THE IMPACT OF THE AFFORDABLE CARE ACT ON UNINTENDED PREGNANCY

By

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ABSTRACT

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Background & Objectives: Nearly half of all pregnancies in the United States (US) are unintended (i.e., mis-timed or unwanted), and roughly 5% of US women experience an unintended pregnancy each year, suggesting the population-level need for contraceptives is not being met. Further, these pregnancies are experienced disproportionately by women who are younger, women of color, and women of lower socioeconomic status – indicating these groups are particularly underserved. The Patient Protection and Affordable Care Act (ACA) had the potential to improve our ability to meet this population-level need by increasing access to and affordability of contraceptive products and services. There is evidence that the ACA increased health insurance coverage and is associated with an increase in the use of highly effective long-acting reversible contraceptives, but it is unclear whether these effects translated into fewer unintended pregnancies. Further, it is unknown whether these effects were equitably distributed across race and ethnicity. Thus, the objectives of this dissertation are to: 1) estimate the overall impact of the ACA on unintended pregnancy, and if evidence of an impact exists, describe the timing of this impact, 2) explore three mechanisms of the ACA by investigating the impact of three major provisions (i.e., the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions), and 3) assess the impact of the ACA on racial/ethnic disparities in unintended pregnancy. Methods: Data from multiple cross-sectional cycles of the National Survey of Family Growth (NSFG) were used. NSFG uses a multistage probabilistic sampling methodology to survey non-institutionalized civilian men and women regarding family planning, marriage, divorce, and both general and reproductive health. I

included sexually active female respondents aged 18-44 interviewed between 2006 and 2019 (n=25,426). To address objectives (1) and (2) I used a difference-in-differences approach to compare trends in unintended pregnancy between women who were eligible to benefit from the intervention (the overall ACA or one of the listed components), to that of women who were ineligible to benefit. Eligibility was determined by respondent age and income. To address objective (3), I used a pre/post analysis to explore how racial/ethnic disparities in unintended pregnancy differed prior to and following enactment of the overall ACA and its components. Results: There was evidence that: 1) the overall ACA was associated with a 2.1 percentage point (ppt) decrease in unintended pregnancy among eligible women, and this decrease was fairly consistent during and following the ACA's implementation period, 2) the dependent coverage provision was associated with a large (8.2 ppt) decrease in unintended pregnancy among lower income young women, and 3) the disparities in unintended pregnancy between Hispanic and non-Hispanic (NH) White women and between NH Black and NH White women decreased by 2.9 ppt and 4.1 ppt, respectively, among eligible women following full implementation of the ACA. There was insufficient evidence that the Marketplace subsidies or insurance expansions were associated with unintended pregnancy, or that the dependent coverage provision, Marketplace subsidies, or insurance expansions were associated with racial/ethnic disparities in unintended pregnancy. Conclusions: The overall ACA and the dependent coverage provision may be associated with reductions in unintended pregnancy, and the magnitude of these associations appear to differ across sociodemographic subgroups (i.e., income, race/ethnicity) – holding implications for health equity. These findings provide insight regarding how the ACA works to influence reproductive health, and for whom – which is critical information for both researchers and public policy makers who seek to improve reproductive health and health equity.

To my family – particularly, my parents – for teaching me the importance of compassion, humility, and knowledge. And to the teachers and mentors who saw potential in me well before I saw it myself. Without these values and without this encouragement, this dissertation would have never been. Thank you.

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CHAPTER 1: INTRODUCTION

1.1 Overall Objective & Specific Aims

Motivated by and drawing from Fundamental Cause Theory [1] and the Reproductive Justice framework [2], this dissertation investigates how health policy and social stratification intersect to impact reproductive health and health equity. The Specific Aims of this work will examine how the Patient Protection and Affordable Care Act (ACA) may have influenced one specific reproductive health outcome, unintended pregnancy, and racial/ethnic disparities in this outcome:

> Specific Aim 1: Estimate the overall impact of the ACA on unintended pregnancy, and if evidence of an impact exists, describe the timing of this impact
>
> Specific Aim 2: Explore the mechanism of the ACA by investigating the impact of three policy levers pulled by the ACA (i.e., the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions) on unintended pregnancy
>
> Specific Aim 3: Assess the impact of the ACA on racial/ethnic disparities in unintended pregnancy

Through this work, I will contribute to the scientific body of literature regarding the impact of the ACA on women's health and racial/ethnic disparities in women's health. The hypothesis(es) associated with each Specific Aim are summarized in Table 1. These hypotheses will be discussed in greater detail in Chapters 4-6 of this dissertation.

Table 1. Specific aims & hypotheses

	Specific Aim	Hypothesis(es)
1	Estimate the overall impact of the ACA on unintended pregnancy, and if evidence of an impact exists, describe the timing of this impact	I hypothesize that the ACA reduced the prevalence of unintended pregnancy, and that this decrease occurred gradually throughout the implementation period (2010-2014)
2	Explore the mechanism of the ACA by investigating the impact of three policy levers pulled by the ACA (i.e., the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions) on unintended pregnancy	I hypothesize that the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions reduced the prevalence of unintended pregnancy
3	Assess the impact of the ACA on racial/ethnic disparities in unintended pregnancy	I enter this investigation in equipoise, hypothesizing that the ACA may or may not have reduced racial/ethnic disparities in unintended pregnancy

1.2 Significance

1.2.1 Scientific Significance

This work contributes to the scientific literature regarding the impact of the ACA on women's health in several important ways: 1) it estimates the impact of the overall ACA and three of its specific components – rather than estimating the impact of only one specific component as prior related works have done [3,4] 2) it evaluates the timing of these potential impacts, and 3) it assesses the impact on racial/ethnic disparities in unintended pregnancy. It also contributes to the scientific literature regarding pregnancy intention – specifically, it contributes to ongoing discussions regarding the construct validity and interpretation of unintended pregnancy [5–9] – by situating this work within the Reproductive Justice framework [2].

1.2.2 Public Health Significance

Over ten years since its enactment, the ACA continues to face legal challenges [10–13], and health care reform remains a central focus of many public policy debates (e.g., Medicare for All, Medicaid expansion, pandemic relief measures) [14–16]. Simultaneously, political and legal

battles over reproductive freedom – particularly abortion rights [17] – have also recently taken center stage. This work provides valuable information for policymakers and public health official as they engage in these ongoing public policy and public health debates regarding the ACA, health care reform, reproductive rights, and reproductive health.

1.3 Dissertation Organization & Overview

This dissertation has been organized in seven chapters. Here, in Chapter 1, I have provided an overview of the dissertation objective, specific aims, and scientific and public health significance. In Chapter 2, I will provide relevant background information and literature regarding the ACA, unintended pregnancy, and racial/ethnic disparities in unintended pregnancy. In Chapter 3, I will broadly describe my research approach, which will be detailed further in Chapters 4-6 as these chapters will present three publishable manuscripts targeting Specific Aims 1-3. Finally, Chapter 7 will provide a discussion summarizing the findings and implications of this dissertation.

1.4 Dissertation Funding

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CHAPTER 2: BACKGROUND

2.1 The ACA

After nearly a century of political battles over universal health care, the ACA was signed into law by President Obama on March 23, 2010 [18,19]. The ACA initiated sweeping health care reform by including provisions that would: expand health insurance coverage and move the United States (US) toward universal coverage, reduce health care costs, improve quality and efficiency of health care, support a healthy clinical and public health workforce, and promote utilization of preventive care [20,21]. Under the scope of this dissertation, I will focus primarily on ways in which the ACA expanded health insurance. The ACA expanded health insurance by both increasing *coverage* (i.e., the number of individuals covered by health insurance), and the *generosity* of coverage offered by health insurance plans (e.g., requiring coverage of preventive care – including FDA approved female contraceptives – without patient cost-sharing) [20–22]. To increase insurance coverage, the ACA used what has been referred to as a "three-legged stool" approach [23,24].

2.1.1 Leg 1, ACA Reforms to the Individual Market

The ACA reformed the non-group/individual health insurance market with most provisions going into effect in 2014 (e.g., guaranteed issue and renewability for individuals with preexisting conditions, modified community ratings and risk adjustment, minimum standards for essential benefit packages) [20,21,23].

2.1.2 Leg 2, The ACA Individual Mandate

The ACA imposed an individual mandate requiring all individuals to obtain health insurance coverage. As enacted, non-exempt individuals who remain uninsured would be subject to a penalty of up to either $695 or 2.5% of one's income annually [20,21,23]. The individual

mandate, however, is one of the least popular pieces of the ACA – often viewed as an infringement on individual rights – and has been challenged multiple times, eventually rising through the court system to the US Supreme Court [25]. The Supreme Court's decision regarding the constitutionality of the mandate revolved around two questions: 1) does Congress' power to regulate commerce extend to mandating health insurance coverage?, and 2) is the individual mandate penalty a tax, and therefore within the power of Congress to levy a tax? The Supreme Court decided the answers to these questions were "no" and "yes," respectively. That is, the Court decided the individual mandate penalty *is* a tax, and therefore the individual mandate is constitutional [25]. Effective as of 2019, however, the individual mandate penalty was eliminated through the Tax Cuts and Jobs Act passed in December of 2017 [26,27]. Given that there is no longer a penalty associated with the mandate, additional legal challenges continue to be raised [12].

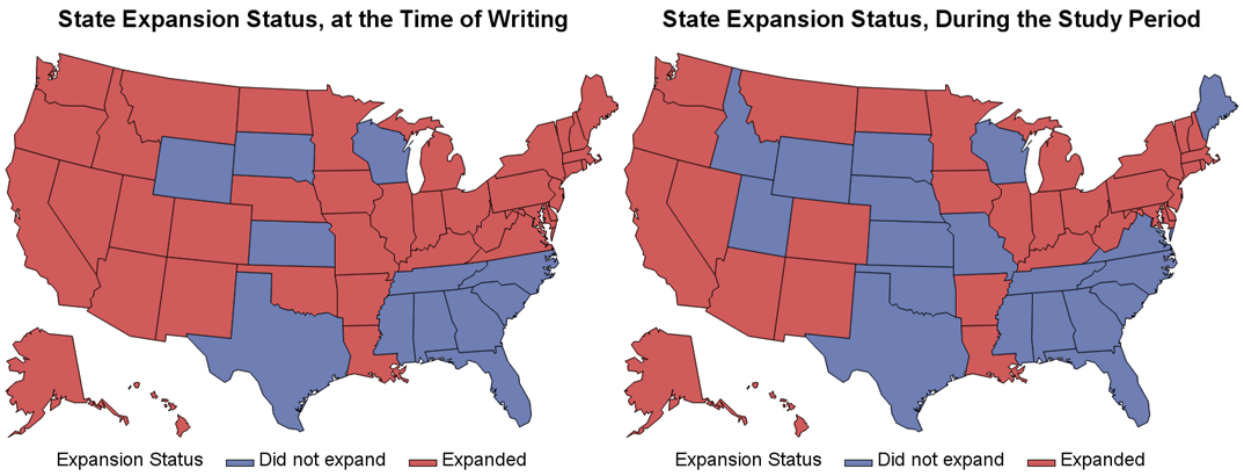
2.1.3 Leg 3, ACA Provisions to Increase Access to Affordable Health Insurance

The ACA increased access to affordable health insurance coverage through three provisions. First, effective as of September 23, 2010, the ACA allowed young adults to stay on their parents' health insurance plans longer by requiring plans to cover insured's dependents up to the age of 26 through its dependent coverage provision [20,21,23]. It has been estimated that 2-3 million young adults gained coverage through this provision [28].

Second, the ACA expanded Medicaid eligibility to all non-elderly adults (<65 years) with an income ≤138% of the federal poverty level (FPL) – regardless of parental, pregnancy, or disability status [20,21]. Medicaid is a program funded by both federal and state governments, and as such, the US Supreme Court decided in June of 2012 that it would be unconstitutionally coercive to withhold federal Medicaid funds from states that did not comply with the expansion, effectively

making the adoption of Medicaid expansion optional for states [25,29]. At the time of this writing, 38 states and DC have adopted the ACA Medicaid expansion and 12 have not (Figure 1) [30]. Seven expansion states elected to expanded after the study period for this dissertation work had ended (i.e., they expanded in 2019 or later) (Figure 1). It has been estimated that Medicaid enrollment increased by roughly 16 million (14 million in expansion states, and 2 million in nonexpansion states) between 2013 and 2017 [28].

Figure 1. State Medicaid expansion decisions



Third, the ACA created state and federally run health insurance exchanges – also known as the Marketplace – through which individual health insurance plans could be reviewed and purchased beginning in 2014. To promote affordability of these plans, the ACA included premium tax credits for individuals purchasing insurance through the Marketplaces with an income between 100-399% of the FPL, and cost sharing subsidies for those with an income <250% of the FPL [20,21,23,31]. These subsidies are limited, however, in that they cannot be used toward non-essential benefits (e.g., dental) or coverage of abortion services – in fact, 25 states have passed laws barring abortion coverage in Marketplace plans altogether [31,32]. By 2017, more than 12 million individuals were insured through coverage purchased from the Marketplace – though, it is

worth noting that this pales in comparison to the estimated 23 million that the Congressional Budget Office had estimated [28].

2.2 Unintended Pregnancy

The primary outcome considered in this dissertation is unintended pregnancy. An unintended pregnancy is defined as a pregnancy that occurred either earlier than desired or when a(nother) pregnancy was not desired at all [33]. Unintended pregnancy is thought to indicate an unmet need for contraceptive products and services [7,33], which may be unmet due to several different causes. For instance, the need may be unmet because contraceptives are inaccessible or unaffordable [34–37], or the need may be unmet due to a lack of contraceptive options that meet user preferences [38]. Nearly half of all pregnancies in the US are unintended with roughly 5% of women aged 15-44 years experiencing an unintended pregnancy each year [33,35]. Between 1981 and 2001, the unintended pregnancy rate declined gradually from roughly 60 unintended pregnancies per 1,000 women aged 15-44 to just under 50 unintended pregnancies per 1,000 women aged 15-44 [39]. This period of gradual decline, however, was followed by a slight increase and, subsequently, a larger decrease, with the unintended pregnancy rate shifting from 49/1,000 in 2001 to 54/1,000 in 2008 and 45/1,000 in 2011 [39]. Given its timing, it is hypothesized that the increase between 2001 and 2008 may reflect underlying changes in fertility desires resulting from the Great Recession [39]. There are many conceptual and operational issues regarding the measurement and interpretation of unintended pregnancy, and these will be discussed in greater detail in Chapter 3.

2.2.1 Disparities in Unintended Pregnancy

Persistent racial/ethnic, socioeconomic, and regional disparities in unintended pregnancy are well documented and likely reflect the structural barriers (e.g., access to contraceptives) faced

by different sociodemographic subgroups. Unintended pregnancies are experienced disproportionately by younger women, women of color, and women with lower income [39,40]. Additionally, higher unintended pregnancy rates have been observed in the South and Southwest US, as well as large urban centers of the Northeast US [41].

2.3 The ACA, Unintended Pregnancy, & Health Equity

The ACA had the potential to reduce the prevalence of unintended pregnancy by increasing access to and affordability of prescription contraceptives through its expansion of health insurance coverage, as discussed in Section 2.1. In fact, there is evidence that the ACA increased the number of women covered by health insurance [42–44], reduced out-of-pocket costs associated with contraceptive services and products [45–47], and may have influenced contraceptive choice [42]. Specifically, the ACA has been associated with an increase in the use of highly effective long-acting reversible contraceptives [LARCs, i.e., contraceptive implants and intrauterine devices (IUDs)] [42,48,49].

It remains unknown, however, whether the effects of the ACA were equitably distributed across race and ethnicity, or whether these effects reduced the risk of unintended pregnancy. I am aware of only two studies to date that have investigated the impact of the ACA, or one of its components, on unintended or unwanted pregnancy. The first study, which I conducted under the guidance of Dr. Claire Margerison, estimated that the ACA preventive care mandate was associated with a non-significant 15% decrease in the odds of unintended pregnancy (OR = 0.85, 95% CI: 0.62, 1.17) among female respondents aged 18-44 years in the first two years following its implementation [3]. The second study, by Myerson, Crawford, and Wherry (2020) estimated that the ACA Medicaid expansion was associated with a non-significant 2.1 percentage point (ppt) decrease (95% CI: -8.5, 4.5) in the prevalence of unwanted pregnancy among women with an

income ≤138% of the FPL who recently had a live birth [4]. A third study, which focused not on the ACA but on generosity of Medicaid eligibility more generally, found that each 10 ppt increase in the generosity of Medicaid eligibility (i.e., the fraction of women without dependent children who were eligible for Medicaid) was associated with a 1.2 ppt decrease (95% CI: -2.2, -0.2) in the percent of pregnancies that were unintended among recent parents who had at most a high school degree [50]. The first listed of these three studies was limited in statistical precision, the second was unable to capture any potential impact on *mistimed* pregnancies, and both the second and third were limited in generalizability as they included only individuals with a recent live birth. Further, none of these studies considered the joint impact of multiple components of the ACA, and none of these studies estimated the impact of the ACA or its specific components on racial/ethnic disparities in unintended or unwanted pregnancies.

Population level interventions, like policy, intersect with existing institutions and are influenced by the sociopolitical and historical context in which they are implemented. As such, the various manifestations of structural racism in the US context make it likely that the impact of the ACA and its specific components differed by race/ethnicity [51–55]. For example, the ACA used income-based eligibility criteria for the expansion of Medicaid (≤138% of the FPL) and subsidies for the Marketplace (100-399% of the FPL). Compared to Asian (13.1%) and White women (16.6%) of reproductive age, a larger percentage of Hispanic (34.2%), American Indian/Alaska Native (AI/AN) (25.1%), and Black (20.4) women were uninsured with an income <400% of the FPL prior to the ACA, so a greater percentage of these groups should have been eligible to benefit from these ACA provisions [56–60]. As mentioned previously, however, the ACA Medicaid expansion was not implemented nationwide [10,11,29]. This effectively created a coverage gap in states that did not expand, leaving some individuals with an income below 100% of the FPL

ineligible for both Medicaid and Marketplace subsidies. Roughly 2.2 million individuals fall into this coverage gap, impacting nearly 15% of uninsured Black individuals and 8% of uninsured White individuals [61,62]. These intersections make it difficult to predict whether the ACA reduced, maintained, or exacerbated pre-existing racial/ethnic disparities.

I recently led a team of epidemiologists and economists in conducting a review of the literature regarding the impact of the ACA on racial/ethnic disparities in health among women of reproductive age, and we found only n=8 relevant studies. We found that there is evidence that the ACA is associated with an increase in health insurance coverage among Hispanic, non-Hispanic (NH) Black, NH other, and NH White women of reproductive age. Little work has been done, however, to investigate whether these race/ethnic-specific increases in coverage translated into reduced racial/ethnic disparities in health insurance coverage, utilization of care, health behaviors, or health outcomes. Further, the work that has been done includes only a limited number of racial/ethnic identities. I have included the full manuscript of this review (currently under review at *SSM – Population Health*) in Appendix A.

To better understand the impact of the ACA on reproductive health and health equity, and on unintended pregnancy, the following objectives must be addressed: 1) evaluate the magnitude and timing of the overall impact of the ACA on unintended pregnancy, 2) explore the mechanism of the ACA's impact (or lack there-of) on unintended pregnancy, and 3) estimate the impact of the ACA on racial/ethnic disparities in unintended pregnancy. Thus, the Specific Aims of my dissertation research, which were introduced in Chapter 1, address these gaps in the scientific literature.

CHAPTER 3: METHODS

3.1 Target Population

The target population of this work – i.e., the group about whom I would like to make inference and draw conclusions – was US adult females of reproductive age (ages 18-44). I focused on adults (ages 18-44) rather than adolescents and adults (ages 15-44) because the ACA provisions investigated in this dissertation targeted US adults.

3.2 Design, Data Source, & Study Population

To investigate the impact of the ACA on unintended pregnancy, I implemented a repeated cross-sectional study design using female respondent data from multiple cycles of the National Survey of Family Growth (NSFG) which included interviews conducted between 2006 and 2019. The NSFG is conducted by the National Center for Health Statistics (NCHS) and surveys a sample of non-institutionalized civilian men and women ages 15-44 using both in person and computer-assisted interviews, collecting current and retrospective information regarding marriage, divorce, fertility, family planning, general health, and reproductive health [63].

NSFG selects its sample using a probabilistic sampling methodology with five stages. First, US counties, groups of counties, or county-equivalent units were categorized into primary sampling units (PSUs) and stratified based on metropolitan status (large metropolitan statistical areas, other metropolitan statistical areas, and nonmetropolitan areas), geographic location, and population size. From each stratum, one or two PSUs were selected using probabilities proportionate to size (PPS; i.e., units with larger populations were more likely to be selected) [64–68].

Second, Census blocks or groups of blocks were selected within PSUs as secondary sampling units (SSUs) – also referred to as "segments." SSUs were stratified into four "domains"

based on the percentage of residents in the area that identified as Hispanic or non-Hispanic Black (i.e., <10% Hispanic and <10% Black, <10% Hispanic and >10% Black, >10% Hispanic and <10% Black, >10% Hispanic and >10% Black) [64–68]. In 2006-2010, SSUs were selected using probabilities proportionate to the number of occupied housing units within the SSU, as estimated by the Census [64]. In 2011-2019, SSUs were selected using PPS with oversampling of SSUs with larger Hispanic and NH Black populations [65–68].

Third, housing units were selected within SSUs as tertiary sampling units. In 2006-2010, households in SSUs that were more than 10% Hispanic or more than 10% Black had higher probabilities of being selected so that these populations were oversampled [64]. In 2011-2019, however, this oversampling was accomplished in stage two of sampling. Thus, in 2011-2019, a sample of housing units was randomly selected within each SSU [65–68].

Fourth, an eligible individual is randomly selected within the household for interview, using probabilities for selection that are proportionate to the target sample size for each sex, age group, race, and ethnicity [64–68].

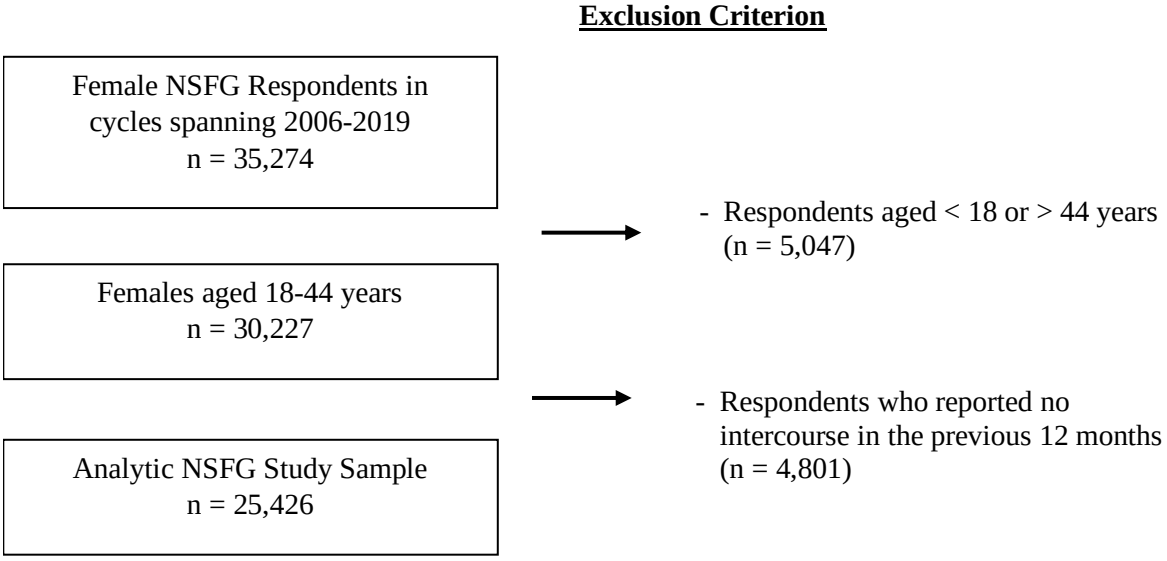
Finally, in the fifth stage of sampling, interviewers attempt to increase representation of housing units that have been contacted, but not successfully interviewed, by reaching out to a sample of these households. The last two weeks of each quarter is used for this purpose [64–68].

To account for the survey sampling design, NSFG data are accompanied by survey weights that: 1) account for sampling methodology (e.g., oversampling), 2) adjust for nonresponse, and 3) provide post-stratification calibration of population estimates by age, sex, race, and ethnicity [69–73]. It is worth noting that the NSFG survey weights adjust for nonresponse to reduce potential nonresponse bias, but little information is available regarding patterns in non-response by

sociodemographic characteristics and whether these patterns change from survey cycle to survey cycle so the potential for nonresponse bias in my estimates is difficult to assess.

I included surveys conducted during the following NSFG cycles: 2006-2010, 2011-2013, 2013-2015, 2015-2017, and 2017-2019. During this period, response rates among females aged 15-44 varied by cycle, ranging from 65.5% in 2017-2019 to 78.0% in 2006-2010 [74–78]. I chose this study period to include the most recent data available, and to include four years of data prior to the ACA, four years of data spanning the implementation of the ACA, and four years of data following implementation of the ACA. Further, NSFG data prior to the 2006-2010 cycle was collected less frequently with large temporal gaps between cycles (i.e., 1973, 1976, 1982, 1988, 1995, 2002). From this data, I included self-reported sexually active female respondents aged 18-44, which resulted in an unweighted analytic sample of n=25,426 respondents (Figure 2).

Figure 2. Unweighted analytic sample of U.S. females (aged 18-44 years)



3.3 Measurements

3.3.1 Measurement of Policy Exposure & Treatment

As a federal-level policy, all US residents were exposed to the ACA. The impact of specific components of the ACA was limited, however, to certain segments of the US population by eligibility criteria employed. For this reason, I differentiate between "exposure" and "treatment." All US residents were *exposed* to the ACA after its enactment, but only eligible subpopulations were *treated* by specific components of the ACA. Thus, treatment was defined by NSFG interview date and respondent eligibility to benefit from the ACA or one of its components.

3.3.1.1 Dependent Coverage Provision

The ACA dependent coverage provision went into effect in September of 2010, and to be eligible to benefit, an individual must be under the age of 26. Therefore, an NSFG respondent was treated by the dependent coverage provision if they were 25 or younger at the time of interview, and were interviewed in the 2011-2013, 2013-2015, 2015-2017, or 2017-2019 NSFG survey cycle. Otherwise, they were not treated by the dependent coverage provision. Age was self-reported by respondents at the time of interview.

3.3.1.2 Medicaid Expansion

The ACA expansion of Medicaid was planned for all states on January 1, 2014, and, as written, expanded Medicaid eligibility to all adults with income ≤138% of the FPL. Accordingly, an NSFG respondent was considered treated by the ACA Medicaid expansion if they had a household income ≤138% of the FPL and were interviewed in the 2015-2017 or 2017-2019 NSFG cycle [30]. Otherwise, they were not treated by the ACA Medicaid expansion. To measure household income, NSFG respondents were asked to estimate their total household income received through all sources in the prior calendar year. These estimates were reported as ranges

(e.g., $50,000-$59,999), the midpoint of which was then used along with household size to determine income as a percentage of the federal poverty level [79–83].

However, as discussed in Chapter 2, Medicaid was not expanded in all states, and in those that did expand, not all expanded on January 1, 2014. Table 2 provides a summary of which states expanded, and when they expanded. Unfortunately, the publicly available NSFG data does not include respondent's state of residence, so this variation cannot be incorporated in analyses that utilize the publicly available data. State of residence can, however, be incorporated if analyses are performed at an NCHS Research Data Center (RDC) – such as that which is housed within the University of Michigan's (U-M's) Institute for Social Research. As such, I have been working with the NCHS and the U-M RDC to perform analyses that do consider state of residence in determining treatment status. As part of this process, I pursued and was granted Special Sworn Status, which is a security clearance granted by the US Census Bureau. I am currently in the process of performing analyses at the RDC and obtaining the associated output. This is a time intensive process that has been ongoing for nearly two years and will continue through the publication and presentation of any results from analyses involving restricted-use data. Thus, for this dissertation, I am using primarily publicly available data and am therefore unable to consider the individual impact of Medicaid expansion.

Table 2. Dates of Medicaid expansion, by state

State	Expansion Status	Date of Expansion
Alabama	Did not expand	---
Alaska	Expanded	September 1, 2015
Arizona	Expanded	January 1, 2014
Arkansas	Expanded	January 1, 2014
California	Expanded	January 1, 2014
Colorado	Expanded	January 1, 2014
Connecticut	Expanded	January 1, 2014
Delaware	Expanded	January 1, 2014
District of Columbia	Expanded	January 1, 2014
Florida	Did not expand	---
Georgia	Did not expand	---
Hawaii	Expanded	January 1, 2014

Table 2. (cont'd)

Idaho*	Expanded	January 1, 2020
Illinois	Expanded	January 1, 2014
Indiana	Expanded	February 1, 2015
Iowa	Expanded	January 1, 2014
Kansas	Did not expand	---
Kentucky	Expanded	January 1, 2014
Louisiana	Expanded	July 1, 2016
Maine*	Expanded	January 10, 2019
Maryland	Expanded	January 1, 2014
Massachusetts	Expanded	January 1, 2014
Michigan	Expanded	April 1, 2014
Minnesota	Expanded	January 1, 2014
Mississippi	Did not expand	---
Missouri*	Expanded	July 1, 2021
Montana	Expanded	January 1, 2016
Nebraska*	Expanded	October 1, 2020
Nevada	Expanded	January 1, 2014
New Hampshire	Expanded	August 15, 2014
New Jersey	Expanded	January 1, 2014
New Mexico	Expanded	January 1, 2014
New York	Expanded	January 1, 2014
North Carolina	Did not expand	---
North Dakota	Expanded	January 1, 2014
Ohio	Expanded	January 1, 2014
Oklahoma*	Expanded	July 1, 2021
Oregon	Expanded	January 1, 2014
Pennsylvania	Expanded	January 1, 2015
Rhode Island	Expanded	January 1, 2014
South Carolina	Did not expand	---
South Dakota	Did not expand	---
Tennessee	Did not expand	---
Texas	Did not expand	---
Utah*	Expanded	January 1, 2020
Vermont	Expanded	January 1, 2014
Virginia*	Expanded	January 1, 2019
Washington	Expanded	January 1, 2014
West Virginia	Expanded	January 1, 2014
Wisconsin	Did not expand	---
Wyoming	Did not expand	---

* These states have expanded Medicaid under the ACA, but did not do so before or during the study period. *Source of dates: "The Henry J. Kaiser Family Foundation. Status of State Action on the Medicaid Expansion Decisions: Interactive Map 2022."*

3.3.1.3 Marketplace Subsidies

The Marketplace opened in 2014 as well, and subsidies for these plans were available to individuals with an income between 100% and 399% of the FPL. Those with an income of ≤138%

of the FPL, however, were also made eligible for Medicaid through the ACA in 2014. Individuals who are eligible for Medicaid coverage are not eligible for subsidies through the Marketplace [31]. As such, an NSFG respondent was considered treated by the ACA Marketplace subsidies if they had a household income between 139% and 399% of the FPL and were interviewed in the 2015-2017 or 2017-2019 NSFG cycle. Household income was measured by the NSFG as described in Section 3.3.1.2.

3.3.1.4 Insurance Expansions

As described in Section 3.3.1.2, I am using only publicly available data to determine treatment status. Therefore, I have only income level (and not state of residence) to determine treatment by the ACA Medicaid expansion and treatment by the Marketplace subsidies. As such, I could define those with incomes ≤138% of the FPL as treated by Medicaid expansion, and those with incomes between 139% and 399% of the FPL as treated by Marketplace subsidies. Given that both Medicaid expansion and Marketplace subsidies occurred simultaneously, however, there is not a suitable comparison ("untreated") group for Medicaid expansion. The only available untreated group would be those with incomes >399% of the FPL because those with incomes between 139% and 399% of the FPL would be affected by the Marketplace subsidies (which also went into effect in 2014) and those in non-expansion states cannot be identified without state of residence. For this reason, rather than investigate Medicaid expansion alone, I considered the joint impact of the 2014 insurance expansions (i.e., Medicaid expansion and Marketplace subsidies). A respondent was considered treated by the 2014 insurance expansions if they reported a household income <400% of the FPL and were interviewed in the 2015-2017 or 2017-2019 NSFG cycle.

3.3.1.5 Overall ACA

As discussed in Chapter 2, this dissertation will focus primarily on ways in which the ACA has expanded health insurance coverage through its dependent coverage provision, Medicaid expansion, and Marketplace subsidies. To consider the joint effect of these three components, I considered an NSFG respondent treated by the "overall ACA" if they were eligible for at least one of these three components. That is, an NSFG respondent was treated by the overall ACA if they were interviewed after the ACA began rolling out (i.e., in or after the 2011-2013 NSFG survey cycle) and: 1) they were <26 years old, or 2) they had an income that was <400% of the FPL.

3.3.2 Measurement of Race & Ethnicity

In addressing Specific Aim 3, race and ethnicity were included as potential effect modifiers. More specifically, race and ethnicity were conceptualized as proxies for exposure to structural racism [84] – i.e., "the totality of ways in which societies foster racial discrimination, through mutually reinforcing inequitable systems (in housing, education, employment, earnings, benefits, credit, media, health care, criminal justice, and so on) that in turn reinforce discriminatory beliefs, values, and distribution of resources…" [55] – which I hypothesized could modify the impact of the ACA, or its specific components, on unintended pregnancy. Race and ethnicity are dynamic social constructs, and as such, the ways we conceptualize, measure, and interpret them continuously evolve [85]. The NSFG measures ethnicity (Hispanic or non-Hispanic) using self-report, and race (Black, other, or White) using a combination of self-report and interviewer observation. More specifically, respondents are provided a list of racialized groups and are asked which of the groups "describes your racial background?" If one group is selected, this is the race reported for the respondent in the publicly available NSFG dataset. If multiple groups are selected, then the respondent is asked, "which of these groups would you say best describes your racial

background?" The group that the respondent reports as "best" describing their background is then reported in the publicly available data. If the respondent did not select a group, or if the respondent selected multiple groups and did not indicate which one best describes them, then the interviewer is asked to observe whether the respondent is "Black," "White," or "Other," and this selection is reported as the respondent's race [79–83].

I considered race and ethnicity as two separate variables, and I also considered a combined race/ethnicity variable (Hispanic, NH Black, NH other or multiple race, or NH White). Supporting the use of a combined variable, there is evidence that many individuals who identify as "Hispanic" often find that the offered race categories do not reflect their racial identity – which may indicate that the "Hispanic" ethnic group is an emerging racial(ized) group in the US [85,86]. Alternatively, combining race and ethnicity into one variable where ethnicity is prioritized over race provides a less complete understanding of an individual's racial and ethnic identity, and may alter the perceived racial composition of a population, thus supporting the consideration of race and ethnicity as two separate variables [85]. I used the combined race/ethnicity variable in my primary analyses because the measurement of this NSFG variable (HISPRACE2) does not incorporate interviewer observation, and it does not require that respondents who identify with more than one race select which they believe "best describes" their background. If a respondent reports that they are not Hispanic, and they identify with more than one race, HISPRACE2 reflects that by categorizing the individual as "NH other or multiple race" [79–83].

3.3.3 Measurement of Unintended Pregnancy

Pregnancy intention was measured as a binary variable that indicates whether an NSFG respondent reported any unintended pregnancies in the calendar year prior to interview. The NSFG attempts to capture a respondent's entire pregnancy history and collects data on pregnancy

intention for all pregnancies reported by the respondent [87–91]. Pregnancy intention is determined in the NSFG by asking the respondent: 1) “Right before you became pregnant, did you yourself want to have a baby at any time in the future?”, and if yes, 2) “Would you say you became pregnant too soon, at about the right time, or later than you wanted?” If the respondent indicates that a baby was wanted, and the pregnancy did not occur too soon (i.e., the pregnancy was not “mis-timed”), the pregnancy was considered “intended.” Otherwise, if the pregnancy was reportedly unwanted or mis-timed, the pregnancy was considered “unintended.” This is consistent with the standard definition of unintended pregnancy as stated by the Centers for Disease Control and Prevention [33], though notably the questions used to determine pregnancy intention never actually use the terms “intended” or “unintended” [92] , and mis-timed pregnancies do not include those that occurred “later than desired” [8].

This retrospective measure of pregnancy intention has been criticized for three reasons. First, as with any retrospective measure, there is the potential for recall bias. There is mixed evidence, however, regarding the extent of recall bias introduced by this retrospective measure [93–95], but I have limited recall bias by including only recent pregnancies (those occurring in the prior calendar year) in these analyses. Further, no prospective measure of pregnancy intention is available through the NSFG. Nevertheless, a prospective measure for *risk* of unintended pregnancy has been developed using the NSFG data. The unintended pregnancy risk index (UPRI) is a prospective measure of unintended pregnancy risk based on the failure rate of the respondent’s reported contraceptive choice(s) [96]. The UPRI conflates contraceptive choice and pregnancy intention, which may not be highly correlated due to contextual constraints around contraceptive choice [5].

Second, pregnancy intention, as measured in the NSFG, is criticized because abortions are underreported in the NSFG [69–73]. Thus, I may be underestimating the number of unintended pregnancies. Whether this measurement error could bias my effect estimates, however, depends on whether the magnitude of underreporting changes across the study period. Because I am generally interested in estimating the *difference* in unintended pregnancy trends between the treated and untreated groups, my estimates should remain unbiased if the absolute magnitude of underreporting is constant across the study period in each treatment group.

Third, pregnancy intention has been criticized, and heavily debated, regarding its construct (in)validity. An unintended pregnancy indicates that an individual became pregnant when they did not desire a(nother) pregnancy. That is, the measure of unintended pregnancy attempts to capture desire for pregnancy just prior to its occurrence. This measure creates a false dichotomy around pregnancy intention [5,6], and it does not capture attitudes toward the pregnancy (e.g., happiness), family planning efforts, the social or economic context in which a pregnancy occurred, or the influence and intentions of sexual partners [5,92]. Given this lack of contextual information in the measure, how do we interpret the meaning of unintended pregnancies? Unintended pregnancies may reflect an unmet need for contraceptive products and services [7] - either due to access and affordability, or to a lack of safe, high quality options that align with user preferences [34–38]. Unintended pregnancies could also, however, be an indication that pregnancies are occurring in a context where the structural social or economic conditions are not supportive of pregnancy, childbearing, or child rearing (e.g., working conditions, housing options, economic circumstance, social support, environmental hazards) [8].

This question of construct (in)validity requires that a great deal of care and caution must be exercised when interpreting unintended pregnancy [6,7,9,92]. Santelli (2003) argued,

"Pregnancy should be understood not as the product of an individual's intentions, but rather as the result of multiple, interwoven social and economic influences. … The focus on whether a woman intends a pregnancy implies that her intentions count the most. However, for millions of women in the United States and around the world, the power to translate these intentions into practice is circumscribed by limited access to resources or health services, or by limited control of their own bodies." When these contextual factors have been ignored, unintended pregnancy has been interpreted in harmful ways:

1. Unintended pregnancy has been framed as an individual-level failure to plan for and prevent pregnancy. This assumes that pregnancy is always a conscious decision that is fully determined by the individual and ignores the structural social and economic context in which people are pursuing their reproductive/fertility desires [5–7,97]. This can also reinforce harmful stereotypes about groups with higher unintended pregnancy rates, contributing to the devaluation of fertility among these groups [98–100].
2. Prevention of unintended pregnancy has been framed as attainable only through increased use of highly effective contraceptives. This narrow focus on prevention can stigmatize the use of abortion to terminate unintended pregnancies, and it also ignores users' contraceptive preferences by focusing exclusively on effectiveness [6,7,38,101,102]. Further, it can lead to discriminatory or coercive contraceptive policies or practices that prioritize reduction of unintended pregnancies over reproductive autonomy [103–106].
3. Unintended pregnancy has been framed as an important public health issue because of its association with adverse maternal and infant outcomes (e.g., preterm birth). This framing may encourage attempts to improve maternal and infant health by preventing

unintended pregnancies, ultimately shifting the distribution of who is having pregnancies while ignoring the fundamental social and economic causes of maternal and infant health [5,6,8,107].

Unintended pregnancy is an important reproductive health outcome because of its inherent indication that women are experiencing pregnancies that they themselves consider to be mistimed or unwanted. Regardless of why they consider a pregnancy mistimed or unwanted, this suggests more can be done to support women in realizing their pregnancy and fertility desires. Work that considers unintended pregnancy should acknowledge the conceptual and operational limitations of the measure and strive to understand individual reproductive experiences while seeking interventions that will promote social, economic, environmental, and reproductive justice.

3.3.4 Measurement of Covariates

Several covariates were also included: nativity, marital status, education, parity, and metropolitan residence. These covariates are measured through the NSFG using self-report. The levels captured by each covariate are summarized in Table 3.

Table 3. Covariate levels

Covariate	**Levels**
Nativity	Born in the US Born outside of the US Unknown
Marital Status*	Married Not married
Education	Less than high school High school Some college/Associate degree Bachelor's Degree More than a Bachelor's Degree
Parity	Nulliparous Primiparous Multiparous
Metropolitan Residence	Metropolitan (urban) Non-metropolitan (rural)

* This NSFG variable does not capture same-sex marriages

3.3.5 Imputation of Analytic Variables

While missingness is rare in NSFG data, some commonly analyzed variables have been imputed by NCHS using both logical and regression-based imputation methods. Table 4 summarizes the variables that have been imputed and are used in analyses for Specific Aims 1-3, along with the unweighted proportion of observation that have had this data imputed [64].

Table 4. Summary of imputed analytic variables

Analytic NSFG Variable	**Analytic Use**	**Imputed?**	**% Of Observations Imputed[1]**
WANTRESP	Used to determine outcome	Yes	0.35
DATECON	Used to determine outcome	Yes	0.92
CMINTVW	Used to determine treatment	No	---
AGER	Used to determine treatment	Yes	0.00
POVERTY	Used to determine treatment	Yes	6.30
RACE	Used as potential effect-modifier	Yes	0.03
HISPANIC	Used as potential effect-modifier	Yes	0.02
HISPRACE2	Used as potential effect-modifier	Yes	0.02
BRNOUT	Used as covariate	No	---
RMARITAL[2]	Used as covariate	Yes	0.01
HIEDUC	Used as covariate	Yes	0.07
PARITY	Used as covariate	Yes	0.04
METRO[3]	Used as covariate	Yes	0.00

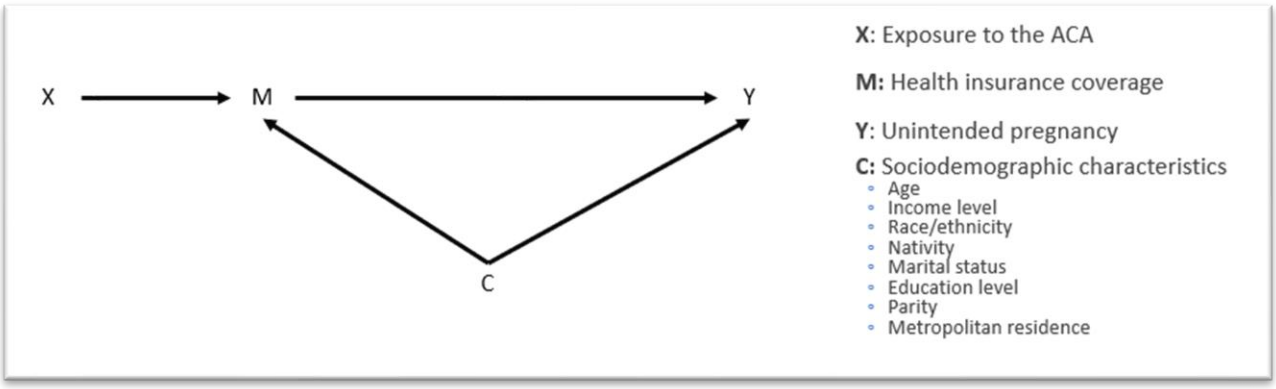
[1] For all listed variables besides WANTRESP and DATECON, this is the unweighted percentage of our study population (i.e., sexually active female respondents ages 18-44) with an imputed value. For WANTRESP and DATECON, this is the unweighted percentage of pregnancies to our study population in the prior calendar year with an imputed value.

[2] This NSFG variable does not capture same-sex marriages

3.4 Conceptual Framework

To guide decisions regarding the analytic strategy, the directed acyclic graphs (DAGs) shown in Figures 3a-3c were developed. Figure 3a depicts the *conceptualized* causal relationship between the ACA and unintended pregnancy.

Figure 3a. Conceptual framework – Conceptualized causal relationship



Note: The relationship between X and M is modified by age and income level.

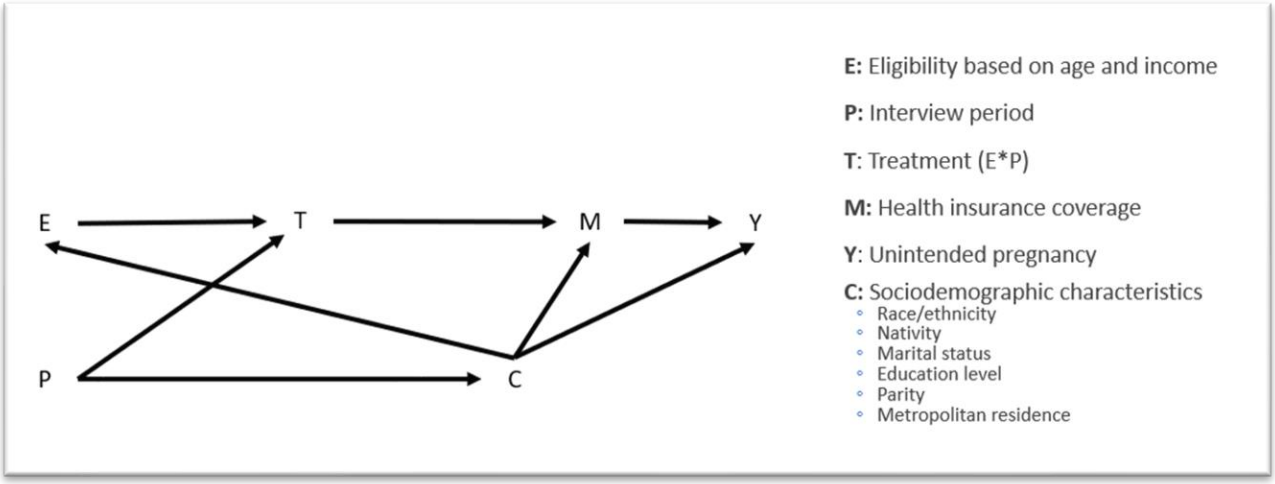
In this framework, I am assuming: 1) that the ACA [X] can influence unintended pregnancy [Y] through its impact on health insurance [M], and 2) no individual-level characteristics influence *exposure* to the ACA because it is a federal-level policy, and therefore all US residents are "exposed." As noted in the footnote of Figure 3a, and previously in Section 3.3, however, the impact of the ACA *is* expected to differ by age and income level because these are used as eligibility criteria for specific provisions of the ACA. I considered those eligible to benefit from the ACA to be "treated." That is, all US residents were *exposed* to the ACA after its enactment, but only eligible subpopulations were *treated* by the ACA. As a result, there is no "unexposed" group in this scenario, but there are "untreated" groups, facilitating the inclusion of comparison/control groups in my analyses. Thus, I used my analyses to identify the impact of *treatment* by the ACA (or one of its components) on unintended pregnancy.

An individual's treatment status [T] was defined by both eligibility [E] and interview period [P] – as depicted in Figure 3b. Further, I assume a relationship between eligibility [E] and individual-level sociodemographic covariates [C]. Additionally, given the repeated cross-sectional nature of the NSFG data, I also assumed a relationship between [P] and [C] which represents the

potential for compositional changes in sociodemographic characteristics [C] across the NSFG survey cycles.

It is important to note that this visual representation simplifies a complex chain of hypothesized relationships between the ACA's enactment and subsequent impact on an individual's experience regarding unintended pregnancy. Additionally, while the ACA influenced not only health insurance (e.g., it also influenced cost and quality within healthcare delivery systems, national public health organizations, healthcare workforce issues), this dissertation focuses only on insurance-related provisions of the ACA. Thus, treatment – [T] in Figure 3b – is defined by the eligibility criteria of three specific provisions of the ACA (i.e., the dependent coverage provision, Marketplace subsidies, and Medicaid expansions). These three provisions increased access to affordable health insurance coverage. The ACA further increased affordability of contraceptive products and services through its preventive care mandate, which required health insurance plans to cover all FDA-approved female contraceptive products and services without patient cost-sharing. Both hypothesized effects – i.e., increased access to affordable health insurance options, and increased generosity in the scope of coverage for contraceptive products and services – would be captured in Figure 3b by the pathway between [T] and [M]. The latter is hypothesized as downstream of the former because one must have health insurance coverage before the preventive care mandate can affect the cost of their contraceptives.

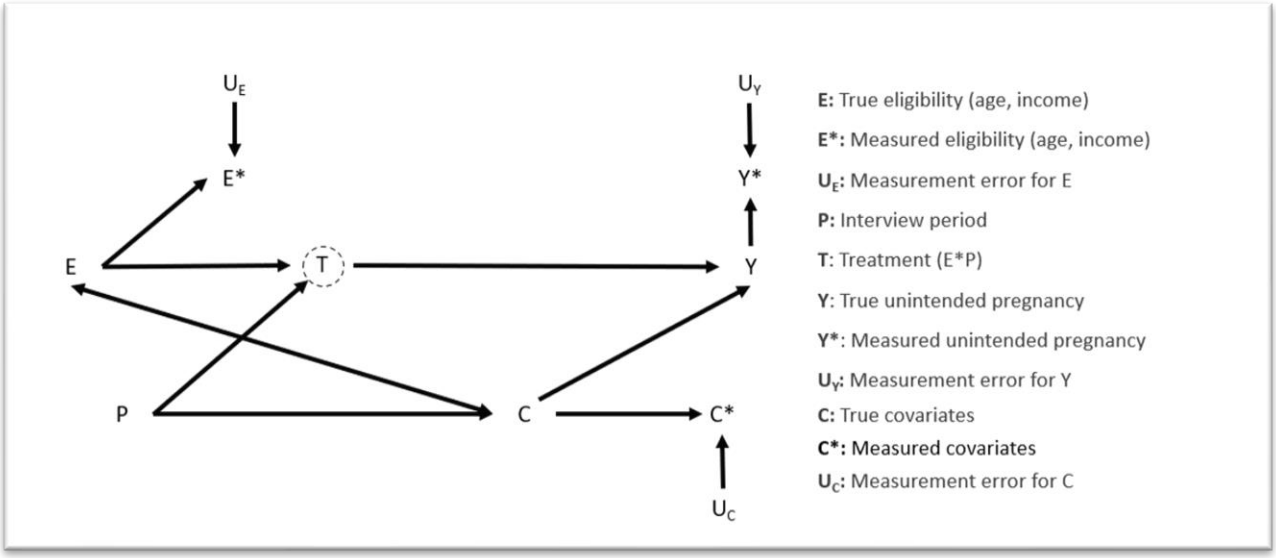
Figure 3b. Conceptual framework – Incorporating treatment (Rather than exposure)



Notes: The pathway between P and C represents compositional changes in sociodemographic characteristics between survey cycles due to the cross-sectional nature of the NSFG data.

Finally, Figure 3c incorporates known sources of measurement error. Measurement error is introduced to [E] through the measurement of income, which is a notoriously difficult measure to capture. As previously discussed, there is also measurement error introduced to [Y] due to underreporting of abortions. Further, among women who experienced a pregnancy in the prior calendar year, I conceptualized eligibility [E] and covariates [C] just prior to pregnancy, but these measures were collected at the time of interview. This too introduces measurement error. To identify the effect of interest, I assumed that these measures prior to pregnancy are similar to those at the time of interview, and that they are not affected by the outcome. If these assumptions hold, and there is no residual confounding, the analytic strategy I have employed will result in causal effect estimates. If these assumptions do not hold, the produced estimates may be biased due to confounding or measurement error. The plausibility of these assumptions will be discussed in greater detail for each manuscript as they are presented in Chapters 4-6.

Figure 3c. Conceptual framework – Incorporating known measurement error



Notes: The pathway between P and C represents compositional changes in sociodemographic characteristics between survey cycles due to the cross-sectional nature of the NSFG data.

3.5 Analytic Strategy

To address Specific Aims 1-3, the impact of the ACA or its specific components on unintended pregnancy and racial/ethnic disparities in unintended pregnancy was estimated using a difference-in-differences (DD) approach. This approach targets the estimation of the average treatment effect on the treated (ATT) by comparing the trends in the outcome (i.e., unintended pregnancy) between those who are treated (i.e., eligible to benefit) and those who are untreated (i.e., ineligible to benefit). The identifying assumption for this approach – known as the common, or parallel, trend assumption – requires that the trends in the treated and untreated groups be equal in the absence of the intervention (i.e., the ACA or one of its specific components) [108]. If this assumption holds, any difference in trends between these two groups following the intervention can be attributed to the intervention. The strengths and limitations of this approach, along with the plausibility of this assumption, will be considered and discussed within the context of each

research question in Chapters 4-6. Importantly, this approach will allow me to conduct an intention-to-treat (ITT) analysis. That is, by operationalizing my treatment variables to indicate age- or income-based eligibility for a particular provision, my analyses focus on groups that were *intended* to benefit from the ACA. It does not, for example, incorporate the 2012 Supreme Court decision regarding Medicaid expansion, geographic proximity to healthcare, or healthcare practices (e.g., provider decisions regarding acceptance of patients with Medicaid coverage) that might limit the impact of the policy. Thus, this approach should produce conservative estimates for the impact of the ACA and its specific provisions.

If the necessary assumptions are met, this approach will allow me to identify eight treatment effects that address Specific Aims 1-3:

1. Specific Aim 1:
    a. The average effect of the overall ACA on unintended pregnancy among women eligible to benefit from at least one of three major provisions of the ACA (i.e., dependent coverage provision, Marketplace subsidies, or Medicaid expansion)
2. Specific Aim 2:
    a. The average effect of the dependent coverage provision on unintended pregnancy among women aged 18-25
    b. The average effect of the Marketplace subsidies on unintended pregnancy among women with income between 139-399% of the FPL
    c. The average effect of the 2014 insurance expansions on unintended pregnancy among women with income <400% of the FPL

3. Specific Aim 3:
    a. The average effect of the overall ACA on absolute racial/ethnic disparities in unintended pregnancy among women eligible to benefit from at least one of three components of the ACA
    b. The average effect of the dependent coverage provision on absolute racial/ethnic disparities in unintended pregnancy among women under the age of 26
    c. The average effect of the Marketplace subsidies on absolute racial/ethnic disparities in unintended pregnancy among women with income between 139-399% of the FPL
    d. The average effect of the insurance expansions on absolute racial/ethnic disparities in unintended pregnancy among women with income <400% of the FPL

The effects listed for Specific Aim 2 will be evaluated within social (e.g., age) and economic (e.g., income) subgroups as well. Further, by considering multiple pre- and post-intervention time periods, I will also be able to describe the timing of the impact associated with the ACA and its specific components. The statistical models used to estimate each effect will be presented in detail in Chapters 4-6. For all estimates, 95% confidence intervals will be provided along with the point estimate to simultaneously provide information regarding estimate magnitude, precision, and statistical significance at the 5% significance level.

3.6 Institutional Review Board Approval

The work conducted for this dissertation was reviewed and approved by the Michigan State University Institutional Review Board (STUDY0005077) (Appendix B).

3.7 Software Used

Survey procedures were used in SAS 9.4 or StataMP 16 for all analyses. Survey weights were used in all analyses, and Taylor series expansion and repeated replication procedures are utilized to appropriately account for this weighting in the calculation of standard error estimates [64]. Further, the DOMAIN statement was utilized in SAS survey procedures, and the subpop( ) option in Stata functions, to ensure the survey design structure remained intact when generating subpopulation estimates [65–68].

CHAPTER 4: THE DYAMIC IMPACT OF THE AFFORDABLE CARE ACT ON UNINTENDED PREGNANCY (MANUSCRIPT 1)

4.1 Introduction

In the United States (US), nearly half of all pregnancies are unintended – i.e., occurred earlier than desired or when there was no desire for a(nother) pregnancy – with roughly 5% of women aged 15-44 experiencing unintended pregnancy each year [39]. The persistently high unintended pregnancy rate in the US may suggest that the population-level need for contraceptive products and services is not being met [7]. The ability to meet this need is limited, in part, by the accessibility and affordability of such products and services

The Patient Protection and Affordable Care Act (ACA) increased access to and affordability of contraceptive products and services. Specifically, the ACA increased access to affordable health insurance coverage through three major components: 1) the dependent coverage provision, which required that health insurance plans cover dependents under the age of 26 years; 2) the creation and subsidization of health insurance exchanges (i.e., the Marketplaces), and 3) the expansion of Medicaid to low-income adults [20,21]. Further, the ACA required that health insurance plans cover preventive care – including contraceptive products and services – without patient cost-sharing [22]. Jointly, these components increased options for health insurance coverage and required coverage of all FDA approved female contraceptives without patient cost-sharing.

Among women of reproductive age, there is evidence that the ACA or its components have increased health insurance coverage [43,109–112], increased the affordability of contraceptive products and services [45,46], and influenced contraceptive use or choice [49,111–114]. Specifically, the ACA was associated with an increase in the use of long-acting reversible

contraceptives (LARCs) [42,48,111]. It is unknown, however, whether these effects translated into fewer unintended pregnancies. To date, two studies have investigated the association between specific provisions of the ACA and unintended or unwanted pregnancy. First, I previously led a study in which we observed a non-significant 15% decrease in the odds of unintended pregnancy following implementation of the ACA preventive care mandate (OR = 0.85, 95% CI: 0.62, 1.17) [3]. Second, Myerson, Crawford, and Wherry estimated the impact of the ACA Medicaid expansion on the prevalence of unwanted pregnancy, and observed a non-significant 2.1 ppt decrease (95% CI: -8.5, 4.5) among low-income women (i.e., income ≤ 138% of the FPL) with a recent live birth [4]. The joint effect of multiple ACA provisions on unintended pregnancy, however, has not been investigated.

The prevalence of unintended pregnancy and the potential for the ACA to increase access to and affordability of contraceptives suggests that there is a need for research that examines the impact of the ACA on unintended pregnancy. In this study, I extend the literature regarding the effects of the ACA on women's health through two contributions: 1) estimating the joint impact of three major ACA provisions on unintended pregnancy, and 2) describing the timing of this impact, if evidence of an impact exists.

4.2 Methods

4.2.1 Design, Data, & Study Population

I targeted women of reproductive age through a repeated cross-sectional study design utilizing data from multiple cycles of the National Survey of Family Growth (NSFG). The NSFG is a survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) through in-person interviews and computer-assisted personal interviewing to gather cross-sectional current and retrospective information about marriage,

divorce, fertility, family life, and general and reproductive health [63]. The NSFG surveys non-institutionalized civilian men and women ages 15-44 using a multistage probabilistic sampling methodology and provides survey weights needed to produce nationally representative estimates [64–68]. I used NSFG data from cycles spanning 2006-2019. From this data, I included self-reported sexually active female respondents aged 18-44. This resulted in an unweighted analytic sample size of n=25,426 respondents (Figure 2 on page 13).

4.2.2 Outcome Measure

A respondent experienced the outcome, unintended pregnancy, if they reported experiencing at least one pregnancy in the prior calendar year that occurred earlier than desired or when a(nother) pregnancy was not wanted. This is consistent with the standard definition of unintended pregnancy as stated by the Centers for Disease Control and Prevention [33]. This was measured using self-reported timing and wantedness indicators that were collected for all reported pregnancies across the lifecourse up to the time of interview.

4.2.3 Treatment Measure

The ACA was a federal-level policy, meaning all US residents were "exposed" to the ACA. Several provisions, however, were applicable only to certain groups. I considered groups that were eligible to benefit from the ACA to be "treated." In this work, I focused specifically on three major components of the ACA: 1) the dependent coverage provision, 2) Marketplace subsidies, and 3) the expansion of Medicaid. These components increased access to affordable health insurance coverage, which was subsequently required (by the ACA preventive care mandate) to include coverage of all FDA-approved female contraceptive products and services without patient cost-sharing. In alignment with the eligibility criteria used for these provisions, I used respondent age and household income to identify individuals that were "treated." Individuals under the age of 26

were eligible to benefit from the dependent coverage provision, individuals with income between 100-399% of the FPL were eligible to benefit from the Marketplace subsidies, and individuals with income ≤138% of the FPL were eligible for Medicaid under the ACA expansion. Thus, these individuals were considered treated. Alternatively, individuals aged 26 years and older with household income ≥400% of the FPL were not eligible to benefit from any of these provisions and were therefore considered untreated.

I operationalized this variable both as a multinomial (8-level) categorical variable that indicated which specific component(s) of the ACA the respondent was eligible for – i.e., the dependent coverage provision, Marketplace subsidies, or Medicaid expansion – and as a dichotomous variable that indicated whether the respondent was eligible to benefit from at least one listed component of the ACA. The multinomial treatment measure was used in descriptive analyses only, while the dichotomous treatment measure was used in all analyses. It is important to note that this treatment definition allows only for an intention-to-treat analysis. That is, it allows me to evaluate the impact among the group that was *targeted* by the ACA through its written eligibility criteria – which, in the case of Medicaid expansion, differs from the group that was made eligible in enactment because several states have elected to not expand Medicaid eligibility.

The timing of the treatment is also important. The ACA was signed into law on March 23, 2010, with implementation occurring throughout the following years. The dependent coverage provision went into effect in September 2010, followed by implementation of the preventive care mandate in August 2012, and the opening of the health insurance exchanges in 2014 [21]. The expansion of Medicaid eligibility also began in 2014 but has continued to the present day. At the time of writing, 39 states plus Washington DC have elected to expand Medicaid and 12 of these states did so after January 2014 [30]. Thus, I defined the pre-ACA period as prior to September

2010, the transitional period (i.e., the period when the ACA was being rolled out) as September 1, 2010 – December 31, 2014, and the post-ACA period as January 1, 2015 and beyond. This definition was operationalized in a variable called *PERIOD* which was based on NSFG survey cycle and interview date:

$$\begin{bmatrix} PERIOD = 0 & if\ interviewed\ in\ 1st\ half\ of\ 2006-2010\ cycle\ \ (i.e., 2006-2008) \\ PERIOD = 1 & if\ interviewed\ in\ 2nd\ half\ of\ 2006-2010\ cycle\ (i.e., 2008-2010) \\ PERIOD = 2 & if\ interviewed\ in\ 2011-2013\ cycle \\ PERIOD = 3 & if\ interviewed\ in\ 2013-2015\ cycle \\ PERIOD = 4 & if\ interviewed\ in\ 2015-2017\ cycle \\ PERIOD = 5 & if\ interviewed\ in\ 2017-2019\ cycle \end{bmatrix}$$

Further, unintended pregnancy was measured in the calendar year prior to interview (e.g., if interviewed anytime in 2013, unintended pregnancy was assessed for 2012) which allowed a 12-month recall period in identifying reports of unintended pregnancy and shifted the dates associated with each period by one year:

$$\begin{bmatrix} PERIOD = 0 & 2005-2007 \\ PERIOD = 1 & 2007-2009 \\ PERIOD = 2 & 2010-2012 \\ PERIOD = 3 & 2012-2014 \\ PERIOD = 4 & 2014-2016 \\ PERIOD = 5 & 2016-2018 \end{bmatrix}$$

Thus, the pre-ACA period includes *PERIOD* = 0 and 1, the transitional period in which the ACA rolled out includes *PERIOD* = 2 and 3, and the post-ACA period includes *PERIOD* = 4 and 5.

4.2.4 Covariate Measures

Potential confounders included respondent sociodemographic characteristics (i.e., race/ethnicity, education level, age, marital status, parity, nativity, and metropolitan residence). These factors are considered possible confounders because: 1) they are associated with both eligibility and unintended pregnancy, and 2) the composition of the treated and untreated groups with respect to these factors may change from survey cycle to survey cycle given the cross-

sectional nature of the data. Please see Appendix C Table C1 for a summary regarding how the composition of treatment groups is changing over the study period.

4.2.5 Statistical Analysis

I summarized sample characteristics overall and by NSFG survey cycle using frequencies (percentages). To estimate the impact of the ACA, I targeted the average treatment effect on the treated (ATT) using a difference-in-differences (DD) approach. The ATT can be interpreted as the average effect of the ACA on unintended pregnancy among those targeted by the ACA based on age and income eligibility criteria (i.e., among those considered "treated"). First, I estimated the using a pooled post period (i.e., a post period that combined multiple NSFG survey cycles). I used a linear probability regression model in which two definitions were considered for the pooled post period: 1) Pooled Post Period A, where the post period included the four years following the ACA's full implementation (2014-2018, *PERIOD* = 4 or 5), and 2) Pooled Post Period B, where the post period included the four years in which the ACA was being implemented as well as the four years following its full implementation (2010-2018, *PERIOD* = 2, 3, 4, or 5). Model 1 was specified as:

$$y_i = \beta_0 + \beta_1(P0_i) + \beta_2(P2_i) + \beta_3(E_i) + \beta_4(P0_i)(E_i) + \beta_5(P2_i)(E_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

In this model:

y_i indicates whether respondent *i* experienced an unintended pregnancy during recall period

$P0_i$ indicates respondent *i* had a recall period of 2005-2007 (PERIOD= 0)

$P2_i$ indicates whether respondent *i* was interviewed in the post period

E_i indicates whether respondent *i* was treated (i.e., targeted by the ACA based on age and income)

$\boldsymbol{c}_i$ represents a vector of covariates for respondent *i*

In this model, a recall period of 2007-2009 (*PERIOD* = 1) was defined as the reference period, and the ATT estimate for the post-ACA period is captured in $\hat{\beta}_5$. Both unadjusted and adjusted models were considered, and adjusted models included race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence.

Second, I estimated the ATT using an unpooled post period. That is, each NSFG survey cycle provided a separate time point, creating four post-ACA time points (*PERIOD* = 2, 3, 4, and 5). I used this analysis to evaluate the timing of the potential impact. Again, I used a linear probability regression. Model 2 was specified as:

$$y_i = \beta_0 + \beta_1(P0_i) + \beta_2(P2_i) + \beta_3(P3_i) + \beta_4(P4_i) + \beta_5(P5_i) + \beta_6(E_i) + \beta_7(P0_i)(E_i) + \beta_8(P2_i)(E_i) + \beta_9(P3_i)(E_i) + \beta_{10}(P4_i)(E_i) + \beta_{11}(P5_i)(E_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

In this model:

y_i indicates whether respondent *i* experienced an unintended pregnancy during recall period

$P0_i$ indicates respondent *i* had a recall period of 2005-2007 (PERIOD=0)

$P2_i$ indicates respondent *i* had a recall period of 2010-2012 (PERIOD=2)

$P3_i$ indicates respondent *i* had a recall period of 2012-2014 (PERIOD=3)

$P4_i$ indicates respondent *i* had a recall period of 2014-2016 (PERIOD=4)

$P5_i$ indicates respondent *i* had a recall period of 2016-2018 (PERIOD=5)

E_i indicates whether respondent *i* was treated (i.e., targeted by the ACA based on age and income)

$\boldsymbol{c}_i$ represents a vector of covariates for respondent *i*

Again, a recall period of 2007-2009 (*PERIOD* = 1) was defined as the reference period. Using this model, ATT estimates for the post-ACA periods are captured in $\hat{\beta}_8$, $\hat{\beta}_9$, $\hat{\beta}_{10}$, and $\hat{\beta}_{11}$. Both unadjusted and adjusted models were considered, and adjusted models included race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence.

The DD approach assumes that the trend observed in the untreated group following the intervention (i.e., the ACA) serves as a reasonable counterfactual for the trend that would have been observed in the treated group if, counter to fact, the intervention had not occurred. While this assumption cannot be verified, I can empirically check whether the trend in the outcome was the same in both the treated and untreated groups prior to intervention – thus, this assumption is often referred to as the common (or parallel) trend assumption. To empirically check for violation of the common trend assumption, I used both hypothesis testing and graphical approaches. To test this assumption, I used $\hat{\beta}_4$ from Model 1 and $\hat{\beta}_7$ from Model 2. Under the null hypothesis that these coefficients are equal to 0, the difference in the trend of unintended pregnancy from 2005-2007 to 2007-2009 between the treated and untreated groups would be 0 (i.e., there would be common pre-ACA trends).

To assess the robustness of my findings, secondary analyses were also conducted. First, I considered an alternative definition for treatment based on age and education level, rather than age and income level. Second, I excluded respondents who were 26 years old at the time of interview. Third, for the adjusted model, I considered race and ethnicity as separate variables rather than one combined variable. The rationale for each of these analyses is provided in Appendix C Table C2.

All analyses were conducted using SAS 9.4. Survey procedures were utilized along with the DOMAIN statement to ensure that weights could be incorporated to properly account for the sampling methodology.

4.2.6 IRB Review

This study was reviewed and approved by the Michigan State University Institutional Review Board (STUDY0005077, Appendix B).

4.3 Results

A summary of sample characteristics for the weighted analytic sample are provided in Table 5. The majority of women were under the age of 35 (62.0%), identified as NH White (58.0%), had a household income that was less than 400% of the FPL (75.7%), had attained up to an associate degree at time of interview (69.9%), were parous (65.2%), and lived in a metropolitan area (83.1%). Over the study period, changes in these characteristics reflected those of the nation (e.g., highest education level attained increased). Across the study period, the percentage of women who would have been eligible to benefit from at least one component of the ACA, as it was written, ranged from a minimum of 76.0% in 2017-2019 to a maximum of 87.2% in 2008-2010 (Table 5). Over the study period, 52.8% of women were eligible for the Marketplace subsidies (based on income), 32.4% of women were eligible for the ACA expansion of Medicaid (based on income), and 26.3% of women were eligible for the dependent coverage provision (based on age).

The percentage of respondents who reported an unintended pregnancy decreased steadily over the study period from a high of 4.8% in 2005-2007 to 3.0% in 2016-2018 (Table 5). Figures 4 and 5 further depict the prevalence of unintended pregnancy by period and treatment group (multinomial and dichotomous, respectively). The prevalence of unintended pregnancy was generally higher among individuals under the age of 26 than among those who were 26 or older (Figure 4). Additionally, prior to the ACA, the observed prevalence of unintended pregnancy among respondents under the age of 26 increased for all income groups with one exception: individuals who had an income that was 139-399% FPL group (i.e., those eligible for the dependent coverage provision and Marketplace subsidies) (Figure 4). Alternatively, among respondents who were 26 or older, the observed prevalence of unintended pregnancy prior to the ACA decreased

for all income groups with one exception: individuals who had an income that was <100% of the FPL (i.e., those eligible only for Medicaid expansion) (Figure 4). Large within group fluctuations in prevalence between periods reflect the limited statistical precision of estimates. This is due to relatively small period-specific sample sizes in some groups (e.g., there were only n=97 respondents in the 2015-2017 NSFG survey cycle who were eligible for the dependent coverage provision, Medicaid expansion, and Marketplace subsidies). Using the dichotomized treatment variable, the percentage of treated individuals that reported an unintended pregnancy decreased steadily over the study period from 5.6% in 2005-2007 to 3.4% in 2016-2018 (Figure 5). Among the untreated group, the percentage of individuals that reported an unintended pregnancy decreased from 1.8% to 1.5% during the same period (Figure 5). Notably, there was a 1.6 percentage point (ppt) increase in the prevalence of unintended pregnancy between 2007-2009 and 2010-2012 among the untreated group – followed by a steady decrease between 2010-2012 and 2016-2018.

Figure 5 can also be used to graphically assess the common trends assumption that is necessary for the DD analyses. The pre-ACA trends in prevalence of unintended pregnancy in both the treated and untreated groups appear similar from 2005-2007 to 2007-2009, though the absolute decrease is greater among the untreated group. This was further evaluated using the linear probability model as previously described. There was no evidence that the unadjusted or adjusted trend in unintended pregnancy between 2005-2007 and 2007-2009 differed between the treated and untreated group (Table 4). This does not verify the common trend assumption, but it also does not indicate that the assumption is violated.

Table 5. Sample characteristics, overall and by interview period – unweighted frequencies and weighted percentages

	Overall n (%)	2006-2008 n (%)	2008-2010 n (%)	2011-2013 n (%)	2013-2015 n (%)	2015-2017 n (%)	2017-2019 n (%)
Sample Size	n=25,426	n=4,417	n=4,835	n=4,254	n=4,298	n=3,646	n=3,976
Socio-demographics at time of interview							
Age group							
18-25 years	7,265 (26.3)	1,314 (26.8)	1,441 (27.3)	1,266 (26.5)	1,218 (26.6)	1,000 (26.4)	1,026 (24.4)
26-34 years	9,906 (35.7)	1,654 (32.5)	1,889 (35.0)	1,650 (36.2)	1,655 (36.1)	1,451 (36.7)	1,607 (37.3)
35-44 years	8,255 (38.0)	1,449 (40.6)	1,505 (37.6)	1,338 (37.2)	1,425 (37.3)	1,195 (36.9)	1,343 (38.3)
Race/ethnicity							
Hispanic	6,064 (19.3)	896 (16.8)	1,160 (17.4)	1,099 (19.7)	1,011 (20.3)	803 (20.8)	1,095 (20.6)
NH Black	5,195 (13.5)	880 (13.6)	979 (13.6)	882 (13.5)	849 (13.1)	836 (13.9)	769 (13.6)
NH other or multiple race	2,164 (9.2)	345 (8.8)	350 (7.5)	330 (8.5)	440 (10.4)	342 (9.9)	357 (10.1)
NH White	12,003 (58.0)	2,296 (60.8)	2,346 (61.5)	1,943 (58.3)	1,998 (56.1)	1,665 (55.4)	1,755 (55.7)
Household income as a percent of the FPL							
<100% FPL	7,296 (22.9)	1,091 (20.4)	1,349 (21.5)	1,424 (26.9)	1,413 (26.2)	1,025 (21.8)	994 (20.6)
100-138% FPL	2,580 (9.5)	501 (11.2)	584 (10.2)	379 (8.0)	361 (7.5)	340 (9.9)	415 (10.2)
139-399% FPL	10,526 (43.3)	1,894 (44.6)	2,232 (52.5)	1,710 (42.3)	1,624 (39.7)	1,441 (40.2)	1,625 (40.7)
≥400% FPL	5,024 (24.3)	931 (23.8)	670 (15.8)	741 (22.8)	900 (26.5)	840 (28.2)	942 (28.5)
Highest Education Level Attained							
Less than high school	3,916 (12.5)	797 (15.5)	1,043 (17.7)	606 (11.3)	581 (10.8)	455 (10.5)	434 (9.0)
High school diploma or GED	7,044 (25.4)	1,255 (26.6)	1,252 (25.8)	1,225 (26.9)	1,181 (24.6)	997 (23.8)	1,134 (24.8)
Some college or associate degree	7,998 (32.0)	1,316 (28.9)	1,434 (30.7)	1,424 (33)	1,414 (32.5)	1,131 (33.4)	1,279 (33.2)
Bachelor's degree	4,398 (20.4)	771 (21.5)	790 (18.2)	662 (18.6)	707 (20.0)	709 (21.9)	759 (22.3)
Master's, doctoral, or professional degree	2,070 (9.7)	278 (7.5)	316 (7.6)	337 (10.1)	415 (12.1)	354 (10.4)	370 (10.6)
Marital Status							
Married	10,287 (49.2)	1,975 (55.1)	1,931 (49.7)	1,690 (48.6)	1,680 (48.3)	1,475 (47.7)	1,536 (46.0)
Not married	15,139 (50.8)	2,442 (44.9)	2,904 (50.3)	2,564 (51.4)	2,618 (51.7)	2,171 (52.3)	2,440 (54.0)
Parity							
Nulliparous	8,691 (34.8)	1,474 (32.2)	1,675 (34.5)	1,364 (33.2)	1,453 (34.9)	1,242 (35.8)	1,483 (38.4)

Table 5. (cont'd)

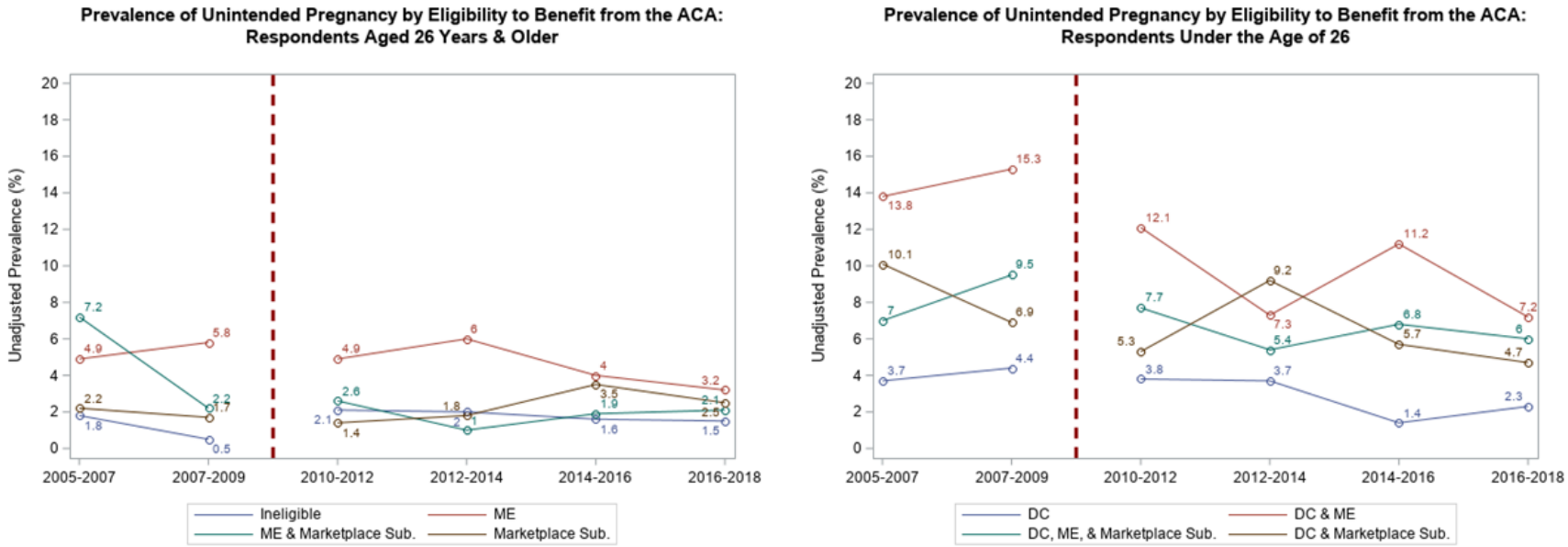
Primiparous	5,414 (19.4)	960 (19.3)	982 (18.5)	950 (20.0)	939 (20.3)	791 (19.1)	792 (19.3)
Multiparous	11,321 (45.7)	1,983 (48.5)	2,178 (47.0)	1,940 (46.8)	1,906 (44.7)	1,613 (45.1)	1,701 (42.3)
Nativity							
Born in the US	21,010 (83.8)	3,636 (83.2)	3,955 (85.1)	3,575 (85.2)	3,482 (81.7)	3,049 (82.9)	3,313 (84.8)
Born outside of the US	4,407 (16.1)	778 (16.6)	880 (14.9)	678 (14.7)	815 (18.3)	596 (17.1)	660 (15.1)
Unknown	9 (0.0)	3 (0.2)	0 (0.0)	1 (0.0)	1 (0.0)	1 (0.0)	3 (0.1)
Metropolitan Residence							
Metropolitan	21,486 (83.1)	3,516 (77.5)	4,323 (82.4)	3,650 (85.1)	3,563 (85.4)	3,104 (83.8)	3,330 (84.5)
Non-metropolitan	3,940 (16.9)	901 (22.5)	512 (17.6)	604 (14.9)	735 (14.6)	542 (16.2)	646 (15.5)
Eligibility for the ACA[1]							
Eligible	21,397 (80.0)	3,690 (80.8)	4,300 (87.2)	3,658 (80.8)	3,579 (78.4)	2,970 (76.9)	3,200 (76.0)
DC Provision	995 (4.3)	204 (4.6)	135 (3.0)	145 (3.6)	181 (5.0)	164 (5.1)	166 (4.5)
Marketplace	7,643 (32.1)	1,358 (33.7)	1,631 (39.4)	1,212 (30.9)	1,184 (29.2)	1,047 (29.2)	1,211 (30.4)
Medicaid Expansion	4,736 (15.0)	690 (12.7)	848 (13.7)	916 (17.7)	924 (17.4)	680 (14.0)	678 (14.2)
DC Provision & Marketplace	2,883 (11.2)	536 (10.8)	601 (13.1)	498 (11.4)	440 (10.6)	394 (11.0)	414 (10.3)
DC Provision & Medicaid Expansion	2,560 (7.9)	401 (7.6)	501 (7.8)	508 (9.1)	489 (8.9)	345 (7.8)	316 (6.4)
Marketplace & Medicaid Expansion	1,753 (6.6)	328 (7.5)	380 (6.8)	264 (5.7)	253 (5.3)	243 (7.3)	285 (7.0)
DC Provision, Marketplace, & Medicaid Expansion	827 (2.9)	173 (3.8)	204 (3.4)	115 (2.3)	108 (2.2)	97 (2.5)	130 (3.2)
Ineligible	4,029 (20.0)	727 (19.2)	535 (12.8)	596 (19.2)	719 (21.6)	676 (23.1)	776 (24)
Outcome in the prior calendar year							
Unintended pregnancy[2]	1,370 (4.0)	273 (4.8)	284 (4.2)	230 (3.9)	218 (4.0)	194 (3.8)	171 (3.0)

ACA = Affordable Care Act; NH = non-Hispanic; FPL = Federal poverty level; DC = Dependent coverage

[1] Based on age and income level; DC provision (age < 26 years), Marketplace subsidies (income 100-399% of the FPL), Medicaid expansion (income ≤138% of the FPL)

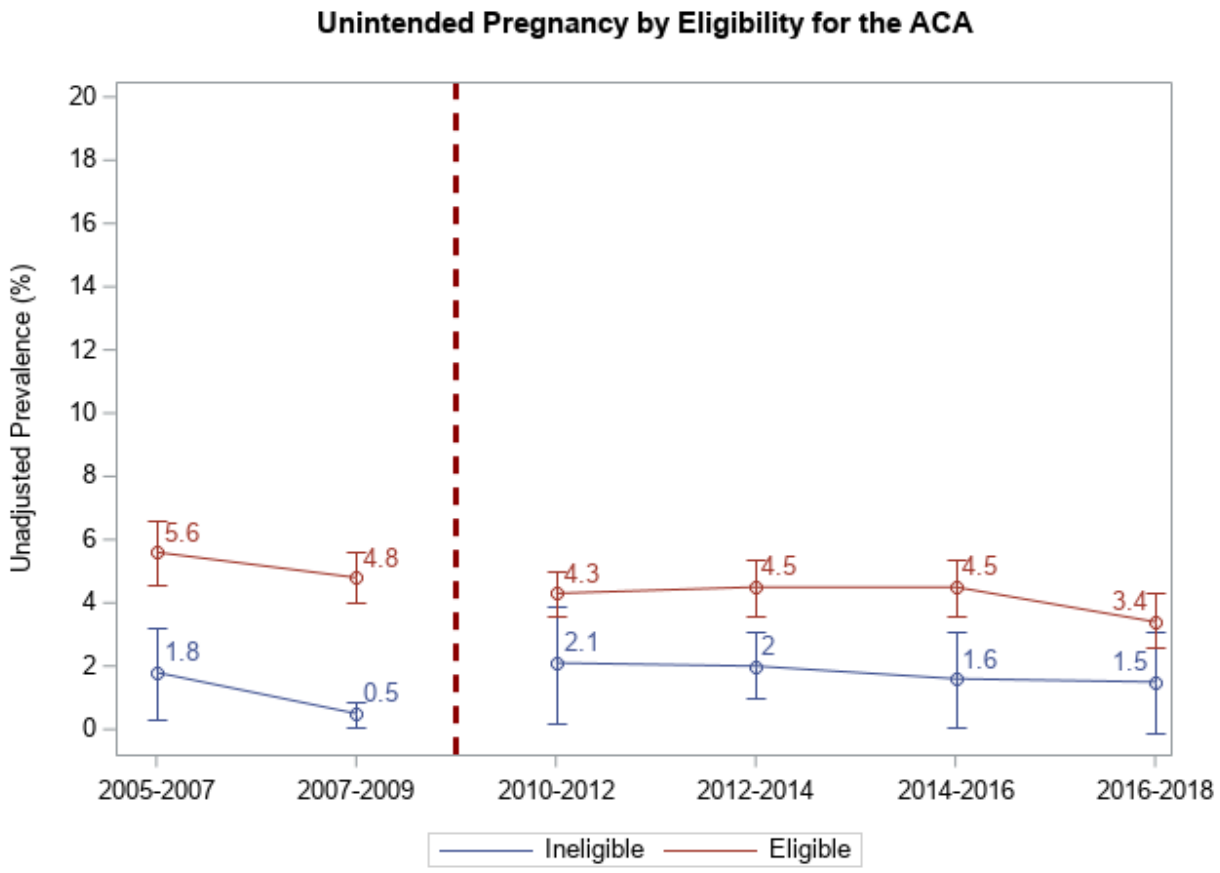
[2] Pregnancy that occurred earlier that desired (mistimed, early) or when no children were desired

Figure 4. Unadjusted prevalence of unintended pregnancy by period and multinomial treatment status (n=25,426)



Dashed vertical line indicates policy signed into law; Error bars indicate 95% confidence limits

Figure 5. Unadjusted prevalence of unintended pregnancy by period and dichotomous treatment status (n=25,426)



Dashed vertical line indicates policy signed into law; Error bars indicate 95% confidence limits

Table 6 presents the unadjusted and adjusted results of the DD analyses. Relative to the baseline period of 2007-2009, I observed a decrease in the prevalence of unintended pregnancy among the treated group and an increase (roughly 1 ppt) in prevalence among the untreated group in both pooled post periods considered (i.e., 2014-2018 and 2010-2018). Following full implementation of the ACA (i.e., in 2014-2018), the adjusted ATT indicated that the ACA was associated with a 2.0 ppt (95% CI: 0.3, 3.6) decrease in unintended pregnancy among those who were eligible to benefit from the ACA based on age and income. The adjusted ATT for 2010-2018

(i.e., during and following implementation) was similar [-2.1 ppt, (95% CI: -3.4, -0.8)]. Estimates produced using the unadjusted model were similar in magnitude and precision.

Similar results were observed in the DD analyses that considered an unpooled post period (Table 6). Relative to the baseline period of 2007-2009, there was evidence that the ACA was associated with a decrease in the prevalence of unintended pregnancy among the treated group in both the transitional and post-ACA periods. During the first two years of the transitional period (i.e., 2010-2012), the adjusted ATT was estimated to be -2.4 ppt (95% CI: -4.7, -0.1). That is, during the first two years in which the ACA was being rolled out, it was estimated that the ACA was associated with a 2.4 ppt (95% CI: 0.1, 4.7) decrease in the prevalence of unintended pregnancy among respondents who were eligible to benefit from the ACA based on age and income. The magnitude of this association varied slightly throughout the study period with the adjusted ATT estimated to be: -1.7 ppt (95% CI: -3.5, 0.1) in 2012-2014, -1.6 ppt (95% CI: -3.6, 0.5) in 2014-2016, and -2.6 ppt (95% CI: -4.8, -0.5) in 2016-2018.

Table 6. Unadjusted and adjusted ATT estimates associated with the impact of the ACA on prevalence of unintended pregnancy among eligible sexually active US females aged 18-44

	Unpooled Post Period (unweighted n=25,426)		Pooled Post Period A[3] (unweighted n=16,874)		Pooled Post Period B[3] (unweighted n=25,426)	
	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)
2005-2007	-0.5 (-2.3, 1.3)	-0.3 (-2.1, 1.5)	-0.5 (-2.3, 1.3)	-0.1 (-1.9, 1.6)	-0.5 (-2.3, 1.3)	-0.3 (-2.1, 1.5)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-2.1 (-4.3, 0.1)	**-2.4 (-4.7, -0.1)**	---	---	---	---
2012-2014	**-1.8 (-3.6, -0.1)**	-1.7 (-3.5, 0.1)	---	---	---	---
2014-2016	-1.4 (-3.5, 0.7)	-1.6 (-3.6, 0.5)	---	---	---	---
2016-2018	**-2.4 (-4.6, -0.3)**	**-2.6 (-4.8, -0.5**)	---	---	---	---
Pooled Post Periods[1]						
2014-2018	---	---	**-1.9 (-3.6, -0.2)**	**-2.0 (-3.6, -0.3)**	---	---
2010-2018	---	---	---	---	**-2.0 (-3.3, -0.7)**	**-2.1 (-3.4, -0.8)**

ATT = Average treatment effect on the treated; CI = Confidence interval

Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% significance level

* The unadjusted DD regression model includes period, treatment, and the interaction between period and treatment. The adjusted model also includes respondent's race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence

[1] Post period A considered unintended pregnancies only in the post-ACA period (2014-2018). Post period B considered unintended pregnancies in the transitional and post-ACA periods (2010-2018).

Secondary analyses resulted in similar conclusions, though the magnitude of associations were slightly larger, when 26-year-olds were excluded (Appendix C Table C4) and when treatment was defined by age and education rather than age and income level (Appendix C Table C3). Results were nearly identical when including race and ethnicity as a combined variable or two separate variables (Appendix C Table C5).

4.4 Discussion

Using a repeated cross-sectional design with a nationally representative sample, I found evidence that the ACA was associated with an immediate 2.4 ppt (95% CI: 0.1, 4.7) reduction in the prevalence of unintended pregnancy among women who were eligible to benefit from the ACA based on age and income eligibility criteria used in the writing of the ACA (i.e., those under the age of 26 or with a household income of <400% of the FPL). The magnitude of this association varied only slightly across the study period with the largest association observed during the 2016-2018 period – i.e., two to four years after the ACA roll-out ended. As of 2016-2018, the ACA was associated with a 2.6 ppt (95% CI: 0.5, 4.8) decrease in the prevalence of unintended pregnancy among women targeted by the ACA. Pooled across the transitional and post-ACA periods (2010-2018), the ACA was associated with a 2.1 ppt (95% CI: 0.8, 3.4) decrease in the prevalence of unintended pregnancy. Thus, our findings suggest that the unmet population-level need for contraceptive products and services decreased following enactment of the ACA among women who were eligible to benefit from the ACA.

This is the first analysis, to my knowledge, that investigates the impact of the ACA, in its entirety, on unintended pregnancy, but I am aware of two studies that have investigated the impact of specific components of the ACA on unintended pregnancy or unwanted pregnancy. We conducted one prior study which investigated the impact of the ACA preventive care mandate on

unintended pregnancy among women of reproductive age (i.e., 18-44 years), and observed that the preventive care mandate was associated with a non-significant 15% decrease in the odds of unintended pregnancy (OR = 0.85, 95% CI: 0.62, 1.17) [3]. Myerson, Crawford, and Wherry (2020) investigated the impact of Medicaid expansion on the prevalence of unwanted pregnancy among low-income women (i.e., income ≤ 138% of the FPL) with a recent live birth, and they observed a non-significant 2.1 ppt decrease (95% CI: -8.5, 4.5) [4]. Our results may differ due, in part, to differences in sample selection and analytic strategy, as well as the fact that I am investigating the joint impact of three major provisions of the ACA, whereas the previous studies each considered only one component of the ACA.

Additionally, neither of the prior works explored the timing of the potential impact, or whether the association between the ACA provision and unintended (or unwanted) pregnancy changed over time. I found evidence of an association immediately following initiation of the ACA roll-out in 2010-2012, followed by a period in which no evidence of such an association was found (i.e., 2012-2014 and 2014-2016), and subsequently yet another period with evidence of the ACA being associated with a decrease in unintended pregnancy two to four years following full enactment of the ACA (i.e., 2016-2018). If there was truly an effect only in 2010-2012 and 2016-2018, this could suggest the dependent coverage provision (enacted in 2010) had an immediate but temporary impact on unintended pregnancy in 2010-2012, and that this was followed by a lagged effect of Medicaid expansion (implemented in 2014 and later) reducing unintended pregnancies in 2016-2018. The magnitude of the observed associations (i.e., the point estimates), however, are quite similar across the post period (ranging from -2.6 to -1.6, with wide and overlapping confidence intervals), so it is also quite possible that magnitude of the association is actually in fact stable across the study period.

My study has several limitations. First, my treatment variable is limited by its use of age and income level, and the cross-sectional nature of the data. More specifically, the use of eligibility criteria (age, income level) to define treatment means that there are important compositional differences in age and income between the treated and untreated groups, which may raise doubts about the plausibility of the common trend assumption. If the common trend assumption is not met, my estimates will be biased. Further, the cross-sectional nature of the data means that income and unintended pregnancy are measured during the same period, making it difficult to determine whether income was affected by the pregnancy. This may also lead to misclassification in the treatment variable. To address this, I conducted a robustness check that defined treatment by education level and age, rather than income level and age, and found similar results regardless of treatment definition. Second, there are small period-specific sample sizes – particularly among the untreated (ineligible) group. Unintended pregnancy is a rare outcome in the untreated group, and the untreated group makes up roughly 20% of the population. Thus, the number of period-specific unintended pregnancies in this group is quite small. Third, a retrospective dichotomous measure of pregnancy intention captured at the time of interview does not conceptually capture the true complexity and fluidity of an individual's pregnancy desires which may be influenced by the economic, social, political, and historical context of the individual and the moment in which they live [5–9,96]. Operationally, my measure of unintended pregnancy may also be affected by an underreporting of pregnancies that ended in elective termination. While I did not consider pregnancy outcome in the definition of unintended pregnancy, it is possible that women are less likely to report a pregnancy that ended in termination. If this is the case, I may be undercounting unintended pregnancies. Further, because of age and income-related disparities in pregnancy termination [115], undercounting of unintended pregnancies could differ by treatment status.

This study also has several important strengths. First, I used a nationally representative sample which increases the generalizability of our results. Second, I used a repeated cross-sectional design that captures unintended pregnancy prevalence between 2005 and 2018 which allowed me to evaluate impacts on unintended pregnancy up to eight years after the rollout of the ACA initiated in 2010 and up to four years since its full enactment in 2014. Third, by considering both pooled and unpooled post periods, I was able to consider the timing of the ACA's impact on unintended pregnancy.

Future contributions can build on this work in several ways. First, additional studies are needed to understand the mechanism through which the ACA influenced unintended pregnancy, and whether this promoted reproductive autonomy. Given the historical and contemporary infringements on women's reproductive freedom, particularly for impoverished women and women of color [98–100,116,117], it is important that researchers, policymakers, and healthcare providers center their efforts to reduce unintended pregnancy within the frameworks of patient-centered care and Reproductive Justice [2] to ensure that they do not simultaneously create or perpetuate barriers to autonomy in contraceptive choice, pregnancy termination, or childbearing. To this end, it is important to understand whether any decrease in unintended pregnancy associated with the ACA resulted from an increase in the number of women using their *preferred* contraceptive method. This distinction is critically important and warrants further investigation. Second, more work is needed to understand whether the ACA promoted health equity in reproductive health. That is, there is a need to evaluate the impact of the ACA on racial/ethnic and socioeconomic disparities in unintended pregnancy. Third, future investigations should refine the methods used to estimate the targeted effect. More specifically, future work can strengthen the plausibility of causal effect estimates for the overall ACA by considering treatment intensity in the

DD study design. This can be done by leveraging geographic differences in baseline uninsured rates because areas with higher rates of uninsurance prior to the ACA had greater capacity to benefit (i.e., greater treatment intensity) from the ACA, which sought universal health insurance coverage [118].

4.5 Conclusion

The ACA was associated with a substantial reduction in the prevalence of unintended pregnancy among women who were eligible to benefit from one of three major ACA provisions (i.e., women who were under the age of 26 or had a household income of <400% of the FPL). This work contributes to our collective understanding of the impact of the ACA on women's health while also providing a framework for evaluating the timing of impact for a policy as it pertains to a specific health outcome. Additional work is needed to determine whether the association observed in this work reflects a causal effect of the ACA, and if so, to understand the mechanism underlying this impact and its implications for health equity.

CHAPTER 5: INVESTIGATING SPECIFIC POLICY LEVERS PULLED BY THE AFFORDABLE CARE ACT, AND THEIR IMPACT ON UNINTENDED PREGNANCY (MANUSCRIPT 2)

5.1 Introduction

Nearly half of all pregnancies in the United States (US) occur earlier than desired or when a(nother) pregnancy was not desired (i.e., they are unintended) [33,35]. Roughly 5% of women ages 15-44 experience an unintended pregnancy each year in the US, and these pregnancies are experienced disproportionately by women who are younger, women of color, and women with lower income [35,39,119,120]. Unintended pregnancies may be an indication that the population-level need for contraceptives is unmet [7,33]. The capacity to meet this need is limited, in part, by structural barriers that influence access to and affordability of these products and services (e.g., cost, insurance coverage, geographic proximity to family planning clinics) [34,35,37].

The Patient Protection and Affordable Care Act (ACA), enacted in March 2010, contained multiple provisions to increase access to and affordability of contraceptive products and services. Specifically, the ACA required that health insurance plans cover all FDA-approved female contraceptives without patient cost-sharing [22], and it included components that increased access to affordable health insurance coverage: 1) the dependent coverage provision which required the coverage of insured's dependents up to the age of 26 years, 2) the creation and subsidization of state and federally run health insurance exchanges (i.e., the Marketplace), and 3) the expansion of Medicaid eligibility to include all adults with a household income ≤138% of the federal poverty level (FPL) [20,21]. Jointly, these components may have reduced insurance-related barriers (e.g., access, affordability) to contraceptive products and services.

In fact, there is evidence that the ACA has: increased the number of women with health insurance coverage [42–44], reduced the out-of-pocket costs associated with contraceptives products and services [45–47], and may have contributed to an increase in the use of highly effective long-acting reversible contraceptives (LARCs) like the contraceptive implant and intrauterine device (IUD) [42,48,121]. Further, there is some evidence that the ACA may be associated with a decrease in unintended pregnancy. In my prior work, I found the overall ACA was associated with a 2.1 ppt (95% CI: 0.8, 3.4) decrease in the prevalence of unintended pregnancy among women who were eligible to benefit from at least one major provision of the ACA (i.e., women who were eligible, based on age and income, to benefit from the dependent coverage provision, Marketplace subsidies, or Medicaid expansion) (not yet published, see Chapter 4). Other works – one led by me, and one by Myerson, Crawford, and Wherry – further explored the individual impact of two specific ACA provisions (i.e., the preventive care mandate, Medicaid expansion) on unintended or unwanted pregnancy and found insufficient evidence of an association in either case [3,4]. Thus, additional work is needed to understand which components of the contributed to the observed association with the overall ACA.

The objective of this study is to explore three mechanisms of the ACA by estimating the impact on eligible persons of individual policy levers pulled by the ACA. Specifically, I aim to:

1. Estimate the impact of the dependent coverage provision on unintended pregnancy among women under the age of 26
2. Estimate the impact of the Marketplace subsidies on unintended pregnancy among women with incomes between 139% and 399% of the FPL

3. Estimate the impact of the ACA insurance expansions (i.e., the expansion of Medicaid and the Marketplace subsidies)[1] on unintended pregnancy among women with incomes below 400% of the FPL

Understanding which policy levers were effective (or ineffective) at impacting specific health outcomes holds important implications for ongoing public policy debates regarding the ACA and health care reform.

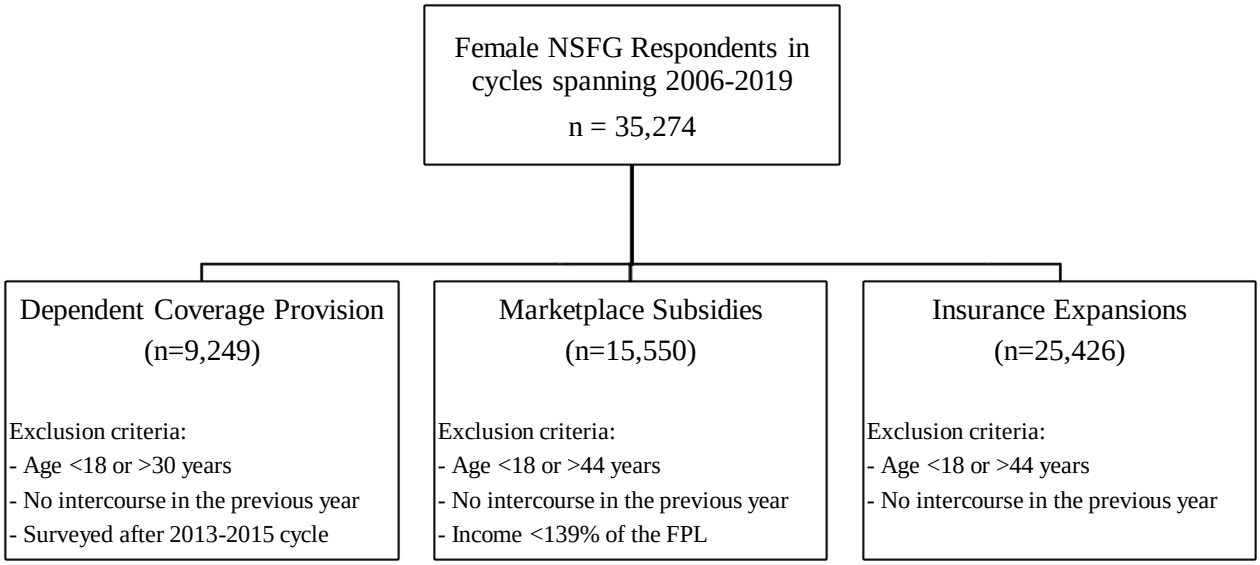
5.2 Methods

5.2.1 Design, Data, & Study Population

I addressed these objectives using a repeated cross-sectional study design. I targeted adult women of reproductive age (i.e., 18-44 years) living in the US by utilizing data from multiple cycles of the National Survey of Family Growth (NSFG) that spanned 2006 to 2019. The NSFG is a cross-sectional survey of non-institutionalized civilian men and women aged 15-44 in which the survey sample is selected using a multistage probabilistic sampling methodology. Survey participants are asked about marriage, divorce, family life, fertility, and family planning. By applying NSFG-provided survey weights, nationally representative estimates can be produced. I used NSFG data from the following survey cycles: 2006-2010, 2011-2013, 2013-2015, 2015-2017, and 2017-2019. From these data, I included sexually active female respondents aged 18-44 (n=25,426) (Figure 2 on page 13). Additional component-specific inclusion/exclusion criteria were used to reduce the possibility of confounding, and these criteria are described in detail in Appendix D and Figure 6.

[1] As discussed in Chapter 3, I am currently unable to report on analyses investigating the impact of Medicaid expansion alone due to data considerations and restrictions.

Figure 6. Unweighted analytic sample of U.S. females (aged 18-44 years) used in Manuscript 2



5.2.2 Measurement of Treatment

I considered three separate ACA provisions (i.e., the ACA dependent coverage provision, Marketplace subsidies, and the ACA insurance expansions). Respondents were considered treated by a particular provision of the ACA if they were eligible to benefit from the provision based on the eligibility criteria that was used in the writing of the ACA, and they were interviewed after the provision's enactment.

5.2.2.1 Dependent Coverage Provision

The dependent coverage provision was implemented in September of 2010 and required that dependents up to the age of 26 be covered by insurance plans. Therefore, I considered an NSFG respondent to be treated by the dependent coverage provision if they were interviewed in or after the 2011-2013 cycle of the NSFG and were under the age of 26 at the time of interview.

5.2.2.2 Marketplace Subsidies

The subsidies for Marketplace insurance plans were implemented in 2014 and were available to individuals with a household income between 100% and 399% of the FPL. Individuals with income between 100% and 138% of the FPL, however, were eligible for Medicaid under the ACA expansion (which also occurred in 2014). As such, I considered an NSFG respondent treated by the ACA Marketplace subsidies only if they were interviewed in or after the 2015-2017 cycle of the NSFG and had a household income that was 139-399% of the FPL.

5.2.2.3 The ACA Insurance Expansions

In 2014, two major insurance expansions occurred simultaneously under the ACA (i.e., the opening of the Marketplace, and the expansion of Medicaid). As discussed previously, the Marketplace subsidies applied to individuals with income between 100% and 399% of the FPL. The ACA expansion of Medicaid was intended to expand eligibility to include all adults with a household income ≤138% of the FPL. Thus, I considered a respondent to be treated by the ACA insurance expansions they had a household income < 400% of the FPL and were interviewed in or after the 2015-2017 cycle of the NSFG. See Chapter 3 page 23 for a more detailed explanation of why Medicaid expansion was not examined separately.

5.2.3 Measurement of Outcome

I measured unintended pregnancy as a binary indicator of whether the respondent experienced at least one unintended pregnancy in the calendar year prior to interview (e.g., if interviewed in 2013, I considered pregnancies that occurred in 2012). The NSFG attempts to collect a full pregnancy history for each respondent, and as part of this history, the NSFG gathers information regarding whether the pregnancy was wanted and whether it occurred too soon. This

information, along with the year of conception and respondent interview date, allowed me to identify unintended pregnancies that occurred in the prior calendar year.

5.2.4 Measurement of Covariates

I also included several covariates that have been shown to have a relationship with unintended pregnancy: race/ethnicity [Hispanic, non-Hispanic (NH) Black, NH other, NH White], education level (less than high school, high school diploma or GED, some college or associate degree, Bachelor's degree, graduate or professional degree), marital status (married, not married), parity (nulliparous, primiparous, multiparous), nativity (born in the US, born outside of the US, unknown), and metropolitan residence (yes, no). All covariates are collected primarily through self-report. The details of measurement for each covariate can be reviewed in the NSFG documentation, available publicly at: https://www.cdc.gov/nchs/nsfg/nsfg_questionnaires.htm. These factors are considered possible confounders because: 1) they are associated with both eligibility and unintended pregnancy, and 2) the composition of the treated and untreated groups with respect to these factors may change from survey cycle to survey cycle given the cross-sectional nature of the data. Please see Appendix D Table D1 for a summary regarding how the composition of treatment groups is changing over the study period.

5.2.5 Statistical Analyses

I summarized sample characteristics using frequencies (percentages). Then, I described trends in unintended pregnancy graphically, depicting the trend overall and by treatment status for each of the three ACA components considered (i.e., the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions). To evaluate the impact of these three components, I used a difference-in-differences (DD) approach to estimate the average treatment effect on the treated (ATT) for each component. This approach identifies the ATT by comparing

trends in unintended pregnancy between the treated group and the untreated group. If the trend is the same for both groups in the absence of the intervention, then any difference in trends can be attributed to the intervention. Thus, this approach necessarily requires a common – or parallel – trends assumption [108]. While this assumption cannot be verified, violations may be identified through graphical assessment and hypothesis tests that evaluate whether trends differed between treatment groups prior to the intervention. I implemented both types of assessments (graphical, hypothesis test) to check for violation of the common trend assumption. I used three separate linear probability regression models to operationalize this approach – one for each of the three components evaluated – and these models are specified in Appendix D. Further, I considered both pooled and unpooled post periods, and both unadjusted and adjusted models were executed. Adjusted models include the following respondent covariates: age group (analyses regarding the Marketplace subsidies or insurance expansions only), income level (analyses regarding the dependent coverage provision only), race/ethnicity, education level, marital status, parity, and metropolitan residence.

Multiple secondary and subgroup analyses were conducted to assess the robustness of our primary findings. First, I included race and ethnicity as separate variables rather than as one combined variable for all adjusted analyses. Second, I evaluated the dependent coverage provision stratified by household income level and whether a parent was reportedly living in the household. Stratifying by both income level and parental presence in the household allowed me to clarify whether the income reported by the respondent (the dependent) reflected their own income or both their parental and own income. Third, I evaluated the impact of the Marketplace subsidies and insurance expansions stratified by age group. I considered subgroup analyses for two reasons: 1) to explore possible effect-modification by income level or age group, and 2) to increase the

plausibility of the common trend assumption by restricting the included sample based on income level or age group (i.e., stratified estimates are restricted to a limited income or age range).

5.2.6 Statistical Software

All analyses were conducted using SAS 9.4. Survey procedures were utilized along with the DOMAIN statement to ensure that weights could be incorporated to properly account for the sampling methodology.

5.2.7 IRB Review

This study was reviewed and approved by the Michigan State University Institutional Review Board (STUDY0005077) (Appendix B).

5.3 Results

5.3.1 Sample Characteristics

Table 5 provides a summary of weighted sample characteristics. Most respondents in the sample identified as non-Hispanic (NH) White (58.0%), had completed up to an associate degree (69.9%), were parous (65.2%), and lived in a metropolitan area (83.1%) (Table 5 on pages 42-43). Roughly a quarter of respondents were treated by the dependent coverage provision (26.3%), just under half of respondents were treated by Marketplace subsidies but not Medicaid expansion (43.3%), and roughly 75% of respondents were treated either by Medicaid expansion or Marketplace subsidies (Table 5 on pages 42-43). Overall, 4.0% of respondents reported experiencing at least one unintended pregnancy in the prior calendar year and this percentage decreased steadily over the study period from 4.8% in the 2006-2008 interview period to 3.0% in the 2017-2019 interview period (Table 5 on pages 42-43).

5.3.2 Primary Analyses

Figures D1 to D4 in Appendix D graphically depict trends in unintended pregnancy over the study period by treatment status, and Table 7 summarizes the results of the DD analyses for each ACA provision. First, the unadjusted and adjusted DD estimates for pre-intervention periods (i.e., 2005-2007 for the dependent coverage provision and 2005-2007, 2007-2009, and 2010-2012 for the Marketplace subsidies and insurance expansions) are all statistically non-significant at the 5% significance level, indicating no evidence that the common trend assumption was violated in the observed pre-intervention periods (Table 7). Despite this lack of statistical significance, some of the confidence interval (CI) limits are quite close to 0 for the Marketplace subsidies and insurance expansions [e.g., the adjusted CI limits for the insurance expansion 2005-2007 estimate are (-0.8, 3.5)], suggesting caution should be exercised in interpretation of the DD estimates for these components. Figure D1 and Figure D4 further show roughly – though not perfectly – parallel trends for treated and untreated groups with regard to the dependent coverage provision when all income levels are included and the insurance expansions when all age groups are included. Figure D3, however, indicates that the pre-intervention trend observed in the treated and untreated groups (with respect to Marketplace subsidies) may have differed when all age groups were included. Thus, the associational estimates produced, particularly for the Marketplace subsidies, should be interpreted with caution as they likely do not reflect causal effects.

ATT estimates from the unadjusted and adjusted DD analyses indicate: 1) no evidence of an association between the dependent coverage provision and prevalence of unintended pregnancy among those aged 18-25 years, 2) no evidence of an association between the Marketplace subsidies and unintended pregnancy among those with a household income between 139% and 399% of the FPL, and 3) no evidence of an association between the ACA insurance expansions (i.e., Medicaid

expansion and Marketplace subsidies, jointly) and unintended pregnancy among those with a household income <400% of the FPL (Table 7).

Table 7. Unadjusted and adjusted ATT estimates associated with the impact of three specific ACA components on prevalence of unintended pregnancy

	Dependent Coverage Provision (n=9,249)		**Marketplace Subsidies (n=15,550)**		**Insurance Expansions (n=25,426)**	
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
2005-2007	-1.4 (-5.4, 2.6)	-1.3 (-5.3, 2.7)	0.5 (-1.8, 2.9)	0.5 (-1.8, 2.8)	1.3 (-0.8, 3.5)	1.3 (-0.8, 3.5)
2007-2009	0.0 (ref)	0.0 (ref)	0.3 (-1.7, 2.4)	-0.1 (-2.2, 1.9)	1.3 (-0.6, 3.3)	0.7 (-1.3, 2.6)
2010-2012	---	---	-1.4 (-3.9, 1.2)	-1.9 (-4.4, 0.7)	-0.3 (-2.7, 2.2)	-0.9 (-3.4, 1.5)
2012-2014	---	---	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
Pooled Post Period						
2010-2014	-2.8 (-6.0, 0.3)	-2.7 (-5.9, 0.4)	---	---	---	---
2014-2018	---	---	0.5 (-1.8, 2.8)	0.0 (-2.3, 2.3)	0.3 (-1.8, 2.3)	0.0 (-2.0, 2.0)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
2005-2007	-1.4 (-5.4, 2.6)	-1.3 (-5.2, 2.7)	0.5 (-1.8, 2.9)	0.6 (-1.7, 2.9)	1.3 (-0.8, 3.5)	1.3 (-0.8, 3.5)
2007-2009	0.0 (ref)	0.0 (ref)	0.3 (-1.7, 2.4)	-0.1 (-2.1, 1.9)	1.3 (-0.6, 3.3)	0.7 (-1.3, 2.6)
2010-2012	-1.9 (-5.4, 1.5)	-2.1 (-5.7, 1.5)	-1.4 (-3.9, 1.2)	-1.8 (-4.4, 0.7)	-0.3 (-2.7, 2.2)	-0.9 (-3.3, 1.6)
2012-2014	-3.3 (-7.0, 0.4)	-3.0 (-6.7, 0.7)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2014-2016	---	---	1.1 (-1.5, 3.6)	0.5 (-2.0, 3.1)	0.9 (-1.4, 3.3)	0.5 (-1.8, 2.8)
2016-2018	---	---	-0.1 (-2.8, 2.6)	-0.4 (-3.1, 2.3)	-0.4 (-2.8, 1.9)	-0.5 (-2.8, 1.9)

ATT = Average treatment effect on the treated; CI = Confidence interval

Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% significance level

* The unadjusted DD regression model includes period, treatment, and the interaction between period and treatment. The adjusted model also includes respondent's race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence. Additionally, the adjusted regression for the dependent coverage provision also includes income level as a percent of the FPL, and the adjusted regression for the Marketplace subsidies and insurance expansions includes age group.

5.3.3 Secondary & Subgroup Analyses

To conduct secondary analyses and evaluate the ATT among income and age subgroups: 1) Figures D1 to D4 in Appendix D depict trends in unintended pregnancy over the study period by treatment status within each income or age subgroup, and 2) Tables D2 and D3 summarize the results of the DD analyses for each subgroup and secondary analysis, respectively. Again, unadjusted and adjusted DD estimates for the pre-intervention periods were not statistically different from 0 at the 5% significance level, providing no evidence that the common trend assumption has been violation (Tables D2 and D3). Figures D1 to D4, however, suggest caution should be exercised in interpretation – particularly with regard to evaluating the impact of the dependent coverage provision among individuals with a household income ≥400% of the FPL (Figure D1) or among dependents who live with a parent (Figure D2), evaluating the impact of the Marketplace subsidies among individuals aged 18-25 or 35-44 years, and evaluating the impact of the insurance expansions among individuals aged 35-44 years. The pre-intervention estimates in Table D3 suggest that the results of secondary analyses should be interpreted with the same level of caution as those of the primary analyses.

Estimates from the unadjusted and adjusted DD analyses provide no evidence of an association between Marketplace subsidies or insurance expansions and unintended pregnancy among any age group considered (i.e., 18-25, 26-34, and 35-44) (Table D2). There was, however, evidence that the dependent coverage provision was associated with an 8.2 percentage point (ppt) (95% CI: 1.4, 15.0) decrease in the prevalence of unintended pregnancy in 2012-2014 among women aged 18-25 with a household income that was <100% of the FPL (Table D2). When further stratifying by both income level and parental presence in the household (Table D2), the results among those who were *not* living with a parent were similar to those of the overall subgroup

analysis, but additionally, there was some suggestion of an association among dependents reporting a household income of at least 400% of the FPL. The associational estimates among those who *were* living with a parent, however, were smaller in magnitude, and there was insufficient evidence of an association between the dependent coverage provision and unintended pregnancy among all income levels considered (Table D2). Secondary analyses indicated: 1) all results are robust to inclusion of race/ethnicity as one or two separate variables, and 2) dependent coverage provision results are robust to inclusion/exclusion of 26-year-old respondents (Table D3).

5.4 Discussion

Using a nationally representative sample from the NSFG and a DD approach, I found evidence that the ACA dependent coverage provision was associated with an 8 ppt reduction in the prevalence of unintended pregnancy among women aged 18-25 with a household income <100% of the FPL, which is roughly a 50% decrease from the pre-intervention prevalence among this group. I found no evidence, however, that the dependent coverage provision was associated with prevalence of unintended pregnancy among other income subgroups, or that the ACA Marketplace subsidies or insurance expansions were associated with prevalence of unintended pregnancy. Given that younger and lower income women generally have higher rates of unintended pregnancy [35,39], these findings suggests the dependent coverage provision of the ACA may have reduced unmet need for contraceptive products and services within a highly underserved group.

My findings regarding the ACA dependent coverage provision are consistent with those of Finer and Zolna (2016) who found that the unintended pregnancy rate declined between 2008 and 2011 among women aged 18-24 years and women with income <100% of the FPL [39], and the

work of Kavanaugh, Jerman, & Finer (2015) that found evidence of an increase in LARC use between 2009 and 2012 among women between the ages of 20-29 and among women with incomes <100% of the FPL[122]. These findings are also consistent with prior work by Heim, Lurie, & Simon (2018) which found evidence that fertility decreased among young adults following enactment of the provision [123]. This is the first study of which I am aware, however, to consider the impact of the dependent coverage provision on unintended pregnancy, specifically, and to consider its impact among sociodemographic subgroups. My previous study (not yet published, Chapter 4) estimated the association between the overall ACA and unintended pregnancy and found that the overall ACA was associated with a roughly 2 ppt decrease in prevalence of unintended pregnancy among women who were eligible to benefit from the ACA. My finding that the dependent coverage provision was associated with a large (roughly 8 ppt) reduction in the prevalence of unintended pregnancy among young women with incomes below the FPL likely explains, at least in part, the association observed between the overall ACA and unintended pregnancy in my previous study. Given that young women (<26 years of age) with a household income <100% of the FPL make up only a fraction of women aged 18-44 who were eligible to benefit from the overall ACA, it is unsurprising that the association with the overall ACA is smaller than that which was observed for the dependent coverage provision.

My null findings regarding the ACA Marketplace subsidies and insurance expansions are more difficult to contextualize within the previous literature. This is the first study of which I am aware to consider the impact of the Marketplace subsidies or insurance expansions on unintended pregnancy. Prior work has, however, considered the impact of the ACA Medicaid expansion, or Medicaid more generally, on contraception use, unintended pregnancy, and fertility. There is some evidence that the ACA Medicaid expansion was associated with a small increase in LARC use

[48], and a slight decrease in fertility among lower income women [124]. Further, there is evidence that an increase in the generosity of Medicaid eligibility is associated with a modest reduction in unintended pregnancy among new parents [50]. My findings regarding the insurance expansions (which include Medicaid expansion) are inconsistent with this literature. Further, I am not aware of any studies that investigate the impact of the Marketplace subsidies alone on contraception, fertility, or unintended pregnancy. While I hypothesized the Marketplace subsidies would be associated with a reduction in unintended pregnancy (through increases in health insurance coverage and contraception use/choice), it is possible that the Marketplace subsidies were unable to influence unintended pregnancy – which would be reflected both in my findings regarding Marketplace subsidies and insurance expansions. Given the complexity inherent in obtaining premium tax credits (e.g., based on expected earnings, you can choose to receive credits monthly to offset premium costs throughout the year, but will have to reconcile this difference when filing taxes), a shift toward high-deductible plans, and implementation issues like the "Family Glitch," the measures that were meant to make Marketplace plans affordable may not have adequately reduced the cost or effort burden associated with obtaining health insurance coverage, which may limit the potential of the Marketplace subsidies to impact health outcomes [31,125,126].

Alternatively, null results could also be explained by the analytic approach. This is an intention-to-treat (ITT) analysis. The treatment definition for Marketplace subsidies and insurance expansions was based on respondent's household income, using the eligibility criteria for Marketplace subsidies and Medicaid expansion as it was written in the ACA. This operationalization allowed me to evaluate the impact of the ACA among the group that was *targeted* by the ACA, but it does not differentiate between eligible individuals who *did* experience a change in their health insurance coverage from those who *did not.* For example, an individual

may be income-eligible for premium tax credits when purchasing insurance through the Marketplace but may choose not to purchase a plan through the Marketplace because they find it unaffordable even with the subsidy. As another example, an individual may have been made eligible for Medicaid *based on the ACA's writing* but live in a state that opted not to expand Medicaid, and therefore cannot enroll. These are just two of many scenarios in which an individual may be eligible to benefit from the ACA but may not receive benefits. Moreover, the Marketplace differs by state [127], and the generosity of the premium tax credit received varies across the range of eligible incomes [20,31]. My ITT analysis does not account for these sources of heterogeneity, considering all eligible individuals "treated." This likely dilutes any potential impact of the interventions, providing a conservative estimate for the targeted effects.

This study has a few important limitations. First, the estimates produced have low statistical precision, as indicated by the wide confidence intervals reported [e.g., the dependent coverage provision is associated with an 8.2 percentage point (95% CI: 1.4, 15.0) decrease in the prevalence of unintended pregnancy]. This makes it difficult to draw conclusions regarding the magnitude of the potential impact. Second, the estimates produced rely on the assumption that treated and untreated groups would experience the same trend in unintended pregnancy in the absence of the intervention (i.e., the dependent coverage provision, the Marketplace subsidies, or the insurance expansions). This assumption cannot be verified, and empirical evaluation of this assumption in the pre-intervention period suggested possible violation – particularly with regard to the ACA Marketplace subsidies and insurance expansions. I incorporated restriction (e.g., limiting dependent coverage provision analyses to 18–30-year-old respondents) and regression adjustment to reduce the potential for confounding, but residual confounding remains possible and could bias my results. Third, without information available on respondent's state of residence, I was unable

to investigate the impact of the Marketplace subsidies and Medicaid expansion separately. Fourth, measuring income among 18-25-year-old respondents is complicated by the fact that many young adults are still financially dependent on their parents and may be in the midst of educational or training pursuits that will eventually increase their earning potential – thus, it is difficult to know whether this measure is a good indicator of material resources. To add context to this measure, I conducted subgroup analyses by both income level and parental presence in the household.

Despite these limitations, this work also offers important contributions. This is the first study of which I am aware that estimates the impact of the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions on unintended pregnancy, overall and by age and income subgroups. These findings thus contribute to understanding both how the ACA influences health, and for whom. Further, this study utilized a nationally representative sample which increases external validity, and a DD approach which reduces the potential for confounding by incorporating a comparison ("untreated") group. Moreover, by incorporating multiple NSFG survey cycles in the post-intervention period, this approach provides information on the *timing* of the impact and allows the impact to change over the post-intervention period.

Future contributions can build upon this study in at least four ways. First, additional work is needed to determine whether the associational estimates produced reflect causal effects. Specifically, methods incorporating treatment intensity may reduce the possibility of confounding between treatment groups when used with datasets where state of residence is known [118]. Second, it is necessary to consider the impact of Medicaid expansion alone on unintended pregnancy. This may be particularly important for young women who are lower income themselves and do not have the option of parental insurance, since this group may have limited health insurance options and generally experiences higher rates of unintended pregnancy. Third,

additional data is needed to understand the interaction between parental and dependent socioeconomic status with respect to the impact of the dependent coverage provision, along with its implications for health equity. This need is reflected in both prior work that finds variation in parental insurance coverage (and subsequently, potential for dependents to benefit from the provision) by sociodemographic characteristics like income level [128], as well as in the findings from my subgroup analyses that found the magnitude of the observed association between the dependent coverage provision and unintended pregnancy differed by both income level and parental presence in the household. Fourth, to better understand the success or failure of specific policy levers pulled by the ACA, qualitative research is needed to understand individual experiences with each of the components evaluated.

5.5 Conclusion

Three specific mechanisms, or policy levers, employed by the ACA were evaluated regarding their potential impact on the prevalence of unintended pregnancy: the ACA dependent coverage provision, the ACA Marketplace subsidies, and the ACA insurance expansions. There was evidence that the ACA dependent coverage provision was associated with a large reduction in the prevalence of unintended pregnancy among younger and lower income women (i.e., women aged 18-25 who had a household income <100% of the FPL). There was no evidence, however, that the ACA Marketplace subsidies or insurance expansions were associated with prevalence of unintended pregnancy (overall or among age subgroups). This work provides important information regarding the mechanism of the ACA, and how it has succeeded (or failed) to influence women's reproductive health. More work is needed to understand the impact of additional ACA components, such as Medicaid expansion, and whether the ACA or its components have improved health equity in women's reproductive health.

CHAPTER 6: THE AFFORDABLE CARE ACT AND RACIAL/ETHNIC DISPARITIES IN UNINTENDED PREGNANCY (MANUSCRIPT 3)

6.1 Introduction

Nearly half of all pregnancies in the United States (US) are unintended (i.e., occur sooner than desired or when unwanted), with roughly 5% of women experiencing an unintended pregnancy each year [33,35]. This suggests the US has an unmet need for contraceptive products and services [7,33]. Further, unintended pregnancies disproportionately affect younger women, women of lower socioeconomic status, and women of color [35,39] – suggesting that policies and programs have done a particularly poor job meeting the needs of women who embody these identities.

The Patient Protection and Affordable Care Act (ACA), signed into law in March of 2010, was designed to help address such unmet public health needs. Regarding contraception specifically, the ACA had the potential to increase access to and affordability of contraceptives through its preventive care mandate, the opening and subsidization of the health insurance exchanges [i.e., the Marketplaces], Medicaid expansion, and the dependent coverage provision [20–22]. Jointly, these provisions of the ACA increased opportunities for affordable health insurance coverage and increased the generosity of available health insurance plans. Additionally, three major provisions of the ACA specifically targeted younger people and people with lower income as its beneficiaries. The dependent coverage provision targeted individuals under the age of 26, while subsidies for the Marketplace targeted individuals with an income between 100% and 399% of the federal poverty level (FPL), and Medicaid expansion targeted adults with an income ≤138% of the FPL [20,21]. Thus, the benefits of the ACA should have been felt most acutely among these targeted (i.e., eligible) groups.

There is evidence that the ACA increased access to and affordability of contraceptives [42–47], and some evidence that the overall ACA – and the dependent coverage provision, specifically – may have reduced the prevalence of unintended pregnancy, particularly among younger and lower income women (not yet published, see Chapters 4 and 5). It is unclear, however, whether these effects were distributed equitably across race/ethnicity. Given the sociopolitical and historical context of the US, and the age- and income-based eligibility criteria used in the ACA, there is reason to hypothesize that these effects would differ by race/ethnicity, but little work has been done to evaluate this hypothesis (Appendix A). As such, it is unclear how the ACA might have impacted racial health equity regarding unintended pregnancy.

Thus, the objective of this study was to evaluate whether the impact of the ACA on unintended pregnancy differed by race/ethnicity, and if so, whether these differences promoted health equity by reducing racial/ethnic disparities in unintended pregnancy. I entered this analysis in equipoise, hypothesizing that either of the following may be true: 1) the ACA reduced, but did not eliminate, racial/ethnic disparities in unintended pregnancy through its income-based eligibility criteria, or 2) the ACA was unable to reduce racial/ethnic disparities in unintended pregnancy due to its interaction with existing structural, institutional, and political forces in the US. A more detailed discussion of these hypotheses has been provided in the Introduction of Appendix A.

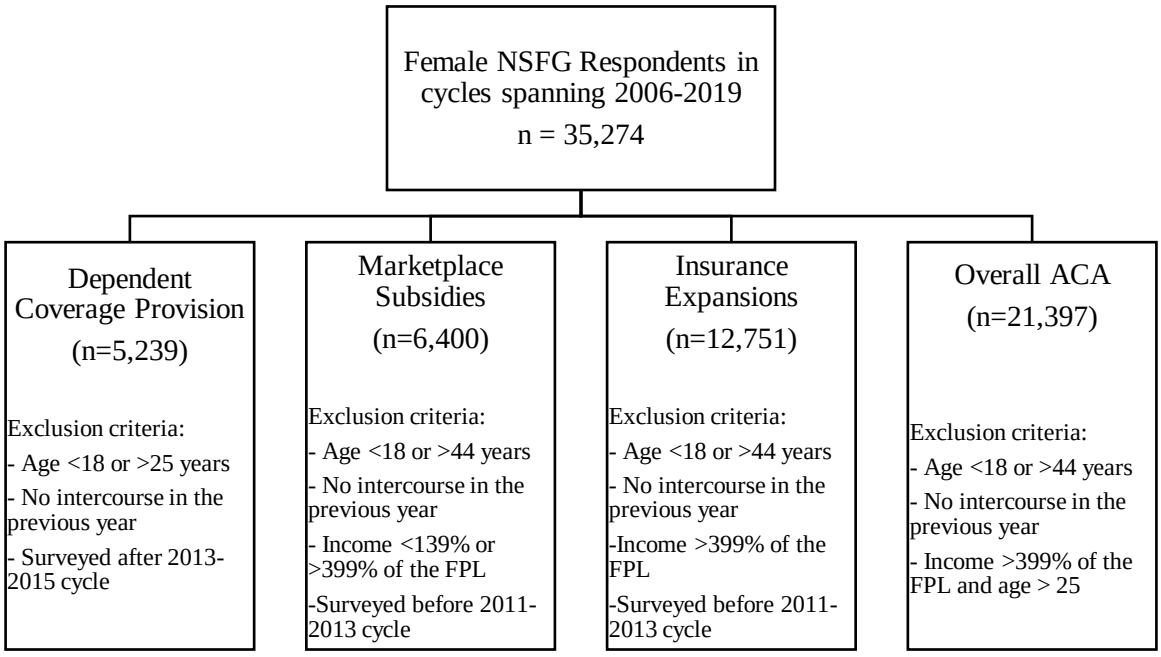
6.2 Methods

6.2.1 Design, Data, & Study Population

To target US adult women of reproductive age (18-44), I used a repeated cross-sectional design and data from multiple cycles of the National Survey of Family Growth (NSFG). The NSFG is a cross-sectional survey of non-institutionalized civilian men and women aged 15-44 in the US,

conducted by the National Center for Health Statistics (NCHS), and the survey sample is selected using a multistage probabilistic sampling methodology. NSFG respondents are asked about marriage, divorce, family life, fertility, and family planning. For these analyses, I used NSFG data from the following survey cycles: 2006-2010, 2011-2013, 2013-2015, 2015-2017, and 2017-2019. From these data, I included sexually active female respondents aged 18-44. Further, I conducted analyses to investigate the impact of the overall ACA and three of its specific components (i.e., the dependent coverage provision, the Marketplace subsidies, and insurance expansions) by race/ethnicity. These three components are explained in greater detail in Section 6.2.2, and the additional inclusion/exclusion criteria that were used for component-specific analyses are detailed in Appendix E and Figure 7.

Figure 7. Unweighted analytic sample of U.S. females (aged 18-44 years) used in Manuscript 3



6.2.2 Measurement of Treatment

To investigate the impact of the ACA, I considered both the overall ACA and three of its specific components. In total, I considered four interventions of the ACA: the dependent coverage provision, the Marketplace subsidies, the 2014 insurance expansions (i.e., the subsidized Marketplace and Medicaid expansion), and the overall ACA. Respondents were considered "treated" by a particular intervention of the ACA if they were its targeted beneficiaries based on the eligibility criteria used in the writing of the ACA, and they were interviewed after enactment of the intervention.

6.2.2.1 Dependent Coverage Provision

The ACA dependent coverage provision went into effect in September of 2010 and required that health insurance plans cover insured's dependents up to the age of 26. Therefore, I considered a respondent to be eligible for the dependent coverage provision if they were under the age of 26 and interviewed in the 2011-2013 NSFG survey cycle or later.

6.2.2.2 Marketplace Subsidies

The ACA Marketplaces opened in late 2013 with plans beginning in 2014, and subsidies were available to those with a household income between 100% and 399% of the FPL. Those with an income between 100% and 138% of the FPL, however, were also eligible for Medicaid through the ACA expansion, and therefore likely ineligible for a premium tax credit for the Marketplace [31]. For this reason, I considered a respondent eligible to benefit from the Marketplace subsidies if they were interviewed in or after the 2015-2017 cycle of the NSFG and had a household income that was 139-399% of the FPL.

6.2.2.3 The ACA Insurance Expansions

In 2014, two major insurance expansions occurred under the ACA. First, as already discussed, the Marketplaces opened. Second, Medicaid eligibility was expanded to all adults with an income ≤138% of the FPL. It would be ideal to evaluate the impact of these two expansions separately, but given that state of residence is unavailable in the publicly available NSFG data (so I cannot identify respondents in states that expanded and those that did not), and that both expansions occurred at the same (leaving us without a suitable control group in the post-Medicaid-expansion period), I cannot evaluate the impact of the ACA Medicaid expansion on its own. I can, however, consider the impact of the two expansions together. Thus, a respondent was considered eligible for the ACA insurance expansions (i.e., Marketplace subsidies or Medicaid expansion) if they had a household income that was <400% of the FPL and they were interviewed in or after the 2015-2017 cycle of the NSFG.

6.2.2.4 Overall ACA

To consider the joint impact of the dependent coverage provision, Marketplace subsidies, and Medicaid expansion, I also evaluated the impact of the overall ACA. A respondent was considered eligible for the overall ACA if they were eligible to benefit from at least one listed component of the ACA. That is, a respondent was eligible for the overall ACA if they were interviewed after the ACA began rolling out (i.e., interviewed in or after the 2011-2013 NSFG survey cycle) and they: 1) were under the age of 26, or 2) had a household income <400% of the FPL.

6.2.3 Measurement of Outcome

I used a binary outcome measure to indicate whether a respondent reported at least one unintended pregnancy in the prior calendar year. The NSFG collects information regarding each

respondent's pregnancy history, and as part of this information, they capture wantedness and timing indicators. If a pregnancy occurred earlier than it was desired, or when a(nother) pregnancy was unwanted, the pregnancy was considered "unintended." Otherwise, the pregnancy was considered "intended." This is consistent with the standard definition used for unintended pregnancy [33].

6.2.4 Measurement of Race/Ethnicity

In this work, race/ethnicity is conceptualized as a proxy for exposure to structural racism, which is hypothesized to be an effect-modifier for the relationship between the ACA and unintended pregnancy. Race/ethnicity is measured primarily through self-report. The publicly available NSFG data includes four racial/ethnic categories (Hispanic, NH Black, NH other, NH White). I pursued greater inclusivity by accessing restricted-use race and ethnicity variables at an NCHS Research Data Center (RDC), and this effort is reflected in the reporting of sample characteristics. Unfortunately, however, sample sizes for three groups (i.e., NH American Indian/Alaska Native, NH Asian, NH Native Hawaiian or other Pacific Islander) were too small to obtain prevalence estimates for unintended pregnancy due to disclosure rules. As such, these groups could not be considered in our statistical analyses beyond describing sample characteristics. The four racial/ethnic categories represented in my primary and secondary analyses are those available in the public NSFG data (Hispanic, NH Black, NH other, NH White).

6.2.5 Measurement of Covariates

I also included several covariates: education level (less than high school, high school diploma or GED, some college or associate degree, Bachelor's degree, graduate or professional degree), marital status (married, not married), parity (nulliparous, primiparous, multiparous), nativity (born in the US, born outside of the US, unknown), and metropolitan residence (yes, no).

These sociodemographic variables are associated with both ACA eligibility criteria (i.e., age and income) and unintended pregnancy, and therefore are potential confounders.

6.2.6 Statistical Analysis

I summarized sample characteristics using frequencies (percentages), overall and by NSFG survey cycle. Then, to describe racial/ethnic disparities in the prevalence of unintended pregnancy across the study period, I calculated the prevalence of unintended pregnancy by race/ethnicity as well as the unadjusted prevalence difference (PD) and prevalence ratio (PR) between each racial/ethnic group and the reference group, which provides a measure of the absolute and relative disparities, respectively. I used NH White women as the reference group because this group had the lowest prevalence of unintended pregnancy across the study period. I calculated prevalence, PD between racial/ethnic groups, and PR between racial/ethnic groups for three time periods: 2005-2009 (pre-ACA), 2010-2014 (ACA implementation period), and 2014-2018 (post-ACA). I chose to aggregate the six available NSFG cycles into three periods for these analyses because the unweighted sample sizes for race/ethnicity-and-cycle-specific estimates were quite small (Appendix E Table E1). By aggregating the six cycles into three periods, I was able to increase period-specific sample sizes, and subsequently, statistical precision.

To estimate the association between the ACA or its specific components and racial/ethnic disparities in unintended pregnancy, I used a pre/post analysis to compare the prevalence of unintended pregnancy before and after the intervention (i.e., the ACA or its specific component) among those who were eligible to benefit. Although a difference-in-differences (DD) approach would have been preferred for estimating the association between the ACA and racial/ethnic disparities in unintended pregnancy, it could not be utilized. Even with aggregating the six NSFG survey cycles into three periods, unweighted sample sizes by race/ethnicity and period were still

quite small, particularly among "ineligible" groups (Appendix E Table E1). Further, the common trend assumption that is necessary for the DD approach either appeared violated or could not be empirically evaluated for violation when NSFG cycles were aggregated into three periods (Appendix E Figures E1-E4). As a result, I conducted a pre/post analysis within the group that was eligible for each of the evaluated ACA components. To do this, I used four separate linear probability regression models and these models are specified in Appendix E. This approach allowed me to calculate the PD between racial/ethnic groups for each period (i.e., a measure of the absolute racial/ethnic disparity in each period), the PD between pre-intervention and post-intervention periods for each racial/ethnic group (i.e., a measure of the association between the ACA or one of its components and unintended pregnancy for each racial/ethnic group), and the difference in PD (PDD) between racial/ethnic groups (i.e., the difference in absolute racial/ethnic disparities over time, or the difference in the magnitude of the association between racial/ethnic groups – both are mathematically equivalent). Thus, the PDD provides an estimate for the association between the ACA or its components and racial/ethnic disparities in unintended pregnancy. I report estimates for the PD between pre-intervention and post-intervention periods for each racial/ethnic group (i.e., race- or ethnic-specific estimates for the association between the intervention and unintended pregnancy), and the PDD between racial/ethnic groups. Both unadjusted and adjusted models were considered. Adjusted models include the following respondent covariates: age (analyses regarding the Marketplace subsidies or insurance expansions only), income (analyses regarding the dependent coverage provision only), education level, marital status, parity, and metropolitan residence.

Multiple secondary analyses were also performed. First, I included race and ethnicity as separate variables rather than as one combined variable for all analyses. Second, for analyses

evaluating the overall ACA, I considered an alternative treatment definition that utilized education level rather than income level. In this definition, I considered respondents who were under the age of 26 or had attained at most an associate degree to be "treated." Third, analyses evaluating the Marketplace subsidies or the insurance expansions were limited to respondents aged 26 and older to reduce the possibility of confounding by the dependent coverage provision.

SAS 9.4 was used to perform generate the reported graphics, and StataMP 16 was used for all descriptive and regression-based analyses. For all analyses, NSFG sampling weights were used. To incorporate weights and apply inclusion criteria, the svy command and subpop option were used in StataMP 16.

6.2.7 IRB Review

This study was reviewed and approved by the Michigan State University Institutional Review Board (STUDY0005077) (Appendix B).

6.2.8 Disclaimer

The findings and conclusions in this paper are those of the author and do not necessarily represent the views of the Research Data Center, the National Center for Health Statistics, or the Centers for Disease Control and Prevention.

6.3 Results

6.3.1 Sample Characteristics

A summary of sample characteristics is provided in Table 8. It is worth noting that this differs from Table 5 (Chapters 4 and 5) through its more inclusive racial/ethnic categories. Most respondents in the sample identified as non-Hispanic (NH) White (58.0%), had completed up to an associate degree (69.9%), were parous (65.2%), and lived in a metropolitan area (83.1%) (Table 8). Overall, 4.0% of respondents reported at least one an unintended pregnancy in the prior

calendar year (Table 8), decreasing from a prevalence of 4.8% in 2006-2008 to a prevalence of 3.0% in 2017-2019 (Table 8).

6.3.2 Unintended Pregnancy by Race/Ethnicity, Over the Study Period

Among the four groups for which I could calculate and report a prevalence for unintended pregnancy, the prevalence generally decreased across the study period with the lowest prevalence observed among NH White respondents, followed by NH other or multiracial respondents, Hispanic respondents, and NH Black respondents (Table 9). Absolute and relative disparities in unintended pregnancy reflected this pattern with both the PD and PR generally decreasing over the study period (Figure 8).

Table 8. Sample characteristics, overall and by interview period – unweighted frequencies and weighted percentages, Manuscript 3

	Overall n (%)	2006-2008 n (%)	2008-2010 n (%)	2011-2013 n (%)	2013-2015 n (%)	2015-2017 n (%)	2017-2019 n (%)
Sample Size	n=25,426	n=4,417	n=4,835	n=4,254	n=4,298	n=3,646	n=3,976
Socio-demographics at time of interview							
Age group							
18-25 years	7,265 (26.3)	1,314 (26.8)	1,441 (27.3)	1,266 (26.5)	1,218 (26.6)	1,000 (26.4)	1,026 (24.4)
26-34 years	9,906 (35.7)	1,654 (32.5)	1,889 (35.0)	1,650 (36.2)	1,655 (36.1)	1,451 (36.7)	1,607 (37.3)
35-44 years	8,255 (38.0)	1,449 (40.6)	1,505 (37.6)	1,338 (37.2)	1,425 (37.3)	1,195 (36.9)	1,343 (38.3)
Race/ethnicity							
Hispanic	6064 (19.3)	896 (16.8)	1160 (17.4)	1099 (19.7)	1011 (20.3)	803 (20.8)	1095 (20.6)
NH American Indian/Alaska Native	254 (1.2)	59 (1.8)	65 (1.7)	66 (2.2)	33 (0.7)	17 (0.4)	14 (0.5)
NH Asian	962 (4.3)	165 (4.5)	143 (3.2)	138 (3.4)	223 (5.9)	145 (4.7)	148 (4.2)
NH Black or African American	5193 (13.5)	880 (13.6)	979 (13.6)	883 (13.5)	848 (13.1)	835 (13.9)	768 (13.5)
Native Hawaiian or other Pacific Islander[1]	---	---	---	---	---	---	---
NH other or multiple races	952 (3.7)	121 (2.5)	142 (2.6)	125 (2.9)	187 (3.9)	181 (4.8)	196 (5.4)
NH White	12001 (58.0)	2296 (60.8)	2346 (61.5)	1943 (58.3)	1996 (56.0)	1665 (55.4)	1755 (55.7)
Household income as a percent of the FPL							
<100% FPL	7,296 (22.9)	1,091 (20.4)	1,349 (21.5)	1,424 (26.9)	1,413 (26.2)	1,025 (21.8)	994 (20.6)
100-138% FPL	2,580 (9.5)	501 (11.2)	584 (10.2)	379 (8.0)	361 (7.5)	340 (9.9)	415 (10.2)
139-399% FPL	10,526 (43.3)	1,894 (44.6)	2,232 (52.5)	1,710 (42.3)	1,624 (39.7)	1,441 (40.2)	1,625 (40.7)
≥400% FPL	5,024 (24.3)	931 (23.8)	670 (15.8)	741 (22.8)	900 (26.5)	840 (28.2)	942 (28.5)
Highest Education Level Attained							
Less than high school	3,916 (12.5)	797 (15.5)	1,043 (17.7)	606 (11.3)	581 (10.8)	455 (10.5)	434 (9.0)
High school diploma or GED	7,044 (25.4)	1,255 (26.6)	1,252 (25.8)	1,225 (26.9)	1,181 (24.6)	997 (23.8)	1,134 (24.8)
Some college or associate degree	7,998 (32.0)	1,316 (28.9)	1,434 (30.7)	1,424 (33)	1,414 (32.5)	1,131 (33.4)	1,279 (33.2)
Bachelor's degree	4,398 (20.4)	771 (21.5)	790 (18.2)	662 (18.6)	707 (20.0)	709 (21.9)	759 (22.3)
Master's, doctoral, or professional degree	2,070 (9.7)	278 (7.5)	316 (7.6)	337 (10.1)	415 (12.1)	354 (10.4)	370 (10.6)

Table 8. (cont'd)

Marital Status							
Married	10,287 (49.2)	1,975 (55.1)	1,931 (49.7)	1,690 (48.6)	1,680 (48.3)	1,475 (47.7)	1,536 (46.0)
Not married	15,139 (50.8)	2,442 (44.9)	2,904 (50.3)	2,564 (51.4)	2,618 (51.7)	2,171 (52.3)	2,440 (54.0)
Parity							
Nulliparous	8,691 (34.8)	1,474 (32.2)	1,675 (34.5)	1,364 (33.2)	1,453 (34.9)	1,242 (35.8)	1,483 (38.4)
Primiparous	5,414 (19.4)	960 (19.3)	982 (18.5)	950 (20.0)	939 (20.3)	791 (19.1)	792 (19.3)
Multiparous	11,321 (45.7)	1,983 (48.5)	2,178 (47.0)	1,940 (46.8)	1,906 (44.7)	1,613 (45.1)	1,701 (42.3)
Nativity							
Born in the US	21,010 (83.8)	3,636 (83.2)	3,955 (85.1)	3,575 (85.2)	3,482 (81.7)	3,049 (82.9)	3,313 (84.8)
Born outside of the US	4,407 (16.1)	778 (16.6)	880 (14.9)	678 (14.7)	815 (18.3)	596 (17.1)	660 (15.1)
Unknown	9 (0.0)	3 (0.2)	0 (0.0)	1 (0.0)	1 (0.0)	1 (0.0)	3 (0.1)
Metropolitan Residence							
Metropolitan	21,486 (83.1)	3,516 (77.5)	4,323 (82.4)	3,650 (85.1)	3,563 (85.4)	3,104 (83.8)	3,330 (84.5)
Non-metropolitan	3,940 (16.9)	901 (22.5)	512 (17.6)	604 (14.9)	735 (14.6)	542 (16.2)	646 (15.5)
Eligibility for the ACA[2]							
Eligible	21,397 (80.0)	3,690 (80.8)	4,300 (87.2)	3,658 (80.8)	3,579 (78.4)	2,970 (76.9)	3,200 (76.0)
DC Provision	995 (4.3)	204 (4.6)	135 (3.0)	145 (3.6)	181 (5.0)	164 (5.1)	166 (4.5)
Marketplace	7,643 (32.1)	1,358 (33.7)	1,631 (39.4)	1,212 (30.9)	1,184 (29.2)	1,047 (29.2)	1,211 (30.4)
Medicaid Expansion	4,736 (15.0)	690 (12.7)	848 (13.7)	916 (17.7)	924 (17.4)	680 (14.0)	678 (14.2)
DC Provision & Marketplace	2,883 (11.2)	536 (10.8)	601 (13.1)	498 (11.4)	440 (10.6)	394 (11.0)	414 (10.3)
DC Provision & Medicaid Expansion	2,560 (7.9)	401 (7.6)	501 (7.8)	508 (9.1)	489 (8.9)	345 (7.8)	316 (6.4)
Marketplace & Medicaid Expansion	1,753 (6.6)	328 (7.5)	380 (6.8)	264 (5.7)	253 (5.3)	243 (7.3)	285 (7.0)
DC Provision, Marketplace, & Medicaid Expansion	827 (2.9)	173 (3.8)	204 (3.4)	115 (2.3)	108 (2.2)	97 (2.5)	130 (3.2)
Ineligible	4,029 (20.0)	727 (19.2)	535 (12.8)	596 (19.2)	719 (21.6)	676 (23.1)	776 (24)
Outcome in the prior calendar year							
Unintended pregnancy	1,370 (4.0)	273 (4.8)	284 (4.2)	230 (3.9)	218 (4.0)	194 (3.8)	171 (3.0)

ACA = Affordable Care Act; NH = non-Hispanic; FPL = Federal poverty level; DC = Dependent coverage

[1] This group was too small to disaggregate. As a result, it is included in "NH other or multiple races"

[2] Based on age and income level; DC provision (age < 26 years), Marketplace subsidies (income 100-399% of the FPL), Medicaid expansion (income ≤138% of the FPL)

Table 9. Unadjusted prevalence of unintended pregnancy among groups that were eligible to benefit from the overall ACA or one of its specific components, stratified by race/ethnicity and period

Eligible for at least one major component of the ACA based on age and income (unweighted n=21,397)			
	2005-2009	2010-2014	2014-2018
	% (SE)[1]	*% (SE)*[1]	*% (SE)*[1]
Race/ethnicity			
Hispanic	7.6 (0.8)	5.5 (0.7)	4.5 (0.7)
NH American Indian/Alaska Native[2]	---	---	---
NH Asian[2]	---	---	---
NH Black	10.2 (0.9)	7.3 (0.9)	5.7 (1.0)
NH Native Hawaiian or Other Pacific Islander[2]	---	---	---
NH other or multiple races	5.0 (1.1)	4.0 (0.9)	4.1 (1.1)
NH White	3.3 (0.3)	3.1 (0.3)	3.4 (0.4)
Eligible for the dependent coverage provision based on age (unweighted n=5,239)			
	2005-2009	2010-2014	2014-2018
	% (SE)[1]	*% (SE)*[1]	*% (SE)*[1]
Race/ethnicity			
Hispanic	13.4 (1.9)	8.9 (1.9)	---
NH American Indian/Alaska Native[2]	---	---	---
NH Asian[2]	---	---	---
NH Black	17.9 (1.9)	12.4 (1.9)	---
NH Native Hawaiian or Other Pacific Islander[2]	---	---	---
NH other or multiple races	10.0 (2.7)	7.5 (2.5)	---
NH White	6.4 (0.8)	5.2 (0.8)	---
Eligible for Marketplace subsidies based on income (unweighted n=6,400)			
	2005-2009	2010-2014	2014-2018
	% (SE)[1]	*% (SE)*[1]	*% (SE)*[1]
Race/ethnicity			
Hispanic	---	3.6 (0.8)	4.3 (0.9)
NH American Indian/Alaska Native[2]	---	---	---
NH Asian[2]	---	---	---
NH Black	---	6.0 (1.3)	4.8 (1.7)
NH Native Hawaiian or Other Pacific Islander[2]	---	---	---

Table 9. (cont'd)

NH other or multiple races	---	3.3 (1.4)	3.3 (1.4)
NH White	---	2.3 (0.4)	3.3 (0.6)

Eligible for insurance expansions based on income (unweighted n=12,751)

	2005-2009	2010-2014	2014-2018
	% (SE)[1]	*% (SE)*[1]	*% (SE)*[1]
Race/ethnicity			
Hispanic	---	5.5 (0.7)	4.3 (0.7)
NH American Indian/Alaska Native[2]	---	---	---
NH Asian[2]	---	---	---
NH Black	---	7.3 (0.9)	5.9 (1.0)
NH Native Hawaiian or Other Pacific Islander[2]	---	---	---
NH other or multiple races	---	4.0 (0.9)	4.3 (1.2)
NH White	---	3.1 (0.3)	3.7 (0.5)

ACA = Affordable Care Act; NH = Non-Hispanic; PD = Prevalence difference; SE = Standard error; PR = Prevalence ratio; 95% CI = 95% confidence interval

[1] Unweighted frequencies (n) and weighted percentages (SEs) are provided. These percentages reflect the percent of female respondents within each race/ethnicity category that reported an unintended pregnancy in the prior calendar year.

[2] These groups were too small to include as their own separate category. As a result, they have been included within the "NH other or multiple races" category.

Figure 8. Unadjusted prevalence difference (PD) and prevalence ratio (PR) measures for unintended pregnancy across the study period, among those eligible to benefit from the ACA

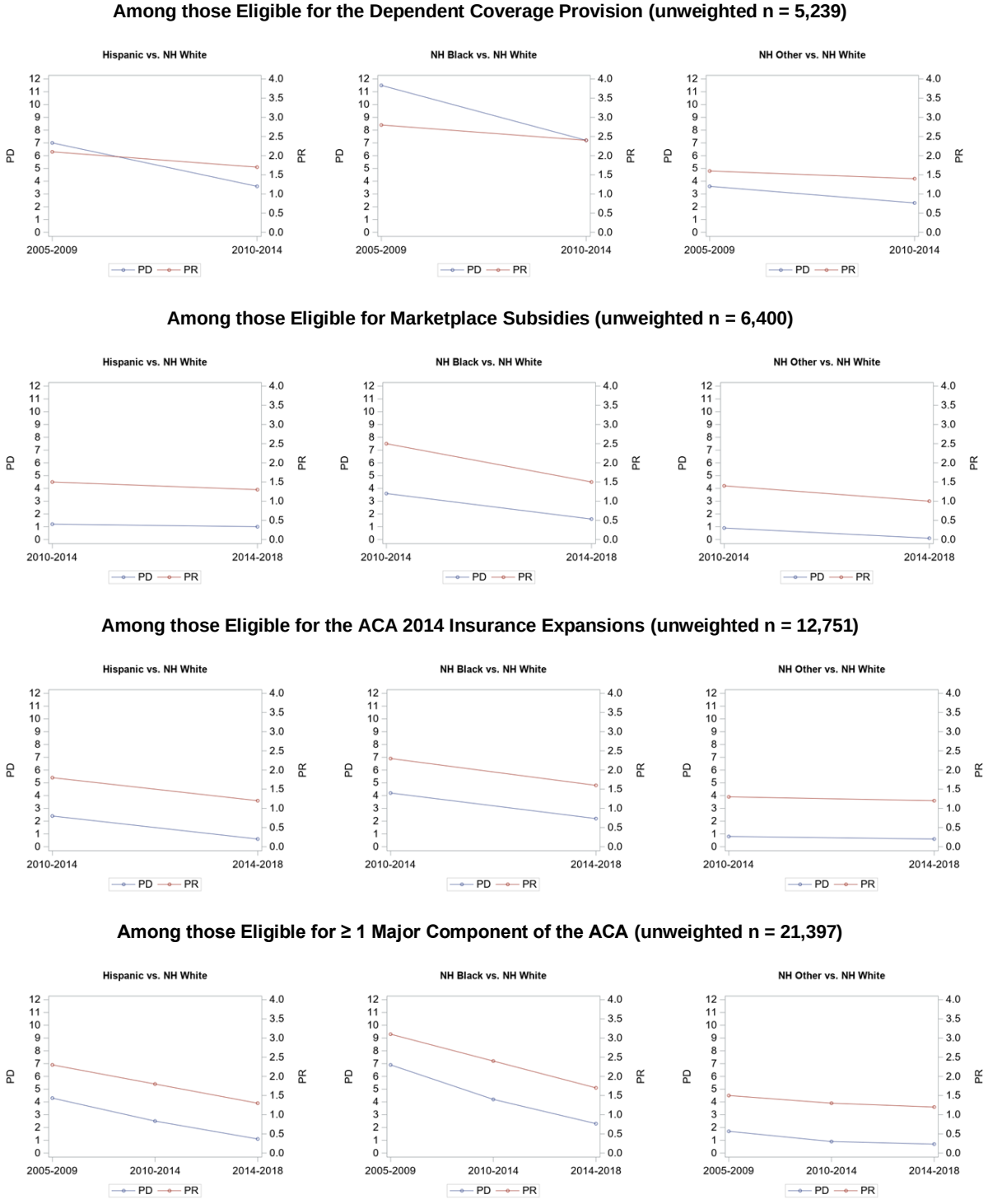


Figure 8. (cont'd)

[3] Prevalence difference (PD) is used to measure the absolute disparity and prevalence ratio (PR) is used to measure the relative disparity. The PD is reported in percentage points and is calculated as the prevalence of unintended pregnancy in one group minus the prevalence of unintended pregnancy in the reference group. The PR is calculated as the prevalence of unintended pregnancy in one group divided by the prevalence of unintended pregnancy in the reference group. The NH White group was selected as the reference group because the lowest prevalence of unintended pregnancy was observed in this group.

6.3.3 The ACA & Unintended Pregnancy, by Race/Ethnicity

Race- and ethnic-specific estimates for the association between the ACA (or one of its specific components) and unintended pregnancy are provided in Table 10, Part A. That is, the top half of Table 10 (Part A) provides the PD estimates comparing prevalence in the pre and post periods within each racial/ethnic group. There was evidence that the unadjusted prevalence of unintended pregnancy decreased following enactment of the dependent coverage provision among eligible NH Black women [PD = -5.5 percentage point (ppt), (95% CI: -10.8, -0.2)] – though the adjusted estimate did not remain statistically significant at the 5% significance level (Table 10, Part A). Among all other included racial/ethnic groups, there was no evidence of an association between the dependent coverage provision and prevalence of unintended pregnancy. Similarly, among all the included racial/ethnic groups, there was no evidence that the ACA Marketplace subsidies or the ACA insurance expansions were associated with prevalence of unintended pregnancy (Table 10, Part A).

There was, however, evidence that the overall ACA was associated with prevalence of unintended pregnancy among Hispanic and NH Black women. There was evidence that the prevalence of unintended pregnancy decreased during the roll-out of the ACA (2010-2014) and following full implementation of the ACA (2014-2018) among Hispanic and NH Black women who were eligible to benefit from at least one major component of ACA (Table 10, Part A). No such evidence was observed among eligible NH other/multiracial or NH White women. Among Hispanic women, it was estimated that the adjusted prevalence of unintended pregnancy decreased by 2.2 ppt (95% CI: -4.4, 0.0) between 2005-2009 and 2010-2014 and by 3.0 ppt (95% CI: -5.1, -0.8) between 2005-2009 and 2014-2018 (Table 10, Part A). Unadjusted estimates were similar, though the unadjusted estimate for 2010-2014 did not reach statistical significance. Among NH

Black women, it was estimated that the adjusted prevalence of unintended pregnancy decreased by 2.5 ppt (95% CI: -4.8, -0.2) between 2005-2009 and 2010-2014 and by 4.1 ppt (95% CI: -6.6, -1.6) between 2005-2009 and 2014-2018 (Table 10, Part A). Unadjusted estimates were similar.

6.3.4 The ACA & Racial/Ethnic Disparities in Unintended Pregnancy

The estimated associations between the ACA (or one of its specific components) and racial/ethnic disparities in unintended pregnancy are provided in Table 10, Part B. That is, the PDD estimates are provided in the bottom half of Table 10. Please note that these estimates correspond both to the difference in the magnitude of the association between the ACA (or its component) and unintended pregnancy between two racial/ethnic groups, and the association between the ACA (or its component) and the absolute disparity in unintended pregnancy between two racial/ethnic groups. They are mathematically equivalent.

There was no evidence that the magnitude of the association between the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions and prevalence of unintended pregnancy differed between eligible Hispanic, NH Black, or NH other/multiracial and eligible NH White women (Table 10, Part B). As such, there was no evidence that the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions were associated with racial/ethnic disparities in unintended pregnancy for the included racial/ethnic groups when NH White women were used as the reference group.

There was, however, evidence that the magnitude of the association between the overall ACA and prevalence of unintended pregnancy in the period following the ACA's full enactment (2014-2018) was larger among eligible Hispanic or NH Black women when compared to that of eligible NH White women. That is, the prevalence of unintended pregnancy decreased more between 2005-2009 and 2014-2018 among eligible Hispanic women and eligible NH black women

than it did among eligible NH White women [adjusted PDD = -2.9 ppt (95% CI: -5.2, -0.6) among Hispanic women, adjusted PDD = -4.1 ppt (95% CI: -6.7, -1.4) among NH Black women] (Table 10, Part B). Unadjusted estimates were similar, but slightly smaller in magnitude. Regarding the period in which the ACA was being implemented (2010-2014), there was not sufficient evidence that the magnitude of associations differed between eligible Hispanic and NH White women, but there was some evidence that the association differed between eligible NH Black and NH White women during this period [unadjusted PDD = -2.7 ppt, (95% CI: -5.2, -0.2)] (Table 10, Part B). Therefore, there is some evidence that the overall ACA was associated with a reduction in the NH Black – NH White disparity in prevalence of unintended pregnancy in 2010-2014, and a reduction in both the Hispanic – NH White and NH Black – NH White disparities in prevalence of unintended pregnancy in 2014-2018.

In summary, there was no evidence that the dependent coverage provision, Marketplace subsidies, or the 2014 insurance expansions were associated with racial/ethnic disparities in unintended pregnancy among the included racial/ethnic groups when NH White women were used as the referent group. There was, however, some evidence that the overall ACA was associated with reductions in the disparity in unintended pregnancy between Hispanic and NH White women, and between NH Black and NH White women. Among those who were eligible to benefit from at least one major component of the ACA, it was estimated that the overall ACA was associated with a 2.9 pp reduction in the Hispanic-NH White disparity in unintended pregnancy, and a 4.1 pp reduction in the NH Black-NH White disparity in unintended pregnancy, in the four years following the ACA's full implementation (2014-2018).

The findings from secondary analyses were largely consistent with those of my primary analyses (Appendix E, Tables E2-E4), with two notable exceptions: 1) when considering race and

ethnicity as two separate variables, the magnitude of the observed associations among the "other" racial group often changed substantially from that of the "NH other/multiracial" group estimated in the primary analysis, though statistical significance and conclusions remained consistent (Appendix E, Table E2), and 2) when excluding respondents under the age of 27, the observed trends in unintended pregnancy among those who were income-eligible for the Marketplace subsidies or insurance expansions differed from those observed in the primary analyses (Appendix E, Table E4). More specifically, when excluding those under the age of 27, there is some evidence that the disparity in unintended pregnancy between NH Black and NH White women decreased among those who were income-eligible for Marketplace subsidies [adjusted PDD = -2.9 ppt, (95% CI: -5.7, 0.0)], though this is accompanied by no evidence of a change in prevalence among NH Black women and evidence of an increase in prevalence among NH White women. Among those who were income-eligible for the insurance expansions, exclusion of those under the age of 27 increased the magnitude of the association observed among NH other/multiracial women [adjusted PD = -0.6 ppt, (95% CI: -2.4, 1.3)] and reduced the magnitude of the association among NH Black women [adjusted PD = -0.9 ppt, (95% CI: -2.8, 1.1)], though conclusions drawn remained consistent.

Table 10. The unadjusted and adjusted association between the ACA or its specific components and unintended pregnancy, by race/ethnicity, as estimated by the pre/post analyses

Part A: Associations, Stratified by Race/Ethnicity

		Hispanic		NH Black		NH Other or Multiracial		NH White	
		Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)
Dependent Coverage Provision[1]	2005-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2010-2014	-4.6 (-9.9, 0.8)	-4.0 (-9.2, 1.2)	**-5.5 (-10.8, -0.2)**	-3.7 (-8.8, 1.4)	-2.5 (-9.8, 4.8)	-2.4 (-9.8, 4.9)	-1.2 (-3.4, 1.1)	-1.1 (-3.4, 1.1)
	Sample size	n = 1,223		n = 1,141		n = 428		n = 2,447	
Marketplace Subsidies[1]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	0.7 (-1.7, 3.1)	0.9 (-1.5, 3.3)	-1.2 (-5.4, 3.1)	-1.3 (-5.6, 3.0)	0.1 (-3.9, 4.0)	-0.4 (-4.3, 3.5)	0.9 (-0.5, 2.3)	0.9 (-0.4, 2.3)
	Sample size	n = 1,461		n = 1,232		n = 566		n = 3,141	
Insurance Expansions[1]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	-1.2 (-3.2, 0.7)	-0.9 (-2.8, 1.0)	-1.4 (-4.0, 1.1)	-1.3 (-3.9, 1.3)	0.3 (-2.6, 3.2)	0.0 (-2.9, 2.9)	0.5 (-0.6, 1.7)	0.8 (-0.4, 1.9)
	Sample size	n = 3,540		n = 2,993		n = 1,059		n = 5,159	
Overall ACA[1]	2005-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2010-2014	-2.1 (-4.2, 0.1)	**-2.2 (-4.4, 0.0)**	**-2.9 (-5.3, -0.5)**	**-2.5 (-4.8, -0.2)**	-1.0 (-3.9, 1.8)	-1.2 (-3.9, 1.6)	-0.2 (-1.1, 0.7)	-0.4 (-1.3, 0.5)
	2014-2018	**-3.1 (-5.2, -1.0)**	**-3.0 (-5.1, -0.8)**	**-4.4 (-7.0, -1.9)**	**-4.1 (-6.6, -1.6)**	-1.0 (-4.1, 2.2)	-1.6 (-4.5, 1.6)	0.1 (-1.0, 1.2)	0.0 (-1.1, 1.0)
	Sample size	n = 5,591		n = 4,789		n = 1,704		n = 9,313	

Table 10. (cont'd)

		Part B: Difference in Associations by Race/Ethnicity (i.e., Differences in Absolute Racial/Ethnic Disparities Over Time)							
		Hispanic		NH Black		NH Other or Multiracial		NH White (reference)	
		Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)
Dependent Coverage Provision[1]	2010-2014	-3.4 (-9.0, 2.2)	-2.9 (-8.4, 2.6)	-4.3 (-10.2, 1.5)	-2.5 (-8.2, 3.1)	-1.3 (-9.0, 6.4)	-1.3 (-9.1, 6.6)	0.0 (ref)	0.0 (ref)
Marketplace Subsidies[1]	2014-2018	-0.2 (-3.0, 2.5)	0.0 (-2.8, 2.8)	-2.1 (-6.5, 2.4)	-2.2 (-6.6, 2.2)	-0.8 (-5.2, 3.5)	-1.3 (-5.5, 2.8)	0.0 (ref)	0.0 (ref)
Insurance Expansions[1]	2014-2018	-1.8 (-4.0, 0.5)	-1.6 (-3.9, 0.6)	-2.0 (-4.8, 0.8)	-2.1 (-4.9, 0.7)	-0.2 (-3.5, 3.0)	-0.8 (-3.9, 2.4)	0.0 (ref)	0.0 (ref)
Overall ACA[1]	2010-2014	-1.8 (-4.1, 0.4)	-1.8 (-4.1, 0.5)	**-2.7 (-5.2, -0.2)**	-2.1 (-4.6, 0.3)	-0.8 (-3.8, 2.2)	-0.8 (-3.7, 2.2)	0.0 (ref)	0.0 (ref)
	2014-2018	**-3.2 (-5.6, -0.9)**	**-2.9 (-5.2, -0.6)**	**-4.6 (-7.2, -1.9)**	**-4.1 (-6.7, -1.4)**	-1.1 (-4.4, 2.2)	-1.4 (-4.6, 1.7)	0.0 (ref)	0.0 (ref)

ACA = Affordable Care Act; NH = Non-Hispanic; PD = Prevalence difference, reported in percentage points; PDD = Prevalence difference-in-differences, reported in percentage points; 95% CI = 95% confidence interval; Estimates that are significant at the 5% significance level are shown in bold

*All adjusted models include the following covariates: education level, marital status, parity, nativity, and metropolitan residence. Analyses evaluating the dependent coverage provision further include income as a percentage of the federal poverty level (FPL), and analyses evaluating the Marketplace subsidies or insurance expansions further include respondent age as a three-level categorical variable (18-25, 26-34, 35-44).

[1] Respondents were considered: eligible for the dependent coverage provision if they were < 26 year of age, eligible for Marketplace subsidies if they had a household income that was between 139 and 399% of the FPL, eligible for the insurance expansions if they had a household income that was <400% of the FPL, and eligible for the overall ACA if they were < 26 years of age or had a household income <400% of the FPL.

6.4 Discussion

Using data from the NSFG, I found evidence that the prevalence of unintended pregnancy decreased following the enactment of the overall ACA among eligible Hispanic and NH Black women, but not eligible NH other/multiracial or NH White women. Further, there was evidence that these decreases were significantly larger than those among eligible NH White women – indicating a reduction of racial/ethnic disparities in unintended pregnancy. There was no such evidence, however, regarding the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions. These findings suggest that the overall ACA may be associated with improved racial equity in at least one reproductive health outcome (unintended pregnancy).

This is the first study of which I am aware to estimate the associations between the overall ACA or its specific components and racial/ethnic disparities in unintended pregnancy. There have been two peer-reviewed studies, however, that considered the impact of the ACA or its components on unintended or unwanted pregnancy [3,4], as well as two studies that have not yet been published (Chapters 4 and 5 of this dissertation). These studies found insufficient evidence that the ACA preventive care mandate [3], Marketplace subsidies (not yet published, Chapter 5), or insurance expansions (not yet published, Chapter 5) were associated with unintended pregnancy. There was, however, evidence that the overall ACA was associated with a 2.1 ppt (95% CI: 0.8, 3.4) decrease in the prevalence of unintended pregnancy between 2010-2018 among those eligible to benefit from at least one major component of the ACA (not yet published, Chapter 4), and that the dependent coverage provision was associated with an 8.2 ppt (95% CI: 1.4, 15.0) decrease in the prevalence of unintended pregnancy among young women (ages 18-25) who reported an income below the FPL. The current study builds upon this prior work revealing that overall association estimates are concealing heterogeneity by race/ethnicity. These findings are

consistent with those of Eliason (2019) that previously found evidence that the dependent coverage provision was associated with an increase in contraception use among Hispanic women only [112], and those of Johnston & McMorrow (2020) that found evidence that the ACA insurance expansions were associated with an increase in contraception use among NH Black women only [111] – which could translate into reduction of unintended pregnancies in these groups. It is important to note, however, that Johnston & McMorrow's work also suggests the ACA insurance expansions likely do not fully explain the observed increase in contraception use among NH Black women during the study period.

This study has important limitations. First, the NSFG has small, unweighted sample sizes for many racial/ethnic groups. When coupled with a rare event (unintended pregnancy), this limited the study design both in its operationalization of race/ethnicity and its analytic strategy. Regarding the operationalization of race/ethnicity, this study aggregates many racial/ethnic groups into the "NH other or multiple races" category to obtain an adequate sample size for analyses. As for the analytic strategy, small sample sizes for "ineligible" respondents limited my ability to incorporate control groups into the analysis. As such, these analyses do not to control for secular trends in the outcome, limiting my results to non-causal associational estimates. Further, small sample sizes limit the statistical precision of my estimates.

Despite these limitations, this work also has important strengths and contributions. As noted, this is the first study of which I am aware that considers the impact of the ACA and its components on unintended pregnancy by race/ethnicity. Further, this work provides both stratified associational estimates and conducts hypothesis tests to formally test for evidence of changes in disparity measures over time. This improves upon a common approach of simply reporting stratified estimates (i.e., associational estimates by race/ethnicity – see Appendix A for examples).

Whereas it can be difficult to draw conclusions regarding potential differences in magnitude from stratified estimates alone, our approach uses one model to produce both associational estimates by race/ethnicity and estimates of the difference in magnitude between racial/ethnic groups. As such, this approach more readily enables drawing conclusions regarding the targeted association between the ACA and racial/ethnic disparity measures. Additionally, while I was unable to disaggregate the "NH other or multiple races" group in my analyses, I did obtain access to restricted-use NSFG race and ethnicity variables, which allowed me to present the unweighted frequencies (percentages) for this more inclusive race/ethnicity variable in my sample characteristics. This may provide useful information for investigators planning future studies centered on health equity.

While this work provides important information regarding the non-causal associations between the overall ACA or its specific components and unintended pregnancy, more work is needed. First, future work is needed to produce estimates that are plausibly causal (e.g., through use of longitudinal or retrospective data that provides greater detail on individual-level changes in insurance coverage and reproductive health experiences as the ACA was enacted). Second, future work is also needed to consider the impact of the ACA and its components on unintended pregnancy in additional populations and subgroups that could not be examined with the NSFG (e.g., disaggregate the "NH other or multiple races" category, consider the impact among different socioeconomic or age subgroups). This may be particularly important regarding the dependent coverage provision since prior work (not yet published, Chapter 5) found that the provision was associated with a decrease in prevalence of unintended pregnancy among only lower income women (<100% of the FPL). Unfortunately, the NSFG sample size is too small to allow investigation among race-and-income subgroups. Third, I was unable to identify the impact of the

ACA expansion of Medicaid without information regarding respondent state of residence, but the impact of Medicaid expansion alone remains an important question with high relevance for public policy. Additionally, the estimated PDDs for the insurance expansions (Hispanic vs. NH White, NH Black vs. NH White) provide evidence of an association with racial/ethnic disparities in unintended pregnancy that is nearly significant at the 5% significance level (i.e., the upper bound of the CIs are just above the null value of 0). This was not the case for Marketplace subsidies alone, and secondary analyses revealed that NH White women who were both eligible for Marketplace subsidies and aged 27 years or older may have actually experienced an increase in prevalence of unintended pregnancy. Together, these findings highlight the need to evaluate the individual impact of Medicaid expansion separate from its joint impact with Marketplace subsidies. Fourth, it is also important that future work investigates the mechanism(s) that produce differential impacts by race/ethnicity. This may require qualitative methods that develop our understanding of women's individual experiences with the implementation of the ACA, and should include evaluation of the ACA's impact on contraceptive preference-use mismatch [129].

6.5 Conclusion

In this work, I evaluated changes in the prevalence of unintended pregnancy around the implementation of the ACA and three of its components, both within and between women with varying racial/ethnic identities to estimate the association between the ACA and racial/ethnic disparities in unintended pregnancy. More specifically, I evaluated the: 1) dependent coverage provision, 2) Marketplace subsidies, 3) insurance expansions, and 4) overall ACA. There was no evidence that the dependent coverage provision, Marketplace subsidies, or insurance expansions were associated with racial/ethnic disparities in unintended pregnancy among the included racial/ethnic groups. There was, however, evidence that the overall ACA was associated with

reductions in Hispanic-NH White and NH Black-NH White racial/ethnic disparities in unintended pregnancy. Additional work is needed to expand inclusivity, improve statistical precision, and examine impacts in additional socioeconomic subgroups. This work provides insights both for researchers who study racial equity in reproductive health as well as public policymakers who seek to understand how policy levers can be employed to improve reproductive health and health equity.

CHAPTER 7: DISCUSSION

7.1 Summary of Findings

In this dissertation, I set out to evaluate the impact of a specific policy (the ACA) on a reproductive health outcome (unintended pregnancy), and racial/ethnic disparities in that outcome. Specifically, I addressed three objectives:

1. Estimate the overall impact of the ACA on unintended pregnancy, and if evidence of an impact exists, describe the timing of this impact
2. Explore the mechanism of the ACA by investigating the impact of three policy levers pulled by the ACA (i.e., the dependent coverage provision, Marketplace subsidies, and ACA insurance expansions) on unintended pregnancy
3. Assess the impact of the ACA on racial/ethnic disparities in unintended pregnancy

In this work, I targeted sexually active US adult women of reproductive age (18-44) using multiple cycles of cross-sectional data from the NSFG, and found:

1. There was evidence that the overall ACA was associated with a roughly 2 ppt reduction in the prevalence of unintended pregnancy among women who were eligible to benefit from at least one major provision of the ACA [i.e., women who were under the age of 26, or who had an income <400% of the federal poverty level (FPL)], and this decrease was first observed during the transitional implementation period (2010-2014) and maintained in the period following full enactment of the ACA (2014-2018).
2. The dependent coverage provision may be one of the ACA's more successful mechanisms for influencing unintended pregnancy. There was evidence that the dependent coverage provision was associated with a large (roughly 8 ppt) reduction in the prevalence of unintended pregnancy among young women (18-25 years) who

reported an income below 100% of the FPL, but there was no evidence of such an association among other income subgroups, and there was no evidence that the Marketplace subsidies or insurance expansions were associated with the prevalence of unintended pregnancy (overall or among age-specific subgroups).

3. There was evidence suggesting the overall ACA was associated with a reduction of racial/ethnic disparities in prevalence of unintended pregnancy, but there was no such evidence regarding the dependent coverage provision, the Marketplace subsidies or the insurance expansions. Among those who were eligible to benefit from at least one major component of the ACA, it was estimated that the absolute disparity between Hispanic and NH White women decreased by 2.9 ppt, and the absolute disparity between NH Black and NH White women decreased by 4.1 ppt, in the four years following the ACA's full implementation (2014-2018).

These findings suggest that the ACA is associated with reductions in unintended pregnancy, and that this association differs across sociodemographic subgroups (i.e., age, income, race/ethnicity). Further, these findings also suggest that some mechanisms leveraged by the ACA were more successful than others at influencing unintended pregnancy (e.g., the dependent coverage provision vs. the Marketplace subsidies). Importantly, these findings provide insight regarding how the ACA works to influence reproductive health, and for whom – which is critical information for both researchers and public policy makers who seek to improve reproductive health and health equity.

7.1.1 Review of Limitations

This work has several important limitations, each of which has been discussed in some length in Chapters 4-6. First, the works of Chapters 4 and 5 utilize a DD approach which relies on the assumption that untreated and treated groups would have the same trend in unintended

pregnancy in the absence of the intervention (i.e., the common trend assumption). The common trend assumption cannot be verified. If this assumption is not met, the estimates that I presented in Chapters 4 and 5 will be biased, and the magnitude and direction of this bias is difficult to predict. Additionally, the work of Chapter 5 is limited in that it does not evaluate the individual impact of the ACA Medicaid expansion because the publicly available NSFG data does not include respondent's state of residence, and I am currently still in the process of working with this data at the RDC. Similarly, the work of Chapter 6 is also limited by its inability to speak to the impact of the ACA Medicaid expansion. Further, and importantly, the work of Chapter 6 is exploratory in nature (using a pre/post analytic strategy) and is therefore limited to non-causal associational interpretations. Small, unweighted race/ethnicity-and-cycle-specific sample sizes further limited analyses included in Chapter 6 by requiring the aggregation of many different racial/ethnic groups into a "NH other or multiracial" category for analyses.

7.1.2 Results in Context of Past Theory & Evidence

This dissertation is the first work of which I am aware to consider the impact of the overall ACA, dependent coverage provision, Marketplace subsidies, or insurance expansions on unintended pregnancy and the racial/ethnic disparities observed in unintended pregnancy. Two previous studies have, however, evaluated the impact of the ACA preventive care mandate on unintended pregnancy [3] and the impact of the ACA Medicaid expansion on unwanted pregnancy [4], and despite observed decreases in unintended and unwanted pregnancy during the study period, neither study found sufficient evidence that the evaluated components of the ACA were associated with unintended or unwanted pregnancy. This dissertation builds on this literature by considering the impact of additional mechanisms engaged by the ACA (i.e., the dependent coverage provision, Marketplace subsidies, and insurance expansions) on unintended pregnancy,

and by considering the joint impact of these three mechanisms. Additionally, two prior works have also considered the impact of the dependent coverage provision and insurance expansions on contraception use by race/ethnicity, finding evidence that the dependent coverage provision was associated with increased contraception use among Hispanic women only [112], and that the ACA insurance expansions were associated with increased contraception use among NH Black women only [111]. My work is consistent with these findings. A greater increase in contraception use among Hispanic and NH Black women suggests that these groups would subsequently have greater potential for reductions in unintended pregnancy, which is what was found in Chapter 6. The work of this dissertation – particularly the finding that the dependent coverage provision was associated with a decrease in unintended pregnancy among young, lower income women – is further consistent with the work of Finer and Zolna (2016) who found that the unintended pregnancy rate declined between 2008 and 2011 among women aged 18-24 and women with income <100% of the FPL [39], and the work of Heim, Lurie, and Simon (2018) who found that the ACA dependent coverage provision was associated with a decline in childbearing [123].

This work also contributes to the epidemiologic investigation of fundamental causes of health [1,52]. Fundamental Cause Theory suggests that there are root causes of health and health disparities that shape access to health-promoting resources. These fundamental causes are structural, and they are created and perpetuated by current and historic institutional policies, programs, and practices. Thus, to intervene, we need to consider macro-level interventions, like policy. By considering the impact of the ACA on unintended pregnancy and the racial/ethnic disparities observed in unintended pregnancy, my dissertation contributes to our collective understanding regarding the potential of public policy as a means to intervene on fundamental causes and thus their subsequent impact on health disparities.

Further, this dissertation contributes to ongoing conversations regarding the construct (in)validity of unintended pregnancy, centering this work in the Reproductive Justice (RJ) framework [2]. The RJ framework has three main tenets: 1) the right to not have children (or pregnancies), 2) the right to have children, and 3) the right to parent children in environments that are safe and healthy [2]. In this work, I considered unintended pregnancy as the outcome of interest, highlighting in Chapter 3 the inherent import of pregnancies that are considered mistimed/unwanted by the individual experiencing them – in alignment with the first tenet of the RJ framework. Incorporating the second tenet, I also contrasted the use of unintended pregnancy as an outcome to the use of pregnancy intention as an exposure (e.g., works that consider the association between pregnancy intention and subsequent maternal and infant health outcomes) (Chapter 3). When pregnancy intention is used as an exposure, estimates are often confounded by socioeconomic status, and findings of adverse associations may lead to policies and programs that promote maternal and infant health through pregnancy prevention in certain groups rather than by improving the conditions in which pregnancies occur [5,107]. Finally, I used the Discussion of each manuscript to emphasize the need for future work that uses both quantitative and qualitative methods to understand individual experiences as they relate to the rollout of the ACA and reproductive health experiences (e.g., patient-physician interactions during contraception counseling, contraceptive preference-use mismatch, satisfaction with current contraceptive) and to evaluate whether reductions in unintended pregnancy are the result of greater autonomy regarding contraceptive use and choice.

7.2 Directions for Future Research

There are several potential routes through which future work can build on this dissertation. First, additional work is needed to produce estimates that are plausibly causal for the impact of the

overall ACA (i.e., the joint impact of the ACA's provisions). For example, to evaluate the overall ACA, baseline state-level uninsurance rates can be used as a measure of treatment intensity for the ACA which may improve plausibility of identifying assumptions [118]. I am currently pursuing this through the RDC for future analyses. Second, additional work is needed to further illuminate which mechanism(s) of the ACA are influencing reproductive health. Based on the findings of this dissertation, I hypothesize that the dependent coverage provision and Medicaid expansion may be contributing jointly to the decreases I observed in association with the overall ACA. Despite a lack of statistical significance, the observed associations between the dependent coverage provision and unintended pregnancy in Manuscripts 2 and 3 were suggestive of a possible relationship, meriting further investigation. Although they were purely exploratory in nature, and lacked enough statistical precision to provide sufficient evidence, large decreases in unintended pregnancy were observed following enactment of the provision among Hispanic and NH Black women who were under the age of 26 (Manuscript 3). Additionally, in Manuscript 2, there was evidence that the dependent coverage provision was associated with a large decrease in unintended pregnancy among lower income women, and the association among women of all income levels neared significance [-2.7, (95% CI: -5.9, 0.4)], suggesting perhaps greater statistical precision would have led to different conclusions overall. Further, in Manuscript 3, the PDD estimates (i.e., the estimated change in absolute disparities) among those who were income-eligible for the insurance expansions also neared statistical significance at the 5% level, but those among the Marketplace-eligible groups did not. This suggests trends in prevalence of unintended pregnancy differed between individuals with income between 139%-399% of the FPL and individuals with income <139% of the FPL, implicating Medicaid expansion. Thus, as part of this work, the impact of the ACA Medicaid expansion on unintended pregnancy should be evaluated. This too is something I

am pursuing through the RDC. Finally, to better understand the impact of the ACA and its components on racial/ethnic disparities in unintended pregnancy, larger and more inclusive datasets are needed. Additionally, this effort should involve both quantitative and qualitative methods to better understand individual-level experiences and impacts of the ACA on reproductive health.

7.3 Implications for Public Health & Public Policy

The findings of this dissertation have important implications for both public health and public policy. First, my findings suggest the prevalence of unintended pregnancy is generally decreasing over the study period, indicating the unmet population-level need for contraceptives is decreasing. Further, racial/ethnic disparities in unintended pregnancy were also generally decreasing over the study period, indicating progress toward racial equity in one reproductive health outcome. Second, the fact that these public health improvements were associated with the overall ACA – and the dependent coverage provision, specifically – further have implications for ongoing public policy debates regarding the ACA [10–13], the American Rescue Plan Act which expanded eligibility for Marketplace subsidies to individuals with an income ≥400% of the FPL [16], and the Build Back Better Act which sought to again expand eligibility for Marketplace subsidies to include individuals with an income <100% of the FPL to reduce the coverage gap created by states opting out of the ACA Medicaid expansion [15].

7.4 Conclusions

In this dissertation, I investigated the impact of the ACA and three of its specific components (i.e., the dependent coverage provision, Marketplace subsidies, and insurance expansions) on the prevalence of unintended pregnancy and racial/ethnic disparities in unintended pregnancy. Through this work, I found evidence that the overall ACA was associated with a

reduction in prevalence of unintended pregnancy, and that the dependent coverage provision, specifically, was associated with a large decrease in the prevalence of unintended pregnancy among young, lower income women. Further, I found non-causal evidence that absolute racial/ethnic disparities in unintended pregnancy between Hispanic and NH White women, and between NH Black and NH White women, decreased following implementation of the ACA. I found no evidence, however, that the Marketplace subsidies or insurance expansions were associated with prevalence of unintended pregnancy (overall or among age-specific subgroups). I also found no evidence that the dependent coverage provision, Marketplace subsidies, or insurance expansions were associated with racial/ethnic disparities in prevalence of unintended pregnancy among the included racial/ethnic groups when NH White women were considered as the referent group. Jointly, these findings suggest the ACA is associated with a reduction in the unmet population-level need for contraceptive products and services, and possibly a reduction of racial/ethnic disparities in this unmet need. This work advances our understanding regarding the impact of the ACA on women's reproductive health and health equity, and contributes to the scientific literature regarding unintended pregnancy, the ACA, and health equity. This work is important both for public health and public policy, as it offers crucial information for both researchers and policymakers who seek to improve population health and health equity.

APPENDICES

APPENDIX A: SYSTEMATIC REVIEW MANUSCRIPT

Title: Did the Affordable Care Act Promote Racial Equity in Health Among Women of Reproductive Age?: A Systematic Review

Authors: Colleen L. MacCallum-Bridges, Danielle R. Gartner, Katlyn Hettinger, Yasamean Zamani-Hank, & Claire Margerison

A.1 Introduction

Women of reproductive age (i.e., 15-44 years) in the United States (US) have poor health outcomes compared to their peer-nation counterparts [130]. For example, in 2017, the maternal mortality ratio was 19 maternal deaths per 100,000 live births in the US, nearly twice as high as that reported for Canada and almost three times as high as that reported for the United Kingdom [131]. Similar patterns have been observed for other health outcomes as well, such as chronic disease burden, emotional distress, and preterm delivery [130,132,133]. Apart from its inherent import, the health of women of reproductive age portends the health of the next generation and is thus crucial to the future health of the nation.

Further, substantial and persistent racial and ethnic health disparities exist among women of reproductive age. For example, the risk of maternal mortality is 3.2 times greater among non-Hispanic (NH) Black women and 2.3 times greater among American Indian/Alaska Native (AI/AN) women compared to NH White women [134,135]. Similar disparities exist for many other outcomes as well, particularly in the area of reproductive and pregnancy health [136,137]. Racial disparities in health among women of reproductive age may be perpetuated across generations, emphasizing the need for intentional efforts to reduce health disparities, and thereby promote health equity.

The passage of the Patient Protection and Affordable Care Act (ACA) had the potential to improve the health of women of reproductive age by reducing insurance-related barriers to healthcare. Specifically, the ACA: 1) provided options for more affordable health insurance coverage through expansion of Medicaid, the dependent coverage provision, and the opening and subsidization of the health insurance exchanges – also known as the Marketplace, and 2) expanded the scope of coverage offered through health insurance by requiring coverage of preventive care, including FDA-approved female contraceptive products and services, without patient cost-sharing. Notably, this expansion of Medicaid included low-income adults outside of Medicaid's historical eligibility groups (disabled adults, children, pregnant women, and some low-income parents), providing options for more women of reproductive age to gain insurance outside of pregnancy. Indeed, among women of reproductive age, the ACA decreased the proportion without insurance, increased access to health care and utilization of preventive care, and affected some health outcomes (e.g., preterm delivery, contraception use) [42,138]. It remains unclear, however, whether these improvements were equitably distributed across race and ethnicity. More specifically, it is unknown whether the ACA reduced racial/ethnic disparities in health insurance, utilization of care, health behaviors, or health outcomes among women of reproductive age. This systematic review aims to fill this gap. We begin by presenting the rationale for two alternative hypotheses regarding the impact of the ACA on racial/ethnic disparities in health among women of reproductive age (hereafter, "women's health" for brevity).

Hypothesis 1: The ACA reduced racial/ethnic disparities in health insurance coverage and, subsequently, in utilization of care, health behaviors, and health outcomes. The ACA targeted individuals with low and modest household incomes by expanding eligibility for Medicaid [≤138% of the federal poverty level (FPL)] and including subsidies for those purchasing coverage through

the Marketplace (100-399% of the FPL) [21]. Compared to White (16.6%) and Asian (13.1%) women of reproductive age, a larger percentage of Hispanic (34.2%), AI/AN (25.1%), and Black (20.4%) women were uninsured with an income <400% of the FPL prior to the ACA, so a greater percentage of these groups should have been eligible to benefit from the ACA [56–60]. Thus, the ACA may have reduced racial/ethnic disparities in health insurance coverage through its use of income-based eligibility criteria. If greater health insurance coverage leads to greater healthcare utilization, improved health behaviors, and improved health outcomes, then the ACA may have reduced racial/ethnic disparities in these domains as well. Under this hypothesis, the ACA would not, however, be expected to *eliminate* racial/ethnic disparities in women's health because health insurance is only one of many pathways thorough which structural and institutional racism cause racial/ethnic disparities [52,54,55,139,140].

Hypothesis 2: The ACA did not reduce racial/ethnic disparities in health insurance, utilization of care, health behaviors, or health outcomes. This hypothesis is based on the following five observations regarding the ACA. First, even if all US residents with income <400% of the FPL gained health insurance through the ACA, a reduction of racial/ethnic disparities in health insurance coverage does not guarantee a reduction of racial/ethnic disparities in healthcare utilization, health behaviors, or health outcomes if the benefit of health insurance coverage is realized unequally across race and ethnicity. The realized benefit of health insurance may be modified by contextual and individual-level factors that differ in prevalence across racial/ethnic groups due to institutional and structural racism and influence an individual's ability or propensity to utilize and benefit from healthcare (e.g., exposure to interpersonal racism in healthcare interactions, geographic proximity to healthcare, quality of care received) [55,141–145]. Further, interventions intended to improve health (e.g., the ACA) often yield the most benefit for those who

are already the most advantaged in terms of education, resources, or power [1]. Such interventions may thus actually exacerbate disparities.

Second, we know that state-level variation in the expansion of Medicaid limited who was able to gain health insurance coverage through the ACA. In 2012, the US Supreme Court decided that states would choose for themselves whether to expand Medicaid [29]. In states that did not expand Medicaid, this created a coverage gap in which roughly 2.2 million individuals with an income <100% of the FPL are eligible for neither Medicaid nor Marketplace subsidies [62]. Compared to 8% of uninsured NH White individuals, nearly twice as many uninsured NH Black individuals (15%) fall into this coverage gap – thereby reducing the potential for the ACA to reduce Black-White disparities in health insurance coverage [61].

Third, among regions in which states *did* expand Medicaid under the ACA, the impact may vary between regions due to the unique sociopolitical and historical context of each region. For instance, Medicaid expansion was associated with a smaller decrease in uninsurance among AI/AN adults in the Great Plains region of the Midwest compared to AI/AN adults in coastal regions like California and Portland [146]. This variation may be due to the interaction between the ACA and the "local historical relationships between tribes, states, the federal government, and healthcare institutions" of different regions [146].

Fourth, an individual's eligibility for Medicaid and ability to purchase insurance through the Marketplace depends on immigration status [147]. Compared to 2% of uninsured NH White individuals, a larger percentage of uninsured Hispanic (30%), NH Asian (18%) and NH Native Hawaiian or other Pacific Islander (15%) individuals are ineligible to benefit from the ACA due to immigration status [61].

Fifth, and finally, some components of the ACA did not employ income-based eligibility criteria which could exacerbate existing racial/ethnic disparities. For example, to benefit from the dependent coverage provision, an individual must be under the age of 26 and their parent(s) must have health insurance [21]. Because there were racial/ethnic disparities in health insurance coverage prior to the ACA, the impact of the dependent coverage provision likely differed by race/ethnicity, potentially perpetuating and further exacerbating racial/ethnic disparities in health insurance coverage among young adults.

Thus, the objective of this review was to synthesize the evidence to-date regarding the impact of the ACA on racial/ethnic disparities in health insurance coverage, utilization of care, health behaviors, and health outcomes among women of reproductive age (i.e., ages 15-44) to assess whether evidence supports Hypothesis 1 or Hypothesis 2 for each outcome.

A.2 Methods

A.2.1 Search & Study Selection

We conducted our review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline [148]. We searched MEDLINE (in February and March 2020) for studies published after 2010 using the search strategy outlined in Table A1. We included peer-reviewed, empirical studies that examined at least one of three relevant questions regarding the ACA or one of its components [i.e., the dependent coverage provision, the preventive care mandate, Medicaid expansion, the Marketplace]: 1) did the ACA impact a racial/ethnic disparity in an outcome of interest, 2) did the impact of the ACA on an outcome of interest differ by race/ethnicity, or 3) what was the impact of the ACA on an outcome of interest within specific racial/ethnic groups? These three questions are summarized in Table A2 for easy reference throughout reading. While our primary interest lies with understanding the answer to question (1),

we also considered questions (2) and (3) because they assess whether the impact of the ACA differ by race/ethnicity, and differences in the impact by race/ethnicity hold implications for the impact on racial/ethnic disparities. We considered studies that used both causal terminology in their objectives (e.g., effect, impact) as well as those that used associational or descriptive language (e.g., association, change in prevalence).

We included literature that examined at least one of the following outcomes: health insurance coverage, utilization of healthcare, health behaviors (e.g., smoking), reproductive health, or pregnancy health. We excluded studies that were not in English, that examined non-health outcomes, and studies that examined health insurance expansions or experiments that were not part of the ACA.

After removing duplicate studies, three reviewers (CMB, KH, YZH) independently reviewed all titles and abstracts to determine which studies would be retained for full review. The methods section was also reviewed to capture studies that evaluated a relevant research question as a secondary objective or robustness check. Next, members of the authorship team (CMB, CM, DG, KH) reviewed the full text of all studies retained to make a final determination regarding fit with inclusion/exclusion criteria. We resolved all disagreements through discussion with the entire authorship team. Finally, one author (CMB) reviewed the reference lists of all included studies to identify additional relevant work.

A.2.2 Data Extraction

We extracted the following data from each included article: publication year, author(s), data source, study setting and population, methods (study design, analytic strategy), construct and measurement of independent and dependent variable(s), research question addressed, and associational measures reported [e.g., prevalence ratio (PR), prevalence difference (PD)]. Where

possible, we report confidence limits to provide a measure of estimate precision. If neither a confidence interval nor a standard error was provided in the original article, we provide the p-value. We report that there is evidence of an association if, under the null hypothesis, the probability of observing an association as extreme or more extreme than that which was observed (i.e., the p-value) is less than or equal to 0.05. Acknowledging the arbitrary nature of this threshold, and its inherent limitations [149,150], we chose this strategy as a means to systematically determine evidence for an association. In cases where an association was investigated, but evidence was not found, we report that "there was no evidence" of the association.

Table A1. Terms used in search strategy to identify studies

	Target	**Search Terms Used**[1]
Exposures	Patient Protection and Affordable Care Act	Patient Protection and Affordable Care Act, Obamacare
	Dependent coverage provision	Young adult, dependent coverage
	Preventive care mandate	Contracept*, mandate
	Health insurance exchanges	Health insurance exchange, health insurance marketplace
	Medicaid expansion	Medicaid, Medicaid expansion
Outcomes	Health insurance coverage[2]	Insurance coverage
	Health care utilization[2]	Preconception care, preventive care, prescriptions
	Health behaviors[2]	Smoking, health behavior
	Reproductive health	Assisted reproductive techniques, contracept*, birth control, childbearing, fertility, reproduct*, unintended pregnancy
	Pregnancy health	Prenatal, maternity, pregnancy
	Pregnancy outcomes	Birth outcome, birth weight, preterm, gestational age, gestational

[1] When available, we used MeSH terms

[2] Search was limited to women

Table A2. Research questions examined in the reviewed literature

	Question being addressed	**Method**
1	Did the ACA reduce a racial/ethnic disparity in an outcome of interest?	Disparity measure is operationalized as the outcome
2	Did the impact of the ACA on an outcome of interest differ by race/ethnicity?	Whether the association between the ACA and an outcome differs by race/ethnicity is evaluated (i.e., the absolute or relative difference in the magnitude of the association between groups is estimated, a confidence interval or standard error for this estimate is provided, and/or the null hypothesis that this absolute difference is equal to 0 or this relative difference is equal to 1 is tested)
3	What was the impact of the ACA on an outcome of interest within specific racial/ethnic groups?	Associational estimates are stratified by race/ethnicity, but whether the association differs by race/ethnicity is not evaluated

A.3 Results

A.3.1 Search Results & Study Characteristics

Our search identified 2,561 records through MEDLINE and 273 records through references of included articles (Figure A1). After removing duplicates, we screened n=987 unique articles and retained n=10 articles for full review. Studies were excluded at this stage if: 1) the exposure was not the ACA or one of its components, 2) the outcome assessed was not an outcome of interest, 3) the study population was not defined as women or females, 4) the study population did not focus on individuals of reproductive age, or 5) the study did not address a relevant research question (Table M11). After full-text review, we concluded that an additional n=2 articles were not eligible for inclusion as they focused primarily on women who were not of reproductive age [151,152]. Thus, n=8 unique records were eligible for inclusion (Figure A1), all of which were obtained through the MEDLINE database search.

A summary of the outcomes and ACA components considered in the n=8 included studies is provided in Table A3. Data extracted from the n=8 included studies are provided in Table A4 , which is located at the end of this Appendix. These studies included m=199 estimates or tests, and n=2 studies considered the dependent coverage provision of the ACA, n=2 studies considered the ACA insurance expansions (i.e., the opening of the Marketplace and the expansion of Medicaid), n=2 studies considered the ACA Medicaid expansion, n=1 study considered the preventive care mandate of the ACA, and n=1 study considered the entire ACA. Most of these studies utilized a repeated cross-sectional design (n=8) and incorporated a pre/post (n=4) or difference-in-differences (n=4) analytic strategy (Table A4).

Figure A1. PRISMA flow diagram for included articles

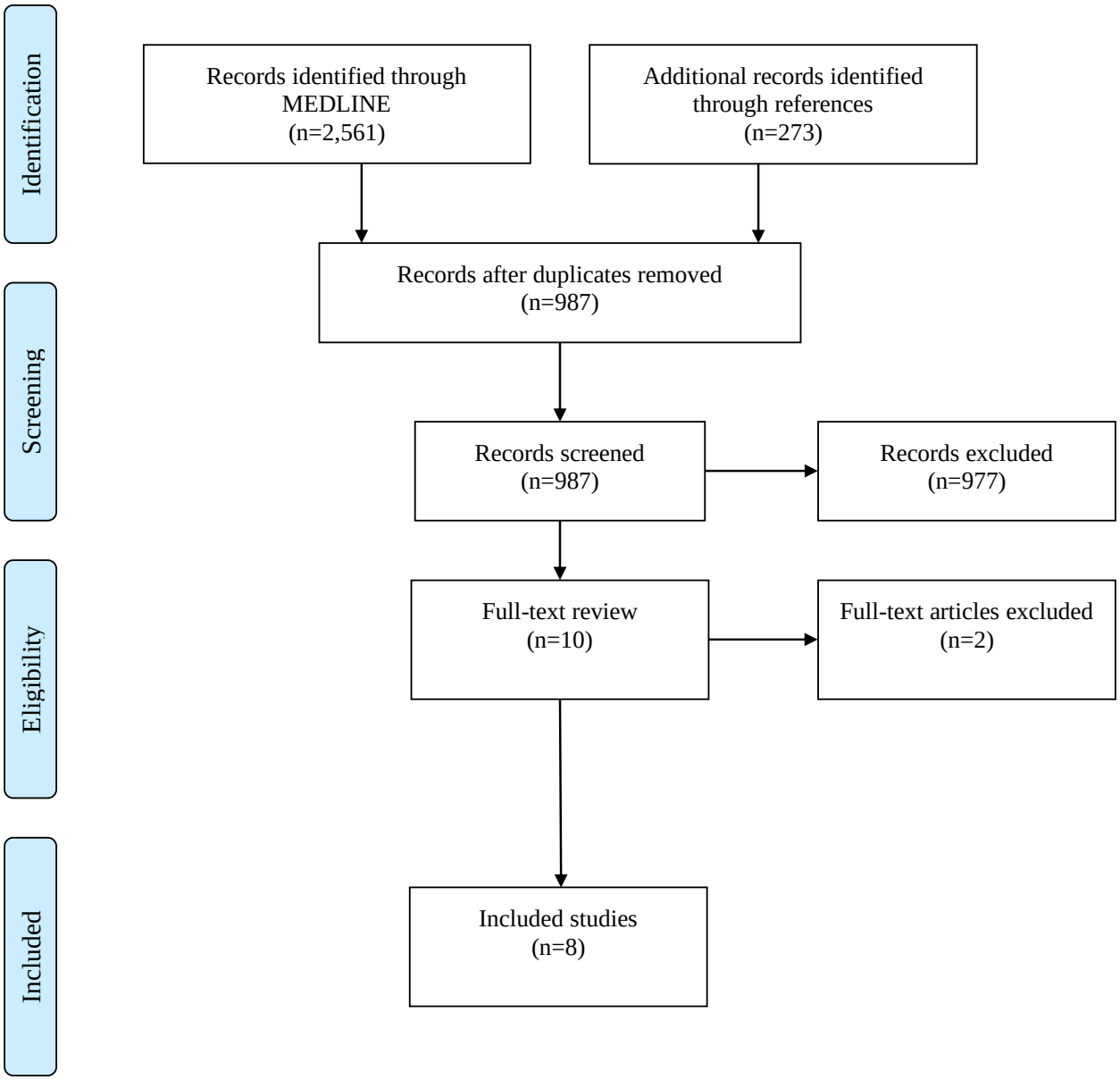


Table A3. Summary of outcomes and ACA components considered in the included studies

	Entire ACA	Preventive Care Mandate	Young Adult Dependent Coverage Provision	Medicaid Expansion	ACA Insurance Expansions
	n[a](m)[b]	**n[a](m)[b]**	**n[a](m)[b]**	**n[a](m)[b]**	**n[a](m)[b]**
Insurance coverage[c]	0(0)	0(0)	2(9)[1,2]	2(10)[3,4]	2(7)[5,6]
Utilization of healthcare					
Emergent care[d]	1(16)[7]	0(0)	0(0)	0(0)	0(0)
Mental healthcare[d]	1(16)[7]	0(0)	0(0)	0(0)	0(0)
Primary care[d]	1(16)[7]	0(0)	0(0)	0(0)	0(0)
Sexual and reproductive healthcare[e]	0(0)	0(0)	1(9)[2]	0(0)	0(0)
Prenatal care[f]	0(0)	0(0)	1(2)[1]	1(6)[4]	0(0)
Postpartum healthcare[g]	0(0)	0(0)	1(2)[1]	0(0)	0(0)
Health behaviors	0(0)	0(0)	0(0)	0(0)	0(0)
Reproductive health					
Contraception use or choice[h]	0(0)	0(0)	2(4)[1,2]	0(0)	1(27)[5]
Unintended pregnancy	0(0)	1(3)[8]	0(0)	0(0)	0(0)
Pregnancy health					
Cigarette use after 1st trimester	0(0)	0(0)	0(0)	1(6)[4]	0(0)
Complications during pregnancy[i]	0(0)	0(0)	0(0)	1(18)[4]	0(0)
Pregnancy outcomes					
Low or very low birthweight	0(0)	0(0)	0(0)	2(24)[4]	0(0)
Preterm or very preterm delivery	0(0)	0(0)	0(0)	2(24)[4]	0(0)
Total n[a](m)[b]	**1 (48)**	**1 (3)**	**2 (26)**	**2 (88)**	**2 (34)**

ACA = Affordable Care Act; CHIP = Children's Health Insurance Plan; STI = Sexually transmitted infection; LARC = Long acting-reversible contraceptives

[a] n indicates the number of studies that investigated the association

[b] m indicates the number of analyses that were conducted to investigate the indicated association

[c] Includes the following outcomes: employer-sponsored health insurance, individually purchased health insurance, Medicaid/CHIP coverage, other (not private or Medicaid/CHIP) health insurance, private health insurance, and uninsurance

[d] Defined by having at least 1 visit of the specified type (i.e., physician office visit, emergency department visit, mental health visit, physician office visit)

[e] Includes the following outcomes: check-up related to birth control, contraceptive counseling, and STI counseling, testing or treatment

[f] Includes the following outcome: prenatal care in the first trimester (i.e., "early" prenatal care)

Table A3 (cont'd)

[g] Defined as having received a postpartum check-up
[h] Includes the following outcomes: contraception use, postpartum contraception use, non-prescription contraception use, prescription contraception use, prescription LARC use, prescription non-LARC use
[i] Includes the following outcomes: any infection during pregnancy, pre-pregnancy diabetes, pre-pregnancy hypertension
[1]Li et al., 2019; [2]Eliason, 2019; [3]Wehby & Lyu, 2018; [4]Brown et al., 2019; [5]Johnston & McMorrow, 2020; [6]Jones & Sonfield, 2016; [7]Manuel 2018; [8]MacCallum-Bridges & Margerison, 2020

A.3.2 Insurance Coverage

Six studies considered a relevant research question regarding health insurance (Table A3). In addition to insurance *coverage*, three of these six studies also considered insurance *type* (e.g., Medicaid, employer-sponsored). Here, we summarize findings regarding only insurance coverage, but associational estimates for both insurance coverage and insurance type are provided in Table A4. Across these studies, racial/ethnic categories of Hispanic, NH Black, NH other, and NH White were included.

Around the time of pregnancy: In the month prior to pregnancy, there was evidence that the dependent coverage provision was associated with decreased uninsurance among NH White women, but not Hispanic or NH Black women. There was no evidence, however, that the magnitude of this association differed between Hispanic or NH Black and NH White women [153]. During pregnancy and at delivery, there was no evidence that the dependent coverage provision was associated with uninsurance among Hispanic, NH Black, or NH White women, and there was no evidence that this association – or the association between Medicaid expansion and uninsurance at delivery – differed between Hispanic or NH Black and NH White women [153,154].

Beyond pregnancy: Outside the time of pregnancy, there was evidence that the dependent coverage provision was associated with decreased uninsurance among NH White [-10.7 percentage points(pp), (95% CI: -18.8, -2.5)] and Hispanic [-17.0 pp, (95% CI: -27.8, -6.1)] women, but not among NH Black women [112]. There was also evidence that the ACA insurance expansions, and Medicaid expansion specifically, were associated with decreased uninsurance among Hispanic, NH Black, NH other, and NH White women [43,110,111]. It was estimated that the ACA insurance expansions were associated with a decrease in both the prevalence [ranging from -7.3 pp to -11.7 pp [111]] and the odds [ranging from a 30% to 80% reduction [43]] of

uninsurance, and that Medicaid expansion alone was associated with a decrease in the prevalence of uninsurance (ranging from -3.8 pp to -5.1 pp) [110]. Whether the magnitude of these associations differ by race/ethnicity, however, has not been evaluated (i.e., Question 2 of Table A2 has not been addressed). Further, despite a wide range in stratified estimates – which address Question 3 (Table A2) – the limited statistical precision of these estimates, or precision measures being unreported, precludes us from concluding whether the magnitude of the association differs between racial/ethnic groups.

Summary: There was no evidence that Medicaid expansion or the dependent coverage provision reduced absolute racial/ethnic disparities in health insurance coverage *around the time of pregnancy among women with a recent live birth*, but we are unable to draw conclusions regarding the impact of the ACA or its components on racial/ethnic disparities in health insurance coverage among women of reproductive age more generally.

A.3.3 Utilization of Healthcare

Four studies considered a relevant research question regarding healthcare utilization (Table A3). Across these studies, Hispanic, NH Asian, NH Black, and NH White women were included.

Mental health care: There was no evidence that the ACA was associated with having a mental health visit in the prior 12 months among Hispanic, NH Asian, NH Black, or NH White women [155].

Emergent care: The ACA was associated with a decrease in emergent care utilization among both Hispanic (-2.3 pp) and NH White (-1.5 pp) women, but not among NH Asian women – and, depending on the definition used for the pre-ACA period, there was either no evidence of an association (comparing 2012 to 2014) or evidence of an increase in emergent care utilization among NH Black women (3.0 pp, comparing 2006 to 2014) [155].

Primary care: The ACA was also associated with a decrease in the proportion of women who had a physician office visit in the past 12 months among Hispanic women (-2.7 pp), but not among NH Asian, NH Black, or NH White women [155].

Sexual and reproductive health services: There was no evidence that the dependent coverage provision was associated with contraceptive counseling or counseling, testing, or treatment for sexually transmitted infections among Hispanic, NH Black, or NH White women [112]. There was, however, evidence that the dependent coverage provision was associated with an increase in utilization of contraceptive related check-ups among Hispanic women [14.6 pp, (95% CI: 1.7, 27.4)], but not among NH Black or NH White women [112].

Prenatal and postpartum care: There was no evidence that the dependent coverage provision was associated with utilization of postpartum check-up among Hispanic, NH Black, or NH White women, and there was no evidence that the magnitude of this association differed by race/ethnicity [153]. There was, however, evidence that the dependent coverage provision was associated with an increase in early prenatal care initiation among NH White women [3.2 pp, (95% CI: 0.7, 5.8)], but not among Hispanic or NH Black women [153]. There was further no evidence that the association between the dependent coverage provision or Medicaid expansion and early prenatal care initiation differed by race/ethnicity [153,154].

Summary: There was no evidence that the dependent coverage provision or Medicaid expansion reduced absolute racial/ethnic disparities in utilization of prenatal or postpartum care, but due to three limiting factors we are unable to draw conclusions regarding the impact of the ACA or the dependent coverage provision on racial/ethnic disparities in utilization in other domains (i.e., mental health care, emergent care, primary care, sexual and reproductive health services). First, studies that considered these domains did not estimate the association with a

racial/ethnic disparity in utilization, nor did they evaluate whether the magnitude of the association differed by race/ethnicity (i.e., they did not address Question 1 or Question 2, Table A2). Second, the stratified associational estimates that address Question 3 (Table A2) were either limited in statistical precision or no measure of precision was provided, limiting our ability to conclude whether the magnitude of these associations differ by race/ethnicity. Third, to relate these findings to health equity, healthcare utilization must be contextualized within the prevalence of need for healthcare services within a given group – i.e., utilization should meet the need that is present in each group [156].

A.3.4 Health Behaviors

We found no relevant studies regarding health behaviors.

A.3.5 Reproductive Health

Four studies considered a relevant research question regarding reproductive health (Table A3). Across these studies, racial/ethnic categories of Hispanic, NH Black, NH White, and NH White or other were included.

Contraceptive use or choice: There was evidence that the dependent coverage provision was associated with increased use of prescription contraceptives among Hispanic women [13.5 pp, (95% CI: 0.3, 26.8)], but not NH Black or NH White women [112]. The ACA insurance expansions, on the other hand, were found to be associated with increased use of prescription contraceptives among NH Black women (10.2 pp), but not Hispanic or NH White women [111]. More specifically, the ACA insurance expansions were associated with increased use of long-acting reversible contraceptives (LARCs) among Hispanic (15.5 pp), NH Black (13.1 pp), and NH White (13.8 pp) women [111]. These increases in LARC use were accompanied by decreases in non-LARC prescription contraception use among Hispanic (-13.6 pp) and NH White (-12.8 pp)

women, but not among NH Black women [111]. Thus, the lack of evidence for an association between the ACA insurance expansions and prescription contraception use among Hispanic and NH White women, despite an associated increase in LARC use, may be explained by the concurrent decrease in use of non-LARC prescription contraceptives [111]. Further, there was no evidence that the ACA insurance expansions were associated with non-prescription contraception use among Hispanic, NH Black, or NH White women [111]. Similarly, there was no evidence that the dependent coverage provision was associated with postpartum contraception use among Hispanic, NH Black, or NH White women, and there was no evidence that this association differed by race/ethnicity [153].

Unintended pregnancy: There was no evidence that the preventive care mandate was associated with unintended pregnancy among Hispanic, NH Black, or NH White or other women [3].

Summary: We are unable to draw conclusions regarding the impact of the ACA insurance expansions or dependent coverage provision on racial/ethnic disparities in contraception use, and we are also unable to draw conclusions regarding the impact of the preventive care mandate on racial/ethnic disparities in unintended pregnancy. First, we are unable to conclude whether associations with contraceptive use (prescription, non-prescription, LARC, non-LARC prescription) and unintended pregnancy differ by race/ethnicity because stratified associational estimates used to address Question 3 (Table A2) were limited in statistical precision, or measures of precision were not provided. Second, whether changes in contraceptive use or choice improve health equity depends on whether these changes align with the preferences of individual contraceptive users. Thus, to relate these findings to health equity, contraceptive use (or choice) needs to be contextualized by individual contraceptive preferences [129].

A.3.6 Pregnancy Health

One study considered a relevant research question regarding pregnancy health (Table A3). In this study, racial/ethnic categories of Hispanic, NH Black, and NH White were included.

There was no evidence that the association between Medicaid expansion and pregnancy health indicators differed between Hispanic or NH Black and NH White women, with one exception: gestational diabetes [154]. It was estimated that the association between Medicaid expansion and gestational diabetes was 0.10 pp more positive (95% CI: 0.05, 0.14) among Hispanic women compared to NH White women [154]. This suggests either a smaller *decrease* or a larger *increase* in prevalence of gestational diabetes among Hispanic women compared to NH White women. In either case, this suggests a more beneficial association among NH White women [154].

Summary: There was no evidence that Medicaid expansion reduced racial/ethnic disparities in pregnancy health (i.e., early prenatal care, maternal cigarette use after the first trimester, infection during pregnancy, gestational diabetes, and gestational hypertension) between Hispanic or NH Black and NH White women.

A.3.7 Pregnancy Outcomes

One study considered a relevant research question regarding pregnancy outcomes (Table A3). Racial/ethnic categories of Hispanic, NH Black, and NH White were included.

Preterm and very preterm birth: Addressing Question 3 (Table A2), there was no evidence that Medicaid expansion was associated with the prevalence of preterm birth (PTB, <37 weeks of gestation) among neonates born to Hispanic, NH Black, or NH White women [154]. There was, however, evidence that Medicaid expansion was associated with a decreased prevalence of very

preterm birth (VPTB, <34 weeks) among neonates born to NH Black women [-0.13 pp, (95% CI: -0.25, -0.01)], but not neonates born to Hispanic or NH White women [154].

Addressing Question 2 (Table A2), the decreases in PTB and VPTB that were associated with Medicaid expansion were slightly larger (0.43 pp and 0.14 pp, respectively) among neonates born to NH Black women than those born to NH White women [154]. There was no evidence, however, that the magnitude of the associations between Medicaid expansion and either PTB or VPTB differed between neonates born to Hispanic and NH White women [154].

Low and very low birthweight: Addressing Question 3 (Table A2), it was estimated that Medicaid expansion was associated with a 0.44 pp decrease (95% CI: -0.77, -0.11) in the prevalence of low birthweight (LBW, <2500 g) and a 0.15 pp decrease (95% CI: -0.25, -0.05) in the prevalence of very low birthweight (VLBW, <1500 g) among neonates born to NH Black women, but no such associations were detected among neonates born to Hispanic or NH White women [154].

Addressing Question 2 (Table A2), the associated decreases in both LBW and VLBW were slightly larger (0.53 pp and 0.13 pp, respectively) among neonates born to NH Black women than those born to NH White women [154]. There was no evidence, however, that the magnitude of the associations between Medicaid expansion and either LBW or VLBW differed between neonates born to Hispanic and NH White women [154].

Summary: There was evidence that Medicaid expansion was associated with a slight reduction in the absolute NH Black-NH White disparity in PTB, VPTB, LBW, and VLBW [154].

A.4 Discussion

In this systematic review, we synthesized the existing evidence regarding the impact of the ACA (or its components) on racial/ethnic disparities in health insurance coverage, utilization of

care, health behaviors, and health outcomes in the areas of reproductive and pregnancy health among women of reproductive age. Our main finding is that large and critical gaps in the literature remain. We found no studies that operationalized a disparity measure as the outcome to investigate whether the ACA affected a racial/ethnic disparity in an outcome of interest (Question 1, Table A2), but we did identify three studies that evaluated whether the impact of the ACA on an outcome of interest differed by race/ethnicity (Question 2, Table A2) and 5 studies that estimated the impact of the ACA on an outcome of interest within specific racial/ethnic groups (Question 3, Table A2). Thus, we identified n=8 relevant studies, and this literature provided mixed evidence regarding our hypotheses.

Hypothesis 1: The ACA reduced racial/ethnic disparities in health insurance coverage and, subsequently, in utilization of care, health behaviors, and health outcomes. There was evidence that Medicaid expansion was associated with a slight reduction in the absolute disparities between NH Black and NH White women with regard to the prevalence of PTB (0.43 pp), VPTB (0.14 pp), LBW (0.53 pp), and VLBW (0.13 pp) [154].

Hypothesis 2: The ACA did not reduce racial/ethnic disparities in health insurance, utilization of care, health behaviors, or health outcomes. There was no evidence that the dependent coverage provision or Medicaid expansion reduced absolute racial/ethnic disparities in uninsurance during pregnancy or at delivery (Hispanic and NH Black women compared to NH White women) [153]. This is unsurprising given the fact that Medicaid eligibility for pregnant women was relatively generous even before the ACA [157]. Similarly, there was no evidence that Medicaid expansion reduced racial/ethnic disparities in several pregnancy health indicators between Hispanic or NH Black and NH White women [154]. In fact, there was evidence that the association between Medicaid expansion and gestational diabetes was slightly more beneficial

among NH White women than among Hispanic women – which could exacerbate the existing disparity in gestational diabetes.

Remaining Gaps: Importantly, we were unable to draw conclusions regarding the impact of the ACA on racial/ethnic disparities in health insurance coverage. This is a critical gap in the literature as health insurance coverage is the pathway through which the ACA is anticipated to influence racial/ethnic disparities in women's health. We were also unable to draw conclusions regarding racial/ethnic disparities in utilization of healthcare, contraception use, and unintended pregnancy. Additionally, we found no evidence regarding health behaviors.

The current literature is strengthened by its use of analytic strategies that reduce the potential for confounding (e.g., difference-in-differences). A difference-in-differences approach was commonly used for this purpose – particularly when investigating the impact of Medicaid expansion and the dependent coverage provision. This approach, however, requires common pre-treatment trends between groups, and careful consideration of the timing of treatment and impact [158] – issues that often are not discussed. The literature is also strengthened by its use of population-based survey data or vital records which generally reduce the risk of selection bias by providing a representative sample, and measurement error by using standard procedures and validated measures in data collection. It is important to note, however, that – even with validated measures – there is still the possibility of differential measurement error between demographic subgroups [159].

Future work can build upon this literature by operationalizing disparity measures (e.g., Index of Disparity, disproportionality measures), both on the absolute and relative scale, as the outcome of interest [160]. Further, work that investigates whether the impact of the ACA differs by race/ethnicity should discuss these findings in the context of baseline disparity measures, and

measures of group-specific outcome prevalence, to more clearly delineate what these differences mean for racial/ethnic disparities [161].

Future research should also expand the included racial/ethnic identities. Most reviewed studies included only Hispanic, NH Black, and NH White women. Women whose racial/ethnic identity falls outside these categories were typically excluded or grouped together in a NH 'other' category. Increasing inclusivity and racial/ethnic data disaggregation can be difficult because the data collection process often prohibits it, or the sample size of a given group may be too small to allow for inclusion in statistical modeling [162,163], but a comprehensive understanding of the ACA's impact on racial/ethnic disparities in health outcomes requires inclusivity. To support health disparities research, policy should promote improved data collection regarding race/ethnicity – particularly in population-based surveys and vital records – so that the data facilitates inclusivity [164,165].

Greater attention to causality is also needed. Investigators generally evaluate the impact of policies, like the ACA, to inform policymaking [166]. This requires investigation of the *causal* impact. Yet, it was unclear in many of the reviewed studies whether a causal research question was being targeted. Readers would benefit from greater transparency regarding whether a causal effect estimate is targeted, and discussion of the assumptions necessary to identify this effect [167]. Causal inference also necessitates an understanding of the ACA impact model – i.e., the timing of the impact on a specific health outcome [168]. To assess the impact model, future work could incorporate analytic methods, such as event study approaches, which allow the effect of an exposure to change over time. Further, understanding the causal impact requires investigation of the hypothesized mechanism(s) through which the ACA could influence racial/ethnic disparities. This work requires understanding and measuring structural racism and its interactions with the

ACA (e.g., residential segregation and the coverage gap) [169]. While included studies hypothesized that the impact of the ACA *would* differ by race/ethnicity, few discussed (and none investigated) *why* it would differ. Qualitative or mixed methods research could also be utilized to understand individual experiences related to the policy, facilitate the refinement of hypotheses around mechanism successes and failures, and inform future policy and program development.

This review is both strengthened and limited by the search strategy employed. We searched only the literature contained within PubMed – limiting the scope of our search. Our search terms, however, encapsulated all elements of the ACA and were not limited by disparity-related terminology (e.g., disparity vs. inequity vs. inequality). Our search strategy was further strengthened by including review of the methods section prior to full-text review to identify studies that may have examined a relevant research question as a secondary analysis or robustness check.

A.5 Conclusions

In summary, the ACA and its components have improved health insurance coverage and some health outcomes among women of reproductive age [42], but the current review revealed that little work has been done to determine whether this translates into reduced racial/ethnic disparities in health insurance coverage, utilization of care, health behaviors, or health outcomes. Given persistent racial/ethnic disparities among women of reproductive age, greater attention to the impact of policy on racial/ethnic disparities is warranted. To promote racial equity in health, we need policy that is not necessarily equal in its impact, but is equitable in its impact [170,171].

Table A4. Summary of data extracted from included literature (n=8)

Year	Authors	Data source	Study population	Methods[1]	Exposure Measure	RQ Addressed	Race/Ethnicity Measure	Outcome Measure	Equity-related Findings[2]
2016	Jones & Sonfield	National survey administered by GfK and developed by the Guttmacher Institute.	Setting: US, 2012 and 2015 Inclusion criteria: Females aged 18-39 years with a history of vaginal sex with a man Exclusion criteria: Currently pregnant, previous tubal ligation, or male sexual partner had obtained a vasectomy Response rate of 53%-59% n=8,000 females (unweighted)	Design: Repeated cross-sectional survey Analytic strategy: A pre-post analytic strategy was utilized through stratified simple logistic regression analysis. Survey weights used in all analyses.	**ACA expansions[3]:** Measured by interview year Pre-ACA: 2012 Post-ACA: 2015	What was the impact of the ACA insurance expansions on insurance coverage within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH other(NHO), NH White (NHW)]	**Uninsurance:** Self-reported current health insurance status. [Uninsured, Insured]	OR_H = 0.7, p=0.052 OR_{NHB} = 0.5, p=0.013 OR_{NHO} = 0.2, p=0.007 OR_{NHW} = 0.5, p=0.000
2018	Manuel	NHIS	Setting: US, 2006-2014 Inclusion criteria: Adults aged ≥18 years. Exclusion criteria:	Design: Repeated cross-sectional Analytic strategy: A pre-post analytic strategy was	**ACA:** Measured by survey date. Pre-ACA: 2006 Post-ACA: 2014	What was the impact of the ACA on access to and utilization of healthcare within specific racial/ethnic groups?	Self-reported [Asian(A), Black(B), Hispanic(H), White(W)]	**Physician office visit:** Respondent reported having a physician office visit in the past 12 months. [Yes, No]	PD_A = -0.3, p>0.05 PD_B = -0.3, p>0.05 PD_H = -1.2, p>0.05 PD_W = -0.4, p>0.05

Table A4 (cont'd)

Individuals who reported a race/ethnicity of "Other" n=143,231 women (unweighted)	employed. Multiple linear probability models, stratified by gender and race/ ethnicity, were used. Covariates included predispose-ing, enabling, and need-related factors. See original article for complete list of factors. We report only estimates for women.	*Note: This is one of two pre-period definitions considered.*			**Mental health visit:** Respondent reported having a mental health visit in the past 12 months. [Yes, No]	PD_A = -0.8, p>0.05 PD_B = 0.9, p>0.05 PD_H = 0.7, p>0.05 PD_W = 0.4, p>0.05
					Emergency room visit: Respondent reported having an emergency room visit in the past 12 months. [Yes, No]	PD_A = -3.5, p>0.05 PD_B = 3.0, p≤0.05 PD_H = -0.8, p>0.05 PD_W = -2.3, p≤0.001
		ACA: Measured by survey date. Pre-ACA: 2012 Post-ACA: 2014 *Note: This is one of two pre-period definitions considered.*	What was the impact of the ACA on access to and utilization of healthcare within specific racial/ethnic groups?	Self-reported [Asian(A), Black(B), Hispanic(H), White(W)]	**Physician office visit:** Respondent reported having a physician office visit in the past 12 months. [Yes, No]	PD_A = 2.6, p>0.05 PD_B = -0.3, p>0.05 PD_H = -2.7, p≤0.05 PD_W = -0.7, p>0.05
					Mental health visit: Respondent reported having a mental health visit in the past 12 months. [Yes, No]	PD_A = -0.3, p>0.05 PD_B = 0.2, p>0.05 PD_H = -0.3, p>0.05 PD_W = -0.6, p>0.05
					Emergency room visits: Respondent reported having an emergency	PD_A = -0.4, p>0.05 PD_B = -0.7, p>0.05

Table A4 (cont'd)

								room visit in the past 12 months. [Yes, No]	PD_H = -2.3, $p \leq 0.05$ PD_W = -1.5, $p \leq 0.05$
2018	Wehby & Lyu	ACS	Setting: US, 2011-2015 Inclusion criteria: Adults aged 19-64 years with at most a high school education. Exclusion criteria: Residents of states that expanded Medicaid after Jan 1, 2014. n=1,438,733 women (unweighted)	Design: Repeated cross-sectional survey Analytic strategy: DD approach with stratified linear probability models. State and year fixed effects were included, and standard errors were clustered at the state level. Model was stratified by potential effect-modifiers. Sensitivity analyses were also conducted to consider alternative "exposure" definitions and an event	**Medicaid expansion (ME):** Measured by survey date and state of residence. Exposed: Women who lived in a state that expanded Medicaid. Unexposed: Women who lived in a state that did not expand Medicaid. Pre-ME: 2011-2013 Post-ME: 2014-2015	Did the impact of Medicaid expansion on insurance coverage differ by race/ethnicity?	Self-reported [Hispanic(H), NH Black(NHB), NH other(NHO), NH White (NHW)]	**Medicaid coverage:** Respondent reported Medicaid health insurance coverage. [Yes, No] **Uninsured:** Respondent reported no health insurance coverage. [Yes, No] **Individually purchased coverage:** Respondent reported individually purchased health insurance coverage. [Yes, No] **Employer-sponsored coverage:** Respondent reported employer-sponsored health insurance	PDD_H = 7.5 (5.0, 10.0) PDD_{NHB} = 6.6 (4.4, 8.8) PDD_{NHO} = 6.0 (2.9, 9.1) PDD_{NHW} = 5.7 (3.9, 7.5) PDD_H = -5.1 (-8.0, -2.2) PDD_{NHB} = -3.8 (-6.0, -1.6) PDD_{NHO} = -4.1 (-7.6, -0.6) PDD_{NHW} = -3.9 (-5.5, -2.3) PDD_H = -1.4 (-3.6, 0.8) PDD_{NHB} = -1.0 (-2.2, 0.2) PDD_{NHO} = -3.1 (-6.0, -0.2) PDD_{NHW} = -0.8 (-1.6, 0.0) PDD_H = -0.9 (-2.3, 0.5) PDD_{NHB} = -1.3 (-2.7, 0.1) PDD_{NHO} = 0.7 (-1.5, 2.9) PDD_{NHW} = -0.9 (-1.9, 0.1)

Table A4 (cont'd)

				study approach, studying the effect estimates in 2014 and 2015 separately. Sensitivity analyses corroborated main findings. Results not shown here. ACS weights were used in all analyses				coverage. [Yes, No] **Any private coverage:** Respondent reported private health insurance coverage. [Yes, No]	PDD_H = -2.4 (-4.4, -0.4) PDD_{NHB} = -2.5 (-4.1, -0.9) PDD_{NHO} = -2.2 (-6.1, 1.7) PDD_{NHW} = -1.7 (-2.9, -0.5)
2019	Brown et al.	NCHS natality files, HRSA Area Health Resource file, and BRFSS	Setting: US, 2011-2016 Inclusion criteria: Births to women aged ≥19 years. Exclusion criteria: Births with missing information, births to women living in states that did not adopt the 2003 revision of the birth certificate by Jan 1, 2013,	Design: Repeated cross-sectional Analytic strategy: A DD approach was used with linear probability models. Covariates included maternal, infant, and state-level factors. See original article for full list.	**Medicaid expansion (ME):** Measured by maternal state of residence and date of birth. Exposed: Births to women living in a state that expanded Medicaid. Unexposed: Births to women living in a state that did not expand Medicaid.	Did the impact of Medicaid expansion on birth outcomes differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White (NHW)]	**Preterm birth:** Birth at <37 weeks gestation based on clinical/obstetric estimate. [Yes, No] **Very preterm birth:** Birth at <32 weeks gestation based on	PDD_H = -0.10 (-0.29, 0.09) PDD_{NHB} = -0.26 (-0.65,0.12) PDD_{NHW} = 0.07 (-0.06,0.20) PDD_{NHB} - PDD_{NHW}: -0.43 (-0.84, -0.02) PDD_H - PDD_{NHW}: 0.02 (-0.15, 0.18) PDD_H = -0.01 (-0.05, 0.03) PDD_{NHB} = -0.13 (-0.25, -0.01)

Table A4 (cont'd)

	births that occurred prior to the state's first full year of adoption of the 2003 revision, and births that occurred in one of the 8 states with approved Section 1115 waivers for Medicaid expansion. n=15,631,174 births	Standard errors were clustered at the state level. Three-way interactions between exposure, period, and race/ethnicity were included to provide stratified and DDD estimates.	Pre-ME: Jan. 1, 2011 – Dec. 31, 2013 Post-ME: Jan. 1, 2014 – Dec. 31, 2016 *Note: If a state expanded after Jan. 1, 2014, then the month of expansion replaced 'Jan. 1, 2014' in the above definitions.*	clinical/obstetric estimate. [Yes, No]	PDD_{NHW} = -0.01 (-0.04, 0.02) PDD_{NHB} - PDD_{NHW}: -0.14 (-0.26, -0.02) PDD_{H} - PDD_{NHW}: 0.03 (-0.02, 0.08)
				Low birthweight: Birthweight <2500g. [Yes, No]	PDD_{H} = -0.09 (-0.22, 0.03) PDD_{NHB} = -0.44 (-0.77, -0.11) PDD_{NHW} = -0.01 (-0.11, 0.10) PDD_{NHB} - PDD_{NHW}: -0.53 (-0.96, -0.10) PDD_{H} - PDD_{NHW}: 0.01 (-0.12, 0.14)
				Very low birthweight: Birthweight <1500g. [Yes, No]	PDD_{H} = -0.01 (-0.06, 0.04) PDD_{NHB} = -0.15 (-0.25, -0.05) PDD_{NHW} = -0.02 (-0.05, 0.01) PDD_{NHB} - PDD_{NHW}:

Table A4 (cont'd)

			-0.13 (-0.25, -0.01)
			PDD_H - PDD_{NHW}: 0.02 (-0.02, 0.06)
Did the impact of Medicaid expansion on maternal health and prenatal care differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Prenatal care initiation:** Prenatal care was initiated in the 1st trimester. [Yes, No]	PDD_{NHB} - PDD_{NHW}: 0.20 (-1.49, 1.88)
			PDD_H - PDD_{NHW}: 0.20 (-1.37, 1.76)
		Pre-pregnancy diabetes: Maternal diagnosis of diabetes prior to pregnancy. [Yes, No]	PDD_{NHB} - PDD_{NHW}: 0.01 (-0.07, 0.09)
			PDD_H - PDD_{NHW}: 0.10 (0.05, 0.14)
		Pre-pregnancy hypertension: Maternal diagnosis of hypertension prior to pregnancy. [Yes, No]	PDD_{NHB} - PDD_{NHW}: -0.02 (-0.36, 0.32)
			PDD_H - PDD_{NHW}: -0.02 (-0.13, 0.09)
		Cigarette use after 1st trimester: Cigarette use after the 1st	PDD_{NHB} - PDD_{NHW}: 0.03 (-0.70, 0.76)

Table A4 (cont'd)

		trimester of pregnancy. [Yes, No]	PDD_H - PDD_{NHW}: 0.03 (-0.46, 0.51)
		Any infection: Infection (gonorrhea, syphilis, chlamydia, Hepatitis B, or Hepatitis C) present and/or treated during pregnancy. [Yes, No]	PDD_{NHB} - PDD_{NHW}: 0.30 (-0.46, 1.07) PDD_H - PDD_{NHW}: 0.09 (-0.21, 0.39)
		Medicaid covered delivery: Medicaid was listed as the primary payer for delivery. [Yes, No]	PDD_{NHB} - PDD_{NHW}: -0.79 (-2.81, 1.24) PDD_H - PDD_{NHW}: -3.24 (-5.78, -0.70)
		Delivery covered by insurance: Some health insurance coverage listed as the primary payer for delivery. [Yes, No]	PDD_{NHB} - PDD_{NHW}: 0.19 (-0.56, 0.95) PDD_H - PDD_{NHW}: -0.56 (-2.07, 0.95)
Among low-income women, did the impact of Medicaid expansion on birth outcomes differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate.	**Preterm birth:** Birth at <37 weeks gestation based on clinical/obstetric	Medicaid-covered births: PDD_H = -0.02 (-0.20, 0.17) PDD_{NHB} = -0.34 (-0.72, 0.04)

Table A4 (cont'd)

Note: Medicaid payer at delivery and education level are used as proxies for being "low-income."	[Hispanic(H), NH Black(NHB), NH White(NHW)]	estimate. [Yes, No]	Medicaid-covered births: PDD_H = -0.02 (-0.20, 0.17) PDD_{NHB} = -0.34 (-0.72, 0.04) PDD_{NHW} = -0.02 (-0.22, 0.17) PDD_{NHB} - PDD_{NHW}: -0.47 (-0.81, 0.12) PDD_H - PDD_{NHW}: 0.13 (-0.07, 0.34) Medicaid-covered births to women with at most a high school degree: PDD_H = -0.07 (-0.29, 0.16) PDD_{NHB} = -0.51 (-1.03, 0.02) PDD_{NHW} = -0.08 (-0.45, 0.30) PDD_{NHB} - PDD_{NHW}: -0.46 (-1.02, 0.10) PDD_H - PDD_{NHW}: 0.14 (-0.31, 0.60)

Table A4 (cont'd)

Very preterm birth: Birth at <32 weeks gestation based on clinical/obstetric estimate. [Yes, No]	Medicaid-covered births: PDD_H = -0.04 (-0.10, 0.02) PDD_{NHB} = -0.21 (-0.37, -0.04) PDD_{NHW} = -0.03 (-0.09, 0.02) PDD_{NHB} - PDD_{NHW}: -0.20 (-0.36, -0.03) PDD_H - PDD_{NHW}: 0.02 (-0.08 0.13) Medicaid-covered births to women with at most a high school degree: PDD_H = 0.01 (-0.06, 0.08) PDD_{NHB} = -0.32 (-0.56, -0.09) PDD_{NHW} = 0.06 (-0.03, 0.14) PDD_{NHB} - PDD_{NHW}: -0.38 (-0.62, -0.13) PDD_H - PDD_{NHW}: -0.03 (-0.19, 0.12)

Table A4 (cont'd)

Low birthweight: Birthweight <2500g. [Yes, No]	Medicaid-covered births: PDD_H = 0.01 (-0.17, 0.20) PDD_{NHB} = -0.53 (-0.88, -0.17) PDD_{NHW} = -0.02 (-0.20, 0.15) PDD_{NHB} - PDD_{NHW}: -0.68 (-1.16, -0.21) PDD_H - PDD_{NHW}: 0.11 (-0.13, 0.35) Medicaid-covered births to women with at most a high school degree: PDD_H = 0.01 (-0.32, 0.35) PDD_{NHB} = -1.09 (-1.57, -0.61) PDD_{NHW} = -0.10 (-0.45, 0.25) PDD_{NHB} - PDD_{NHW}: -1.01 (-1.55, -0.47) PDD_H - PDD_{NHW}: 0.15 (-0.39, 0.69)

Table A4 (cont'd)

Very low birthweight: Birthweight <1500g. [Yes, No]	Medicaid-covered births: PDD_H = -0.02 (-0.09, 0.04) PDD_{NHB} = -0.19 (-0.33, -0.05) PDD_{NHW} = -0.05 (-0.09, -0.01) PDD_{NHB} - PDD_{NHW}: -0.16 (-0.32, 0.00) PDD_H - PDD_{NHW}: 0.02 (-0.06, 0.10) Medicaid-covered births to women with at most a high school degree: PDD_H = 0.07 (0.01, 0.13) PDD_{NHB} = -0.33 (-0.57, -0.10) PDD_{NHW} = 0.02 (-0.07, 0.12) PDD_{NHB} - PDD_{NHW}: -0.36 (-0.60, -0.13) PDD_H - PDD_{NHW}: 0.02 (-0.12, 0.16)

Table A4 (cont'd)

Among low-income women, did the impact of Medicaid expansion on maternal health and prenatal care differ by race/ethnicity? *Note: Medicaid payer at delivery and education level are used as proxies for being "low-income."*	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Prenatal care initiation:** Prenatal care was initiated in the 1st trimester. [Yes, No]	Medicaid-covered births: PDD_{NHB} - PDD_{NHW}: -0.91 (-2.84, 1.03) PDD_{H} - PDD_{NHW}: -0.31 (-2.69, 2.06) Medicaid-covered births to women with at most a high school degree: PDD_{NHB} - PDD_{NHW}: -1.50 (-3.65, 0.64) PDD_{H} - PDD_{NHW}: -0.72 (-3.78, 2.33)
		Pre-pregnancy diabetes: Maternal diagnosis of diabetes prior to pregnancy. [Yes, No]	Medicaid-covered births: PDD_{NHB} - PDD_{NHW}: -0.03 (-0.12, 0.07) PDD_{H} - PDD_{NHW}: 0.13 (0.07, 0.20) Medicaid-covered births to women with

Table A4 (cont'd)

		at most a high school degree: PDD_{NHB} - PDD_{NHW}: 0.02 (-0.22, 0.26) PDD_{H} - PDD_{NHW}: 0.29 (0.14, 0.45)
Pre-pregnancy hypertension: Maternal diagnosis of hypertension prior to pregnancy. [Yes, No]		Medicaid-covered births: PDD_{NHB} - PDD_{NHW}: -0.16 (-0.50, 0.18) PDD_{H} - PDD_{NHW}: -0.07 (-0.23, 0.10)
		Medicaid-covered births to women with at most a high school degree: PDD_{NHB} - PDD_{NHW}: -0.46 (-1.46, 0.53) PDD_{H} - PDD_{NHW}: -0.20 (-0.56, 0.17)

Table A4 (cont'd)

Cigarette use after 1st trimester: Cigarette use after the 1st trimester of pregnancy. [Yes, No]	Medicaid-covered births: PDD_{NHB} - PDD_{NHW}: 0.17 (-1.30, 1.64)	
	PDD_{H} - PDD_{NHW}: 0.70 (-0.33, 1.72)	
	Medicaid-covered births to women with at most a high school degree: PDD_{NHB} - PDD_{NHW}: -0.65 (-2.61, 1.31)	
	PDD_{H} - PDD_{NHW}: 0.04 (-1.37, 1.44)	
Any infection: Infection (gonorrhea, syphilis, chlamydia, Hepatitis B, or Hepatitis C) present and/or treated during pregnancy. [Yes, No]	Medicaid-covered births: PDD_{NHB} - PDD_{NHW}: 0.28 (-0.69, 1.26)	
	PDD_{H} - PDD_{NHW}: 0.07 (-0.54, 0.69)	
	Medicaid-covered births	

Table A4 (cont'd)

									to women with at most a high school degree: PDD_{NHB} - PDD_{NHW}: 0.15 (-0.80, 1.11) PDD_{H} - PDD_{NHW}: -0.07
2019	Eliason	NSFG	Setting: US, 2006-2013 Inclusion criteria: Females aged 19-34 years. Exclusion: Respondents who were aged 26 years, or were interviewed in 2010, or were missing analytic data, or were currently pregnant, on maternity leave, or trying to become pregnant. n=7,649 (unweighted)	Design: Repeated cross-sectional Analytic strategy: A DD approach was used with linear probability models. Covariates included individual and household characteris-tics. See original article for full list. Sensitivity analyses considered alternative post period to address confounding	**YADC provision:** Measured by respondent age and interview date. Exposed: Respondents aged 19-25 years Unexposed: Respondents aged 27-34 years Pre-YADC: 2006-2009 Post-YADC: 2011-2013	What was the impact of the YADC provision on sexual and reproductive healthcare utilization within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Prescription birth control:** Respondent reported receiving a method or a prescription for birth control in the last 12 months. [Yes, No] **Birth control counseling:** Respondent reported receiving counseling or information about birth control in the last 12 months. [Yes, No] **Check-up related to birth control:** Respondent reported receiving a	PDD_{H} = 13.5 (0.3, 26.8) PDD_{NHB} = 0.2 (-13.7, 14.1) PDD_{NHW} = -4.3 (-14.8, 6.2) PDD_{H} = -2.1 (-11.5, 7.3) PDD_{NHB} = 4.2 (-7.3, 15.7) PDD_{NHW} = 1.1 (-6.7, 8.9) PDD_{H} = 14.6 (1.7, 27.4) PDD_{NHB} = -7.8 (-19.9, 4.3) PDD_{NHW} = -3.2 (-13.0, 6.6)

Table A4 (cont'd)

				by contracept-ive mandate. We do not report results of sensitivity analyses, but they corroborated main findings. Sampling weights were used in all analyses.				check-up or medical test related to birth control in the last 12 months. [Yes, No] **Counseling, testing, or treatment for STI:** Respondent reported receiving counseling, testing or treatment for STI in the past 12 months. [Yes, No]	PDD_H = -5.8 (-16.8, 5.2) PDD_{NHB} = -0.2 (-13.3, 12.9) PDD_{NHW} = 1.4 (-5.9, 8.8)
						What was the impact of the YADC provision on insurance coverage within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Uninsurance:** Respondent reported having no health insurance at some point during the last 12 months. [Yes, No]	PDD_H = -17.0 (-27.8, -6.1) PDD_{NHB} = -1.6 (-13.9, 10.8) PDD_{NHW} = -10.7 (-18.8, -2.5)
2019	Li et al.	PRAMS	Setting: US, 2009-2013 Inclusion criteria: Women aged 19-31 years who had a live birth during the study period.	Design: Repeated cross-sectional Analytic strategy: A DD approach was used. Analyses	**YADC Provision:** Measured by age and date of last menstrual period (LMP). Exposed: Women aged 19-25 years.	Did the impact of the YADC provision on insurance coverage just before pregnancy differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Medicaid before pregnancy:** The respondent had Medicaid insurance coverage in the month before pregnancy. [Yes, No]	PDD_H = 2.8 (-1.8, 7.5) PDD_{NHB} = -6.5 (-14.3, 1.3) PDD_{NHW} = -0.8 (-2.8, 1.3) PDD_H vs. PDD_{NHW}: $p \geq 0.05$

Table A4 (cont'd)

	Exclusion criteria: Women aged 26 years, women who lived in states that did not release PRAMS data for all 5 years of the study period, women who lived in states that did not approve release of maternal age as a continuous variable, and women whose last menstrual period was from March 1 to December 31, 2010. n=44,960 women (unweighted)	controlled for maternal characteristics, whether delivery occurred in a state that already had expanded coverage to young adults, temporal trends, and state fixed effects. Sensitivity analyses further controlled for income. Models were stratified by potential effect-modifiers. Sampling weights were used in all analyses	Unexposed: Women aged 27-31 years. Pre-YADC: LMP in 2009-Mar. 2010 Post-YADC: LMP in 2011-2013			**Private insurance before pregnancy:** The respondent had private insurance coverage in the month before pregnancy. [Yes, No]	PDD_H = 0.4 (-5.1, 5.9) PDD_{NHB} = 13.8 (5.7, 21.9) PDD_{NHW} = 6.8 (4.3, 9.3) PDD_H vs. PDD_{NHW}: $p \geq 0.05$ PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
						Uninsurance before pregnancy: The respondent had no insurance coverage in the month before pregnancy. [Yes, No]	PDD_H = -3.2 (-9.3, 2.8) PDD_{NHB} = -7.3 (-17.0, 2.5) PDD_{NHW} = -6.0 (-8.6, -3.5) PDD_H vs. PDD_{NHW}: $p \geq 0.05$ PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
				Did the impact of the YADC provision on insurance coverage during pregnancy differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Medicaid during pregnancy:** The respondent had Medicaid insurance coverage during pregnancy. [Yes, No]	PDD_H = 1.6 (-4.0, 7.1) PDD_{NHB} = -13.0 (-20.5, -5.5) PDD_{NHW} = -6.7 (-10.3, -3.0) PDD_H vs. PDD_{NHW}: $p < 0.01$

Table A4 (cont'd)

				PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
			Private insurance during pregnancy: The respondent had private insurance coverage during pregnancy. [Yes, No]	PDD_{H} = -1.2 (-5.9, 3.5) PDD_{NHB} = 12.5 (5.2, 19.7) PDD_{NHW} = 6.0 (3.0, 9.1)
				PDD_{H} vs. PDD_{NHW}: $p<0.01$
				PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
			Uninsurance during pregnancy: The respondent had no insurance coverage during pregnancy. [Yes, No]	PDD_{H} = -0.4 (-5.1, 4.4) PDD_{NHB} = 0.5 (-1.8, 2.8) PDD_{NHW} = 0.6 (-0.6, 1.9)
				PDD_{H} vs. PDD_{NHW}: $p \geq 0.05$
				PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
	Did the impact of the YADC provision on insurance coverage at delivery differ by race/ethnicity?	Maternal race/ethnicity is typically (though not always) self-reported for the birth certificate. [Hispanic(H), NH	**Medicaid at delivery:** The respondent had Medicaid insurance coverage at delivery. [Yes, No]	PDD_{H} = 1.9 (-4.7, 8.6) PDD_{NHB} = -9.9 (-18.2, -1.6) PDD_{NHW} = -5.4 (-9.0, -1.9)

Table A4 (cont'd)

		Black(NHB), NH White(NHW)]		PDD_H vs. PDD_{NHW}: $p<0.01$ PDD_{NHB} vs. PDD_{NHW}: $p\geq0.05$
			Private at delivery: The respondent had private insurance coverage at delivery. [Yes, No]	PDD_H = -2.4 (-8.3, 3.4) PDD_{NHB} = 10.3 (1.4, 19.1) PDD_{NHW} = 5.9 (2.6, 9.1) PDD_H vs. PDD_{NHW}: $p<0.01$ PDD_{NHB} vs. PDD_{NHW}: $p\geq0.05$
			Uninsurance at delivery: The respondent had no insurance coverage at delivery. [Yes, No]	PDD_H = 0.5 (-2.8, 3.8) PDD_{NHB} = -0.4 (-2.6, 1.9) PDD_{NHW} = -0.4 (-1.6, 0.7) PDD_H vs. PDD_{NHW}: $p\geq0.05$ PDD_{NHB} vs. PDD_{NHW}: $p\geq0.05$
	Did the impact of the YADC provision on prenatal and postpartum	Maternal race/ethnicity is typically (though not always) self-	**Timely prenatal care:** Prenatal care was initiated in	PDD_H = 4.7 (-1.7, 11.1) PDD_{NHB} = 2.4 (-5.6, 10.4)

Table A4 (cont'd)

preventive services differ by race/ethnicity?	reported for the birth certificate. [Hispanic(H), NH Black(NHB), NH White(NHW)]	the first trimester. [Yes, No]	PDD_{NHW} = 3.2 (0.7, 5.8) PDD_{H} vs. PDD_{NHW}: $p \geq 0.05$ PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
		Postpartum checkup: A postpartum check-up was received after delivery. [Yes, No]	PDD_{H} = -3.6 (-14.8, 7.6) PDD_{NHB} = -0.9 (-4.7, 2.8) PDD_{NHW} = -0.3 (-3.5, 2.9) PDD_{H} vs. PDD_{NHW}: $p \geq 0.05$ PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$
		Postpartum contraception: The respondent reported using contraceptives postpartum. [Yes, No]	PDD_{H} = -0.7 (-5.3, 3.9) PDD_{NHB} = 2.0 (-4.9, 8.8) PDD_{NHW} = -1.6 (-3.9, 0.7) PDD_{H} vs. PDD_{NHW}: $p \geq 0.05$ PDD_{NHB} vs. PDD_{NHW}: $p \geq 0.05$

Table A4 (cont'd)

2020	Johnston & McMorrow	NSFG	Setting: US, 2006-2010 & 2015-2017 Inclusion criteria: Females aged 15-44 who have had intercourse with a man in the past 3 months and are not pregnant, trying to become pregnant, or postpartum. Exclusion criteria: Respondents who reported sterilization as their current birth control method or reported being sterile. Respondents who reported "NH other" as their racial/ethnic identity. n=7,972 females (unweighted)	Design: Repeated cross-sectional Analytic strategy: The Oaxaca-Blinder decomposition method was used to assess whether ACA-induced changes in health insurance coverage could explain observed changes in the use of prescription contraceptives. To do this, first, changes in prescription contracept-ion use and changes in insurance coverage between pre and post periods were examined (unadjusted	**ACA expansions[3]:** Measured by interview date. Pre-ACA: 2006-2010 Post-ACA: 2015-2017	What was the impact of the ACA expansions on insurance coverage within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Private insurance:** Respondent reported private coverage at the time of the survey. [Yes, No]	$PD_H = 7.7$, $p \geq 0.05$ $PD_{NHB} = 1.4$, $p \geq 0.05$ $PD_{NHW} = 0.9$, $p \geq 0.05$
								Medicaid/CHIP insurance: Respondent reported Medicaid or CHIP coverage at the time of the survey. [Yes, No]	$PD_H = 1.9$, $p \geq 0.05$ $PD_{NHB} = 8.1$, $p < 0.05$ $PD_{NHW} = 5.2$, $p < 0.05$
								Other insurance: Respondent reported some coverage at the time of survey, but it was not private or Medicaid/CHIP. [Yes, No]	$PD_H = 2.1$, $p \geq 0.05$ $PD_{NHB} = -2.2$, $p \geq 0.05$ $PD_{NHW} = 2.2$, $p < 0.05$
								Uninsurance: Respondent reported no coverage at the time of the survey. [Yes, No]	$PD_H = -11.7$, $p < 0.05$ $PD_{NHB} = -7.3$, $p < 0.05$ $PD_{NHW} = -8.3$, $p < 0.05$

Table A4 (cont'd)

	PD estimates presented). Then, the relationship between insurance coverage and prescription contracept-ive use was estimated in each period using linear probability models which controlled for respondent characteris-tics. See original article for full list. Finally, these models were used to assess whether the observed change in insurance coverage (due to the ACA) could explain the observed change in prescription contra-ception use	What was the impact of the ACA expansions on contraception use within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH White(NHW)]	**Prescription contraceptives:** Respondent reported use of LARC or other hormonal birth control method in the month of the interview. [Yes, No]	$PD_H = 2.0$, $p \geq 0.05$ $PD_{NHB} = 10.2$, $p < 0.05$ $PD_{NHW} = 0.9$, $p \geq 0.05$ **EPD, based on pre-ACA relationship and insurance status[4]:** $EPD_H = 1.6$, $p < 0.05$ $EPD_{NHB} = 1.2$, $p \geq 0.05$ $EPD_{NHW} = 1.7$, $p < 0.05$ **EPD, based on pre-ACA relationship and insurance type[4]:** $EPD_H = 1.3$, $p \geq 0.05$ $EPD_{NHB} = 1.2$, $p \geq 0.05$ $EPD_{NHW} = 1.4$, $p \geq 0.05$ **EPD, based on post-ACA relationship and insurance status[4]:** $EPD_H = -1.3$, $p \geq 0.05$ $EPD_{NHB} = 2.2$, $p \geq 0.05$ $EPD_{NHW} = 2.7$, $p < 0.05$

Table A4 (cont'd)

	was estimated in each period using linear probability models which controlled for respondent characteris-tics. See original article for full list. Finally, these models were used to assess whether the observed change in insurance coverage (due to the ACA) could explain the observed change in prescription contracept-ive use following the ACA. This method was carried out for each racial/ethnic group. Sensitivity analyses limited to		**EPD, based on post-ACA relationship and insurance type[4]:** EPD_H = -1.0, p≥0.05 EPD_{NHB} = 2.3, p≥0.05 EPD_{NHW} = 2.5, p≥0.05
		Prescription (LARC): Respondent reported use of LARC in the month of the interview. [Yes, No]	PD_H = 15.5, p<0.05 PD_{NHB} = 13.1, p< 0.05 PD_{NHW} = 13.8, p< 0.05
		Prescription (non-LARC): Respondent reported use of non-LARC hormonal birth control method in the month of the interview. [Yes, No]	PD_H = -13.6, p<0.05 PD_{NHB} = -3.0, p≥0.05 PD_{NHW} = -12.8, p<0.05
		Non-prescription contraceptives: Respondent reported use of male condoms, withdrawal, fertility awareness, other barrier method, or emergency	PD_H = -2.2, p≥0.05 PD_{NHB} = -4.1, p≥0.05 PD_{NHW} = -0.1, p≥0.05

Table A4 (cont'd)

				women aged ≥19 years, and included women using sterilization as their current birth control method. Survey weights were used in all analyses.				contraception in the month of the interview. [Yes, No]	
								Contraception nonuse: Respondent reported no use of prescription or non-prescription birth control method. [Yes, No]	PD_H = 0.2, p≥0.05 PD_{NHB} = -6.1, p≥0.05 PD_{NHW} = -0.8, p≥0.05
2020	MacCallum-Bridges & Margerison	NSFG	Setting: US, 2008-2010, 2013-2015 Inclusion criteria: Females aged 18-44 Exclusion criteria: Respondents who were not sexually active	Design: Repeated cross-sectional Analytic strategy: Pre/post analysis (logistic regression). Models were stratified by race/ ethnicity	**Preventive Care Mandate (PCM):** Measured by interview date. Pre-PCM: 2008-2010 Post-PCM: 2013-2015	What was the impact of the PCM on unintended pregnancy within specific racial/ethnic groups?	Self-reported [Hispanic(H), NH Black(NHB), NH White or other(NHWO)]	**Unintended pregnancy (individual-level):** Respondent reported at least 1 unintended pregnancy in the 12 months prior to interview. [Yes, No]	OR_H = 0.8 (0.5, 1.3) OR_{NHB} = 0.9 (0.6, 1.4) OR_{NHWO} = 0.9 (0.6, 1.4)

Table A4 (cont'd)

	or reported being sterile or infertile for at least 36 months. n=7,409 females (unweighted) n=939 pregnancies (unweighted)	Sensitivity analyses were performed among only contraceptive users. Results from sensitivity analyses are not reported here, but corroborated main findings. Survey weights were used in all analyses.		**Unintended pregnancy (pregnancy-level):** Most recent pregnancy in the prior 12 months was unintended pregnancy. [Yes, No]	OR_H = 0.7 (0.4, 1.4) OR_{NHB} = 0.7 (0.3, 1.6) OR_{NHWO} = 0.8 (0.4, 1.4)

[1] We use 'Methods' to refer to Study Design and Analytic Strategy
[2] Parentheses contain 95% confidence intervals. Subscripts indicate groups subject to the estimate. If confidence intervals and standard errors were not available, a p-value is given instead of confidence interval.
[3] ACA expansions include Medicaid expansion and the opening of the Marketplace/Health Insurance Exchanges
[4] EPD is obtained by applying the estimated linear probability model, which predicts the use of prescription contraceptives, based on observed changes in health insurance coverage between the pre-ACA and post-ACA period. Linear probability models were fit in both the pre-ACA and post-ACA period, and changes in both insurance status (insured, uninsured) and insurance type (private, Medicaid/CHIP, other, uninsured) were considered, resulting in four EPD values reported for each racial/ethnic group
ACA: Affordable Care Act
ACS: American Community Survey
BRFSS: Behavioral Risk Factor Surveillance System
CHIP: Children's Health Insurance Program
DD: Difference-in-differences
DDD: Difference-in-difference-in-differences
EPD: Expected prevalence difference
Gfk: Growth from Knowledge
HRSA: Health Resources & Services Administration
LARC: Long-acting reversible contraceptive
NCHS: National Center for Health Statistics
NH: Non-Hispanic
NHIS: National Health Interview Survey
NSFG: National Survey of Family Growth
OR: Odds ratio, calculated as the odds of the outcome in the post period divided by the odds of the outcome in the pre period

Table A4 (cont'd)

PD: Prevalence difference, reported in percentage points, and calculated as the percentage of women with the outcome in the post period minus the percentage of women with the outcome in the pre period.
PDD: Prevalence difference-in-differences, reported in percentage points. PDD is calculated as the difference between the pre-post change in the "exposed" group versus the "unexposed" group.
PR: Prevalence ratio, calculated as the prevalence of the outcome in the post period divided by the prevalence of the outcome in the pre period
PRAMS: Pregnancy Risk Assessment Monitoring System
RQ: Research question. To be included, the estimates produced by each study needed to address one of the following research questions: 1) did the ACA reduce a racial/ethnic disparity in an outcome of interest, 2) did the impact of the ACA on an outcome of interest differ by race/ethnicity, or 3) what was the impact of the ACA on an outcome within specific racial/ethnic groups? Please note that studies may address these questions by producing causal or non-causal estimates.
STI: Sexually transmitted infection
YADC: Young adult dependent coverage

APPENDIX B: IRB DETERMINATION

MICHIGAN STATE
UNIVERSITY

Initial Study APPROVAL
Revised Common Rule

October 15, 2020

To: Claire Margerison

Re: **MSU Study ID:** STUDY00005077
IRB: Biomedical and Health Institutional Review Board
Principal Investigator: Claire Margerison
Category: Expedited 7
Submission: Initial Study STUDY00005077
Submission Approval Date: 10/15/2020
Effective Date: 10/15/2020
Study Expiration Date: None; however modification and closure submissions are required (see below).

Title: The Impact of the Affordable Care Act (ACA) on Unintended Pregnancy: Combining epidemiological and econometric methods

Grant Title: The Impact of the Affordable Care Act (ACA) on Unintended Pregnancy: Combining epidemiological and econometric methods.
Sponsor: National Inst. of Child Health & Human Development
Status: Funded

This submission has been approved by the Michigan State University (MSU) BIRB. The submission was reviewed by the Institutional Review Board (IRB) through the Non-Committee Review procedure. The IRB has found that this study protects the rights and welfare of human subjects and meets the requirements of MSU's Federal Wide Assurance (FWA00004556) and the federal regulations for the protection of human subjects in research (e.g., 2018 45 CFR 46, 21 CFR 50, 56, other applicable regulations).

This letter notes that Colleen MacCallum-Bridges is a study team member on this study and this study is for her F31 (FAIN: F31HD103404).

This study meets the criteria for approval in 46.111. The funder required review under expedited category 7. MSU IRB typically would not apply this category to secondary analyses of existing data because of guidance issued by OHRP. Normally, secondary analyses of existing data would fit into Exempt category 4(ii) or Expedited category 5.

Office of Regulatory Affairs
Human Research Protection Program

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APPENDIX C: MANUSCRIPT 1

Table C1. Summary of compositional changes by eligibility

	Covariate	Level	P-Values*
Overall ACA Referent period: 2007-2009	Race/ethnicity	Hispanic	0.7852, 0.8846,0.6623, 0.4544, 0.4038
		NH Black	0.3361, **0.0369**, 0.2626, **0.0279**, 0.1210
		NH other or multiple race	0.6878, **0.0846**, **0.0358**, **0.0348**, **0.0099**
		NH White	0.9116, 0.9096, 0.3240, 0.6673, 0.9947
	Education level	Less than high school	0.2397, 0.4481, 0.2917, 0.2323, **0.0540**
		High school diploma or GED	0.5744, 0.2714, **0.0620**, 0.9492, **0.0411**
		Some college or associate degree	0.2113, 0.2726, 0.9777, 0.1162, 0.5859
		Bachelor's degree	0.6099, 0.5733, 0.2030, 0.6158, 0.6827
		Master's, doctoral, or professional degree	0.5292, 0.1995, **0.0284**, 0.5615, **0.0743**
	Marital Status	Married	0.1751, **<0.0001**, **0.0002**, **0.0002**, **<0.0001**
	Parity	Nulliparous	**<0.0001**, **<0.0001**, **<0.0001, <0.0001, <0.0001**
		Primiparous	0.2767, **0.0002**, **0.0374**, **0.0077**, 0.1047
		Multiparous	**<0.0001**, **<0.0001**, **<0.0001, <0.0001, <0.0001**
	Nativity	Born in the US	0.3729, **0.0198**, **0.0215**, **0.0244**, **0.0091**
	Metropolitan Residence	Lives in a metropolitan residence	**0.0467**, 0.3419, 0.1018, 0.1475, 0.5234

*These p-values are produced for each non-referent period using a DD regression model where the covariate level indicated is the outcome. This allowed me to evaluate whether the composition of the covariate was changing differentially between the eligible and ineligible groups. I bold an p-values ≤0.10 to indicate covariates for which there is suggestive evidence the composition was changing differentially between groups.

Table C2. Rationale for secondary analyses

	Modification	Explanation & Rationale
1	Alternative treatment definition based on age and education	In our primary analyses, I used age and income to define treatment. The NSFG income variable is likely weakened by measurement error and may be affected by the outcome (unintended pregnancy). Education level is highly correlated with income but is less susceptible to these issues, making it a useful proxy for income. For this reason, I considered an alternative definition for treatment based on age and highest education level attained, rather than age and household income level. Thus, I used educational level as a proxy for income – and subsequently, treatment. In this definition, I considered respondents who were under the age of 26 or had attained at most an associate degree to be "treated."
2	Include race and ethnicity in adjusted models as two separate variables	It is very common for researchers to include race and ethnicity as one combined variable, but there are conceptual reasons to consider these variables separately as well (e.g., race and ethnicity are two separate facets of individual social identity). To address these concerns, I considered race and ethnicity both as a combined variable and as two separate variables in my adjusted models.
3	Excluded respondents who were 26 years old at the time of interview	Women who were 26 at the time of interview might have turned 26 in the interview year, or they may be turning 27 later in the interview year. At a given moment in the prior calendar year, those who turned 26 in the interview year would have been 24 or 25 years old. Those who turned 27 in the interview year may have been 25 or 26 at a given moment in the prior calendar year. I would consider the former "treated" and the latter "untreated." Without year of birth – which is not available in the 2015-2017 and 2017-2019 public use NSFG data – I cannot know which 26-year- old respondents should be considered "treated." In the original analysis, I assumed all 26-year-old female respondents were "untreated." An alternative approach, utilized here, is to exclude these individuals from analyses.

Table C3. Unadjusted and adjusted ATT estimates associated with the impact of the ACA on prevalence of unintended pregnancy among sexually active US females aged 18-44, treatment based on age and education level rather than age and income level

	Unpooled Post Period (unweighted n=25,426)		Pooled Post Period A[3] (unweighted n=16,874)		Pooled Post Period B[3] (unweighted n=25,426)	
	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)
2005-2007	-0.9 (-2.6, 0.8)	-0.8 (-2.6, 1.0)	-0.9 (-2.6, 0.8)	-0.6 (-2.5, 1.2)	-0.9 (-2.6, 0.8)	-0.7 (-2.5, 1.1)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-1.5 (-3.5, 0.5)	-1.6 (-3.7, 0.5)	---	---	---	---
2012-2014	-1.6 (-3.3, 0.1)	-1.4 (-3.2, 0.4)	---	---	---	---
2014-2016	**-3.2 (-5.2, -1.3)**	**-3.1 (-5.1, -1.1)**	---	---	---	---
2016-2018	**-2.1 (-3.6, -0.6)**	**-2.0 (-3.5, -0.5)**	---	---	---	---
Pooled Post Periods[1]						
2014-2018	---	---	**-2.5 (-3.9, -1.1)**	**-2.4 (-3.9, -0.9)**	---	---
2010-2018	---	---	---	---	**-2.1 (-3.3, -1.0)**	**-2.0 (-3.3, -0.8)**

ATT = Average treatment effect on the treated; CI = Confidence interval

Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% significance level

* The unadjusted DD regression model includes period, treatment, and the interaction between period and treatment. The adjusted model also includes respondent's race/ethnicity, marital status, parity, nativity, and metropolitan residence

[1] Post period A considered unintended pregnancies only in the post-ACA period (2014-2018). Post period B considered unintended pregnancies in the transitional or post-ACA period (2010-2018).

Table C4. Unadjusted and adjusted ATT estimates associated with the impact of the ACA on prevalence of unintended pregnancy among sexually active US females aged 18-44, excluding 26-year-old respondents

	Unpooled Post Period (unweighted n=25,426)		Pooled Post Period A[3] (unweighted n=16,874)		Pooled Post Period B[3] (unweighted n=25,426)	
	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)
2005-2007	-0.5 (-2.3, 1.4)	-0.3 (-2.1, 1.5)	-0.5 (-2.3, 1.4)	-0.1 (-2.0, 1.7)	-0.5 (-2.3, 1.4)	-0.3 (-2.1, 1.5)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-2.1 (-4.4, 0.2)	**-2.5 (-4.9, -0.1)**	---	---	---	---
2012-2014	**-2.0 (-3.8, -0.2)**	**-2.0 (-3.8, -0.2)**	---	---	---	---
2014-2016	-1.7 (-3.7, 0.4)	-1.9 (-4.0, 0.2)	---	---	---	---
2016-2018	**-2.4 (-4.6, -0.2)**	**-2.7 (-4.9, -0.5)**	---	---	---	---
Pooled Post Periods[1]						
2014-2018	---	---	**-2.0 (-3.7, -0.3)**	**-2.2 (-3.9, -0.5)**	---	---
2010-2018	---	---	---	---	**-2.1 (-3.4, -0.8)**	**-2.3 (-3.7, -1.0)**

ATT = Average treatment effect on the treated; CI = Confidence interval

Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% significance level

* The unadjusted DD regression model includes period, treatment, and the interaction between period and treatment. The adjusted model also includes respondent's race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence

[1] Post period A considered unintended pregnancies only in the post-ACA period (2014-2018). Post period B considered unintended pregnancies in the transitional or post-ACA period (2010-2018).

Table C5. Adjusted ATT estimates associated with the impact of the ACA on prevalence of unintended pregnancy among sexually active US females aged 18-44, race and ethnicity included as two separate variables

	Unpooled Post Period (unweighted n=25,426)		Pooled Post Period A[3] (unweighted n=16,874)		Pooled Post Period B[3] (unweighted n=25,426)	
	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)	Unadjusted* (95% CI)	Adjusted* (95% CI)
2005-2007	---	-0.3 (-2.1, 1.5)	---	-0.1 (-1.9, 1.6)	---	-0.3 (-2.0, 1.5)
2007-2009	---	0.0 (ref)	---	0.0 (ref)	---	0.0 (ref)
2010-2012	---	**-2.4 (-4.7, -0.1)**	---	---	---	---
2012-2014	---	-1.6 (-3.4, 0.2)	---	---	---	---
2014-2016	---	-1.4 (-3.5, 0.6)	---	---	---	---
2016-2018	---	**-2.5 (-4.7, -0.4)**	---	---	---	---
Pooled Post Periods[1]						
2014-2018	---	---	---	**-1.8 (-3.4, -0.1)**	---	---
2010-2018	---	---	---	---	---	**-2.0 (-3.3, -0.7)**

ATT = Average treatment effect on the treated; CI = Confidence interval

Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% significance level

* The adjusted DD regression model includes period, treatment, and the interaction between period and treatment, as well as the following covariates: The adjusted model also includes respondent's race, ethnicity, education level, marital status, parity, nativity, and metropolitan residence

[1] Post period A considered unintended pregnancies only in the post-ACA period (2014-2018). Post period B considered unintended pregnancies in the transitional or post-ACA period (2010-2018).

APPENDIX D: MANUSCRIPT 2

Inclusion/Exclusion Criteria & Specification of Regression Models

To capture timing of interview, a variable called *PERIOD* was created based on NSFG survey cycle and interview date:

$$\begin{bmatrix} PERIOD = 0 & if\ interviewed\ in\ 1st\ half\ of\ 2006-2010\ cycle\ \ (i.e., 2006-2008) \\ PERIOD = 1 & if\ interviewed\ in\ 2nd\ half\ of\ 2006-2010\ cycle\ (i.e., 2008-2010) \\ PERIOD = 2 & if\ interviewed\ in\ 2011-2013\ cycle \\ PERIOD = 3 & if\ interviewed\ in\ 2013-2015\ cycle \\ PERIOD = 4 & if\ interviewed\ in\ 2015-2017\ cycle \\ PERIOD = 5 & if\ interviewed\ in\ 2017-2019\ cycle \end{bmatrix}$$

Further, unintended pregnancy was measured in the prior calendar year, which allowed a 12-month recall period for identifying reports of unintended pregnancy and shifted the dates associated with each period by one year:

$$\begin{bmatrix} PERIOD = 0 & 2005-2007 \\ PERIOD = 1 & 2007-2009 \\ PERIOD = 2 & 2010-2012 \\ PERIOD = 3 & 2012-2014 \\ PERIOD = 4 & 2014-2016 \\ PERIOD = 5 & 2016-2018 \end{bmatrix}$$

The ACA Dependent Coverage Provision

Inclusion/Exclusion Criteria: To evaluate the ACA dependent coverage provision, which went into effect in September of 2010, I limited analyses to include only NSFG cycles that span 2006-2015. By doing this, my analyses considered only pregnancies that occurred up to 2014, which reduces the possibility that my estimates are confounded by the effects of ACA components that were implemented in and after 2014. I further limited analyses to include only respondents aged 18-30 to reduce the possibility of confounding by age through restriction. This resulted in an unweighted analytic sample size of n=9,249.

Model Specification: The regression model used to estimate the ATT for the ACA dependent coverage provision with an unpooled post period was specified as:

$$y_i = \beta_0 + \beta_1(P0_i) + \beta_2(P2_i) + \beta_3(P3_i) + \beta_4(DC_i) + \beta_5(P0_i)(DC_i) + \beta_6(P2_i)(DC_i) + \beta_7(P3_i)(DC_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent* i *experienced an unintended pregnancy*

$P0_i$ *indicates respondent* i *had a recall period of* $2005-2007$ $(PERIOD = 0)$

$P2_i$ *indicates respondent* i *had a recall period of* $2010-2012$ $(PERIOD = 2)$

$P3_i$ *indicates respondent* i *had a recall period of* $2012-2014$ $(PERIOD = 3)$

DC_i *indicates whether respondent* i *was aged* < 26 *years old*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent* i

This model specifies 2007-2009 as the referent period. Using this model, the ATT of the dependent coverage provision was estimated in 2010-2012 ($\hat{\beta}_6$) and 2012-2014 ($\hat{\beta}_7$). Further, $\hat{\beta}_5$ allows us to test the hypothesis that the trend in unintended pregnancy from 2005-2007 to 2007-2009 was the same in both treated and untreated groups. If there is not evidence that this coefficient differs from 0 (i.e., if the hypothesis test for this coefficient is not statistically significant), then there is no evidence that the common trend assumption is violated. To consider a pooled post period, I aggregated periods 2 and 3 into one post period.

The ACA Marketplace Subsidies

Inclusion/Exclusion Criteria: To evaluate the impact of the ACA Marketplace subsidies, which went into effect in 2014, I limited analyses to respondents with a household income that was at least 139% of the FPL to reduce income-level variation in the "untreated" group, and to remove individuals who were targeted by both Medicaid expansion and Marketplace subsidies (those with incomes of 100-138% of the FPL). Without this limitation, the untreated group would have contained both individuals with a household income <100% of the FPL, who would have

been eligible for Medicaid in states that expanded under the ACA, and individuals with a household income ≥400% of the FPL. The untreated group has greater conceptual clarity if limited to individuals with a household income ≥400% of the FPL. This resulted in an unweighted analytic sample size of n=15,550.

Model Specification: The regression model used to estimate the ATT for the ACA Marketplace subsidies with an unpooled post period was specified as:

$$y_i = \beta_0 + \beta_1(P0_i) + \beta_2(P1_i) + \beta_3(P2_i) + \beta_4(P4_i) + \beta_5(P5_i) + \beta_6(MS_i) + \beta_7(P0_i)(MS_i) + \beta_8(P1_i)(MS_i) + \beta_9(P2_i)(MS_i) + \beta_{10}(P4_i)(MS_i) + \beta_{11}(P5_i)(MS_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P0_i$ *indicates respondent i had a recall period of* $2005-2007$ $(PERIOD = 0)$

$P1_i$ *indicates respondent i had a recall period of* $2007-2009$ $(PERIOD = 1)$

$P2_i$ *indicates respondent i had a recall period of* $2010-2012$ $(PERIOD = 2)$

$P4_i$ *indicates respondent i had a recall period of* $2014-2016$ $(PERIOD = 4)$

$P5_i$ *indicates arespondent i had recall period of* $2016-2018$ $(PERIOD = 5)$

MS_i *indicates whether respondent i had a household income* $139-399\%$ *of the FPL*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specifies 2012-2014 as the referent period. Using this model, the ATT of the ACA Marketplace subsidies was estimated in 2014-2016 ($\hat{\beta}_{10}$) and 2016-2018 ($\hat{\beta}_{11}$). Further, $\hat{\beta}_7$, $\hat{\beta}_8$, and $\hat{\beta}_9$ allow us to test the hypothesis that the trends in unintended pregnancy prior to enactment of the Marketplace subsidies were the same in both treated and untreated groups. If there is no evidence that these coefficients differ from 0 (i.e., if the hypothesis tests for these coefficients are not statistically significant), then there is no evidence that the common trend assumption is violated. To consider a pooled post period, I aggregated periods 4 and 5 into one post period.

The ACA Insurance Expansions

Inclusion/Exclusion Criteria: To evaluate the ACA insurance expansions, which began on January 2, 2014, no additional inclusion/exclusion criteria were applied. Thus, the unweighted analytic sample included n=25,426 respondents.

Model Specification: I used the following regression model to estimate the ATT for the ACA insurance expansions with an unpooled post period:

$$y_i = \beta_0 + \beta_1(P0_i) + \beta_2(P1_i) + \beta_3(P2_i) + \beta_4(P4_i) + \beta_5(P5_i) + \beta_6(IE_i) + \beta_7(P0_i)(IE_i) + \beta_8(P1_i)(IE_i) + \beta_9(P2_i)(IE_i) + \beta_{10}(P4_i)(IE_i) + \beta_{11}(P5_i)(IE_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P0_i$ *indicates respondent i had a recall period of* $2005-2007$ $(PERIOD = 0)$

$P1_i$ *indicates respondent i had a recall period of* $2007-2009$ $(PERIOD = 1)$

$P2_i$ *indicates arespondent i had recall period of* $2010-2012$ $(PERIOD = 2)$

$P4_i$ *indicates respondent i had a recall period of* $2014-2016$ $(PERIOD = 4)$

$P5_i$ *indicates respondent i had a recall period of* $2016-2018$ $(PERIOD = 5)$

IE_i *indicates whether respondent i had a household income* $< 400\%$ *of the FPL*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specifies 2012-2014 as the referent period. Using this model, the ATT of the ACA insurance expansions was estimated in 2014-2016 ($\hat{\beta}_{10}$) and 2016-2018 ($\hat{\beta}_{11}$). Further, $\hat{\beta}_7$, $\hat{\beta}_8$, and $\hat{\beta}_9$ allow us to test the hypothesis that the trends in unintended pregnancy prior to enactment of the Marketplace subsidies were the same in both treated and untreated groups. If there is no evidence that these coefficients differ from 0 (i.e., if the hypothesis tests for these coefficients are not statistically significant), then there is no evidence that the common trend assumption is violated. To consider a pooled post period, I aggregated periods 4 and 5 into one post period.

Table D1. Summary of compositional changes by eligibility

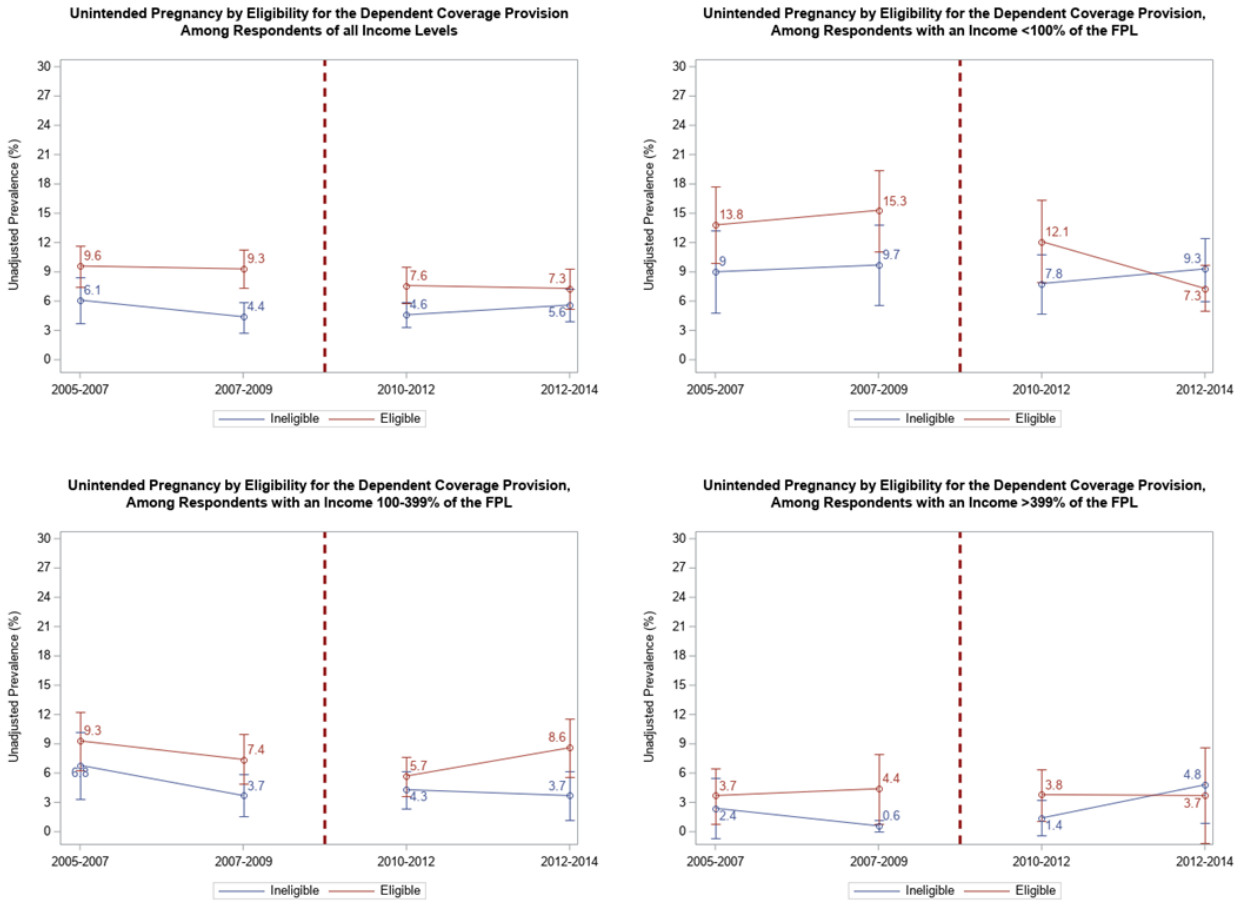
	Covariate	Level	P-Values*
Dependent Coverage Provision	Income level	<100% of the FPL	0.6144, 0.8014, 0.4577
		100-399% of the FPL	0.4356, 0.3333, 0.2510
		≥400% of the FPL	0.6098, 0.3673, **0.0321**
Referent period: 2007-2009	Race/ethnicity	Hispanic	0.6980, 0.5781, 0.1104
		NH Black	0.7013, 0.2786, 0.3270
		NH other or multiple race	0.6471, 0.9991, 0.6476
		NH White	0.7954, 0.2870, 0.6379
	Education level	Less than high school	0.1865, 0.4012, **0.0912**
		High school diploma or GED	0.5624, 0.8262, 0.9766
		Some college or associate degree	0.9528, 0.4644, 0.2497
		Bachelor's degree	0.4962, 0.6129, 0.5551
		Master's, doctoral, or professional degree	0.6809, 0.9615, 0.2653
	Marital Status	Married	0.2201, 0.1594, **0.0653**
	Parity	Nulliparous	0.9368, 0.9932, 0.9474
		Primiparous	0.9613, 0.3409, 0.7666
		Multiparous	0.9109, 0.3968, 0.8509
	Nativity	Born in the US	0.5509, 0.9865, 0.9045
	Metropolitan Residence	Lives in a metropolitan residence	0.7880, 0.8347, 0.8011
Marketplace Subsidies	Age Group	18-25	0.3767, 0.6059, 0.3860, 0.6953, 0.6589
		26-34	**0.0073**, **0.0004**, 0.4883, 0.1139, **0.0198**
		35-44	**0.0007**, **<0.0001**, 0.9820, 0.2267, **0.0571**
Referent period: 2012-2014	Race/ethnicity	Hispanic	0.7610, 0.2302, 0.4088, 0.1067, **0.0147**
		NH Black	0.4332, **0.0345**, 0.6583, **0.0879**, 0.9011
		NH other or multiple race	0.2621, 0.2422, 0.7779, 0.4863, 0.8335
		NH White	0.5708, 0.6933, 0.2700, 0.1112, **0.0996**
	Education level	Less than high school	**0.0602**, 0.7014, 0.6903, 0.2629, 0.4094
		High school diploma or GED	0.5423, 0.6446, 0.9929, 0.7567, 0.2590
		Some college or associate degree	0.1119, 0.6552, 0.2155, 0.6477, 0.5128
		Bachelor's degree	0.4105, 0.3208, **0.0209**, **0.0598**, **0.0561**
		Master's, doctoral, or professional degree	**0.0242**, **0.0670**, 0.5064, 0.1793, 0.9723
	Marital Status	Married	**0.0139**, **0.0003**, 0.4269, 0.5675, 0.1188
	Parity	Nulliparous	**0.0023**, **<0.0001**, 0.3303, **0.0359**, 0.1487
		Primiparous	0.1569, **0.0587**, 0.1892, 0.6267, 0.8926
		Multiparous	**<0.0001**, **<0.0001**, 0.9916, **0.0723**, **0.0889**
	Nativity	Born in the US	0.2030, **0.0920**, 0.8839, 0.9932, 0.9863
	Metropolitan Residence	Lives in a metropolitan residence	0.5273, 0.2706, 0.8131, 0.5692, 0.7512

Table D1. (cont'd)

Insurance Expansions	Age Group	18-25	0.7767, 0.7929, 0.3479, 0.7498, 0.7008
		26-34	**0.0019**, **0.0002**, 0.6031, **0.0705**, **0.0019**
		35-44	**0.0004**, **<0.0001**, 0.8174, 0.1351, **0.0055**
Referent period: 2012-2014	Race/ethnicity	Hispanic	0.9973, 0.4743, 0.4433, 0.4338, 0.1625
		NH Black	0.7034, 0.1499, 0.5495, 0.2633, 0.8604
		NH other or multiple race	0.1969, 0.1995, 0.8816, 0.7599, 0.8835
		NH White	0.5381, 0.6839, 0.2672, 0.2887, 0.3681
	Education level	Less than high school	**0.0266**, 0.3549,0.6095, 0.9288, 0.2914
		High school diploma or GED	**0.0045**, **0.0631**, 0.9373, 0.2406, 0.5091
		Some college or associate degree	0.3144, 0.9510, 0.1402, 0.2348, 0.1968
		Bachelor's degree	0.5528, 0.4065, **0.0175**, 0.1432, 0.1521
		Master's, doctoral, or professional degree	**0.0068**, **0.0525**, 0.6301, 0.1918, 0.9614
	Marital Status	Married	0.1010, **0.0029**, **0.0802**, 0.5343, **0.0838**
	Parity	Nulliparous	**0.0485**, **<0.0001**, 0.3865, **0.0868**, 0.3712
		Primiparous	0.1319, **0.0750**, 0.1817, 0.5175, 0.5771
		Multiparous	**0.0009**, **<0.0001**, 0.8696, 0.1958, 0.1304
	Nativity	Born in the US	0.3798, 0.1241, 0.8009, 0.5358, 0.8761
	Metropolitan Residence	Lives in a metropolitan residence	0.8072, **0.0722**, 0.4458, 0.7939, 0.4304

*These p-values are produced for each non-referent period using a DD regression model where the covariate level indicated is the outcome. This allowed me to evaluate whether the composition of the covariate was changing differentially between the eligible and ineligible groups. I bold an p-values ≤0.10 to indicate covariates for which there is suggestive evidence the composition was changing differentially between groups.

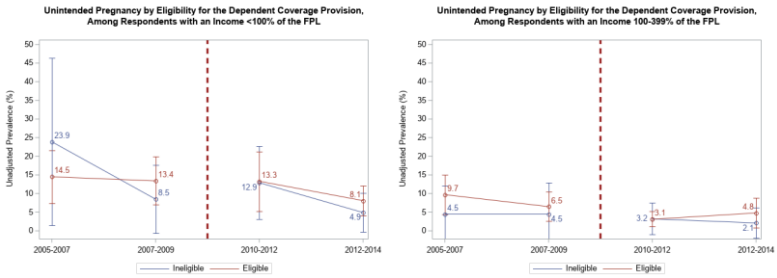
Figure D1. Prevalence of unintended pregnancy over the study period by dependent coverage treatment status, overall and stratified by income level



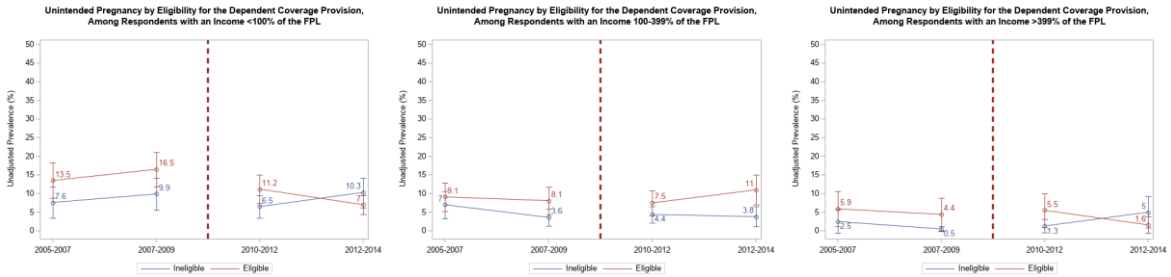
Red dashed line indicates the implementation of the dependent coverage provision

Figure D2. Prevalence of unintended pregnancy over the study period by dependent coverage treatment status, stratified by income level and parental presence in the household

Among Dependents Living with a Parent

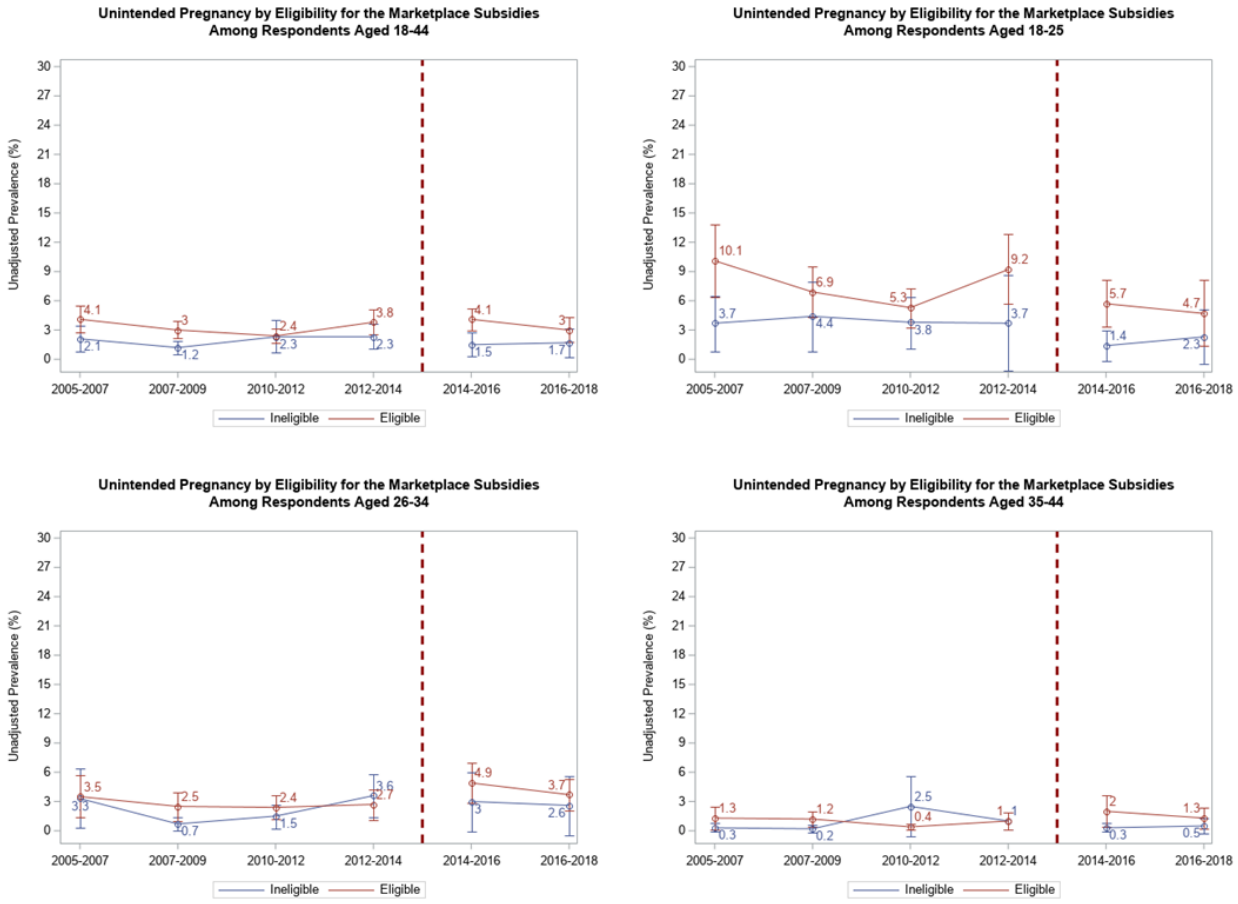


Among Dependents Not Living with a Parent



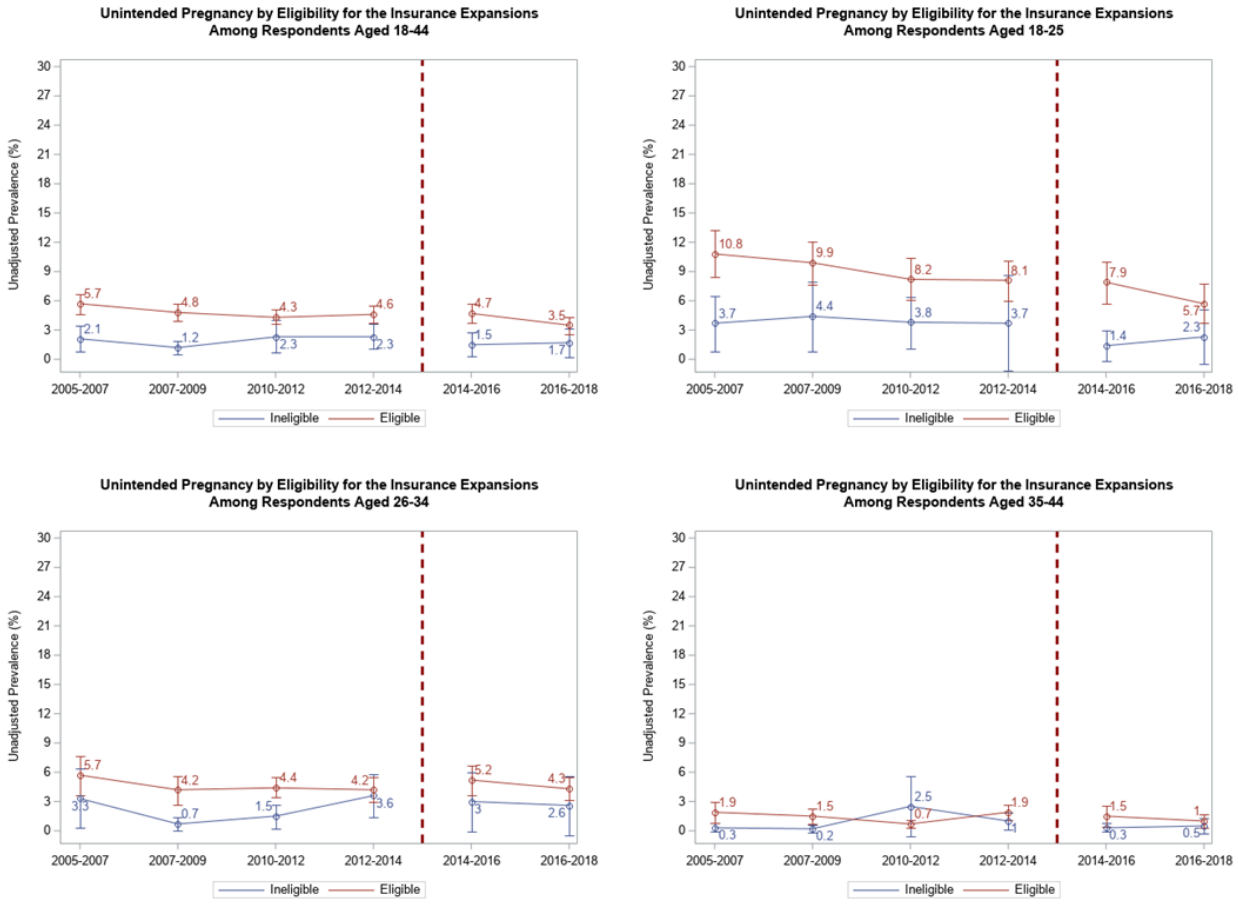
Note: Sample size was too small to estimate prevalence of unintended pregnancy among dependents living with their parents with a household income of ≥400% of the FPL

Figure D3. Prevalence of unintended pregnancy over the study period by Marketplace treatment status, overall and stratified by age group



Red dashed line indicates the implementation of the ACA Marketplace subsidies

Figure D4. Prevalence of unintended pregnancy over the study period by insurance expansions treatment status, overall and stratified by age group



Red dashed line indicates the implementation of the ACA insurance expansions

Table D2. Estimated prevalence difference in unintended pregnancy associated with the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions, by income or age subgroup, as estimated from the difference-in-differences models

	Dependent Coverage Provision (Unweighted n= 9,249)					
	Income <100% of the FPL (n=3,190)		**Income 100-399% of the FPL (n=4,709)**		**Income ≥400% of the FPL (n=1,350)**	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	-0.8 (-8.1, 6.5)	-0.9 (-8.7, 6.8)	-1.2 (-6.9, 4.6)	-1.3 (-6.9, 4.3)	-2.5 (-8.1, 3.1)	-1.7 (-6.0, 2.6)
2007-2009 Pooled Post Period	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2014	-4.7 (-11.3, 1.9)	-5.9 (-12.5, 0.7)	-0.7 (-4.8, 3.4)	-1.0 (-5.2, 3.2)	-3.7 (-8.6, 1.1)	-2.9 (-7.6, 1.7)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	-0.8 (-8.1, 6.5)	-0.8 (-8.5, 6.8)	-1.2 (-6.9, 4.6)	-1.3 (-6.9, 4.4)	-2.5 (-8.1, 3.1)	-1.9 (-6.5, 2.6)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-1.2 (-9.0, 6.6)	-3.4 (-11.3, 4.4)	-2.3 (-6.8, 2.2)	-2.6 (-7.3, 2.1)	-1.4 (-6.0, 3.3)	-0.5 (-4.8, 3.8)
2012-2014	**-7.5 (-14.2, -0.8)**	**-8.2 (-15.0, -1.4)**	1.2 (-3.6, 6.1)	1.0 (-3.8, 5.8)	-4.9 (-12.2, 2.5)	-4.2 (-11.3, 3.0)
	Dependent Coverage Provision Respondents Living with a Parent (Unweighted n=2,536)					
	Income <100% of the FPL (n=858)		**Income 100-399% of the FPL (n=1,306)**		**Income ≥400% of the FPL (n=372)**	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	-14.4 (-39.7, 10.9)	-14.5 (-39.8, 10.8)	3.1 (-10.5, 16.8)	0.4 (-13.4, 14.3)	***	***
2007-2009 Pooled Post Period	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2014	-2.0 (-14.6, 10.6)	-3.4 (-14.7, 8.0)	-1.0 (-11.0, 9.0)	-1.9 (-12.5, 8.7)	***	***
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	-14.4 (-39.7, 10.9)	-13.9 (-39.2, 11.4)	3.1 (-10.5, 16.8)	0.5 (-13.3, 14.2)	***	***
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-4.6 (-20.7, 11.5)	-7.4 (-23.3, 8.5)	-2.2 (-12.5, 8.2)	-2.4 (-13.5, 8.6)	***	***
2012-2014	-1.7 (-13.7, 10.2)	-1.2 (-12.1, 9.7)	0.7 (-10.4, 11.8)	-0.3 (-11.8, 11.3)	***	***

Table D2. (cont'd)

	Dependent Coverage Provision Respondents NOT Living with a Parent (Unweighted n=6,713)					
	Income <100% of the FPL (n=2,332)		**Income 100-399% of the FPL (n=3,403)**		**Income ≥400% of the FPL (n=978)**	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	-0.7 (-9.3, 7.8)	0.2 (-8.8, 9.1)	-2.4 (-9.3, 4.5)	-1.6 (-8.2, 5.0)	-0.6 (-8.0, 6.8)	0.5 (-5.2, 6.2)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
Pooled Post Period						
2010-2014	-7.0 (-14.3, 0.3)	**-7.6 (-15.2, -0.1)**	0.7 (-4.4, 5.8)	0.7 (-4.3, 5.8)	-4.1 (-9.9, 1.7)	-2.9 (-8.1, 2.3)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	-0.7 (-9.3, 7.8)	**0.1 (-8.8, 9.1)**	-2.4 (-9.3, 4.5)	-1.5 (-8.2, 5.1)	-0.6 (-8.0, 6.8)	0.2 (-5.6, 6.0)
2007-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-1.9 (-10.1, 6.2)	-3.6 (-12.0, 4.8)	-1.4 (-7.2, 4.4)	-1.5 (-7.3, 4.3)	0.2 (-6.4, 6.9)	1.3 (-4.7, 7.3)
2012-2014	**-10.0 (-17.9, -2.1)**	**-10.3 (-18.3, -2.2)**	2.7 (-3.1, 8.6)	3.1 (-2.7, 8.9)	**-7.4 (-14.1, -0.7)**	-6.1 (-12.5, 0.3)
	Marketplace Subsidies (Unweighted n=15,550)					
	Ages 18-25 (n=3,878)		**Ages 26-34 (n=5,976)**		**Ages 35-44 (n=5,696)**	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	0.8 (-6.2, 7.9)	0.0 (-6.6, 6.6)	1.1 (-2.6, 4.9)	0.6 (-3.3, 4.5)	1.0 (-0.8, 2.8)	1.0 (-0.9, 2.9)
2007-2009	-3.0 (-10.0, 4.0)	-4.2 (-10.9,2.5)	2.7 (-0.3, 5.7)	1.7 (-1.5, 4.8)	1.0 (-0.6, 2.6)	1.4 (-0.4, 3.1)
2010-2012	-4.1 (-10.4, 2.3)	-5 (-11.1,1)	1.9 (-1.1, 4.8)	1.6 (-1.4, 4.7)	-2.1 (-5.5, 1.3)	-2.1 (-5.5, 1.2)
2012-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
Pooled Post Period						
2014-2018	-2.0 (-8.3, 4.3)	-2.9 (-9.0, 3.1)	2.4 (-1.5, 6.3)	1.7 (-2.3, 5.6)	1.2 (-0.5, 2.9)	1.1 (-0.7, 2.8)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	0.8 (-6.2, 7.9)	0.1 (-6.5, 6.7)	1.1 (-2.6, 4.9)	0.6 (-3.3, 4.5)	1.0 (-0.8, 2.8)	1.0 (-0.9, 2.8)
2007-2009	-3.0 (-10.0, 4.0)	-4.2 (-10.9, 2.5)	2.7 (-0.3, 5.7)	1.6 (-1.5, 4.7)	1.0 (-0.6, 2.6)	1.3 (-0.4, 3.0)

Table D2. (cont'd)

2010-2012	-4.1 (-10.4, 2.3)	-5.1 (-11.1, 1.0)	1.9 (-1.1, 4.8)	1.6 (-1.4, 4.7)	-2.1 (-5.5, 1.3)	-2.1 (-5.5, 1.2)
2012-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2014-2016	-1.2 (-7.5, 5.0)	-2.9 (-8.8, 3.1)	2.9 (-2.0, 7.8)	2.2 (-2.8, 7.2)	1.7 (-0.4, 3.8)	1.5 (-0.6, 3.7)
2016-2018	-3.1 (-10.1, 3.9)	-3.3 (-10.1, 3.5)	2.0 (-2.4, 6.5)	1.5 (-3.0, 5.9)	0.8 (-1.1, 2.6)	0.6 (-1.2, 2.5)
	Insurance Expansions (Unweighted n=25,426)					
	Ages 18-25 (n=7,265)		**Ages 26-34 (n=9,906)**		**Ages 35-44 (n=8,255)**	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	2.8 (-3.4, 9.0)	2.7 (-3.3, 8.7)	1.7 (-2.2, 5.6)	1.4 (-2.6, 5.3)	0.7 (-1.0, 2.4)	0.7 (-1.0, 2.3)
2007-2009	1.2 (-5.4, 7.7)	0.6 (-5.8, 6.9)	2.8 (-0.1, 5.7)	1.9 (-1.1, 4.9)	0.4 (-1.1, 1.9)	0.5 (-1.0, 2.1)
2010-2012	0.1 (-6.0, 6.2)	-0.9 (-6.7, 5.0)	2.3 (-0.5, 5.1)	2.2 (-0.7, 5.0)	-2.7 (-6.0, 0.7)	-2.8 (-6.1, 0.6)
2012-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
Pooled Post Period						
2014-2018	0.9 (-4.7, 6.6)	0.6 (-4.9, 6.1)	1.1 (-2.5, 4.7)	0.7 (-3.0, 4.4)	0.0 (-1.5, 1.4)	-0.2 (-1.7, 1.3)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	2.8 (-3.4, 9.0)	2.6 (-3.4, 8.6)	1.7 (-2.2, 5.6)	1.4 (-2.6, 5.3)	0.7 (-1.0, 2.4)	0.7 (-1.0, 2.3)
2007-2009	1.2 (-5.4, 7.7)	0.5 (-5.9, 6.9)	2.8 (-0.1, 5.7)	1.8 (-1.2, 4.9)	0.4 (-1.1, 1.9)	0.5 (-1.1, 2.1)
2010-2012	0.1 (-6.0, 6.2)	-0.9 (-6.7, 5.0)	2.3 (-0.5, 5.1)	2.1 (-0.7, 5.0)	-2.7 (-6.0, 0.7)	-2.8 (-6.1, 0.6)
2012-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
2014-2016	2.1 (-3.6, 7.8)	0.9 (-4.7, 6.5)	1.5 (-2.9, 6.0)	1.2 (-3.3,5.7)	0.3 (-1.4, 2.1)	0.2 (-1.6, 1.9)
2016-2018	-0.9 (-7.0, 5.2)	-0.2 (-6.2, 5.7)	1.1 (-3.1, 5.2)	0.8 (-3.4, 5.0)	-0.4 (-2.0, 1.2)	-0.6 (-2.2, 1.0)

CI = Confidence interval; Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% level

* The unadjusted regression model includes period, treatment status, and the interaction between period and treatment status. The adjusted model also includes respondent's race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence

*** = Insufficient sample size, estimates are not produced

Table D3. Estimated prevalence difference in unintended pregnancy associated with the ACA dependent coverage provision, Marketplace subsidies, or insurance expansions, results from secondary analyses

	Dependent Coverage Provision					
	Original Estimates (n= 9,249)		Including Race, Ethnicity as Separate Variables (n= 9,249)		Excluding 26 Year Olds (n=8,436)	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period		Pooled Post Period	
2005-2007	-1.4 (-5.4, 2.6)	-1.3 (-5.3, 2.7)	---	-1.4 (-5.4, 2.6)	-2.1 (-6.4, 2.2)	-1.6 (-5.9, 2.6)
2007-2009	0.0 (ref)	0.0 (ref)	---	0.0 (ref)	0.0 (ref)	0.0 (ref)
Pooled Post Period						
2010-2014	-2.8 (-6.0, 0.3)	-2.7 (-5.9, 0.4)	---	-2.7 (-5.9, 0.4)	-2.8 (-6.1, 0.5)	-2.6 (-6.0, 0.7)
	Unpooled Post Period		Unpooled Post Period		Unpooled Post Period	
2005-2007	-1.4 (-5.4, 2.6)	-1.3 (-5.2, 2.7)	---	-1.3 (-5.3, 2.7)	-2.1 (-6.4, 2.2)	-1.6 (-5.9, 2.6)
2007-2009	0.0 (ref)	0.0 (ref)	---	0.0 (ref)	0.0 (ref)	0.0 (ref)
2010-2012	-1.9 (-5.4, 1.5)	-2.1 (-5.7, 1.5)	---	-2.1 (-5.6, 1.5)	-2.0 (-5.5, 1.6)	-2.1 (-5.7, 1.6)
2012-2014	-3.3 (-7.0, 0.4)	-3.0 (-6.7, 0.7)	---	-3.1 (-6.8, 0.6)	-3.2 (-7.1, 0.7)	-2.8 (-6.7, 1.2)
	Marketplace Subsidies					
	Original Estimates (n=15,550)		Including Race, Ethnicity as Separate Variables (n=15,550)			
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)		
	Pooled Post Period		Pooled Post Period			
2005-2007	0.5 (-1.8, 2.9)	0.5 (-1.8, 2.8)	---	0.5 (-1.8, 2.8)		
2007-2009	0.3 (-1.7, 2.4)	-0.1 (-2.2, 1.9)	---	-0.1 (-2.2, 1.9)		
2010-2012	-1.4 (-3.9, 1.2)	-1.9 (-4.4, 0.7)	---	-1.9 (-4.5, 0.6)		
2012-2014	0.0 (ref)	0.0 (ref)	---	0.0 (ref)		
Pooled Post Period						
2014-2018	0.5 (-1.8, 2.8)	0.0 (-2.3, 2.3)	---	0.1 (-2.2, 2.3)		
	Unpooled Post Period		Unpooled Post Period			
2005-2007	0.5 (-1.8, 2.9)	0.6 (-1.7, 2.9)	---	0.5 (-1.8, 2.8)		
2007-2009	0.3 (-1.7, 2.4)	-0.1 (-2.1, 1.9)	---	-0.1 (-2.2, 1.9)		

Table D3. (cont'd)

2010-2012	-1.4 (-3.9, 1.2)	-1.8 (-4.4, 0.7)	---	-1.9 (-4.5, 0.7)
2012-2014	0.0 (ref)	0.0 (ref)	---	0.0 (ref)
2014-2016	1.1 (-1.5, 3.6)	0.5 (-2.0, 3.1)	---	0.6 (-1.9, 3.1)
2016-2018	-0.1 (-2.8, 2.6)	-0.4 (-3.1, 2.3)	---	-0.4 (-3.1, 2.3)
		Insurance Expansions		
	Original Estimates (n=25,426)		Including Race, Ethnicity as Separate Variables (n=25,426)	
	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted* PD (95% CI)	Adjusted* PD (95% CI)
	Pooled Post Period		Pooled Post Period	
2005-2007	1.3 (-0.8, 3.5)	1.3 (-0.8, 3.5)	---	1.3 (-0.9, 3.4)
2007-2009	1.3 (-0.6, 3.3)	0.7 (-1.3, 2.6)	---	0.6 (-1.4, 2.6)
2010-2012	-0.3 (-2.7, 2.2)	-0.9 (-3.4, 1.5)	---	-1.0 (-3.5, 1.5)
2012-2014	0.0 (ref)	0.0 (ref)	---	0.0 (ref)
Pooled Post Period				
2014-2018	0.3 (-1.8, 2.3)	0.0 (-2.0, 2.0)	---	0.0 (-2.0, 2.1)
	Unpooled Post Period		Unpooled Post Period	
2005-2007	1.3 (-0.8, 3.5)	1.3 (-0.8, 3.5)	---	1.3 (-0.9, 3.4)
2007-2009	1.3 (-0.6, 3.3)	0.7 (-1.3, 2.6)	---	0.6 (-1.4, 2.6)
2010-2012	-0.3 (-2.7, 2.2)	-0.9 (-3.3, 1.6)	---	-1.0 (-3.4, 1.5)
2012-2014	0.0 (ref)	0.0 (ref)	---	0.0 (ref)
2014-2016	0.9 (-1.4, 3.3)	0.5 (-1.8, 2.8)	---	0.6 (-1.7, 2.9)
2016-2018	-0.4 (-2.8, 1.9)	-0.5 (-2.8, 1.9)	---	-0.4 (-2.8, 1.9)

CI = Confidence interval; Estimates reported as percentage point change; Bold estimates indicate statistical significance at the 5% level

* The unadjusted regression model includes period, treatment status, and the interaction between period and treatment status. The adjusted model also includes respondent's race/ethnicity, education level, marital status, parity, nativity, and metropolitan residence. Additionally, the adjusted regression for the dependent coverage provision also includes income level as a percent of the FPL, and the adjusted regression for the Marketplace subsidies and insurance expansions includes age group.

APPENDIX E: MANUSCRIPT 3

Inclusion/Exclusion Criteria & Specification of Regression Models

To capture timing of interview, a variable called *PERIOD* was created based on NSFG survey cycle and interview date:

$$\begin{bmatrix} PERIOD = 1 & if\ interviewed\ in\ 2006-2010\ cycle \\ PERIOD = 2 & if\ interviewed\ in\ 2011-2013\ or\ 2013-2015\ cycle \\ PERIOD = 3 & if\ interviewed\ in\ 2015-2017\ or\ 2017-2019\ cycle \end{bmatrix}$$

Further, unintended pregnancy was measured in the prior calendar year, which allowed a 12-month recall period for identifying reports of unintended pregnancy and shifted the dates associated with each period by one year:

$$\begin{bmatrix} PERIOD = 1 & 2005-2009 \\ PERIOD = 2 & 2010-2014 \\ PERIOD = 3 & 2014-2018 \end{bmatrix}$$

The ACA Dependent Coverage Provision

Inclusion/Exclusion Criteria: To evaluate the ACA dependent coverage provision, which went into effect in September of 2010, I limited analyses to include only NSFG cycles that span 2006-2015. By doing this, my analyses considered only pregnancies that occurred up to 2014, which reduces the possibility that my estimates are confounded by the effects of ACA components that were implemented in and after 2014. I further limited pre/post analyses to include only those who were eligible to benefit from the dependent coverage provision (i.e., those under the age of 26). This resulted in an unweighted analytic sample size of n=5,239.

Model Specification: The regression model used to estimate the association between the ACA dependent coverage and absolute racial/ethnic disparities in unintended pregnancy was specified as:

$$y_i = \beta_0 + \beta_1(P2_i) + \beta_2(HISP_i) + \beta_3(NHB_i) + \beta_4(NHO_i) + \beta_5(P2_i)(HISP_i) + \beta_6(P2_i)(NHB_i) + \beta_7(P2_i)(NHO_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P2_i$ *indicates respondent i had a recall period between* $2010 - 2014$ $(PERIOD = 2)$

$HISP_i$ *indicates whether respondent i reported Hispanic race/ethnicity*

NHB_i *indicates whether respondent i reported NH Black race/ethnicity*

NHO_i *indicates whether respondent i reported NH Other race/ethnicity*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specified 2005-2009 as the referent period, and NH White as the referent racial/ethnic group. NH White was chosen as the referent group because this group had the lowest prevalence of unintended pregnancy over the study period. In this model, $\hat{\beta}_1$ provides an estimate for the PD between the pre and post period among NH White women. $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ provide estimates for the PD between the specified racial/ethnic group and the referent group (NH White women) in the pre period. The coefficients on the two-way interaction ($\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$) provide estimates for the PDDs. That is, $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ estimate the association between the dependent coverage provision and each of the considered racial/ethnic disparities in unintended pregnancy. Further, $\hat{\beta}_1$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence in the pre and post period for each racial/ethnic group, and $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence for a given racial/ethnic group to that of the referent group for each time period.

The ACA Marketplace Subsidies

Inclusion/Exclusion Criteria: The ACA Marketplace subsidies went into effect in 2014 and applied to individuals with a household income between 100% and 399% of the FPL. Individuals with an income of 100%-138% of the FPL, however, may have also been eligible for Medicaid through the ACA expansion of Medicaid eligibility. As such, to evaluate the impact of the ACA Marketplace subsidies, I limited my analyses to respondents with a household income between 139% and 399% of the FPL. I further limited my analyses to include only respondents interviewed in or after the 2011-2013 NSFG cycle. This resulted in an unweighted analytic sample size of n=6,400.

Model Specification: The regression model used to estimate the association between the ACA Marketplace subsidies and absolute racial/ethnic disparities in unintended pregnancy was specified as:

$$y_i = \beta_0 + \beta_1(P3_i) + \beta_2(HISP_i) + \beta_3(NHB_i) + \beta_4(NHO_i) + \beta_5(P3_i)(HISP_i) + \beta_6(P3_i)(NHB_i) + \beta_7(P3_i)(NHO_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P3_i$ *indicates respondent i had a recall period between* $2014 - 2018$ $(PERIOD = 3)$

$HISP_i$ *indicates whether respondent i reported Hispanic race/ethnicity*

NHB_i *indicates whether respondent i reported NH Black race/ethnicity*

NHO_i *indicates whether respondent i reported NH Other race/ethnicity*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specified 2010-2014 as the referent period, and NH White as the referent racial/ethnic group. NH White was chosen as the referent group because this group had the lowest prevalence

of unintended pregnancy over the study period. In this model, $\hat{\beta}_1$ provides an estimate for the PD between the pre and post period among NH White women. $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ provide estimates for the PD between the specified racial/ethnic group and the referent group (NH White women) in the referent (pre) period. The coefficients on the two-way interaction provide estimates for the PDDs. That is, $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ estimate the association between the Marketplace subsidies and each of the considered racial/ethnic disparities in unintended pregnancy. Further, $\hat{\beta}_1$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence in the pre and post period for each racial/ethnic group, and $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence for a given racial/ethnic group to that of the referent group for each time period.

The ACA Insurance Expansions

Inclusion/Exclusion Criteria: The ACA insurance expansions (Medicaid expansion and the opening of the Marketplaces) occurred in 2014 and applied to individuals with a household income <400% of the FPL. As such, to evaluate the impact of the ACA insurance expansions, I limited my analyses to respondents with a household income below 400% of the FPL. I further limited my analyses to include only respondents interviewed in or after the 2011-2013 NSFG cycle. This resulted in an unweighted analytic sample size of n=12,751.

Model Specification: The regression model used to estimate the association between the ACA insurance expansions and absolute racial/ethnic disparities in unintended pregnancy was specified as:

$$y_i = \beta_0 + \beta_1(P3_i) + \beta_2(HISP_i) + \beta_3(NHB_i) + \beta_4(NHO_i) + \beta_5(P3_i)(HISP_i) + \beta_6(P3_i)(NHB_i) + \beta_7(P3_i)(NHO_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P3_i$ *indicates respondent i had a recall period between* $2014 - 2018$ $(PERIOD = 3)$

$HISP_i$ *indicates whether respondent i reported Hispanic race/ethnicity*

NHB_i *indicates whether respondent i reported NH Black race/ethnicity*

NHO_i *indicates whether respondent i reported NH Other race/ethnicity*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specified 2010-2014 as the referent period, and NH White as the referent racial/ethnic group. NH White was chosen as the referent group because this group had the lowest prevalence of unintended pregnancy over the study period. In this model, $\hat{\beta}_1$ provides an estimate for the PD between the pre and post period among NH White women. $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ provide estimates for the PD between the specified racial/ethnic group and the referent group (NH White women) in the referent (pre) period. The coefficients on the two-way interaction provide estimates for the PDDs. That is, $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ estimate the association between the insurance expansions and each of the considered racial/ethnic disparities in unintended pregnancy. Further, $\hat{\beta}_1$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence in the pre and post period for each racial/ethnic group, and $\hat{\beta}_2, \hat{\beta}_3$, and $\hat{\beta}_4$ can be used together with $\hat{\beta}_5, \hat{\beta}_6$, and $\hat{\beta}_7$ to produce PD estimates comparing prevalence for a given racial/ethnic group to that of the referent group for each time period.

The Overall ACA

Inclusion/Exclusion Criteria: To evaluate the overall ACA, which was implemented between 2010 and 2014, I considered a pre/post analysis using data from respondents that were eligible to benefit from at least one of three major components of the ACA (i.e., dependent coverage provision, Marketplace subsidies, or insurance expansions). Thus, I included only those

individuals who were under the age of 26 or had a household income <400% of the FPL. This resulted in an unweighted analytic sample of n=21,397 respondents.

Model Specification: The regression model used to estimate the association between the overall ACA and absolute racial/ethnic disparities in unintended pregnancy was specified as:

$$y_i = \beta_0 + \beta_1(P2_i) + \beta_2(P3_i) + \beta_3(HISP_i) + \beta_4(NHB_i) + \beta_5(NHO_i) + \beta_6(P2_i)(HISP_i) + \beta_7(P2_i)(NHB_i) + \beta_8(P2_i)(NHO_i) + \beta_9(P3_i)(HISP_i) + \beta_{10}(P3_i)(NHB_i) + \beta_{11}(P3_i)(NHO_i) + \boldsymbol{\gamma c}_i + \varepsilon_i$$

y_i *indicates whether respondent i experienced an unintended pregnancy*

$P2_i$ *indicates respondent i had a recall period between* $2010 - 2014$ $(PERIOD = 2)$

$P3_i$ *indicates respondent i had a recall period between* $2014 - 2018$ $(PERIOD = 3)$

$HISP_i$ *indicates whether respondent i reported Hispanic race/ethnicity*

NHB_i *indicates whether respondent i reported NH Black race/ethnicity*

NHO_i *indicates whether respondent i reported NH Other race/ethnicity*

$\boldsymbol{c}_i$ *represents a vector of covariates for respondent i*

This model specified 2005-2009 as the referent period, and NH White as the referent racial/ethnic group. NH White was chosen as the referent group because this group had the lowest prevalence of unintended pregnancy over the study period. In this model, $\hat{\beta}_1$ and $\hat{\beta}_2$ provide estimates for the PD between the pre and post periods among NH White women (2010-2014 vs. 2005-2009 and 2014-2018 vs. 2005-2009, respectively). $\hat{\beta}_3, \hat{\beta}_4,$ and $\hat{\beta}_5$ provide estimates for the PD between the specified racial/ethnic group and the referent group (NH White women) in the pre period. The coefficients on the two-way interaction provide estimates for the PDDs. That is, $\hat{\beta}_6, \hat{\beta}_7,$ and $\hat{\beta}_8$ estimate the association between the insurance expansions and each of the considered racial/ethnic

disparities in unintended pregnancy in 2010-2014, and $\hat{\beta}_9, \hat{\beta}_{10}$, and $\hat{\beta}_{11}$ estimate the association between the insurance expansions and each of the considered racial/ethnic disparities in unintended pregnancy in 2014-2018. Further, $\hat{\beta}_1$ can be used together with $\hat{\beta}_6 - \hat{\beta}_{11}$ to produce PD estimates comparing prevalence in the pre and post period for each racial/ethnic group, and $\hat{\beta}_3, \hat{\beta}_4$, and $\hat{\beta}_5$ can be used together with $\hat{\beta}_6 - \hat{\beta}_{11}$ to produce PD estimates comparing prevalence for a given racial/ethnic group to that of the referent group for each time period.

Table E1. Unweighted sample sizes by period, component, and eligibility – stratified by race/ethnicity

	Overall ACA					
	2006-2008	2008-2010	2011-2013	2013-2015	2015-2017	2017-2019
Hispanic (n=6,064)						
Eligible	824	1,103	1,012	933	725	994
Ineligible	72	57	87	78	78	101
NH Black (n=5,195)						
Eligible	799	920	821	776	777	696
Ineligible	81	59	61	73	59	73
NH Other (n=2,164)						
Eligible	280	305	266	335	258	260
Ineligible	65	45	64	105	84	97
NH White (n=12,003)						
Eligible	1,787	1,972	1,559	1,535	1,210	1,250
Ineligible	509	374	384	463	455	505
	Dependent Coverage Provision					
	2006-2008	2008-2010	2011-2013	2013-2015	2015-2017	2017-2019
Hispanic (n=2,202)						
Eligible	264	327	325	307	---	---
Ineligible	217	277	276	209	---	---
NH Black (n=2,007)						
Eligible	283	324	280	254	---	---
Ineligible	206	250	204	206	---	---
NH Other (n=748)						
Eligible	103	114	98	113	---	---
Ineligible	77	85	63	95	---	---
NH White (n=4,292)						
Eligible	664	676	563	544	---	---
Ineligible	484	544	417	400	---	---

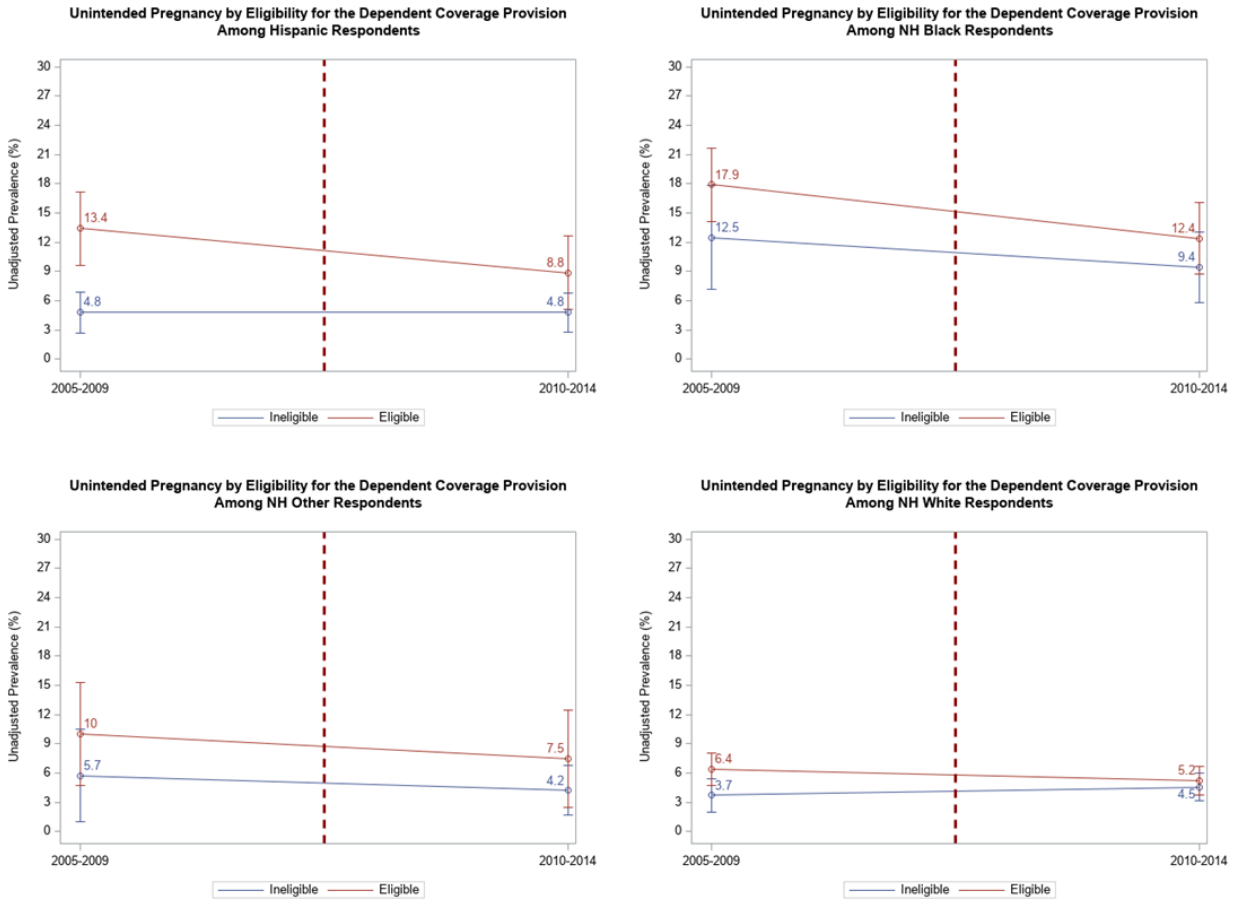
Table E1. (cont'd)

	Marketplace Subsidies					
	2006-2008	2008-2010	2011-2013	2013-2015	2015-2017	2017-2019
Hispanic (n=2,925)						
Eligible	336	475	371	328	312	450
Ineligible	109	76	101	114	113	140
NH Black (n=2,440)						
Eligible	326	359	302	295	323	312
Ineligible	104	76	80	97	75	91
NH Other (n=1,422)						
Eligible	144	164	142	165	125	134
Ineligible	81	57	77	124	98	111
NH White (n=8,763)						
Eligible	1,088	1,234	895	836	681	729
Ineligible	637	461	483	565	554	600
	Insurance Expansions					
	2006-2008	2008-2010	2011-2013	2013-2015	2015-2017	2017-2019
Hispanic (n=6,064)						
Eligible	787	1,084	998	897	690	955
Ineligible	109	76	101	114	113	140
NH Black (n=5,195)						
Eligible	776	903	802	752	761	678
Ineligible	104	76	80	97	75	91
NH Other (n=2,164)						
Eligible	264	293	253	316	244	246
Ineligible	81	57	77	124	98	111
NH White (n=12,003)						
Eligible	1,659	1,885	1,460	1,433	1,111	1,155
Ineligible	637	461	483	565	554	600

Table E1. (cont'd)

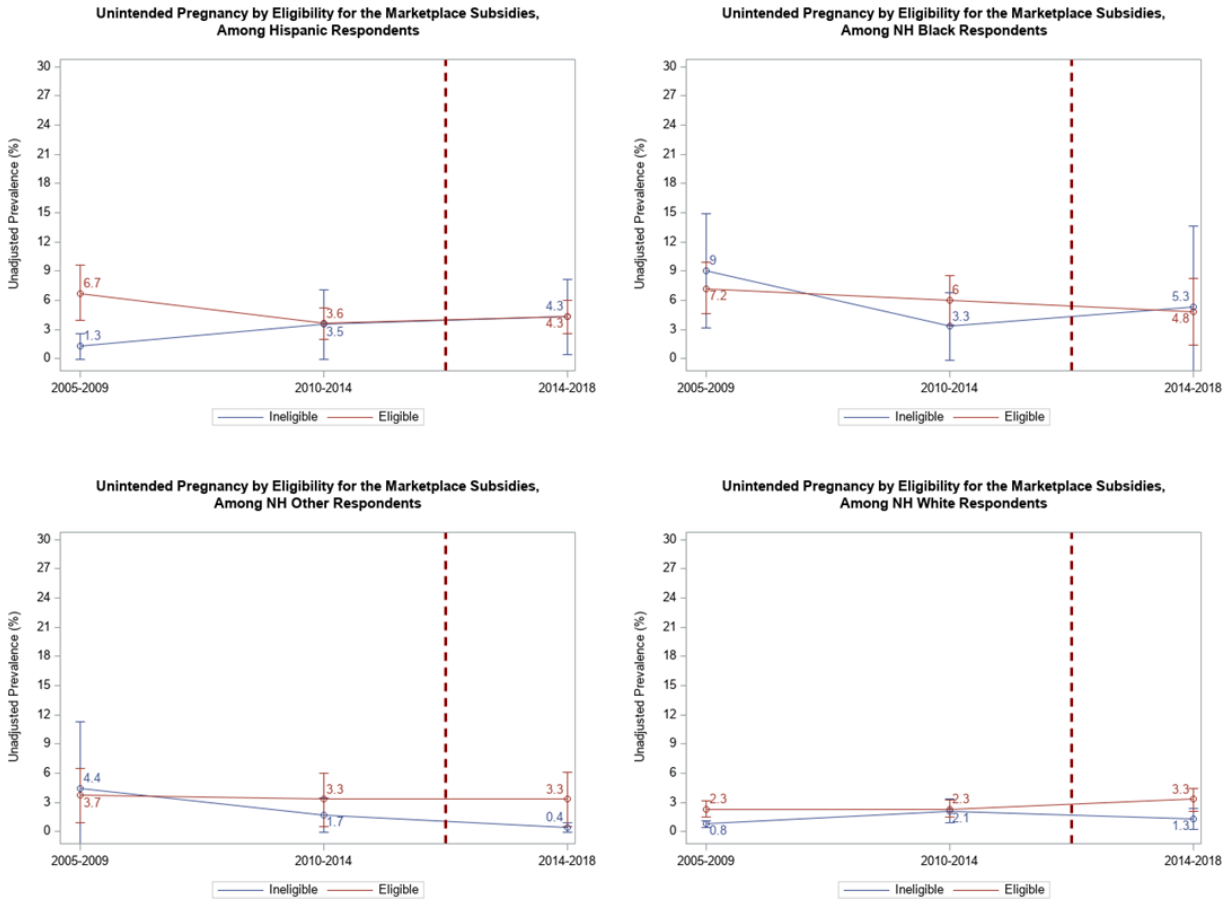
Note: Inadequate sample sizes have been highlighted in yellow. Sample size considered inadequate if <5 unintended pregnancy would be expected based on pre-intervention prevalence among the ineligible group when all racial/ethnic groups are combined (e.g.,1% for the overall ACA, 5% for the dependent coverage provision, and 2% for the Marketplace subsidies and insurance expansions)

Figure E1. Unadjusted trends in unintended pregnancy over the study period by eligibility for the dependent coverage provision, stratified by race/ethnicity



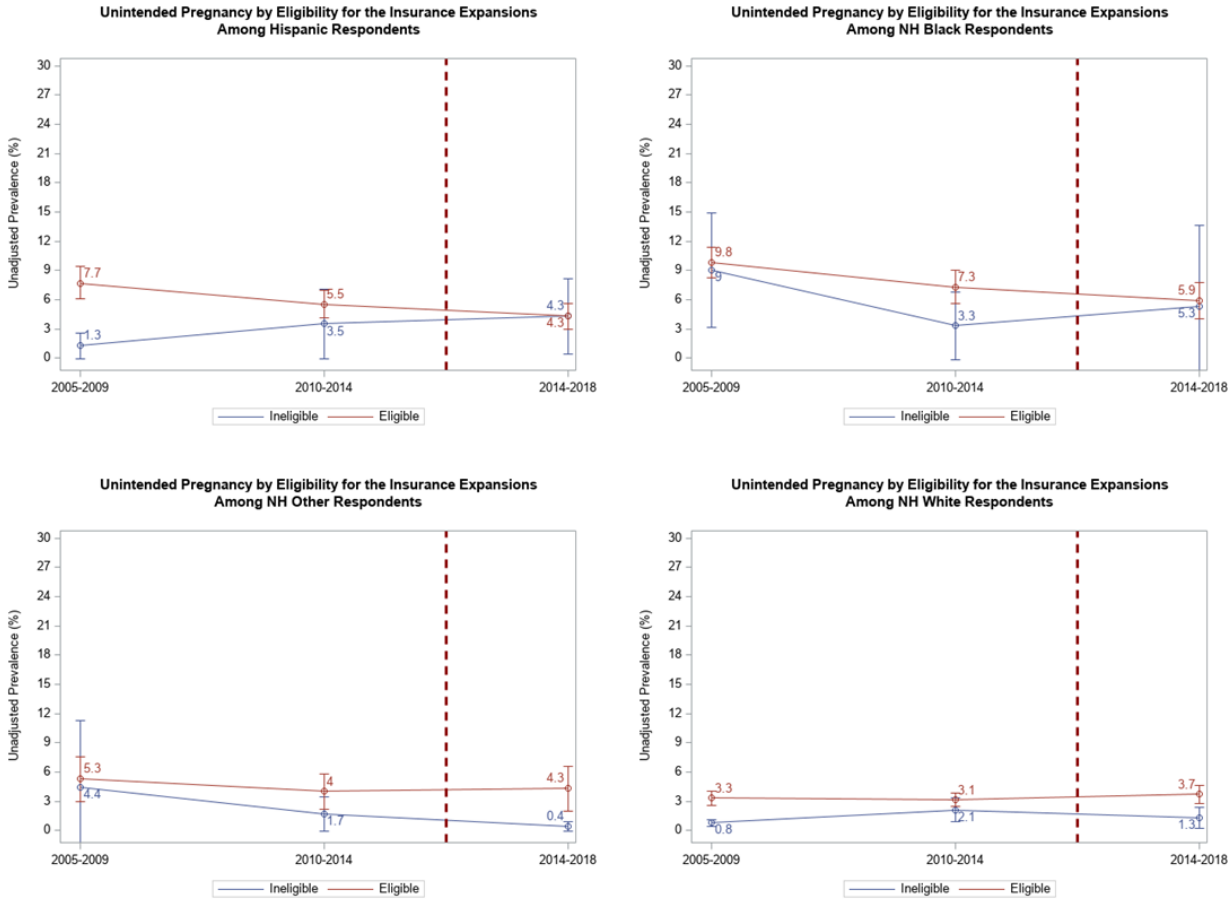
Red dashed line indicates the implementation of the dependent coverage provision

Figure E2. Unadjusted trends in unintended pregnancy over the study period by eligibility for Marketplace subsidies, stratified by race/ethnicity, NSFG cycles aggregated into three periods



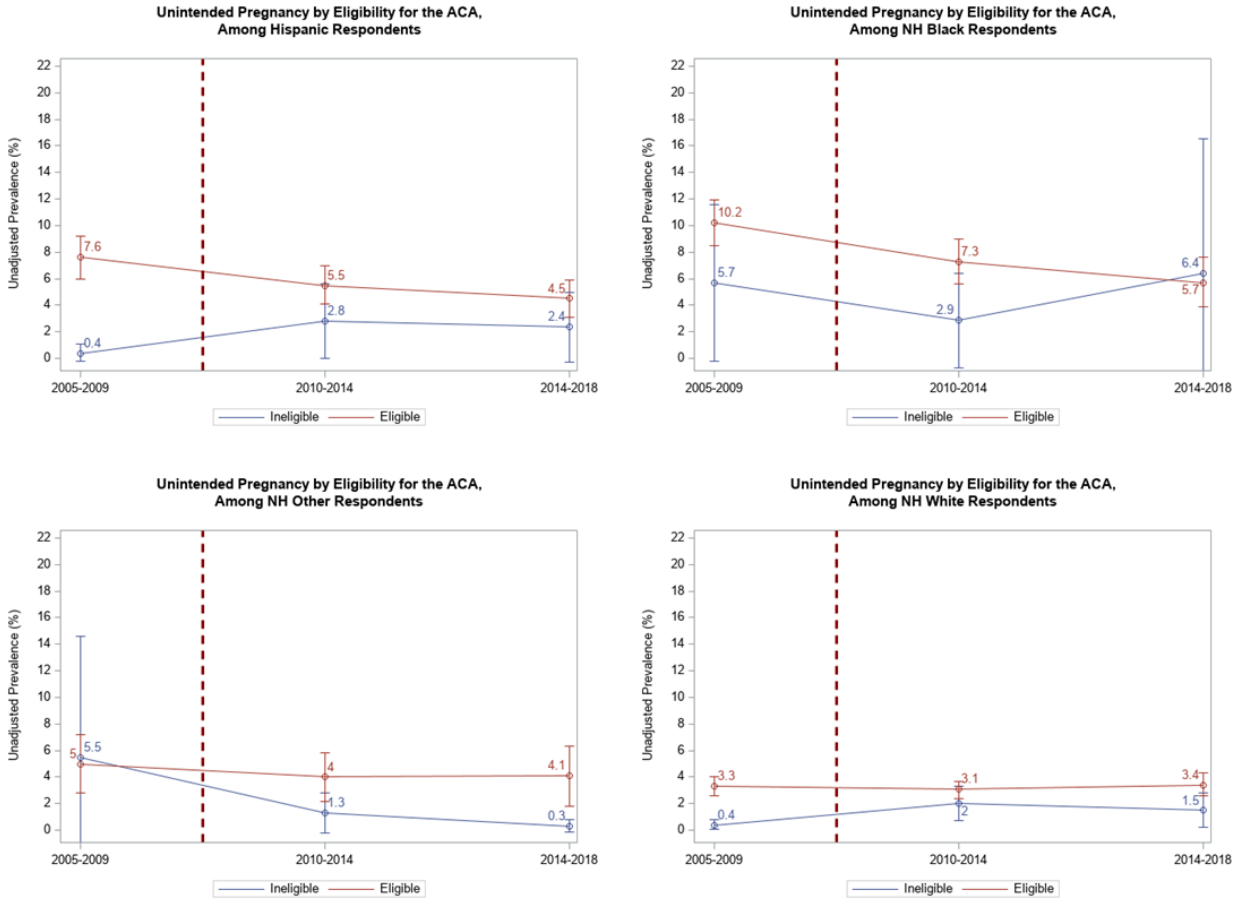
Red dashed line indicates the implementation of the ACA Marketplace subsidies

Figure E3. Unadjusted trends in unintended pregnancy over the study period by eligibility for ACA insurance expansions, stratified by race/ethnicity, NSFG cycles aggregated into three periods



Red dashed line indicates the implementation of the ACA insurance expansions

Figure E4. Unadjusted trends in unintended pregnancy over the study period by eligibility to benefit from the overall ACA, stratified by race/ethnicity, NSFG cycles aggregated into three periods



Red dashed line indicates the initiations of the ACA's implementation

Table E2. The unadjusted and adjusted association between the ACA or its specific components and unintended pregnancy, by race and by ethnicity (separately), as estimated by the pre/post analyses

Part A: Associations, Stratified by Race/Ethnicity

		Ethnicity				Race					
		Hispanic		Non-Hispanic		Black		Other		NH White	
		Unadj. PD (95% CI)	Adj.* PD (95% CI)	Unadj. PD (95% CI)	Adj.* PD (95% CI)	Unadj. PD (95% CI)	Adj.* PD (95% CI)	Unadj. PD (95% CI)	Adj.* PD (95% CI)	Unadj. PD (95% CI)	Adj.* PD (95% CI)
Dependent Coverage Provision[1]	2005-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2010-2014	-4.6 (-9.9, 0.8)	-3.8 (-9.1, 1.4)	-2.0 (-4.1, 0.1)	-1.6 (-3.6, 0.3)	-4.3 (-9.1, 0.5)	-2.4 (-7.1, 2.2)	-4.6 (-11.1, 1.9)	-4.6 (-10.9, 1.8)	-1.6 (-4.0, 0.8)	-1.5 (-3.9, 0.8)
Marketplace Subsidies[1]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	0.7 (-1.7, 3.1)	0.9 (-1.5, 3.3)	0.6 (-0.7, 1.9)	0.5 (-0.8, 1.8)	-0.8 (-4.8, 3.1)	-0.9 (-4.8, 3.1)	2.2 (-2.4, 6.8)	1.5 (-3.1, 6.0)	0.7 (-0.5, 1.9)	0.7 (-0.4, 1.9)
Insurance Expansions[1]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	-1.2 (-3.2, 0.7)	-0.9 (-2.8, 1.1)	0.1 (-0.9, 1.1)	0.3 (-0.7, 1.3)	-1.1 (-3.4, 1.2)	-1.0 (-3.2, 1.3)	0.2 (-3.5, 3.9)	0.2 (-3.6, 4.0)	0.0 (-1.0, 1.0)	0.1 (-0.7, 1.2)
Overall ACA[1]	2005-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2010-2014	-2.1 (-4.2, 0.1)	-2.2 (-4.4, 0.0)	-0.7 (-1.6, 0.2)	-0.8 (-1.7, 0.1)	**-2.4 (-4.6, -0.2)**	-2.0 (-4.1, 0.2)	**-3.2 (-6.3, -0.2)**	**-3.3 (-6.3, -0.3)**	-0.2 (-1.2, 0.7)	-0.4 (-1.4, 0.5)
	2014-2018	**-3.1 (-5.2, -1.0)**	**-2.9 (-5.0, -0.8)**	-0.7 (-1.7, 0.3)	-0.9 (-1.9, 0.0)	**-3.5 (-5.8, -1.3)**	**-3.2 (-5.4, -1.0)**	-2.5 (-6.6, 1.6)	-2.4 (-6.5, 1.7)	-0.4 (-1.3, 0.6)	-0.5 (-1.4, 0.4)

Part B: Difference in Associations by Race/Ethnicity
(i.e., Differences in Absolute Racial/Ethnic Disparities Over Time)

		Ethnicity				Race					
		Hispanic		Non-Hispanic (reference)		Black		Other		NH White (reference)	
		Unadj. PDD (95% CI)	Adj.* PDD (95% CI)	Unadj. PDD (95% CI)	Adj.* PDD (95% CI)	Unadj. PDD (95% CI)	Adj.* PDD (95% CI)	Unadj. PDD (95% CI)	Adj.* PDD (95% CI)	Unadj. PDD (95% CI)	Adj.* PDD (95% CI)
Dependent Coverage Provision[1]	2010-2014	-2.6 (-8.2, 3.0)	-2.3 (-7.7, 3.2)	0.0 (ref)	0.0 (ref)	-2.7 (-8.0, 2.7)	-1.0 (-6.2, 4.2)	-3.0 (-10.0, 4.0)	-3.1 (-10.1, 3.8)	0.0 (ref)	0.0 (ref)

Table E2. (cont'd)

Marketplace Subsidies[1]	2014-2018	0.1 (-2.5, 2.8)	0.4 (-2.3, 3.1)	0.0 (ref)	0.0 (ref)	-1.5 (-5.6, 2.5)	-1.6 (-5.7, 2.4)	1.5 (-3.4, 6.4)	0.7 (-4.0, 5.5)	0.0 (ref)	0.0 (ref)
Insurance Expansions[1]	2014-2018	-1.4 (-3.6, 0.8)	-1.1 (-3.3, 1.1)	0.0 (ref)	0.0 (ref)	-1.1 (-3.6, 1.3)	-1.2 (-3.7, 1.2)	0.2 (-3.7, 4.1)	0.1 (-4.0, 3.9)	0.0 (ref)	0.0 (ref)
Overall ACA[1]	2010-2014	-1.4 (-3.7, 0.9)	-1.4 (-3.7, 1.0)	0.0 (ref)	0.0 (ref)	-2.1 (-4.5, 0.2)	-1.5 (-3.8, 0.7)	-3.0 (-6.2, 0.2)	-2.9 (-6.1, 0.3)	0.0 (ref)	0.0 (ref)
	2014-2018	**-2.4 (-4.7, -0.1)**	-2.0 (-4.3, 0.3)	0.0 (ref)	0.0 (ref)	**-3.2 (-5.5, -0.8)**	**-2.7 (-4.9, -0.4)**	-2.2 (-6.4, 2.0)	-1.9 (-6.1, 2.3)	0.0 (ref)	0.0 (ref)

ACA = Affordable Care Act; NH = Non-Hispanic; PD = Prevalence difference, reported in percentage points; PDD = Prevalence difference-in-differences, reported in percentage points; 95% CI = 95% confidence interval; Estimates that are significant at the 5% significance level are shown in bold

*All adjusted models include the following covariates: maternal education level, marital status, parity, nativity, and metropolitan residence. Analyses evaluating the dependent coverage provision further include income as a percentage of the federal poverty level (FPL), and analyses evaluating the Marketplace subsidies or insurance expansions further include respondent age as a three-level categorical variable (18-25, 26-34, 35-44).

[1] Respondents were considered: eligible for the dependent coverage provision if they were < 26 year of age, eligible for Marketplace subsidies if they had a household income that was between 139 and 399% of the FPL, eligible for the insurance expansions if they had a household income that was <400% of the FPL, and eligible for the overall ACA if they were < 26 years of age or had a household income <400% of the FPL.

Table E3. The unadjusted and adjusted association between the overall ACA and unintended pregnancy, by race/ethnicity, as estimated by the pre/post analyses using an alternative treatment definition based on education and age rather than income and age

Part A: Associations, Stratified by Race/Ethnicity

		Hispanic		NH Black		NH Other or Multiracial		NH White	
		Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)
Overall ACA[1]	2005-2009	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2010-2014	**-2.3 (-4.5, -0.1)**	**-2.6 (-4.8, -0.4)**	**-2.8 (-5.2, -0.4)**	**-2.8 (-5.2, -0.4)**	-0.7 (-3.9, 2.5)	-1.9 (-4.1, 2.2)	-0.1 (-1.2, 0.9)	-0.3 (-1.4, 0.7)
	2014-2018	**-2.9 (-5.1, -0.6)**	**-3.1 (-5.4, -0.8)**	**-4.7 (-7.3, -2.2)**	**-4.8 (-7.4, -2.2)**	-1.6 (-4.9, 1.7)	-1.7 (-4.9, 1.5)	-0.2 (-1.3, 0.9)	-0.5 (-1.5, 0.6)

Part B: Difference in Associations by Race/Ethnicity
(i.e., Differences in Absolute Racial/Ethnic Disparities Over Time)

		Hispanic		NH Black		NH Other or Multiracial		NH White (reference)	
		Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)
Overall ACA[1]	2010-2014	-2.1 (-4.5, 0.2)	-2.3 (-4.7, 0.1)	**-2.7 (-5.2, -0.1)**	-2.4 (-5.0, 0.2)	-0.6 (-4.0, 2.8)	-0.6 (-4.0, 2.8)	0.0 (ref)	0.0 (ref)
	2014-2018	**-2.6 (-5.1, -0.1)**	**-2.6 (-5.1, -0.1)**	**-4.5 (-7.3, -1.7)**	**-4.3 (-7.1, -1.6)**	-1.3 (-4.8, 2.2)	-1.2 (-4.6, 2.2)	0.0 (ref)	0.0 (ref)

ACA = Affordable Care Act; NH = Non-Hispanic; PD = Prevalence difference, reported in percentage points; PDD = Prevalence difference-in-differences, reported in percentage points; 95% CI = 95% confidence interval; Estimates that are significant at the 5% significance level are shown in bold

*Adjusted models include the following covariates: marital status, parity, nativity, and metropolitan residence

[1] Treatment (eligibility) was defined as being under 26 years of age or having at most am associate degree

Table E4. The unadjusted and adjusted association between the ACA Marketplace subsidies or insurance expansions and unintended pregnancy, by race/ethnicity, as estimated by the pre/post analyses when excluding those who were aged ≤ 26 years

Part A: Associations, Stratified by Race/Ethnicity

		Hispanic		NH Black		NH Other or Multiracial		NH White	
		Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)	Unadjusted PD (95% CI)	Adjusted* PD (95% CI)
Marketplace Subsidies[1]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	2.2 (0.0, 4.5)	2.2 (-0.1, 4.4)	-1.1 (-3.6, 1.5)	-1.2 (-3.9, 1.4)	0.7 (-1.6, 3.1)	0.6 (-1.8, 3.0)	**1.7 (0.3, 3.1)**	**1.6 (0.3, 3.0)**
Insurance Expansions[2]	2010-2014	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)	0.0 (ref)
	2014-2018	-0.8 (-2.5, 0.9)	-0.7 (-2.3, 1.0)	-0.7 (-2.7, 1.2)	-0.9 (-2.8, 1.1)	-0.4 (-2.3, 1.4)	-0.6 (-2.4, 1.3)	0.9 (-0.2, 2.0)	0.9 (-0.2, 2.0)

Part B: Difference in Associations by Race/Ethnicity
(i.e., Differences in Absolute Racial/Ethnic Disparities Over Time)

		Hispanic		NH Black		NH Other or Multiracial		NH White (reference)	
		Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)	Unadjusted PDD (95% CI)	Adjusted* PDD (95% CI)
Marketplace Subsidies[1]	2014-2018	0.5 (-2.1, 3.1)	0.5 (-2.1, 3.1)	-2.8 (-5.6, 0.1)	-2.9 (-5.7, 0.0)	-1.0 (-3.7, 1.7)	-1.0 (-3.7, 1.7)	0.0 (ref)	0.0 (ref)
Insurance Expansions[2]	2014-2018	-1.7 (-3.7, 0.3)	-1.6 (-3.6, 0.4)	-1.6 (-3.9, 0.6)	-1.8 (-4.0, 0.5)	-1.3 (-3.5, 0.8)	-1.5 (-3.6, 0.6)	0.0 (ref)	0.0 (ref)

ACA = Affordable Care Act; NH = Non-Hispanic; PD = Prevalence difference, reported in percentage points; PDD = Prevalence difference-in-differences, reported in percentage points; 95% CI = 95% confidence interval; Estimates that are significant at the 5% significance level are shown in bold

*Adjusted models include the following covariates: income as a percentage of the federal poverty level (FPL), maternal education level, marital status, parity, nativity, and metropolitan residence

[1] Treatment (eligibility) was defined as having an income between 139% and 399% of the FPL

[2] Treatment (eligibility) was defined as having an income below 400% of the FPL

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