met. Exposure to TJ radio was associated with a 2.64 odds increase in current family planning use ($p < 0.001$), 2.59 odds increase in actual needs met for modern family planning ($p < 0.001$), and 0.35 odds decrease in perceived needs met. Exposure to TJ leaders or infographics was associated with 2.06 increased odds in modern family planning use ($p = 0.004$) and 1.91 increased odds in actual needs met for modern family planning. Exposure to TJ groups, activity cards, and story cards was associated with 1.63 increased odds in current family planning use ($p = 0.045$), 2.47 increased odds in intention to use modern family planning ($p < 0.001$), and 1.68 increased odds in meeting actual needs for family planning.

Men's exposure to TJ programming once again had less positive response in their family planning behaviors compared to women at endline. Exposure to TJ radio was associated with increased odds in current modern family planning use (aOR=2.19, $p < 0.001$), intention to use modern family planning (aOR=1.73, $p = 0.002$), actual need met for family planning (aOR=2.38, $p < 0.001$), and decreased odds in perceived needs (aOR=0.31, $p = 0.006$). Exposure to TJ leaders or infographics was associated with decreased odds in actual need met for family planning (aOR=0.664, $p = 0.026$). Exposure to TJ groups, activity cards, or story cards was associated with decreased odds in intention to use modern family planning (aOR=0.58, $p = 0.006$). Further results to endline exposures are available in Appendix Tables 4.1 and 4.2.

Comparison to 2012 Beninese DHS

As a test of regions included in the TJ program, we performed basic tabulations of current modern family planning use, intention to use modern family planning, and unmet need for family planning using the Benin DHS data. Among respondents in Atlantique, the control site, there was

a 34% unmet need rate for modern family planning and 32% in Ouémé. For current use, only 6% in Atlantique were current users and 25% were not current users but were intending to do so in the future. In Ouémé, 9% were current users and 21% were not currently using but intended to do so in the future. We perform further comparisons between the DHS sample and our sample and include these results in Table 4.1.

Discussion

The results suggest that there were large treatment effects regarding the intention to use modern family planning methods but less so for current family planning use at the time of interview. This difference was likely attributed to respondents expecting children or respondents wanting to have a child within the next year or developing more favorable attitudes despite immediate need for modern family planning. Respondents who had participated in the treatment group were also more likely to participate in social network diffusion at endline about family planning use such as communicating with other people about family planning or correcting others when hearing incorrect messages about family planning.

Moreover, hearing TJ messages about family planning from groups and Influentials and exposure to TJ program materials had significant and positive effects on family planning outcomes for women. The results for endline exposures men were not as strong, apart from listening to TJ programs on the radio. This result can propose that radio broadcasts of intervention programs were more effective to teach men about family planning use than Influentials, infographics, stories, or participating in TJ activities.

Limitations

Since the survey data consisted of only particular communities in Benin, the results of this study would not be generalizable to the entire Beninese population. The TJ program also did not produce positive changes in attitudes and gender norms surrounding family planning, mostly for men. However, this may be a result that the survey questions and response options had confused some of the respondents. Additionally, participating in TJ for men did not produce nearly as strong results in family planning outcomes as it had done for women. This does not necessarily mean that the intervention was totally ineffective for men, but rather certain TJ components were more effective at changing men's behavior (e.g. TJ radio) or that the TJ program effectively changed men's social diffusion about contraception rather than actual contraceptive use outcomes.

There were also concerns of the ability to cluster by village. We knew that 32 of the villages in the departments had been sampled. Ideally, we would have wanted to cluster on village, but these data were not available. Thus, our results may present more bias.

Research Implications

The results of our study add to the growing body of social network diffusion and family planning literature. Our results also confirm that interventions supporting more informative dialogue about family planning use can increase its prevalence among populations where it is low, especially for women. Though the odds of using family planning were not necessarily greater at the time of interview; there were increased odds for intention to use and increased odds of meeting needs for modern family planning. The increased odds of meeting needs were also occurring with reducing perceived needs. The shifts in the rates may have been a result of more people choosing to engage in modern family planning use or the desire to conceive a child.

Our study also adds to research where men participate in family planning interventions. Since the United Nations has expressed the need to engage men in family planning programs, it is necessary that more interventions include them. In developing nations, men are more likely to become religious leaders, lawmakers, and health-care professionals. This is not to say that women are incapable of such career paths but rather men who have positive attitudes towards and who use family planning will more likely aim to keep family planning programs funded and accessible. By including men in the TJ intervention program, it also encouraged more women to discuss with their husbands their reproductive health needs.

It is essential for family planning programs to consider the community and social components of health behaviors to achieve the most positive results. Using Influentials and mass media to diffuse new ideas had a positive impact on proximal determinants of family planning use, particularly in raising self-efficacy and increasing couple communication about family planning. Additionally, parts of the TJ intervention decreased the unmet need of family planning, which is one of the largest priorities of USAID family planning programs. Despite men's lack of change for gender roles and attitudes, our results still justify the significance of addressing changing social norms about family planning. This was evident in the changes witnessed for couple communications, one of the largest predictors and determinants of family planning use. Future research involving family planning interventions must continue to emphasize the significance of men's involvement and addressing social norms.

Figure 4.1. The Social Network Diffusion Model (Package of TJ Social Network Interventions)

INTERVENTION COMPONENTS

1 ENGAGE COMMUNITIES IN SOCIAL MAPPING



2 SUPPORT INFLUENTIAL GROUPS IN REFLECTIVE DIALOGUE



3 ENCOURAGE INFLUENTIAL INDIVIDUALS TO ACT



4 USE RADIO TO CREATE AN ENABLING ENVIRONMENT

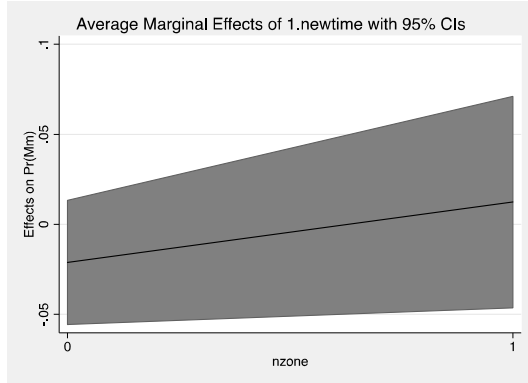


5 LINK FP PROVIDERS WITH INFLUENTIAL GROUPS

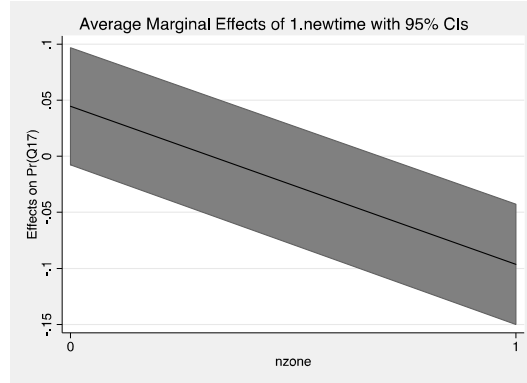


Figure 4.2. Margins plot of adjusted predictions of time period interacting with treatment condition for women (a) current modern method use, (b) intentions to use modern method, (3) actual need met, and (4) perceived need met.

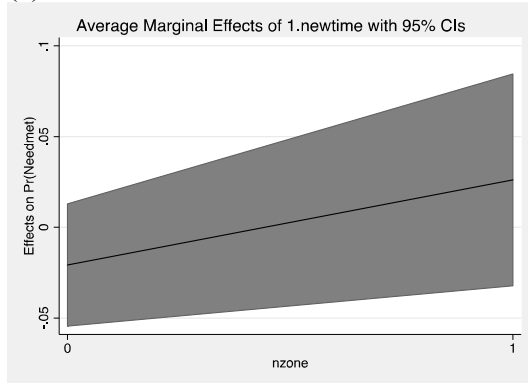
(a)



(b)



(c)



(d)

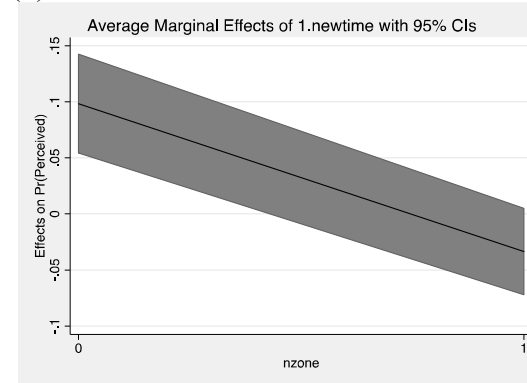
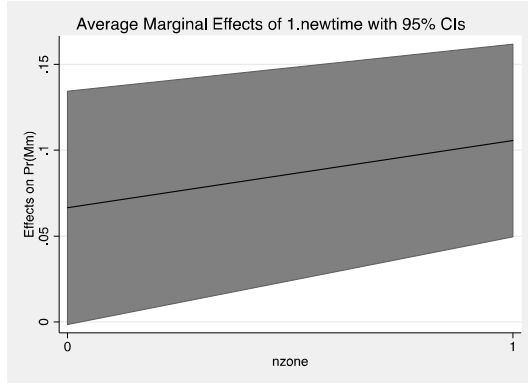
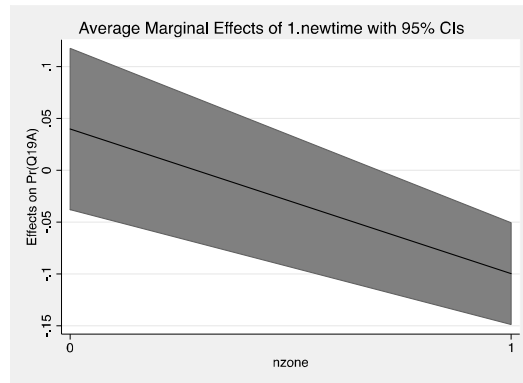


Figure 4.3. Margins plot of adjusted predictions of time period interacting with treatment condition for men (a) current modern method use, (b) intentions to use modern method, (3) actual need met, and (4) perceived need met.

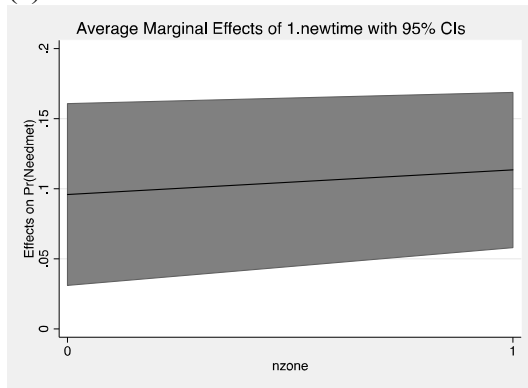
(a)



(b)



(c)



(d)

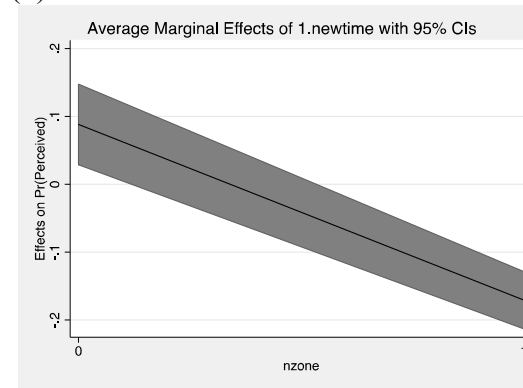


Table 4.1a. Sample characteristics (women).

Characteristics	Baseline (N=1,043)			Endline (N=1,046)		
	Control (N=524)	Treat (N=519)	P-value	Control (N=523)	Treat (N=523)	P-value
Socio-demographic			0.126	135 (25.81)	127 (24.28)	
Age (years; %)	126 (24.05)	113 (21.77)		249 (47.61)	244 (46.65)	
18-24	266 (50.76)	246 (47.40)		139 (26.58)	152 (29.06)	
25-34	132 (25.19)	160 (30.83)				0.009**
35 and older			0.134	379 (72.47)	340 (65.01)	
Education	329 (62.79)	347 (66.86)		103 (19.69)	145 (27.72)	
None	134 (25.57)	130 (25.05)		41 (7.84)	38 (7.27)	
Primary	61 (11.64)	42 (8.09)				<0.001***
Secondary or more			<0.001***	407 (77.82)	475 (90.82)	
Religion	356 (67.94)	465 (89.60)		89 (17.02)	32 (6.12)	
Christian	132 (25.19)	30 (5.78)		3 (0.57)	9 (1.72)	
Traditional	10 (1.91)	21 (4.05)		24 (4.59)	7 (1.34)	
Muslim	26 (4.96)	3 (0.58)				<0.001***
None			<0.001***	30 (5.75)	2 (0.38)	
Ethnicity	34 (6.54)	4 (0.77)		3 (0.57)	7 (1.34)	
Adja	10 (1.92)	14 (2.071)		489 (93.68)	513 (98.28)	
Yoruba	476 (91.54)	499 (96.52)				0.320
Fon or other			0.164	19 (3.63)	36 (6.88)	
Number of living children	34 (6.49)	20 (3.85)		79 (15.11)	78 (14.91)	
None	75 (14.31)	60 (11.56)		98 (18.74)	91 (17.40)	
1	113 (21.56)	103 (19.85)		106 (20.27)	107 (20.46)	
2	88 (16.79)	103 (19.85)		94 (17.97)	93 (17.78)	
3	89 (16.98)	101 (19.56)		127 (24.28)	118 (22.56)	
4	125 (23.85)	132 (25.43)				0.020*
5 or more			<0.001***	425 (81.26)	394 (75.33)	
Cowives	371 (70.80)	314 (60.50)		98 (18.74)	129 (24.67)	
No	153 (29.20)	205 (39.50)		135 (25.81)	127 (24.28)	
Yes			0.126	249 (47.61)	244 (46.65)	

Note: *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Table 4.1a1. % Comparison to Beninese DHS (women only)

Characteristics	Control (Atlantique), 37.09%	Treatment (Ouémé), 62.91%
Socio-demographic		
Age (years; %)		
18-24	8.14	7.13
25-34	39.70	39.77
35 and older	52.16	53.09
Education		
None	74.44	80.30
Primary	17.54	14.32
Secondary or more	8.02	5.39
Religion		
Christian	71.68	61.75
Traditional	20.76	28.98
Muslim	3.99	5.87
None	3.56	3.41
Ethnicity		
Adja	8.17	39.99
Yoruba	0.59	0.20
Fon or other	94.24	59.82
Number of living children		
None	0.29	0.24
1	5.46	4.89
2	13.56	10.17
3	17.63	16.16
4	19.47	19.57
5 or more	43.58	48.97
Cowives		
No	57.37	53.11
Yes	52.63	46.86

Source: Beninese DHS, 2012

Sample of women who are 18 and older only in Atlantique and Ouémé

Table 4.1b. Sample characteristics (men).

Characteristics	Baseline (N=1,030)			Endline (N=1,045)		
	Control (N=525)	Treat (N=505)	P-value	Control (N=523)	Treat (N=522)	P-value
Socio-demographic						
Age (years; %)			0.034*			0.003**
18-24	29 (5.52)	12 (2.38)		19 (3.62)	3 (0.59)	
25-34	181 (34.48)	185 (36.63)		9 (1.71)	11 (2.18)	
35 and older	315 (60.00)	308 (60.99)		497 (94.67)	491 (97.23)	
Education			<0.001***			<0.001***
None	222 (42.29)	139 (27.52)		307 (58.70)	151 (28.93)	
Primary	186 (35.43)	219 (43.37)		150 (28.68)	220 (42.15)	
Secondary or more	117 (22.29)	147 (29.11)		66 (12.62)	151 (28.93)	
Religion			0.115			<0.001***
Christian	191 (50.66)	275 (57.89)		216 (52.43)	291 (59.39)	
Traditional	144 (38.20)	164 (34.53)		135 (32.77)	167 (34.08)	
Muslim	13 (3.45)	13 (2.74)		51 (12.38)	12 (2.45)	
None	29 (7.69)	23 (4.84)		10 (2.43)	20 (4.08)	
Ethnicity			0.003**			<0.001***
Adja	19 (3.62)	3 (0.59)		30 (5.74)	4 (0.77)	
Yoruba	9 (1.71)	11 (2.18)		4 (0.76)	12 (2.30)	
Fon or other	491 (94.87)	491 (97.23)		489 (93.50)	506 (96.93)	
Number of living children			0.002**			0.090
None	33 (6.29)	12 (2.38)		19 (3.63)	36 (6.91)	
1	75 (14.29)	48 (9.50)		57 (10.90)	66 (12.67)	
2	80 (15.24)	77 (15.25)		83 (15.87)	80 (15.36)	
3	78 (14.86)	78 (15.45)		85 (16.25)	92 (17.66)	
4	72 (13.71)	68 (13.47)		71 (13.58)	74 (14.20)	
5 or more	187 (35.62)	222 (43.96)		208 (39.77)	173 (33.21)	
Cowives			<0.001***			<0.001***
No	394 (75.05)	308 (60.99)		450 (86.04)	393 (75.29)	
Yes	131 (24.95)	197 (39.01)		73 (13.96)	129 (24.71)	

Note: *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Table 4.2a. Indicators of family planning use, women

Indicators	Control (N=1,047)			Intervention (N=1,042)			Difference in Changes	P-value
	Baseline	Endline	% Change	Baseline	Endline	% Change		
Self-efficacy								
Confidence that I could use a modern method correctly all the time to delay or avoid pregnancy	325 (62.02)	370 (70.75)	8.73	329 (63.39)	476 (91.01)	27.62	18.89	<0.001***
Confidence I could use modern method correctly all the time to delay/avoid, even if husband disagrees	274 (52.29)	183 (34.99)	-17.30	251 (48.36)	208 (39.77)	-8.59	8.71	0.042*
My family would support my decision to use modern method to delay/avoid pregnancy	289 (55.15)	283 (54.11)	-1.04	293 (56.45)	385 (73.61)	17.16	18.2	<0.001***
My in-laws would support my decision to use a modern method to avoid/delay pregnancy	229 (43.70)	155 (29.64)	-14.06	205 (39.50)	278 (53.15)	13.65	27.71	<0.001***
My entourage would support my decision to use a modern method to delay/avoid pregnancy.	327 (62.40)	294 (56.41)	-5.99	270 (52.02)	378 (72.28)	20.26	26.25	<0.001***
Access								
I have the info to make decisions about modern contraception.	307 (58.59)	274 (52.39)	-6.20	345 (66.47)	492 (94.07)	27.6	33.80	<0.001***
I know where to obtain contraception.	274 (52.29)	324 (61.95)	9.66	335 (64.55)	481 (91.97)	27.42	17.76	<0.001***
I can reach this place with too much difficulty.	273 (52.10)	277 (52.96)	0.85	295 (56.84)	461 (88.15)	31.31	30.45	<0.001***
If I wanted to obtain, I have the means to purchase.	266 (50.76)	230 (43.98)	-6.78	291 (56.07)	438 (83.75)	27.68	34.46	<0.001***
Couple communications								
Husband definitely approves of FP use	124 (23.66)	94 (17.97)	-5.69	92 (17.73)	163 (31.17)	13.44	19.13	<0.001***
You know how many children	161 (30.73)	152 (29.06)	-1.67	168 (32.37)	319 (60.99)	28.62	30.29	<0.001***

husband wants you to have.								
You are comfortable talking with your partner about FP use.	318 (60.69)	288 (55.07)	-5.62	245 (47.21)	332 (63.48)	16.27	21.89	<0.001***
You have discussed your opinion of having children with your husband.	281 (53.63)	162 (30.98)	-22.65	238 (45.86)	384 (73.42)	27.56	50.21	<0.001***
In the last 12 months, you discussed your opinion about having children with your husband,	238 (45.42)	111 (21.22)	-24.20	143 (27.55)	262 (50.10)	22.55	46.75	<0.001***
In the last 12 months, you discussed with your husband which modern method you want to use to delay or avoid pregnancy, if you wanted to use one.	121 (23.09)	68 (13.00)	-10.09	83 (15.99)	266 (50.86)	34.87	44.96	<0.001***
In the last 12 months, you discussed with your husband how you would obtain a modern method to delay or avoid pregnancy, if you wanted to use one (payment, where to get it, etc).	118 (22.52)	60 (11.47)	-11.05	83 (15.99)	249 (47.61)	31.62	42.67	<0.001***
Attitudes about FP and gender norms								
It is good to have many children to provide for you in the future.	102 (19.47)	103 (19.69)	0.27	167 (32.18)	151 (28.87)	-3.31	-3.53	0.41
Women who use FP have multiple sexual partners.	120 (22.90)	165 (31.55)	8.65	53 (10.21)	97 (18.55)	8.34	-0.31	0.27
Men whose wives use family planning lack authority.	121 (23.09)	121 (23.14)	0.05	46 (8.86)	78 (14.91)	6.05	6.00	0.02*
It is shameful to be associated with a woman who is known	86 (16.41)	64 (12.24)	-4.17	39 (7.51)	50 (9.56)	2.05	6.22	0.03*

to use FP.								
In this village, it is acceptable to discuss FP in public.	151 (28.82)	186 (35.56)	6.74	91 (17.53)	232 (44.36)	26.83	20.09	<0.001***
In the home, a man must have the final word in decision-making.	455 (86.83)	423 (80.88)	-5.95	480 (92.49)	291 (55.64)	-36.85	-30.90	<0.001***
A woman must always obey her husband.	441 (84.16)	410 (78.39)	-5.77	475 (91.52)	345 (65.97)	-25.55	-19.78	<0.001***
Men who have many more children are more respected than those who have few	239 (45.61)	237 (45.32)	0.29	215 (41.43)	281 (58.73)	-17.30	-17.59	0.004**
It's a woman's responsibility to bring up the topic of family planning for discussion with her husband.	35 (6.68)	62 (11.85)	-5.17	99 (19.08)	89 (17.02)	-2.06	3.11	0.005**
If a couple does not want to get pregnant and the wife is not using FP, her husband should do so.	327 (62.40)	309 (59.08)	-3.32	310 (59.73)	226 (43.21)	-16.52	-13.20	<0.001***
Social diffusion								
In the past 3 months, you asked friends or family members about their experiences with family planning.	93 (17.75)	46 (8.80)	-8.95	74 (14.26)	243 (46.46)	32.20	41.95	<0.001***
In the past 3 months, you shared knowledge or positive experiences with family planning with family or friends.	61 (11.64)	48 (9.18)	-2.46	86 (16.57)	223 (42.64)	26.08	28.53	<0.001***
In the past 3 months, you corrected someone if you heard someone saying something incorrect or untrue about family	36 (6.87)	39 (7.46)	0.59	39 (7.51)	143 (27.15)	19.64	19.05	<0.001***

planning.								
Intention to use FP in the future	271 (51.72)	277 (52.96)	1.24	279 (53.76)	339 (64.82)	11.06	9.82	0.02*
Currently using method	102 (28.33)	135 (35.59)	7.26	164 (45.81)	243 (65.85)	20.04	12.78	0.18
Would like to become pregnant within next year	80 (15.27)	87 (16.63)	1.36	66 (12.72)	44 (8.41)	-4.31	-5.67	0.03*
Actual met need for FP	58 (11.07)	40 (7.65)	-3.42	122 (23.51)	212 (40.54)	17.03	20.45	<0.001***
Perceived met need	42 (8.02)	93 (17.78)	9.76	44 (8.48)	36 (6.88)	-1.6	-11.36	<0.001***

Note: P-value corresponds to the comparison of changes between control and intervention groups. We calculated difference in changes by subtracting change in the intervention to changes in the control groups. *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Table 4.2b. Indicators of family planning use, men

Indicators	Control (N=1,048)			Intervention (N=1,027)			Difference in Changes	P-value
	Baseline	Endline	% Change	Baseline	Endline	% Change		
Self-efficacy								
Confidence that I could use a modern method correctly all the time to delay or avoid pregnancy	327 (62.29)	395 (75.53)	13.24	292 (57.82)	425 (81.42)	23.60	10.36	0.007**
Confidence I could use modern method correctly all the time to delay/avoid, even if wife disagrees	326 (62.10)	369 (70.55)	8.45	2765 (54.65)	373 (71.46)	16.81	8.36	0.06
My family would support my decision to use modern method to delay/avoid pregnancy	353 (67.24)	265 (50.67)	-16.57	224 (44.36)	311 (59.58)	15.22	31.79	<0.001***
My in-laws would support my decision to use a modern method to avoid/delay pregnancy	325 (61.90)	216 (41.30)	-20.60	201 (39.80)	286 (54.79)	14.99	35.59	<0.001***
My entourage would support my decision to use a modern method to delay/avoid pregnancy.	351 (66.86)	215 (41.11)	-25.75	222 (43.96)	315 (60.34)	16.38	42.13	<0.001***
Access								
I have the info to make decisions about modern contraception.	296 (56.38)	217 (41.49)	-14.89	245 (48.51)	397 (76.05)	27.54	42.43	<0.001***
I know where to obtain contraception.	320 (60.95)	263 (50.29)	-10.66	3156 (62.38)	442 (84.67)	22.29	32.95	<0.001***
I can reach this place with too much difficulty.	313 (59.62)	192 (36.71)	-22.91	274 (54.26)	423 (81.03)	26.77	49.68	<0.001***
If I wanted to obtain, I have the means to purchase.	312 (59.43)	180 (34.42)	-25.01	263 (52.08)	3910 (74.71)	22.63	47.64	<0.001***
Couple communications								
You believe your wife definitely approves of FP use.	55 (10.48)	137 (26.20)	15.72	111 (21.98)	149 (28.54)	6.56	-9.16	0.001**
You know how many children	81 (15.43)	271 (51.82)	36.39	198 (39.21)	226 (43.30)	4.09	-32.30	<0.001***

your wife wants to have.								
You are comfortable talking with your wife about FP use.	307 (58.48)	318 (60.80)	2.32	228 (45.15)	338 (64.75)	19.60	17.28	<0.001***
In the last 12 months, you discussed your opinion about having children with your wife.	114 (21.71)	311 (59.46)	37.75	189 (37.43)	283 (54.21)	16.78	-20.97	<0.001***
In the last 12 months, you discussed with wife which modern method you want to use to delay or avoid pregnancy, if you wanted to use one.	83 (15.81)	200 (38.24)	22.43	135 (26.73)	228 (43.68)	16.95	-5.48	0.029*
In the last 12 months, you discussed with your wife how you would obtain a modern method to delay or avoid pregnancy, if you wanted to use one (payment, where to get it, etc).	76 (14.48)	113 (21.61)	7.13	115 (22.77)	208 (39.85)	16.08	8.95	0.133
Attitudes about FP and gender norms								
It is good to have many children to provide for you in the future.	113 (21.52)	177 (33.84)	12.32	163 (32.28)	193 (36.97)	4.69	-7.63	0.031*
Women who use FP have multiple sexual partners.	151 (28.76)	304 (58.13)	29.37	190 (37.62)	187 (35.82)	-1.80	-31.17	<0.001***
Men whose wives use family planning lack authority.	119 (22.67)	340 (65.01)	42.34	203 (40.20)	189 (36.21)	-3.99	-46.33	<0.001***
It is shameful to be associated with a woman who is known to use FP.	45 (8.57)	82 (15.68)	7.11	55 (10.89)	58 (11.11)	0.22	-6.89	0.018*
In this village, it is acceptable to discuss FP in public.	400 (76.19)	149 (28.49)	-47.70	175 (34.65)	420 (80.46)	45.81	93.51	<0.001***

In the home, a man must have the final word in decision-making.	448 (85.33)	241 (46.08)	-39.25	426 (84.36)	378 (72.41)	-11.95	27.30	<0.001***
A woman must always obey her husband.	480 (91.43)	230 (43.98)	-47.45	370 (73.27)	430 (82.38)	9.11	56.56	<0.001***
Men who have many more children are more respected than those who have few	254 (43.38)	35 (6.69)	-36.69	73 (14.46)	125 (23.95)	9.49	46.18	<0.001***
It's a woman's responsibility to bring up the topic of family planning for discussion with her husband.	61 (11.62)	44 (8.41)	-3.21	129 (25.54)	167 (31.99)	6.45	9.66	0.007**
If a couple does not want to get pregnant and the wife is not using FP, her husband should do so.	274 (52.19)	114 (21.80)	-30.39	128 (25.35)	221 (42.34)	16.99	47.38	<0.001***
Social diffusion								
In the past 3 months, you asked friends or family members about their experiences with family planning.	11 (2.10)	95 (18.16)	16.06	68 (13.47)	170 (32.57)	19.10	3.04	0.001**
In the past 3 months, you shared knowledge or positive experiences with family planning with family or friends.	17 (3.24)	77 (14.72)	11.48	79 (15.64)	172 (32.95)	17.31	5.83	0.035*
In the past 3 months, you corrected someone if you heard someone saying something incorrect or untrue about family planning.	19 (3.62)	89 (17.02)	13.40	38 (7.52)	62 (11.88)	4.36	-9.04	<0.001***
Intention to use FP in the future	254 (43.38)	298 (56.98)	13.60	188 (37.23)	253 (48.47)	11.24	-2.36	0.516
Currently using method	131 (37.86)	201 (58.77)	20.91	199 (57.85)	223 (59.47)	1.62	-19.29	<0.001***

Would like to become pregnant within next year	99 (18.86)	72 (13.77)	-5.09	87 (17.23)	54 (10.34)	-6.89	-1.80	0.393
Actual met need for FP	81 (15.43)	109 (20.84)	5.41	92 (18.22)	196 (37.55)	19.33	13.92	<0.004**
Perceived met need	58 (11.05)	86 (16.44)	-5.39	109 (21.58)	17 (3.26)	-18.32	-12.93	<0.001***

Note: P-value corresponds to the comparison of changes between control and intervention groups. We calculated difference in changes by subtracting change in the intervention to changes in the control groups. *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Table 4.3a. Adjusted Odds Ratios of (1) current modern method family planning use, (2) intention to use modern family planning, (3) actual need met, and (4) perceived need met for women, N=2,081, and marginal effects.

	aOR	p	aOR	p	aOR	p	aOR	p
Time								
Baseline	1.00	Ref	1.000	Ref	1.00	Ref	1.000	Ref
Endline	0.737	0.23	1.337	0.095	0.731	0.229	2.651	<0.001***
Exposure								
Control	1.00	Ref	1.000	Ref	1.00	Ref	1.000	Ref
Treatment	2.949	<0.001***	1.592	0.009**	2.491	<0.001***	1.186	0.493
Difference-in-difference estimator	1.471	0.218	0.389	<0.001***	1.629	0.126	0.231	<0.001***
Marginal effects of time over treatment condition	diff	p	diff	p	diff	p	diff	p
Control	-	0.228	0.045	0.094	-	0.227	0.098	<0.001***
Treatment	0.012	0.682	0.096	<0.001***	0.026	0.380	0.034	0.088
Difference	2.989	<0.001***	1.592	0.009**	2.491	<0.001***	1.186	0.493

Note: *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Table 4.3b. Adjusted Odds Ratios of (1) current modern method family planning use, (2) intention to use modern family planning, (3) actual need met, and (4) perceived need met for men, N=1,753, and marginal effects.

	aOR	p	aOR	p	aOR	p	aOR	p
Time								
Baseline	1.00	Ref	1.000	Ref	1.00	Ref	1.000	Ref
Endline	1.656	0.057	1.278	0.314	2.2	0.004**	2.429	0.004**
Exposure								
Control	1.00	Ref	1.000	Ref	1.00	Ref	1.000	Ref
Treatment	1.518	0.063	0.555	0.005**	1.825	0.011*	3.179	<0.001***
Difference-in-difference estimator	1.186	0.598	0.377	0.002**	0.958	0.898	0.054	<0.001***
Marginal effects of time over treatment condition	diff	p	diff	p	diff	p	diff	p
Control	0.066	0.055	0.040	0.314	0.096	0.004**	0.088	0.004**
Treatment	0.106	<0.001	0.100	<0.001***	0.113	<0.001***	0.171	<0.001***
Difference	1.518	0.063	0.555	0.005**	1.824	0.011*	3.179	<0.001***

Note: *P<0.05, **P<0.01, ***P<0.001. Data source: TJ Survey Data.

Chapter 5: Conclusion

The purpose of this research was to examine the determinants of unintended pregnancy and the use of family planning services in the U.S. and West Africa. Despite the vastly different political and economic conditions in these divergent context, many women residing in these places are unable to fully control their reproductive lives. West Africa suffers from some of the world's highest infant and maternal mortality rates, which are disproportionately concentrated in preventable unintended pregnancies. The United States is the wealthiest nation in the world yet nearly 50% of pregnancies are unintended.

This dissertation contributes to the literature about unintended pregnancy and modern family planning use in several different ways. Particularly:

- (1) I identified specific socioeconomic and intrapersonal factors that contribute to racial and ethnic disparities in unintended pregnancy in the United States. Previous research and analysis had focused on finding the disparity only and discussed other factors associated with unintended pregnancy such as education level or marital status. My research provides new evidence on what differences in these factors drive racial and ethnic disparities in unintended pregnancy.
- (2) I identified a relationship between health literacy and family planning use in Senegal. I also identified which indicators of health literacy that may be most useful in future modern family planning interventions.
- (3) I determined how a social network intervention influenced a population's contraceptive prevalence rate and its unmet need rate for modern contraception. I also

described a modern family planning use intervention that included men in family planning dialogue.

Summary of Research Findings

Each of the chapters of this dissertation offered some expected and unexpected results. Racial and ethnic minorities do experience greater odds of unintended pregnancy compared to white women in the United States. However, after adjusting for factors across levels of the Social Ecological Model (SEM), race/ethnicity no longer predicts unintended pregnancy. For example, a woman who is on Medicaid or a woman who has not completed a college education is more likely to experience an unintended pregnancy, and ethnic and racial minority women are more likely to be Medicaid recipients or more likely to not yet have completed a college education. Our results contribute to the literature by using a methodological approach (SEM) to understand the underlying factors of racial and ethnic disparities in unintended pregnancy. Consistent with the SEM, the results confirm that that different levels (intrapersonal, interpersonal, institutional, community, and public policy) contribute to racial and ethnic disparities in unintended pregnancies.

In researching family planning use in Senegal, I had expected that reading about family planning use would be indicative of its increased utilization. However, this turned out not to be a strong predictor, even among women who could read a complete sentence. Instead, the results confirmed that other mass media outlets, mostly television, were more persuasive at encouraging family planning use. Our research contributes to the literature of health literacy and is to our knowledge only the second to address health literacy research using the Demographic and Health Surveys (DHS). Furthermore, our research is the first to address health literacy and its relationship with modern family planning use.

A similar result appeared in the Beninese intervention. Our study evaluated a program in Benin using quasi-experimental methods. We found that men did not respond as strongly to social diffusion messages spread by speaking with other community members. However, radio broadcasts focused on family planning were more persuasive at increasing family planning use. These findings suggest that audio and visual programs can encourage health behaviors in West Africa. Our research adds to the growing body of social network diffusion research that considers how relationships and message diffusion contribute to family planning uptake. Furthermore, it also adds to the limited research where men participate in family planning interventions. By including men in the intervention program, the intervention also encouraged more women to discuss family planning and reproductive health needs with their husbands.

A Synthesis of Evidence Across Studies

The common themes are such that women of reproductive age, no matter what a nation's gross domestic product is, do not always wish to become pregnant. The difference among the chapters were that Chapter 2 focused on unintended pregnancy among racial and ethnic minorities, Chapter 3 focused on modern family planning use only, and Chapter 4 study addressed the unmet needs for modern family planning. The locations of each of the study were different. However, researching unintended pregnancy first then made me want to go to one of the causes of this public health outcome. The cause being that not using modern family planning could lead to unintended pregnancy. Researching Senegal's contraceptive prevalence rates then lead me to research determinants of non-use, which was a reason I addressed health literacy in Chapter 3. Since my third chapter used data from the DHS, I noticed one short-coming of the DHS was that there is not a question that asks women, "Do you want to become pregnancy in the next year?" There is a variable that asks about unmet need, however, it is much clearer to

determine what a nation's unmet need rates are when asking outright whether a woman wants to become pregnancy in the next year. If we know someone does not want to become pregnant in the next year and is not using contraception, then unmet need for contraception exists. This information was available in the data for Chapter 4. The limitations of Chapter 3 lead me to my desire to address unmet need in Chapter 4, which was possible for me to answer because of the structure of the questionnaires.

Policy Implications within the United States

Since 2014, in the United States, the Patient Protection and Affordable Care Act (ACA) has required that plans must cover FDA-approved contraceptive methods and counseling without cost sharing ("Birth control benefits," 2013). Chapter 2 found that disparate levels of unintended pregnancy across racial and ethnic lines in the US are due to differences of education and insurance type, suggesting that policies such as the ACA contraception mandate might reduce such disparities. However, questions have arisen as to how the Trump Administration will modify, reduce, or eliminate contraception coverage under the ACA. What we can expect is that under such federal changes, including requirements for contraception without cost sharing, will now largely be at each state's discretion (Sobel, Salganicoff, & Rosenzweig, 2017).

Given the enormous health and economic consequences of mistimed and unwanted child bearing, allowing a woman to choose when or if she becomes pregnant is should be treated as basic human right. By having greater access to family planning services, more families have been able to invest in their socioeconomic wellbeing. Delaying childbirth until it is intended enables education and work experience, and leads to increased lifetime earnings (Bailey, 2013). Furthermore, family planning in the United States has managed to delay marriage and reduce divorce, which would reduce spending of divorce proceedings, and maintain intact families,

which also increase household income (Christensen, 2012; Goldin & Katz, 2002; Rotz, 2011). Through US supported family planning programs in 2010 alone, family planning visits averted approximately 2,200,000 unintended pregnancies. The averted cases included women suffering from sexually transmitted infections, complicated births and pregnancies, and miscarriages. The estimated net public savings attributed to such services were approximately \$13.6 billion (Frost, Sonfield, Zolna, & Finer, 2014). The costs and hardships associated with unintended pregnancy are not equally distributed, but often fall hardest on the most vulnerable populations. Reducing access to family planning may likely accelerate the intergenerational transmission of inequality.

Policy Implications in West Africa: The United Nations' Millennium Development and Sustainable Development Goals

The results of Chapters 3 and 4 have global economic and health policy implications in addition to further research implications. International development and health have also addressed the need to include family planning as a health, economic, and human rights priority (Fabric et al., 2015; “SDGs & Topics,” 2015, United Nations, 2015, World Health Organization, 2014). The actions of the current administration do not affect only the United States. On his fourth day in office, President Trump signed an executive order known as the Mexico City Policy or the Global Gag Rule. The policy imposes that United States family planning funds may not support foreign non-governmental organizations that provide abortion services, counseling, referrals, or advocate for legalizing abortion in other nations – even when using their own government’s funds for such actions (Trump, 2017). The consequence is that the United States will reduce funding for NGO programs that aid also HIV/AIDS prevention, maternal, infant, and child health programs (such as Zika, nursing support, and vaccines), or water and sanitation, unless they abide by the financial ruling (Starrs, 2017).

In 2015, the Millennium Development Goals (MDG) concluded, and the United Nations defined its more ambitious Sustainable Development Goals (SDG). The MDG listed global partnership for development as a goal. Target 8.F stated that new technology, especially information and communications, needed to increase as well (“Millennium Development Goals and Beyond 2015,” 2008). The SDG has promoted Goal 17 for Partnership for the Goals (“SDGs & Topics,” 2015). Now more than ever, there has been a push for public and private partnerships in family planning (S. Bradley, Eva, Rena, Samarthya-Howard, & Quijada, 2016; “Family Planning Partnerships,” 2016; Pandit-Rajani, Sharma, & Muramutsa, 2010). With the existence of mobile health programs and the encouragement of private-public partnerships, there are now more mobile health programs to encourage youth to engage in healthy behaviors.

As technology evolves to include health communication applications, private-public partners may prompt contraception use through smart phones. Such technology measures have become more prevalent, typically for adolescent and young adults who engage in more communication via social media and short messaging services (SMS). Nearly 75% of South African young adults talk to strangers at least once a week through mobile networks and social media, and 68% indicate that they most often talk to family and friends through such methods (Beger, Hoveyda, & Sinha, 2011). African technological organizations have recognized the growth of the youth population and their mobile phone consumption, so they have invested in youth public health communication through mobile telephone technology (S. Bradley et al., 2016). It is likely West Africa will likely follow with similar communication patterns in the near future. Furthermore, the influence of organizations such as the Bill and Melinda Gates Foundation, the Clinton Global Initiative, and the Obama Foundation – organizations that promote technology and health – will continue to rise in Africa through health and

communication. Future research will need to examine the impact of such communications, available mostly through private-public partnerships, on health behaviors.

The implications at stake for continuing to support family planning go beyond technological outcomes. The global contribution to investing in family planning supply produces worldwide economic gains, which serves Sustainable Development Goal 8: Decent Work and Economic Growth (“SDGs & Topics,” 2015). I have already described the financial gain of \$1.47 for each \$1 invested into global family planning programs. Fertility decline produces a temporary boost to economic growth as the proportion of the working age population rises (John Bongaarts & Sinding, 2011). As seen in Senegal and Benin, where parity of 5 or more children is very common, this leads to nearly 50% of the population being children. By controlling fertility, women then have more opportunity to contribute to the work force as opposed to childrearing at all times. The increased proportion of working women then increases the per capita income and investment in health, education, and the economy (Birdsall, Kelley, & Sinding, 2001).

Despite the known benefits of investing in family planning programs globally, the international contributions to family planning have declined. In 1995, the international support was \$723 million in 1995 and \$338 million in 2007 (Moon, 2012). The United States’ contributions rapidly increased in the late 2000s and slowly declined after 2010. The total United States funding for family planning and reproductive health, which included contributions to the United Nations Population Fund paid \$425 million in 2006, \$715 million in 2010, and \$608 million in 2016 (“Kaiser Family Foundation,” 2017).

To make contraception more affordable and effective for all women, the World Health Organization encourages expanding access to long-acting reversible contraception (LARCs) and sterilization (World Health Organization, 2012). Such devices tend to have higher up-front costs

compared to oral contraceptive pills or condoms but are also more cost effective over time. A reversible device such as an intrauterine device is useful for couples wishing to further space their pregnancies or for adolescent and young women wanting to postpone motherhood by more than two years. Sterilization methods are meant to limit pregnancy for those who do not want any or further pregnancies. A method to increase LARC uptake could encourage more private and public partnerships where the private sector can provide more expensive methods at a lower cost while the public sector oversees and monitors utilization. An unintended consequence, however, of such partnerships is that patients may not build trust in the partners overseeing such personal matters and that if patients develop adverse outcomes, they may not have the means or the knowledge for any recourse.

Another more bold method to eliminate the adolescent birth rate within marriage is to eliminate child marriage, which MDG 4 & 5 (Reducing Child Mortality and Improve Maternal Health) addressed and SDG 4 and 5 (Quality Education and Gender Equality) will continue to do (“SDGs & Topics,” 2015, “WHO | MDG 5,” 2014). Even as of December 2014, one-third of the world’s women (700 million living women today) married before age 15 (UNICEF, 2014). The United Nations has urged all nations to uphold laws on child marriage (Resolution adopted by the General Assembly: Child, Early and Forced Marriage, 2014). By enforcing laws banning child marriage, we can also eliminate any expectation that adolescent women should become mothers.

Postponing marriage alone is not sufficient to reduce adolescent pregnancy. Sexual debut remains in the adolescent years (Adjamagbo & Bakass, 2009; Brieger et al., 2001). There would still be a need for contraception for young and unmarried people. Policy should not dictate contraception access based on age, and comprehensive sexual education has proven its efficacy

in numerous nations. To make reproductive health a priority, there needs to be comprehensive knowledge of reproductive health. Educational interventions in schools worldwide must teach comprehensive sexual education so that youth can gain knowledge about reproductive health and effective family planning use. Furthermore, all youth must be encouraged to attend school through young adulthood.

Future Research

One component that I did not thoroughly research in this dissertation was the role of religion in fertility intentions and behaviors. We did consider what religion respondents identified as in Chapters 2 and 4. However, we did not consider how strong of a role religious identity may have pressured or supported a person's fertility behaviors. There is great diversity regarding the religions of the world, and some religions are more supportive of family planning use than others. There are different branches of Islam and Christianity, and the influence can be at the local-village level or at the global level (Crissman, Adanu, & Harlow, 2012; Hanretta, 2009; Izugbara et al., 2010; Mbacké & Hunwick, 2005; Simelela, 2006; Ujuju et al., 2011). The Roman Catholic Church remains a large obstacle in advancing family planning on ethics of fertility control despite concern for aggregate effects on society or advancing women's and children's rights and health (Greenwell, 2012; Shiffman & Quissell, 2012). The enormous criticism from other Christian religious leaders have not influenced health behavior decisions as much as we expected, since women who attend Christian services have increased use of modern family planning and do not necessarily have negative views of the methods in Mozambique and Ghana (Agadjanian, 2013; Hindin et al., 2014). However, in certain Muslim Sub-Saharan communities such as the Enugu and Katsina states of Nigeria, modern family planning is more likely to be rejected compared to counting days in menstrual cycles (Ujuju et al., 2011). These

Muslim health teachings often conflict with the family planning opinion of Muslim leaders in other regions of the world. In other Islamic parts of the world such as South Asia and the Middle East, there is growing support of family planning, as a means of improving maternal and child health outcomes, and it is not viewed as conflicting with the Qur'an (Mahmood, 2012; Roudi-Fahimi, 2004; Simelela, 2006; Underwood et al., 2013). Future research can examine the relationship between the religious leaders' attitudes of modern family planning use and its use among people in their communities.

Besides the usual messages of graduating from secondary school, messages to youth will also need to include the necessity of technology. We cannot ignore its purpose in health communication, even among illiterate populations. Future research can focus on how effective mobile health interventions through SMS, social media, or video channels may be to influencing family planning use compared to more traditional media such as radio, television, newspapers, and community theaters. Most importantly, the knowledge people can gain regarding family planning use is that people should be aware that options exist for those who do not yet or ever want to bear children.

Conclusion

What my dissertation confirms is the necessity for women to have knowledge of and access to health services such as family planning counseling, education, and methods so that they may prevent unintended pregnancy. I have yet to incorporate the role of religious identity in fertility intentions and behaviors. I also wish to further investigate the role of husbands and boyfriends in contraception use. Chapter 4 confirmed that including husbands in dialogue assisted in increasing modern family planning use. This is a question I wish to address even in United States fertility research because often men perceive contraception as women's health and

not public health. One of my prospective research options is to explore the role of public health professionals regarding modern family planning use in Senegal. Though this is not exclusively a male population, most health care professionals in Senegal are men. Furthermore, I wish to hear the perspective of public health professionals, both in the United States and abroad disclose that family planning must be a public health priority and not only a women's health priority. By including everyone in fertility dialogue worldwide, I anticipate that the United States would want to lead in this public health behavior change.

Appendices

Table A.2.1 Hierarchical logistic models measuring the association between respondent characteristics and unintended pregnancy

Table A.2.2 Logistic regression model measuring the association between respondent characteristics and unintended pregnancy and comparing to the logistic regression model where the sample of women younger than 20 years at time of conception is excluded (583 cases removed).

Table A.2.3 Distribution of variables by different racial and ethnic groups: NSFG, 2006-2010.

Table A.3.1 Comparison of current modern family planning users to non-users by region

Table A.3.1 Results of the structural equation model, direct effects only, region included

Table A.4.1a Endline exposures, women

Table A.4.1b Endline exposures, women, (1) modern FP users, (2) intentions to use modern FP, (3) actual need met, and (4) perceived need met

Table A.4.2a Endline exposures, men

Table A.4.2b Endline exposures, men, (1) modern FP users, (2) intentions to use modern FP, (3) actual need met, and (4) perceived need met

Glossary

If needed.

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