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Maternal Adverse Childhood Experiences and Non-Live Births

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MATERNAL ADVERSE CHILDHOOD EXPERIENCES AND NON-LIVE BIRTHS

by

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ABSTRACT

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by

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Considering the frameworks of social stress, life course, and intergenerational transmission of inequality, this research examined whether maternal exposure to Adverse Childhood Experiences (ACEs) is linked to non-live births (pregnancy loss or abortion). The study addressed three research questions using data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), spanning wave I (1994-1995) to wave IV (2007-2008). Data analysis was conducted in R, using multiple imputation with chained equations to handle missing data. Descriptive statistics showed that 15.3% of women experienced pregnancy loss, and 14.7% had abortions. On average, women with non-live births had 2.4 ACEs (SD = 1.7) on the conventional ACEs scale (10 types) and 2.9 ACEs (SD = 2.0) on the extended scale (14 types).

The first research question examined whether the extended ACE scale or the conventional ACE scale has greater predictive power in associating ACEs with (i) abortion, (ii) pregnancy loss, and (iii) non-live births overall. I used Generalized Linear Mixed Models; GLM with binary logit link for first pregnancies and GLMER for all pregnancies. Results indicated that the accumulation of ACEs, measured using either

scale, was associated with non-live births and abortion. For instance, women with a history of ACEs were 1.57 times more likely to have a non-live birth when assessed using the conventional scale (AOR=1.57; 95% CI: 1.23–2.01), with slightly higher odds using the extended scale (AOR=1.62; 95% CI: 1.23 - 2.14). No significant relationship was found between ACEs and pregnancy loss.

Building on these findings, the second research question examined the association between ACEs and non-live births, controlling for socio-demographics, health conditions, and risk factors using GLM with binary logit link. Results suggested that ACE exposure increased the likelihood of non-live births (AOR=1.40; 95% CI: 1.05-1.88). Disaggregated analysis on abortion and pregnancy loss offers a more nuanced understanding, which suggests there is a need to employ new approaches to obtain more accurate data on abortion count.

The third research question explored the intergenerational effects of family-of-origin SES on pregnancy loss and abortion through mediators such as maternal age, education, and marital status using Structural Equation Modeling. Findings indicated that higher SES increased maternal age and marital status before pregnancy, reducing the likelihood of unintentional pregnancy and subsequent abortion ($\beta=0.53$, $p<.001$). These findings suggest the need for trauma-informed healthcare, ACEs screening, and policies to address SES disparities to reduce non-live births and improve reproductive health outcomes.

(187 pages)

PUBLIC ABSTRACT

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Around 62 percent of adults in the United States have endured at least one type of Adverse Childhood Experience (ACE), and 25 percent of women reported experiencing three or more ACEs in their lifetime. This study explored whether maternal exposure to ACEs was associated with pregnancy loss or abortion, utilizing the National Longitudinal Study of Adolescent to Adult Health (known as Add Health) to explore this association. I found that cumulative ACEs, assessed through either the conventional ACE scale (reflecting 10 types of ACEs) or the extended ACE scale (reflecting 14 types of ACEs), are associated with a higher likelihood of having an abortion. However, my study found no significant association between ACEs and pregnancy loss during their first or all pregnancies.

In examining the independent effects of ACE types, maternal exposure to emotional abuse increased the risk of pregnancy loss as well as the likelihood of having an abortion. Exposure to physical abuse, sexual abuse, and emotional neglect also increased the likelihood of having an abortion. Age at the time of pregnancy (older age compared to younger) and having a chronic health condition increased the risk of pregnancy loss.

Maternal childhood socioeconomic status (SES) influenced exposure to ACEs, socio-economic conditions, and subsequently, the risk of pregnancy loss or likelihood of having an abortion. My study found that lower childhood SES is associated with an early

age at the time of pregnancy, which in turn increases the chances of having an unintentional pregnancy and increasing the likelihood of having an abortion. The second pathway suggests that lower childhood SES increases the likelihood of being unmarried, which increases the chances of unintended pregnancies, subsequently increasing the likelihood of having an abortion.

The findings suggest that there is a need to introduce interventions to reduce childhood SES disparities in order to decrease the risk of ACEs, and subsequently reduce future issues pertaining to maternal health. Childhood SES disparities reflect structural inequalities that often limit access to resources, education, and healthcare, perpetuating a cycle of disadvantage. Moreover, structural inequalities hinder women's autonomy over their reproductive decisions, which is essential for breaking the cycle of intergenerational inequality. Without addressing these deep-rooted structural issues, efforts to reduce SES disparities, mitigate ACEs, and enhance reproductive autonomy will face significant barriers, ultimately perpetuating the cycle of inequality and its adverse effects on maternal and child health.

DEDICATION

Dedicated to my father and my five siblings, who, after the loss of my mother when I was 10 years old, devoted their lives to raising me with love and care, ensuring I, as a first-generation student, pursued my dreams through education. I also dedicate this to my mother-in-law, who selflessly allowed me, along with my spouse and kids, to move to the USA for studies, despite the challenges of her old age and being alone. Thanks to technology as well, I was able to stay connected with her and our family, receiving their ongoing motivation and prayers, which have been invaluable to me.

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I would like to thank the two women (whose names I cannot share due to confidentiality) whom I met at a university graduate event. I shared my interest in researching pregnancy outcomes for my dissertation, with some uncertainty about the predictors of pregnancy outcomes. Apart from being a social demographer and medical sociologist, I was drawn to exploring pregnancy outcomes due in part to my own experiences with two miscarriages before the birth of my first child, Zuhaira. As I discussed this with those women, they started sharing their journey of experiencing pregnancy loss and reproductive health concerns. One of them shared how her adverse childhood experiences haunted her during her first pregnancy. She described how her

stress and fear of becoming a parent at that time impacted her reproductive health decisions. Their personal stories of pregnancy loss and reproductive health challenges profoundly influenced my decision to explore this area of research. This realization inspired me to delve deeper into this area of research, which eventually became the focus of my dissertation.

I am also grateful to Dr. Hyojun Park for supporting the initial conceptualization of my dissertation and teaching me methodological techniques. I also extend my thanks to Dr. Brenna Gomer, Dr. Hamid Karimi, Dr. Nazanin Donyapour, and Dr. Olusola A. Omisakin for their guidance in resolving data analysis issues and helping me complete dissertation analyses.

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CHAPTER I
Introduction

This chapter starts by briefly discussing the importance of the childhood phase, particularly shedding light on the relationship of Adverse Childhood Experiences (ACEs) with pregnancy loss and abortion, then provides an overview of research and closes the chapter by discussing the significance of the overall study.

Over the last two decades, the sociological and biological developmental frameworks shed light on the importance of the childhood phase, particularly traumatic childhood experiences – exposure to toxic stress- which affects child development and health over the life-course (Danese et al. 2009; Kalmakis and Chandler 2015; Krinner et al. 2021). One such lens from which to study the cumulative impact of childhood over the life-course is to measure ACEs, a scale measuring exposure to stressful and negative child experiences before 18 years of age (Felitti et al. 1998). Assessing ACEs began in the United States in 1995 with the ACE study by Kaiser Permanente. Data collection is still on-going through an ACE module added to the Behavioral Risk Factor Surveillance System – an annual statewide survey conducted in the United States (Felitti et al. 1998). In addition, decreasing the number of young adults who report three or more ACEs is also set as one of the national health priorities in the United States, under Healthy People 2030 Objective IVP-D03 (NCHS 2021).

Despite recognition of ACEs and consistent efforts to reduce ACEs in the United States, approximately 62 percent of adults had exposure to at least one type of ACE, and one-quarter reported experiencing three or more ACEs (Merrick et al. 2018). These

percentages were measured using ACE scale, renowned as a conventional ACE scale or Kaiser ACE study (hereafter, conventional ACE scale). The conventional ACE scale measures 10 types of adverse experiences including emotional abuse, physical abuse, sexual abuse, community violence, substance abuse, suicide, divorce, parental incarceration, low parental warmth, and physical neglect. ACEs research has been described as sources of "toxic stress," associated with disruptions of social and emotional development, particularly influencing behavioral, physical and mental health conditions, which further predispose individuals to experience adverse life and health circumstances (Finlay et al. 2022; Karatekin et al. 2022; McEwen and McEwen 2017).

However, the ACEs field has been strongly criticized due to the lack of consensus on the number of ACEs or experience categories (Anda, Porter, and Brown 2020; Briggs et al. 2021; Finkelhor et al. 2015; Krinner et al. 2021; Lacey and Minnis 2020). In addition, the conventional ACE scale primarily focuses on capturing toxic stress at the household level, thereby overlooking childhood adversity within broader social contexts like neighborhood and school environments (Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). These contexts play crucial roles in experiencing cumulative disadvantages that impact child development over the years (Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). Linking childhood adversities to neighborhood disadvantage or school environments in life trajectories is an effort to capture the structural disadvantages individuals face in society (Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). In addition, some studies have highlighted modern phenomena such as the experience of

living in foster homes, and institutional responses to abuse facilitated through involvement with social services as an indicator of child maltreatment (Brumley, Brumley, and Jaffee 2019; Wachs and Evans 2010). Therefore, studies have highlighted the need to broaden the ACE scale (hereafter, extended ACE scale), such as to capture the effects of social context and structures such as living in foster, experiencing school violence, or neighborhood disadvantage, etc. (Brumley, Jaffee, and Brumley 2017; Cronholm et al. 2015; Finkelhor et al. 2015).

Over the last two decades, research on ACEs has found them to be associated with a myriad of physical and mental health outcomes (Danese et al. 2009; Kalmakis and Chandler 2015; Kendall-Tackett 2002; Krinner et al. 2021; McEwen and McEwen 2017). Women with a history of ACEs are at higher risk of anxiety and depression (Bellis et al. 2019; Danese et al. 2009; Kalmakis and Chandler 2015); post-traumatic stress disorder or symptoms in adulthood (McRae et al. 2021); as well as chronic health conditions (Danese et al. 2009). Adults who have experienced ACEs have a higher likelihood of substance misuse and smoking (Bellis et al. 2019; Kalmakis and Chandler 2015) and alcohol abuse (Lee and Chen 2017). Among the many explanations for the above-mentioned consequences of ACEs, one prominent debate in both sociology and neuroscience is the impact of toxic stress from cumulative early adverse life experiences on the physical, mental, and social well-being throughout the life course. Exposure to chronic stress (e.g., ACEs) and social conditions (e.g., lower socio-economic status) in the absence of strong social support systems impairs child's development affecting their self-regulation of emotions and behaviors (McEwen and McEwen 2017). Adverse health behaviors resulting from ACEs activate the same biological systems and contribute to further

adverse health consequences and outcomes over the life course, including pregnancy outcomes, particularly linked to non-live births over the life course (McEwen and McEwen 2017).

Many of these above-mentioned consequences of ACEs are related to non-live births – which refers to pregnancies that do not result in a live birth, as independent factors. Such as, smoking and pre-existing medical conditions such as diabetes are determinants of preeclampsia (Hutcheon, Lisonkova, and Joseph 2011), and preeclampsia and pre-existing diabetes in pregnancy are associated with poor maternal and fetal outcomes (Sibai 2002; Wahabi et al. 2012). In addition, maternal smoking is also directly linked with increasing the risk of stillbirth (Flenady et al. 2011). Depression or depressive symptoms are also considered a risk of pregnancy loss (Quenby et al. 2021). In addition, a study exploring several pre-pregnancy risk factors such as drinking alcohol, cigarette smoking, and certain health conditions, highlighted that women have at least one risk factor, and around 19 percent have two or more risk factors (Denny et al. 2012). These above-mentioned factors provide a glimpse of predictors that are independently linked to non-live births. However, as mentioned previously, ACEs are associated with multiple of the aforementioned negative health behaviors that predict non-live births. Hence, it indirectly reflects the importance of the childhood phase as an important phase of the pre-pregnancy care continuum, particularly with reference to a life-course framework. This highlights the need for further research to explore the importance of addressing early-life adversities to improve pregnancy outcomes. This study is an effort to not only explore the independent effects of ACEs but also to demonstrate how early-life adversities influence life outcomes and how these affect non-live births. However, it is crucial to acknowledge that the prevalence and impact of ACEs are often exacerbated by underlying structural

inequalities, which I will discuss in detail in the following section (Karatekin et al. 2022; McEwen and McEwen 2017). Therefore, research focused on ACEs and their effects on negative outcomes should not solely emphasize individual behaviors but rather consider the broader social determinants that shape health trajectories across the life course (Karatekin et al. 2022; McEwen and McEwen 2017).

Nevertheless, the pre-pregnancy period is often suggested as three months before pregnancy, or maximum refer to one to two years before pregnancy (Dean et al. 2014). Without focusing on the early childhood period concerning the pre-pregnancy care continuum, especially for girls and young women "who often receive little or no healthcare from age five until their first pregnancy," the gap will remain in the continuum (Dean et al. 2014). This gap garnered substantial attention in the last couple of decades and several studies tried to explore the relationship between childhood adversities, particularly ACEs, and an extensive array of physical or biological, psychological, reproductive, and risk behavior outcomes (Kalmakis and Chandler 2015; Kelly-Irving and Delpierre 2019; Olsen 2018b). However, scholarship is limited in regard to childhood experiences and their association with pregnancy-related outcomes. I found only four studies exploring the relationship of ACEs with miscarriages and stillbirths. Previous scholarship suggests that cumulative ACEs or independent types of ACEs are associated with miscarriages or stillbirths (Freedman et al. 2017; Hillis et al. 2004; Kerkar et al. 2021; Mersky and Lee 2019). Moreover, a few studies highlighted that the cumulative disadvantage measured through ACEs is associated with likelihood of having repeated abortions (Bleil et al. 2011; Steinberg and Tschann 2013). However, the above-cited studies in this paragraph mainly utilized cross-sectional data conducted in either one or few states in the United States. Therefore, there is the paucity of research presenting

analysis on both pregnancy loss and abortion utilizing the same dataset. In addition, there is scant research presenting a comparative analysis of live versus non-live births. Non-live births refer to those pregnancies that do not result in live births, presenting an overall analysis regardless of whether it ended as abortion or pregnancy loss.

Non-live births are a more neutral term that does not imply anything about the cause of the pregnancy ending. This can be important for people who have experienced a non-live birth, particularly an abortion. Regarding abortion, in states where abortion is banned or restricted, women might be more likely to use terms like "miscarriage" or “stillbirths” when reporting their experiences in self-report surveys (Lindberg and Scott 2018; Tierney 2019). The restrictive abortion laws lead to inaccurate data about the incidence of abortion in terms of misreporting or underreporting of abortions in social surveys to avoid stigma and legal repercussions (Lindberg et al. 2020). Using social surveys and presenting disaggregated analysis on abortion or miscarriages may lead to giving biased estimates, and previous research suggests using data with caution (Lindberg et al. 2020; Lindberg and Scott 2018; Tierney 2019). Though there is a dire need to improve abortion reporting in order to strengthen the quality of pregnancy data to support maternal and reproductive health research (Desai et al. 2021), yet until such quality of data is ensured, there is a need to present analysis in a way that helps to avoid erroneous interpretation of factors. This study is an effort to present a comparative analysis by comparing the overall analysis using the term non-live births, with disaggregated analysis on abortion and pregnancy loss. The comparative analysis will provide a chance to compare the factors across abortion, pregnancy loss, and non-live births, in order to explore a holistic set of factors for both pregnancy loss and abortion.

Additionally, previous research highlighted the need to "shifting the narrative" in ACEs research from focusing solely on individuals to a broader set of "social determinants of inequities or health" (Karatekin et al. 2022). This shift emphasizes that 'making healthy choices' is often not an option for many families, redirecting attention to systemic issues such as poverty and the socio-economic status of parents, which have impacts across generations (Karatekin et al. 2022; Solar and Irwin 2010). Previous studies discussed that "toxic stress" arises not only from direct exposure to ACEs but also from adverse social conditions during childhood, which are deeply intertwined with social structures and processes (McEwen and Gregerson 2019; McEwen and McEwen 2017). Therefore, cumulative stressors, including childhood poverty and racism, along with ACEs, result from chronic exposure to adverse conditions (Karatekin et al. 2022; McEwen and McEwen 2017). This approach emphasizes viewing the effects of ACEs not merely as individual risk factors but as societal challenges that families face, which carry intergenerational consequences, such as perpetuating cycles of poverty, poor health outcomes, and limited educational and economic opportunities (Kalmakis and Chandler 2015; Karatekin et al. 2022; McEwen and Gregerson 2019; McEwen and McEwen 2017; Scorza et al. 2023). Therefore, understanding the effect of ACEs also requires adjusting or exploring the pathway of family socio-economic status with health outcomes to capture the intergenerational effects. Intergenerational effect or impact refers to how childhood circumstances influence health behaviors, and socio-economic conditions from one generation to another (Kalmakis and Chandler 2015; Karatekin et al. 2022; McEwen and Gregerson 2019; McEwen and McEwen 2017; Scorza et al. 2023).

The intergenerational effect over the life course, following social determinants of health inequities, involves structures, hierarchies, and determinants of health (Karatekin et al. 2022; Solar and Irwin 2010). Structures refer to policies and laws that create hierarchies based on race, gender, or income. These hierarchies lead to intermediary determinants of health, including stressors such as ACEs, working and living conditions, and health-risk behaviors. Not all individuals exposed to the same adversities have the same outcomes because different groups within the hierarchy are exposed to varying levels of stress, resources, choices, and opportunities, resulting in health inequities (Karatekin et al. 2022; Solar and Irwin 2010). To achieve equitable health outcomes for all, it is essential to collectively address the structures (i.e., laws and policies) that unequally distribute health risks (Karatekin et al. 2022; Solar and Irwin 2010; Walsh et al. 2019). Considering this, this study ensures the inclusion of variables reflecting hierarchies and determinants of health in order to see the multifaceted influences on health outcomes. The variables include race, childhood income, parents' education, respondents' education, respondent marital status, age at the time of pregnancy, etc. By integrating these variables, my study aims to provide a comprehensive understanding of how structural inequities contribute to health disparities.

In addition, considering the fact that reproductive health conditions have complex etiologies and an individual's risk for health cannot be accurately determined solely based on an ACE score, research highlights the need to examine different pathways that may mediate the effects of ACEs on health (Anda et al. 2020; Briggs et al. 2021; Kelly-Irving and Delpierre 2019). Such as, the scholarship suggests that women with ACEs are at higher risk of having an unintended pregnancy (versus intended pregnancy) compared to

women with no ACEs (Hall et al. 2019; Testa et al. 2021). Around 41.6% of women living in United States still experienced unintended pregnancies in 2019 - referring to a pregnancy that was undesired or mistimed (Rossen et al. 2023) Further, women experiencing unintended pregnancies have a higher risk of miscarriages and likelihood of having an abortion (Hall et al. 2017). However, research exploring the pathway of ACEs to unintended pregnancies and its mediated effect on non-live births is understudied. This study is an effort to explore the intergenerational effects on influencing life outcomes and/or adversities, and how those outcomes and/or adversities become determinants of unintended pregnancies, subsequently influencing non-live births.

1.1 Research Overview

Capitalizing on the above literature and research gaps, this study aims to answer the primary research question: Is maternal exposure to ACEs associated with non-live births; and do unintended pregnancy mediate the effects of SES and ACEs on non-live births?" Within the remits of this research question, the study assessed three questions utilizing nationally representative longitudinal data in the presence of a set of covariates and confounders.

1. Are ACEs associated with non-live births; and which ACE scale, conventional or extended, is more appropriate to examine this question?
2. Is exposure to ACEs- measured using an extended ACE scale-, associated with pregnancy loss, abortion, or non-live births, in the presence of health conditions, negative health behaviors, and individual-level time-variant covariates after adjusting for socio-demographic confounders?

3. Is the family-of-origin socio-economic status associated with pregnancy loss, abortion, or non-live birth, via mediated pathways, including the mother's age at the time of pregnancy, the maternal educational level before pregnancy and marital status, and exposure to ACEs by linking it with pregnancy intentions (i.e., unintended pregnancies)?

To answer the above research questions, three separate studies were conducted, each including a specific set of hypotheses to be tested and a set of variables. Table 1.1 provides a comprehensive overview of the application of various variables across three different studies focusing on non-live birth outcomes. The studies incorporated a mix of predictor variables, covariates, and confounders to analyze their respective impacts on the outcome.

Study 1 focused on examining the role of ACEs in predicting non-live birth outcomes using a specific set of confounders (Table 1.1). The study also provided a comparison between the Conventional ACE Scale and the Extended ACE Scale as predictor variables, aiming to understand their influence on non-live births. This study accounted for key time-invariant confounders, including race, parents' education, childhood household income, parents and respondents' nativity, to ensure the robustness of the findings. The findings and details are presented in Chapter II.

Study 2 also aimed to analyze non-live birth outcomes but incorporated a broader range of covariates and confounders. In this study, the Extended ACE Scale was used as the sole predictor variable (Table 1.1). This decision was based on the findings of study # 1, as the extended ACE scale provided better predictive power for non-live births. An independent and adjusted analysis was presented by including a list of time-invariant

covariates: age at the time of pregnancy, education before pregnancy, marital status before pregnancy, and depressive symptoms before pregnancy, chronic health conditions, alcohol drinking before pregnancy, and smoking before pregnancy. These covariates provided a comprehensive view of several factors that could influence non-live births. Time-invariant confounders such as race, parents' education, childhood household income, parents and respondents' nativity were also included to control for potential biases in the analysis. The findings and details are presented in Chapter III.

Table 1.1: Summary of variables application across three studies

Variables	**Study 1**	**Study 2**	**Study 3**
Outcome: Non-Live Birth	***	***	***
Predictor Variables**:**			
Conventional ACE Scale	***		
Extended ACE Scale	***	***	***
Covariates:			
Unintended Pregnancies			
Age at Time of Pregnancy		***	***
Education Before Pregnancy		***	***
Married Before Pregnancy		***	***
Depressive Symptoms Before Pregnancy		***	***
Chronic Health Conditions		***	
Alcohol Drinking Before Pregnancy		***	
Smoking Before Pregnancy		***	
Confounders:			
Race	***	***	***
Parents Education	***	***	***
Childhood Household Income	***	***	***
Parents Nativity	***	***	***
Respondent Nativity	***	***	***

Notes: Three stars *** represent the relevant variable used for that study.

Study 3 continued the investigation into non-live birth outcomes, examining the integrational effect of socio-economic status (parents' education, childhood household income, parents' nativity status) on four pathways: exposures to ACEs, age at the time of pregnancy, education before pregnancy, and marital status before pregnancy (Table 1.1). The study explored how these four variables predict pregnancy intention and, subsequently, how unintended pregnancies increase the likelihood of non-live births. The analysis controlled for the respondent's race, the respondent's nativity status, and depressive symptoms before pregnancy. The findings and details are presented in Chapter IV.

1.2 Significance of the study

What is already known? The relationship of ACEs, either utilizing conventional or extended ACEs or sub-scales with miscarriages , stillbirths, and abortions, has been established by previous scholarship (Bleil et al. 2011; Demakakos, Linara-Demakakou, and Mishra 2020; Hillis et al. 2004; Kerkar et al. 2021). However, these studies mainly use cross-sectional data and limited geographical boundaries (one or a few states). Previous studies analyzed the relationship of ACEs with non-live births only for nulliparous women, first pregnancies, and teenage groups (Freedman et al. 2017; Hall et al. 2019; Kane, Harris, and Siega-Riz 2018; Kerkar et al. 2021). In addition, previous studies explored the relationship between ACEs and unintended pregnancies (Hall et al. 2019), or unintended pregnancies as predictors of abortions (Bearak et al. 2020), but there are limited studies exploring pathways of family socio-economic status to ACEs, influencing intention of pregnancies, subsequently influencing non-live births.

What will this study add? This study investigates the enduring effect of ACEs on women's health across their life course, with a focus on reproductive outcomes. It examines the association between ACEs and pregnancy loss (including miscarriages, stillbirths, and ectopic pregnancies) and abortions, particularly among women with a history of ACEs. Previous literature highlighted that abortions are often underreported and can influence the misreporting of miscarriages due to abortion stigma, suggesting the use of only live birth data for analysis in social surveys. By utilizing the term "non-live births"; a neutral term to represent all pregnancies that did not result in live births, this study put an effort to introduce a new methodological perspective to the literature. This study provides an overall analysis using the term non-live births and then disaggregates analyses to examine the association of ACEs with pregnancy loss and abortion. The variation in results in overall or disaggregated analyses reflects data issues or concerns related to the underreporting of certain pregnancy outcomes. In addition, using nationally representative data, this study innovates by assessing the association between ACEs and these outcomes while comparing conventional and extended measurement scales. Moreover, this study explores both the independent and cumulative effects of ACEs on pregnancy outcomes, presenting disaggregated analyses by first pregnancy, all pregnancies, abortion, pregnancy loss, and overall non-live birth. Lastly, this study is contributing to the literature on the intergenerational effect of socio-economic status (SES) on ACEs and other pathways leading to non-live births.

1.3 References

Anda, Robert F., Laura E. Porter, and David W. Brown. 2020. “Inside the Adverse Childhood Experience Score: Strengths, Limitations, and Misapplications.” *American Journal of Preventive Medicine* 59(2):293–95. doi: 10.1016/j.amepre.2020.01.009.

Bearak, Jonathan, Anna Popinchalk, Bela Ganatra, Ann-Beth Moller, Özge Tunçalp, Cynthia Beavin, Lorraine Kwok, and Leontine Alkema. 2020. “Unintended Pregnancy and Abortion by Income, Region, and the Legal Status of Abortion: Estimates from a Comprehensive Model for 1990–2019.” *The Lancet Global Health* 8(9):e1152–61. doi: 10.1016/S2214-109X(20)30315-6.

Bellis, Mark A., Karen Hughes, Kat Ford, Gabriela Ramos Rodriguez, Dinesh Sethi, and Jonathon Passmore. 2019. “Life Course Health Consequences and Associated Annual Costs of Adverse Childhood Experiences across Europe and North America: A Systematic Review and Meta-Analysis.” *The Lancet Public Health* 4(10):e517–28. doi: 10.1016/S2468-2667(19)30145-8.

Bleil, Maria E., Nancy E. Adler, Lauri A. Pasch, Barbara Sternfeld, Renee A. Reijo-Pera, and Marcelle I. Cedars. 2011. “Adverse Childhood Experiences and Repeat Induced Abortion.” *American Journal of Obstetrics and Gynecology* 204(2):122.e1-122.e6. doi: 10.1016/j.ajog.2010.09.029.

Briggs, Ernestine C., Lisa Amaya-Jackson, Karen T. Putnam, and Frank W. Putnam. 2021. “All Adverse Childhood Experiences Are Not Equal: The Contribution of Synergy to Adverse Childhood Experience Scores.” *American Psychologist* 76(2):243–52. doi: 10.1037/amp0000768.

Brumley, Lauren D., Benjamin P. Brumley, and Sara R. Jaffee. 2019. “Comparing Cumulative Index and Factor Analytic Approaches to Measuring Maltreatment in the National Longitudinal Study of Adolescent to Adult Health.” *Child Abuse & Neglect* 87:65–76. doi: 10.1016/j.chiabu.2018.08.014.

Brumley, Lauren D., Sara R. Jaffee, and Benjamin P. Brumley. 2017. “Pathways from Childhood Adversity to Problem Behaviors in Young Adulthood: The Mediating Role of Adolescents’ Future Expectations.” *Journal of Youth and Adolescence* 46(1):1–14. doi: 10.1007/s10964-016-0597-9.

Cronholm, Peter F., Christine M. Forke, Roy Wade, Megan H. Bair-Merritt, Martha Davis, Mary Harkins-Schwarz, Lee M. Pachter, and Joel A. Fein. 2015. “Adverse Childhood Experiences: Expanding the Concept of Adversity.” *American Journal of Preventive Medicine* 49(3):354–61. doi: 10.1016/j.amepre.2015.02.001.

Danese, Andrea, Terrie E. Moffitt, HonaLee Harrington, Barry J. Milne, Guilherme Polanczyk, Carmine M. Pariante, Richie Poulton, and Avshalom Caspi. 2009. “Adverse Childhood Experiences and Adult Risk Factors for Age-Related Disease: Depression, Inflammation, and Clustering of Metabolic Risk Markers.” *Archives of Pediatrics & Adolescent Medicine* 163(12):1135–43. doi: 10.1001/archpediatrics.2009.214.

Dean, Sohni V., Zohra S. Lassi, Ayesha M. Imam, and Zulfiqar A. Bhutta. 2014. “Preconception Care: Closing the Gap in the Continuum of Care to Accelerate Improvements in

Maternal, Newborn and Child Health." *Reproductive Health* 11(S3):S1. doi: 10.1186/1742-4755-11-S3-S1.

Demakakos, Panayotes, Eleni Linara-Demakakou, and Gita D. Mishra. 2020. "Adverse Childhood Experiences Are Associated with Increased Risk of Miscarriage in a National Population-Based Cohort Study in England." *Human Reproduction* 35(6):1451–60. doi: 10.1093/humrep/deaa113.

Denny, Clark H., R. Louise Floyd, Patricia P. Green, and Donald K. Hayes. 2012. "Racial and Ethnic Disparities in Preconception Risk Factors and Preconception Care." *Journal of Women's Health* 21(7):720–29. doi: 10.1089/jwh.2011.3259.

Desai, Sheila, Laura D. Lindberg, Isaac Maddow-Zimet, and Kathryn Kost. 2021. "The Impact of Abortion Underreporting on Pregnancy Data and Related Research." *Maternal and Child Health Journal* 25(8):1187–92. doi: 10.1007/s10995-021-03157-9.

Felitti, Vincent J., Robert F. Anda, Dale Nordenberg, David F. Williamson, Alison M. Spitz, Valerie Edwards, Mary P. Koss, and James S. Marks. 1998. "Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults." *American Journal of Preventive Medicine* 14(4):245–58. doi: 10.1016/S0749-3797(98)00017-8.

Finkelhor, David, Anne Shattuck, Heather Turner, and Sherry Hamby. 2015. "A Revised Inventory of Adverse Childhood Experiences." *Child Abuse & Neglect* 48:13–21. doi: 10.1016/j.chiabu.2015.07.011.

Finlay, Sabine, Cody Roth, Tiansha Zimsen, Tahnee Lee Bridson, Zoltan Sarnyai, and Brett McDermott. 2022. "Adverse Childhood Experiences and Allostatic Load: A Systematic Review." *Neuroscience & Biobehavioral Reviews* 136:104605.

Flenady, Vicki, Laura Koopmans, Philippa Middleton, J. Frederik Frøen, Gordon C. Smith, Kristen Gibbons, Michael Coory, Adrienne Gordon, David Ellwood, Harold David McIntyre, Ruth Fretts, and Majid Ezzati. 2011. "Major Risk Factors for Stillbirth in High-Income Countries: A Systematic Review and Meta-Analysis." *The Lancet* 377(9774):1331–40. doi: 10.1016/S0140-6736(10)62233-7.

Freedman, Alexa A., Alison L. Cammack, Jeff R. Temple, Robert M. Silver, Donald J. Dudley, Barbara J. Stoll, Michael W. Varner, George R. Saade, Deborah Conway, Robert L. Goldenberg, and Carol J. Hogue. 2017. "Maternal Exposure to Childhood Maltreatment and Risk of Stillbirth." *Annals of Epidemiology* 27(8):459-465.e2. doi: 10.1016/j.annepidem.2017.07.005.

Hall, Jennifer A., Lorna Benton, Andrew Copas, and Judith Stephenson. 2017. "Pregnancy Intention and Pregnancy Outcome: Systematic Review and Meta-Analysis." *Maternal and Child Health Journal* 21(3):670–704. doi: 10.1007/s10995-016-2237-0.

Hall, Kelli Stidham, Jennifer L. Beauregard, Shelby T. Rentmeester, Melvin Livingston, and Kathleen Mullan Harris. 2019. "Adverse Life Experiences and Risk of Unintended Pregnancy in Adolescence and Early Adulthood: Implications for Toxic Stress and Reproductive Health." *SSM - Population Health* 7:100344. doi: 10.1016/j.ssmph.2018.100344.

Hillis, Susan D., Robert F. Anda, Shanta R. Dube, Vincent J. Felitti, Polly A. Marchbanks, and James S. Marks. 2004. "The Association between Adverse Childhood Experiences and Adolescent Pregnancy, Long-Term Psychosocial Consequences, and Fetal Death." *Pediatrics* 113(2):320–27. doi: 10.1542/peds.113.2.320.

Hutcheon, Jennifer A., Sarka Lisonkova, and K. S. Joseph. 2011. "Epidemiology of Pre-Eclampsia and the Other Hypertensive Disorders of Pregnancy." *Best Practice & Research Clinical Obstetrics & Gynaecology* 25(4):391–403. doi: 10.1016/j.bpobgyn.2011.01.006.

Kalmakis, Karen A., and Genevieve E. Chandler. 2015. "Health Consequences of Adverse Childhood Experiences: A Systematic Review." *Journal of the American Association of Nurse Practitioners* 27(8):457–65. doi: 10.1002/2327-6924.12215.

Kane, Jennifer B., Kathleen Mullan Harris, and Anna Maria Siega-Riz. 2018. "Intergenerational Pathways Linking Maternal Early Life Adversity to Offspring Birthweight." *Social Science & Medicine* 207:89–96. doi: 10.1016/j.socscimed.2018.04.049.

Karatekin, Canan, Susan M. Mason, Amy Riegelman, Caitlin Bakker, Shanda Hunt, Bria Gresham, Frederique Corcoran, and Andrew Barnes. 2022. "Adverse Childhood Experiences: A Scoping Review of Measures and Methods." *Children and Youth Services Review* 136:106425. doi: 10.1016/j.childyouth.2022.106425.

Kelly-Irving, Michelle, and Cyrille Delpierre. 2019. "A Critique of the Adverse Childhood Experiences Framework in Epidemiology and Public Health: Uses and Misuses." *Social Policy and Society* 18(3):445–56. doi: 10.1017/S1474746419000101.

Kendall-Tackett, Kathleen. 2002. "The Health Effects of Childhood Abuse: Four Pathways by Which Abuse Can Influence Health." *Child Abuse & Neglect* 26(6):715–29. doi: 10.1016/S0145-2134(02)00343-5.

Kerkar, Shweta, Arti Shankar, Renee Boynton-Jarrett, and Emily W. Harville. 2021. "Adverse Childhood Experiences Are Associated with Miscarriage in Adulthood: The GROWH Study." *Maternal and Child Health Journal* 25(3):479–86. doi: 10.1007/s10995-020-03079-y.

Krinner, Lisa M., Jan Warren-Findlow, Jessamyn Bowling, L. Michele Issel, and Charlie L. Reeve. 2021. "The Dimensionality of Adverse Childhood Experiences: A Scoping Review of ACE Dimensions Measurement." *Child Abuse & Neglect* 121:105270. doi: 10.1016/j.chiabu.2021.105270.

Lacey, Rebecca E., and Helen Minnis. 2020. "Practitioner Review: Twenty Years of Research with Adverse Childhood Experience Scores – Advantages, Disadvantages and Applications to Practice." *Journal of Child Psychology and Psychiatry* 61(2):116–30. doi: 10.1111/jcpp.13135.

Lee, Rosalyn D., and Jieru Chen. 2017. "Adverse Childhood Experiences, Mental Health, and Excessive Alcohol Use: Examination of Race/Ethnicity and Sex Differences." *Child Abuse & Neglect* 69:40–48. doi: 10.1016/j.chiabu.2017.04.004.

Lindberg, Laura, Kathryn Kost, Isaac Maddow-Zimet, Sheila Desai, and Mia Zolna. 2020. "Abortion Reporting in the United States: An Assessment of Three National Fertility Surveys." *Demography* 57(3):899–925. doi: 10.1007/s13524-020-00886-4.

Lindberg, Laura, and Rachel H. Scott. 2018. "Effect of ACASI on Reporting of Abortion and Other Pregnancy Outcomes in the US National Survey of Family Growth." *Studies in Family Planning* 49(3):259–78. doi: 10.1111/sifp.12068.

McEwen, Craig A., and Scout F. Gregerson. 2019. "A Critical Assessment of the Adverse Childhood Experiences Study at 20 Years." *American Journal of Preventive Medicine* 56(6):790–94. doi: 10.1016/j.amepre.2018.10.016.

McEwen, Craig A., and Bruce S. McEwen. 2017. "Social Structure, Adversity, Toxic Stress, and Intergenerational Poverty: An Early Childhood Model." *Annual Review of Sociology* 43(Volume 43, 2017):445–72. doi: 10.1146/annurev-soc-060116-053252.

McRae, Elizabeth M., Laura Stoppelbein, Sarah E. O'Kelley, Paula Fite, and Shana B. Smith. 2021. "An Examination of Post-Traumatic Stress Symptoms and Aggression among Children with a History of Adverse Childhood Experiences." *Journal of Psychopathology and Behavioral Assessment* 43(3):657–70. doi: 10.1007/s10862-021-09884-1.

Merrick, Melissa T., Derek C. Ford, Katie A. Ports, and Angie S. Guinn. 2018. "Prevalence of Adverse Childhood Experiences From the 2011-2014 Behavioral Risk Factor Surveillance System in 23 States." *JAMA Pediatrics* 172(11):1038. doi: 10.1001/jamapediatrics.2018.2537.

Mersky, Joshua P., and ChienTi Plummer Lee. 2019. "Adverse Childhood Experiences and Poor Birth Outcomes in a Diverse, Low-Income Sample." *BMC Pregnancy and Childbirth* 19(1):387. doi: 10.1186/s12884-019-2560-8.

NCHS, (National Center for Health Statistics). 2021. "Reduce the Number of Young Adults Who Report 3 or More Adverse Childhood Experiences — Evidence-Based Resources - Healthy People 2030 | Health.Gov." Retrieved June 18, 2024 (https://health.gov/healthypeople/objectives-and-data/browse-objectives/violence-prevention/reduce-number-young-adults-who-report-3-or-more-adverse-childhood-experiences-ivp-d03/evidence-based-resources).

Olsen, Jeanette M. 2018. "Integrative Review of Pregnancy Health Risks and Outcomes Associated With Adverse Childhood Experiences." *Journal of Obstetric, Gynecologic & Neonatal Nursing* 47(6):783–94. doi: 10.1016/j.jogn.2018.09.005.

Quenby, Siobhan, Ioannis D. Gallos, Rima K. Dhillon-Smith, Marcelina Podesek, Mary D. Stephenson, Joanne Fisher, Jan J. Brosens, Jane Brewin, Rosanna Ramhorst, Emma S. Lucas, Rajiv C. McCoy, Robert Anderson, Shahd Daher, Lesley Regan, Maya Al-Memar, Tom Bourne, David A. MacIntyre, Raj Rai, Ole B. Christiansen, Mayumi Sugiura-Ogasawara, Joshua Odendaal, Adam J. Devall, Phillip R. Bennett, Stavros Petrou, and Arri Coomarasamy. 2021. "Miscarriage Matters: The Epidemiological, Physical, Psychological, and Economic Costs of Early Pregnancy Loss." *The Lancet* 397(10285):1658–67. doi: 10.1016/S0140-6736(21)00682-6.

Rossen, Lauren, Brady Hamilton E., Joyce Abma, Elizabeth C.W., Vladislav Beresovsky, Andriana Resendez, Anjani Chandra, and Joyce Martin. 2023. *Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States*. National Center for Health Statistics (U.S.). doi: 10.15620/cdc:124395.

Scorza, Pamela, Cristiane S. Duarte, Seonjoo Lee, Haotian Wu, Jonathan Posner, Andrea Baccarelli, and Catherine Monk. 2023. "Epigenetic Intergenerational Transmission: Mothers' Adverse Childhood Experiences and DNA Methylation." *Journal of the American Academy of Child & Adolescent Psychiatry*. doi: 10.1016/j.jaac.2023.02.018.

Sibai, Baha M. 2002. "Chronic Hypertension in Pregnancy12." *Obstetrics & Gynecology* 100(2):369–77. doi: 10.1016/S0029-7844(02)02128-2.

Solar, Orielle, and Alec Irwin. 2010. *A Conceptual Framework for Action on the Social Determinants of Health*. WHO Document Production Services.

Steinberg, Julia R., and Jeanne M. Tschann. 2013. "Childhood Adversities and Subsequent Risk of One or Multiple Abortions." *Social Science & Medicine* 81:53–59. doi: 10.1016/j.socscimed.2012.11.011.

Testa, Alexander, Dylan B. Jackson, Kyle T. Ganson, and Jason M. Nagata. 2021. "Maternal Adverse Childhood Experiences and Pregnancy Intentions." *Annals of Epidemiology* 64:47–52. doi: 10.1016/j.annepidem.2021.09.011.

Tierney, Katherine I. 2019. "Abortion Underreporting in Add Health: Findings and Implications." *Population Research and Policy Review* 38(3):417–28. doi: 10.1007/s11113-019-09511-8.

Wachs, Theodore D., and Gary W. Evans. 2010. "Chaos in Context." Pp. 3–13 in *Chaos and its influence on children's development: An ecological perspective.*, edited by G. W. Evans and T. D. Wachs. Washington: American Psychological Association.

Wahabi, Hayfaa A., Samia A. Esmaeil, Amel Fayed, Ghadeer Al-Shaikh, and Rasmieh A. Alzeidan. 2012. "Pre-Existing Diabetes Mellitus and Adverse Pregnancy Outcomes." *BMC Research Notes* 5(1):496. doi: 10.1186/1756-0500-5-496.

Walsh, David, Gerry McCartney, Michael Smith, and Gillian Armour. 2019. "Relationship between Childhood Socioeconomic Position and Adverse Childhood Experiences (ACEs): A Systematic Review." *Journal of Epidemiology and Community Health* 73(12):1087–93. doi: 10.1136/jech-2019-212738.

CHAPTER II
Comparison of Conventional and Extended Adverse Childhood Experiences Scales and their Association with Non-Live Births

2.1 Introduction

2.1.1 Non-Live Births: Concept and Statistics

Miscarriage, stillbirth, and ectopic pregnancy pertain to the concept of involuntary termination of pregnancy, which is often recognized as pregnancy loss (Robinson 2014; Rossen et al. 2023). Despite consistent efforts to reduce the burden of pregnancy loss (miscarriages and stillbirths), the percentage of pregnancy loss has slightly increased from 19.4 in 2010 to 20.0 in 2019 (Rossen et al. 2023). Miscarriage refers to the loss of a baby before the 20th week of pregnancy, while stillbirth is defined as the loss of a baby after the 20th week of pregnancy (Gregory, Valenzuela, and Hoyert 2022; Rossen et al. 2023). Ectopic pregnancy refers to the end of pregnancy when the fetus does not survive due to implantation occurring outside of the uterus or womb (Mullany et al. 2023). In the United States, there were 13.7 ectopic pregnancies per 1,000 live births in 2013; these are the latest statistics available as there is no national surveillance infrastructure in place to monitor ectopic pregnancies regularly (Mann et al. 2020).

Abortion is the voluntary termination of pregnancy. The percentage of abortion is decreased from 15.8 in 2010 to 13.1 in 2019 (Rossen et al. 2023). But there are many concerns regarding this decrease, especially regarding the undercount of abortion cases due to debates over the reproductive choices and the effect of social stigma towards abortion (Donley and Lens 2022; Cockrill and Nack 2013; Goffman 1963). The women who have an abortion are familiar with the abortion associated stigma. Thus, they try to

manage their abortion information to avoid stigma related attitudes and behaviors (Cockrill and Nack 2013); such management may distort the accuracy of reporting of abortion and miscarriage (Donley and Lens 2022). This is particularly importance in contexts where abortion is banned or restricted, as individuals often use terms like "miscarriage" or “stillbirths” when describing their experiences in self-reported social surveys (Donley and Lens 2022; Lindberg et al. 2020). This leads to misreporting or underreporting of abortions in social surveys (Lindberg et al. 2020). Misreporting can serve as a means for individuals to evade legal consequences, stigmatic attitudes, or societal judgment linked to discussing abortions in surveys (Lindberg et al. 2020).

Non-live births refer to pregnancy outcomes other than live births, including ectopic pregnancy, stillbirths or fetal death, spontaneous abortion or miscarriage, and induced abortions (Witt et al. 2012; Zhu et al. 2023). Keeping reporting issue of abortion data in view, a recent scholarship suggested that abortion data gathered through survey self-reports should be used with caution (Lindberg et al. 2020). A few national surveys, such as the National Survey of Family Growth (NSFG), provided a written statement in their guideline documentation to use the abortion data with caution because of incomplete reporting (NCHS 2020). Though the other national surveys did not provide any warning statements regarding the use of abortion data, they are not immune from abortion-related data quality issues (Lindberg et al. 2020). Considering misreporting of abortion or miscarriage, a study concluded that only live birth cases from the self-report surveys could be used without concern of biased reporting (Lindberg et al. 2020). This may imply that using non-live birth terms to compare with live births may give a more

accurate picture of the reproductive health of a population, while presenting disaggregated information on abortion or pregnancy loss.

In sum, this study was an effort to present a separate analysis on abortion and pregnancy loss, but also presented the overall analysis or total number of non-live births. With comparison across abortion and pregnancy loss, non-live births analysis provided an overall picture, or less biased estimates, even if the data about these events was incomplete or inaccurate. This approach is particularly important to compare and contrast the predictors across disaggregated and overall analysis and then compare with existing literature to ensure that the study discusses contrast results with caution regarding the interpretation of misreported data. However, it is pertinent to mention here that presenting aggregated analysis by non-live births without providing disaggregated analysis, may also provide an incomplete picture of the population's reproductive outcomes..

2.2 Theoretical Framework

This study challenges the concept of the pre-pregnancy continuum care period, which usually emphasizes the importance of the immediate time period before a pregnancy, about three months to two years, while overlooking the childhood stage. I challenge this notion by engaging with ecological system theory and life-course theory. By incorporating these theoretical frameworks, the study aims to investigate the relationship between adverse childhood experiences (ACEs) and non-live births. The ecological theory, in particular, aided in focusing on an expanded version of the ACEs scale to capture a more comprehensive understanding of early life adversities. While life-course theory guided the focus on two-time points, it also facilitated the exploration of

the relationship between ACEs and pregnancy outcomes. Further details on these theories are provided as follows.

2.2.1 Pre-Pregnancy Conditions and Pregnancy Outcomes: Accounting for the Childhood Context

Pre-pregnancy conditions are strongly linked to the outcome of pregnancy, live birth versus pregnancy loss. However, healthcare policies often limit the pre-pregnancy period to women's reproductive years, defined usually as 18 to 44 years (Robbins et al. 2018). The Centers for Disease Control (CDC) identified several health domains that could improve pre-pregnancy care or pre-pregnancy health care. These domains included assessing and working on social determinants of health, family planning, alcohol and tobacco use, nutrition, mental health, physical activity, chronic conditions, family planning, and infectious diseases (Robbins et al. 2018). Moreover, the pre-pregnancy period is often suggested as three months before pregnancy, and sometimes it is extended to one to two years before pregnancy (Dean et al. 2014). Within the context of a three-month to one-year approach to pre-pregnancy pregnancy care, extensive research focused on understanding the pathways of stressors in the year preceding pregnancy (Hawks et al. 2018; Lassi et al. 2014; Witt et al. 2012). Nevertheless, the focus on mere pre-pregnancy period without creating a safer and healthier environment in childhood creates a noticeable gap in research exploring the lifelong effects of childhood adversities or stressors on pregnancy outcomes and overall reproductive, maternal, and child health outcomes.

Childhood has emerged as a critical window for risk determination in different spheres of life, mainly to prevent hard-to-treat and costly later-life diseases (Weintraub et al. 2011). Sociologists and public health advocates say that adverse childhood

experiences are a “hidden health crises” and must be assessed timely to prevent long-term effects on individuals. Without addressing the early childhood stage in relation to the pre-pregnancy care continuum, especially for girls and young women “who often receive little or no healthcare from age five until their first pregnancy,” the gap in women’s early life care will remain in the continuum (Dean et al. 2014).

In the realm of reproductive health research, there has been a historical tendency to overemphasize the impact of individual pre-pregnancy conditions (Bearak et al. 2020; Biggs, Gould, and Foster 2013; Leppälahti et al. 2016; United Nations 2014), ignoring that those conditions may result from structural inequalities like a chain rather solely individual choices, on outcomes such as abortion (Dehlendorf, Harris, and Weitz 2013). The emphasis on pre-pregnancy conditions often come at the expense of understanding the broader context of childhood experiences with life-course perspective (Bleil et al. 2011; Steinberg and Tschann 2013). Childhood adversities are reported to contribute to mental health issues before abortion, highlighting the link between pre-pregnancy conditions and childhood experiences (Steinberg et al. 2016). Therefore, the narrow focus of immediate pre-pregnancy conditions neglects the profound influence that early life adversities or stressors, known as ACEs, can exert on reproductive decisions and outcomes. By solely concentrating on immediate pre-pregnancy factors, researchers may overlook crucial developmental stages that shape individuals' health trajectories, including their attitudes towards pregnancy and abortion (Dehlendorf, Harris, and Weitz 2013).

Therefore, understanding the interconnectedness of childhood experiences with reproductive health outcomes is essential for developing holistic interventions that

address the root causes of reproductive health disparities and support individuals throughout their life-course.

Considering the importance of childhood on women's overall health and reproductive outcomes in the context of the life-course trajectories, this study tried to assess the relationship between childhood adversities (i.e., ACEs) and pregnancy-related outcomes. The theoretical debate on the importance of childhood is presented in the following section.

2.2.2 Social Ecology of Childhood

An ecological perspective of childhood highlights the significance of the child's interaction with their social environment and how it shapes their behavior. Ecological theories offer various conceptual and methodological tools for assessing and organizing health-promotion strategies or interventions. Bronfenbrenner, a psychologist, introduced Ecological System Theory, describing that human development is shaped by "environmental interconnections and their impact on the force directly affecting psychological growth" (Bronfenbrenner 1979). According to this theory, there are four systems in society that operate as layered or hierarchical systems: the microsystem, mesosystem, exosystem, and macrosystem. All four are further embedded in a chronosystem representing an era in which an individual grows up.

The microsystem involves interaction between the individual and immediate social environment surroundings such as school, home, or workplace. The mesosystem comprises the interaction between different microsystems in the child's life, such as the relationship between a parent and their child's teacher (Bronfenbrenner 1979). The exosystem consists of extrinsic environments, embraces social structures, or refers to

major influences of society, such as mass media or parents' workplace. The exosystem influences the child indirectly as the child is not an active participant. The macrosystem refers to societal characteristics or blueprints of a particular society, such as laws and regulations, norms, customs, beliefs, or political structures. These four systems are considered the base of ecological theory (Bronfenbrenner 1979).

Bronfenbrenner's model developed in different stages; the chronosytem component in the ecological framework was included in the mid-1990s, reflecting the changes over time. It entails how child development is affected by specific time points or events, such as parent divorce, which may influence significant changes in a child's family structure, impacting their development over time. The final phase of this theory further emphasizes the importance of the Person, Process, Context, and Time framework (Lopez et al. 2021). Bronfenbrenner uses these words to clear, link, and extend the previously proposed ecological theory. Accounting for a person would require analyzing how individual characteristics (such as gender, age, education, etc.) can influence their development and interaction with another social environment. The process would need to assess the regular interaction with their significant others (inspired by Mead's idea, reflecting with whom one has the most contact and could shape one's behavior). Context implies assessing the influences of different systems, macrosystems, or exosystems. Lastly, adding time requires a longitudinal study with at least two measurement points, which could be the current and historical points.

To sum up, in order to assess one's childhood experiences and to link them with negative health outcomes, this theoretical perspective helped me to include the measures reflecting child experiences in different domains of life, from the household environment

to neighborhood environments, by considering different layers of ecological systems and interactions among them. So, for this study, to capture negative life children's experiences, I followed the term Adverse Childhood Experiences (ACEs), which encompasses a range of childhood adversities discussed in the following sections.

2.2.3 Life-Course Theory

The Life-Course Theory emphasizes the changes in individual life over time, focusing on the timing and temporal context of individuals' lived experiences and how these experiences can influence personal development and well-being over time.

Thomas and Znaniecki, a Polish-American sociologist and an American sociologist, respectively, were known as pioneers in discussing life-course perspective through their longitudinal studies (1918–1920) of Polish peasants in Europe and America (Roberts 2010; Thomas and Znaniecki 1919). They highlight the enduring effects of early childhood experiences with behavior and cognitive and psycho-social outcomes; they also discuss the role of family dynamics and socio-economic conditions in shaping the life trajectory of individuals.

The life-course theory proposed by Glen H. Elder, a sociologist, emphasizes how the life course of individuals is shaped by their historical times, places, and decisions, as well as how it influences the development of individuals impacted by their life events (Elder 1998; Elder, Johnson, and Crosnoe 2003). It has five basic principles: (i) Life-Span Development – reflecting that aging and human development are lifelong processes and social conditions need to be studied over an extended period of time; (ii) Human Agency- individual development is impacted by their own choices and action they take within the limited availability of opportunities and constraints; (iii) Time and Place –

individuals life is shaped by their historical time and geographical locations or places, suggesting that people have different life paths and experiences; (iv) Timings of Life Events – the life events impact individual development but patterns vary according to their timings in their person's life. Lastly, (v) Interdependence of Human Lives – human development is also influenced by their social network or shared relationships (Elder 1998; Elder, Johnson, and Crosnoe 2003).

In summary, life course theory paved the way to link the influence of adverse childhood experiences to pregnancy outcomes, filling the gap in the pre-pregnancy care continuum, as discussed in the above section. Moreover, the accumulative nature of risk factors over time suggests that the effects of ACEs should be assessed independently as well as cumulatively. In this chapter, I am presenting analysis based on the accumulation of risk model, focusing on exploring the relationship at two time-points in life. Particularly, examining how exposure to ACEs among women can influence their pregnancy outcomes.

2.2.4 Social Stress Theory

Within the sociological paradigm, social stress theory emphasizes that social conditions are associated with stress, particularly for members of disadvantaged social groups (Nurius, Uehara, and Zatzick 2013; Pearlin 1989). This theory categorizes stress related to life events into two types: acute stressors, which are short-term adverse experiences, and chronic stressors, which encompass traumatic life events leading to recurrent adversities. The theory of stress proliferation posits that stress is a process whereby initial stressors lead to additional adversities over time (Nurius et al. 2013; Pearlin et al. 2005). For example, exposure to ACEs increases the risk of subsequent exposure to secondary stressors, which in turn contributes to adverse health outcomes

either cumulatively or independently of the initial event. These secondary stressors can set off a chain of experiences, leading to further adversities throughout life (Nurius et al. 2013; Pearlin et al. 2005). Furthermore, chronic stressors are also influenced by one's societal position. Individuals with low socioeconomic status (SES) or those from disadvantaged groups are more likely to experience adverse life events in childhood due to limited resources for coping with challenging situations (Nurius et al. 2013; Pearlin et al. 2005).

Moreover, such chronic stressors in early life may lead to various biological and psychosocial problems that impact individual's health in later years and may also have intergenerational adverse social and health outcomes (Cundiff et al. 2013; McEwen and Gregerson 2019). In sociological debates, a key explanation for the above-mentioned consequences of ACEs is the impact of toxic stress from cumulative early negative life experiences on social and behavioral health throughout the life course. Chronic stress (e.g., ACEs) and poor social conditions (e.g., lower socio-economic status) without robust social support systems impede an optimal social and emotional development (McEwen and McEwen 2017). Health risk behaviors stemming from ACEs activate the same biological health systems and stress-response mechanism, subsequently contributing to influence adverse health behaviors and conditions over the life course, which in turn effect pregnancy outcomes, particularly increase the likelihood of non-live births(Bleil et al. 2011; Freedman et al. 2017; Kerkar et al. 2021; McEwen and McEwen 2017).

Therefore, this study aims to assess how ACEs, known to influence adult health outcomes, may impact non-live births. This study also adjusted the analysis by including

a set of confounders that capture childhood SES (in the first two studies) and as a causal path in study 3, aiming to comprehensively assess the impact of ACEs on non-live births.

2.3 Literature Review

2.3.1 Adverse Childhood Experiences: Concepts and Measurement

Non-live births result from interrelated multifaceted factors, including genetic, physiological, behavioral, environmental, and psychosocial. Regarding psychosocial factors, prior research has established an association between adverse childhood experiences (ACEs) and non-live births. The term ACEs was coined by Vincent Felitti and his colleagues, and it refers to a set of stressful or traumatic life events occurring before the age of 18 years (Felitti et al. 1998). They introduced an ACE scale, based on a score concept that has become a standard measure of ACE and is renowned as a conventional ACE scale or Kaiser ACE study (hereafter, conventional ACE scale). The conventional ACE scale measures 10 types of traumas, including emotional abuse, physical abuse, sexual abuse, community violence, substance abuse, suicide, divorce, parental incarceration, low parental warmth, and physical neglect. The validity and reliability of conventional ACE scale has been discussed elsewhere (Dong et al. 2004; Dube et al. 2004). Most of the ACEs type in conventional scale reflect interaction between the individual and immediate social environment surroundings according to ecological system theory, as discussed earlier, and missing many other important aspects of life. The academic literature also highlighted the same gap, despite predictive ability of conventional ACE scale and a dose-response relationship with many health outcomes, the scale and its component items

were severely criticized and literature highlighted the need to expand the ACEs definition and scope (Cronholm et al. 2015; Finkelhor et al. 2013, 2015; Karatekin and Hill 2019).

Within the framework of ecological systems theory (as discussed earlier), each part of the microsystem interacts with one another, which is facilitated by the mesosystem (Bronfenbrenner 1979). An example of such interaction is the influence of the school environment and connectedness. Furthermore, modern aspects such as experiences in foster homes and involvement with social services, which were not part of the conventional scale developed in 1998, reflect the exosystem of ecological system theory. All these factors play a crucial role in child development, and their adverse life experiences can significantly impact their future health and life outcomes.

In addition, regarding social stress theory, the ACEs research has been described as sources of "toxic stress," associated with disruptions of physical and mental health development of a child, , which subsequently influence their life trajectories into adolescence and adulthood, affecting their behaviors, outcomes and overall health.(Finlay et al. 2022; Karatekin et al. 2022; McEwen and McEwen 2017). The exposure to toxic stress varies by experiencing different type of ACEs, in this regard, the conventional ACE scale mainly captures toxic stress at the household level and only includes one item assessing community violence, thereby overlooking childhood negative experiences within broader social contexts like interaction within the neighborhood and school environments (Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). Child interactions within household and outside of home play important roles in experiencing cumulative disadvantages that affects a child’s personality, influencing their adolescence and adult socio-economic conditions

and health outcomes(Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). Expanding the horizon of child's experiences from household to neighborhood disadvantage or school environments is an effort to capture and examine the role of structural disadvantages that child face in society(Brumley, Brumley, and Jaffee 2019; Karatekin et al. 2022; McEwen and McEwen 2017; Wachs and Evans 2010). In addition, some studies highlight modern phenomena like foster care experiences in childhood and institutional responses to abuse through social services involvement that were not part of conventional ACE scale when it was introduced in 1998. These two above-mentioned indicators were considered as part of ACEs under indicators of child maltreatment (Brumley, Brumley, and Jaffee 2019; Wachs and Evans 2010).

In light of these considerations, it becomes evident that incorporating these new indicators into the ACE scale is important. So, expanding the ACE scale to include neighborhood disadvantage, school environments, foster care experiences, and institutional responses to abuse, researchers may accurately capture the breadth of adversities that children face. This enhanced version, referred to as the extended ACE scale in this study, allows for a deeper understanding of how structural disadvantages and modern phenomena contribute to children's development and long-term outcomes. However, ACEs research remains subject to strong criticism due to the persistent lack of agreement on the number and classification of ACEs, which is an ongoing debate (Anda, Porter, and Brown 2020; Briggs et al. 2021; Krinner et al. 2021; Lacey and Minnis 2020). This study planned to utilize an extended ACE scale, contingent upon the availability of information in the study

dataset, along with considering new ACE categories identified in academic literature concerning pregnancy outcomes.

In addition, the conceptual issues on the ACEs scale arise due to (i) lack of agreement in definitions of adversity, (ii) assigning individuals into binary categories regarding ACEs, (iii) lack of justification for using conventional ACEs scale, and (iv) the use of different items in various ACE screening and survey questionnaires (Anda et al. 2020; Briggs et al. 2021; Krinner et al. 2021; Lacey and Minnis 2020). The ACEs scale also has various measurement issues, such as considering that (i) each adversity or subscale of ACEs has the same association with the outcome of interest, and (ii) a score of 4+ is considered a de facto cut point to label respondents as "high risk," even though the scholarship reported heterogeneity in the degree of risk for the same outcomes among individuals with identical ACE scores (Anda et al. 2020; Briggs et al. 2021; Kelly-Irving and Delpierre 2019; Lacey and Minnis 2020). Extant research highlights the need to consider the synergetic pairing of ACEs, the use of multiple individual risk models in addition to the cumulative risk model, and the utilization of longitudinal studies measuring the outcome of interest (Briggs et al. 2021; LaNoue et al. 2020; Olsen 2018). Moreover, research suggests that a history of ACEs combined with more recent adverse life events (such as intimate partner violence, financial hardships, etc.) significantly increases the risk for adverse mental health in adulthood (Morgan et al. 2014). Nevertheless, there is a literature gap examining differences in the association between non-live births and i) the conventional ACE scale, ii) the extended ACE scale with synergetic ACEs pairing, and iii) adjusting the analysis for recent adverse life events.

In the United States, 62 percent of adults report having experienced at least one type of ACE, while 25 percent reported having experienced three or more ACEs (Merrick et al. 2018). These prevalence estimates of ACEs are based on the data gathered through the Behavioral Risk Factor Surveillance System (BRFSS), which is an annual and nationally representative telephone survey conducted in 23 states of the United States. The ACE module used in BRFSS consists of 11 questions adapted from the conventional ACE scale. The prevalence estimates of ACEs unveiled a gender difference in enduring ACEs, with women being more likely than men to have experienced ACEs (Merrick et al. 2018). Nevertheless, it is important to mention that including the ACEs module in BRFSS surveys is not uniform across all states, and participation can vary from year to year. However, it is pertinent to mention here that the inclusion of the ACEs module in BRFSS surveys needs to be more consistent across all states, and participation can fluctuate from year to year (CDC 2023). Nevertheless, since 2009, ACE-related questions have been included in the BRFSS surveys of all 50 states and the District of Columbia for at least one year (CDC 2023).

2.3.2 Maternal Exposure to ACEs and Pregnancy Outcome

The recognition that maternal exposure to ACEs may be linked to future pregnancy outcomes is not new. Several studies have highlighted that maternal exposure to ACEs or specific types of ACEs influenced birth outcomes. Yet, only a few studies *(I found only six studies and elaborated as follows)* conducted in the United Sates highlight ACEs effect on non-live births.

A study conducted by Hillis et al. (2004) in San Diego, California, between 1995 and 1997 established a relationship between pregnancy loss and ACE score. The ACE

score, resembling mainly the Conventional ACE scale, was calculated based on categories: emotional abuse, physical abuse, sexual abuse, exposure to domestic violence, substance abuse, mentally ill or criminal household member, or separated/divorced parent (Hillis et al. 2004).

Freedman et al. (2017) reported findings of a population-based case-control study from the Stillbirth Collaborative Research Network (SCRN) conducted in five catchment areas of the United States between 2006 and 2009. The findings highlighted that there is no relationship between the overall child maltreatment scale and stillbirth, but only emotional neglect is related to stillbirth. Child maltreatment consists of only five categories of Kaiser or extended ACE scale, including emotional, physical, and sexual abuse and emotional and physical neglect. This study added respondent age, race, education, marital status, body mass index, insurance, depression, smoking status, alcohol use, and illicit drug use.

A study utilizing the 19-item scale to capture ACEs, which included almost all Kaiser categories and extended ACE scale, endorsed that each additional score of ACE increases the risk of pregnancy loss (Mersky and Lee 2019). This study was conducted in Wisconsin, and the sample was based on low-income women. This study only included the age, race, and education status of the respondents in the analysis.

Another study establishing a relationship between miscarriages and ACE scores based on the Conventional ACE scale was conducted in Southern Louisiana (Kerkar et al. 2021). The study analysis was adjusted by marital status, race, education, and smoking in the last two years.

A study, conducted in California, captured 26 items of the stressful life events scale before 12 years of age by including most of the categories of Kaiser and extended ACE scale, and revealed that women having repeat abortions were more likely to have childhood stressful life events than those having 0 or 1 abortion (Bleil et al. 2011). This study included a list of respondents and parent's socio-demographics for adjusted analysis, such as age, race, education, marital status, and mother and father education.

Another study explored relationship of ACEs and repeated abortions United States National Comorbidity Survey-Replication data which represented a multistage clustered area probability sample of the US household-based population. The data was conducted between 2001 to 2003, and respondents were asked to list their reproductive history information and experiences of childhood adversities. Among the women who reported that they had abortion, the study restricted analysis to only those women who were 13 or younger in January 1973, with a purpose to ensure that the option to have an abortion was legal during women's entire reproductive years. This study reported that women's exposure to at least one type of ACE- out of ten distinct types of childhood adversities- was related to repeated abortions as compared to one abortion (Steinberg and Tschann 2013). The analysis was also adjusted by age, race, total number of pregnancies and childhood household income.

In sum, the relationship between ACEs or types of ACEs has been established by previous studies with pregnancy loss or abortion. However, these studies had mainly cross-sectional study designs and were either conducted in one or a few states, except study conducted by Steinberg and Tschann 2013 on abortion which had a nationally representative sample. So, most of these studies may not represent the national-level

estimates. Moreover, some studies only included individual-level socio-demographic traits, while a few included health risk behaviors. In addition, the studies presented analysis either on stillbirth, pregnancy loss, or abortion. However, none of the studies presented analysis on both pregnancy loss and abortion by utilizing the same dataset. There is also inconsistency in the operational definition of the ACE measure; some utilize the Kaiser Scale, and others utilize the extended ACE scale, but there is variation in utilizing items of each scale. Hence, there is a need to contribute to the literature using a national-level representative survey, and the study may include a list of confounders and covariates.

2.3.3 Research Gaps

Use of Longitudinal and National-Level Data: Though prior research has established a relationship between ACEs (or a subscale of ACEs) with fetal losses and/or abortion by using cross-sectional data and data also has been limited to only one or a few states in the United States (Bleil et al. 2011; Freedman et al. 2017; Kerkar et al. 2021; Mersky and Lee 2019).. There is scant research exploring the relationship of ACEs with either fetal losses and/or abortion (aka, non-live births) utilizing longitudinal national data in the United States. This study uses a longitudinal dataset that has a nationally representative sample.

Consideration Related to Analytical Sample: Previous research in the field, which has delved into the connection between birth outcomes (encompassing both live and non-live births) and early life adversities, has identified specific gaps in knowledge and offered recommendations concerning analytical sample considerations. For example, the studies suggested that the parity of the women should be considered when selecting an analytical sample. Parity refers to the number of previous births a woman has had. A few studies

suggested including a sample of multiparous women (i.e., a woman has had at least one previous birth) rather than only focusing on nulliparous women (i.e., a woman who has not given birth to a child) (Gavin et al. 2012; Kane, Harris, and Siega-Riz 2018). This finding also led the authors to suggest that future studies should analyze the data by the pregnancy order rather than only analyzing the data for first pregnancies (Kerkar et al. 2021). So, this study presented an analysis of first pregnancy and any pregnancies to assess whether it influences the significant association between variables.

Comparison of Conventional and Extended ACE Scale with Different Levels of Measurement: There is limited research available exploring the relationship of ACEs to pregnancy outcomes utilizing both conventional and extended ACE scales and assessing the ACEs on distinct levels of measurement (cumulative, binary, or count). This study is innovative in exploring this relationship.

2.3.4 Role of Socio-Demographics Characteristics

Certain variables are associated with non-live births or ACEs and can influence the relationship between variables.

A systematic review explored the relationship between childhood SES and ACEs found that parental education is related to exposure to ACEs as 16 studies out of 18 reviewed studies found this association to be significant (Walsh et al. 2019). Parent's income or childhood household income was another significant predictor of experiencing ACEs as the same study reported that 7 studies out of 18 confirmed this relationship (Walsh et al. 2019). A study utilizing these dataset from National Child Abuse and Neglect Data System between 2005 to 2009 reported that higher income inequality was associated with higher rates of child maltreatment across the United States (Eckenrode et al. 2014).

Moreover, the variation in intergenerational effects of parent's education and parent's income (or childhood household income) impact pregnancy loss reported by studies conducted in United Kingdom (Woolner et al. 2019) and Finland (Pouta et al. 2005). In addition, a study conducted in Finland also found intergenerational effects on induced abortion as study found the girls experiencing underage induced abortion were more likely to have parents who received income support (reflecting lower household income) and had lower educational attainment (Leppälahti et al. 2016). Therefore, parents educational attainment and parents' income seems to be relevant confounding variables.

Racial disparities with regard to exposure to ACEs were also documented in the literature (Maguire-Jack, Lanier, and Lombardi 2020), and it varies by income or socio-economic status of individuals (Mersky and Janczewski 2018). Race is also a determinant of pregnancy loss and abortion, with racial disparities existing in the risk of pregnancy loss, and black women having a higher risk of miscarriage than white women (Mukherjee et al. 2013). In addition, abortion also varies by race, particularly when analysis is based on state laws and women's income-to-poverty status (Solazzo 2019). As race is linked with exposure to ACEs and pregnancy outcome, thus, this study considers race as a confounder. By including race, I am not considering any biological or genetic trait but rather use it as a proxy to capture the lived experiences of a racialized society.

The variation in experiencing ACEs is also exist by nativity(whether they were born in United States or foreign-born) status of parents and their offspring, even a generation variation of experiencing ACEs has been noticed by a previous study (Zarei et al. 2022). Foreign-born status is also linked with pregnancy or birth outcomes. Such as, a study conducted in 1996 reflected that foreign-born status was associated with birth outcomes,

such as being born in a foreign country lowering the risk of low birthweight and infant mortality (Singh and Yu 1996). Even after 17 years of this research, another study validated the relationship between birth outcomes and foreign-born status. However, it also mentioned that this relationship varies by racial group and educational level (Acevedo-Garcia et al. 2013). Hence, nativity or foreign-born status has variation by ACEs and birth outcome, there, this study expanded this relationship to non-live births and the analysis was adjusted on nativity of the parents and respondents.

In nutshell, a list of five confounders including race, childhood household income, parents and respondents' nativity, and parents' education, were selected for this study as they all linked with both exposure to ACEs and pregnancy outcome. Based on this, the Figure 2.1 present the conceptual framework of the study, suggesting that this study explored the relationship of ACEs with: (i) abortion, (ii) pregnancy loss, and (iii) non-live births – overall analysis.

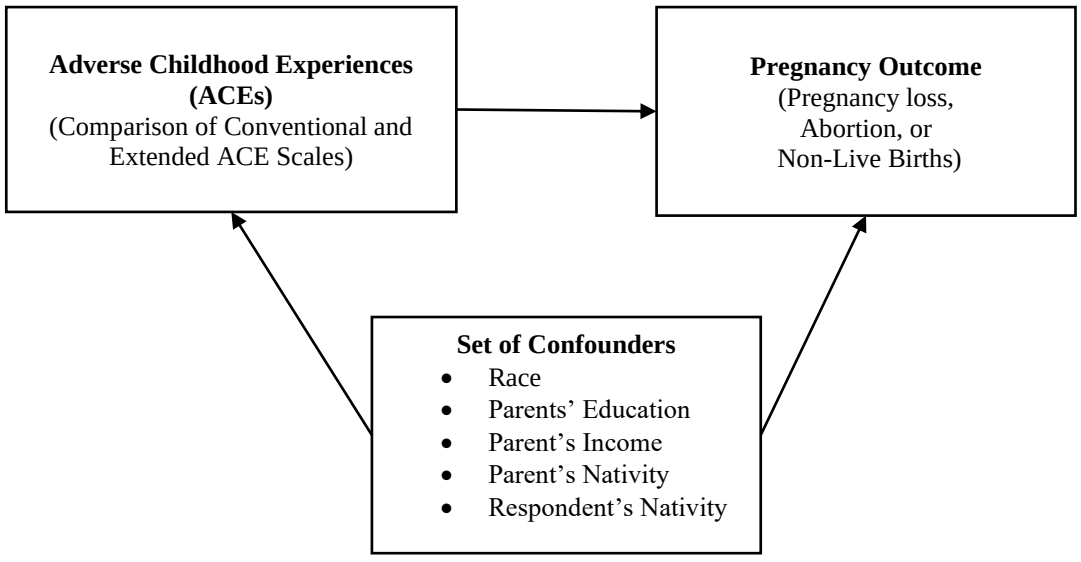

Figure 2.1: Conceptual Framework of the Study - Comparison of Conventional and Extended ACE Scales with Non-Live Births with a Set of Confounders

2.4 Research Hypotheses

Based on the above literature and research gaps, the hypothesis of this study is:

- H_1: The extended ACE scale, at different levels of measurement (continuous, binary, and multinomial), has a stronger association with ***pregnancy loss*** compared to the conventional ACE scale after adjusting for a set of confounders.
    - $H_{1.1}$: Each type of ACE has an independent association with ***pregnancy loss*** after adjusting for a set of confounders.
- H_2: The extended ACE scale, at different levels of measurement (continuous, binary, and multinomial), has a stronger association with ***abortion*** compared to the conventional scale after adjusting for a set of confounders.
    - $H_{2.1}$: Each type of ACE has an independent association with ***abortion*** after adjusting for a set of confounders.
- H_3: The extended ACE scale, at different levels of measurement (continuous, binary, and multinomial), has a stronger association with ***non-live births*** compared to the conventional scale after adjusting for a set of confounders.
    - $H_{.3.1}$: Each type of ACE has an independent association with ***non-live births*** after adjusting for a set of confounders.

In addition to testing the hypotheses, the study provides a comparative analysis of ACEs across abortion, pregnancy loss, and non-live births.

2.5 Methods

2.5.1 Data

This study utilized secondary data analyses of the "National Longitudinal Study of Adolescent to Adult Health (Add Health)," United States. This is a nationally representative, probability-based survey. A cohort of adolescents between Grades 7 and 12 initially participated in the study in 1994-1995, then followed up for five waves conducted in 2018. However, this study only used publicly available datasets from Wave I (1994-1995), Wave II (1996), Wave III (2001-2002), and Wave IV (2008-2009). For the pregnancy dataset, this study used the pregnancy table from wave IV.

This dataset was appropriate to address the study's research objectives as it has data on how pregnancy ended (live births or non-live births) as well as a list of variables to develop both Kaiser and extended ACE scales. The reason for only utilizing the dataset until wave IV and not using data from the latest wave (wave V) is that the questions related to non-live births are asked differently in wave V than in wave IV. In wave IV, the women were asked "how pregnancy ended" for all previous pregnancies they had in their lives. So, for each pregnancy they had, they reported whether it was a live birth or non-live birth, including miscarriage, abortion, or ectopic pregnancy. However, Wave V instead focused on the total number of live or non-live births, such as how many induced abortions or miscarriages the women or their partners had, or in case of having live births, they were further inquired about pregnancy or child characteristics.

To maintain deductive disclosure risk, the public-use data of Add Health includes only one-third of the data from in-home interviews. This public-use data comprised a robust representative sample of 6,504 in Wave I, 4,834 in Wave II, 4,882 in Wave III, and

5,114 in Wave IV. The documentation of the Add Health implementation procedures for all waves is available on the Add Health website[1].

2.5.2 Study Population

This study excluded: (i) pregnancies reported as refused or don't know (coded as 96/98), having 79 cases in total; the reason for dropping these cases was that these cases also don't contain information on other pregnancy-related variables such as year, unintended pregnancy, or birth control, year was also an essential variable for pregnancy that was used to restricted analysis to first pregnancy; (ii) pregnancies reported by men as this study focuses on maternal exposure to ACE, so dropped 2494 cases, (iii) currently pregnant cases, resulting in dropping 295 cases. After this exclusion, the analytical sample had data for 1794 women with a history of 4213 pregnancies, of which only 2420 were first pregnancies.

2.5.3 Measures

2.5.3.1 Dependent variable

At wave IV, the women who indicated that they had given birth they were asked to report the outcome of all previous pregnancies they had by asking the question, "How did this pregnancy end?" (hereafter referring to it as pregnancy outcome) The information about pregnancy outcomes was dichotomized into a live birth (coded as 0) or a non-live birth (coded as 1). Non-live birth refers to cases of abortion, ectopic or tubal pregnancy, miscarriage, and stillbirth. A live birth is referred to as delivering a child either through a cesarean section or vaginal delivery. For disaggregated analyses within non-live births, I further developed two binary variables: abortion and pregnancy loss. The abortion variable

[1] www.cpc.unc.edu/addhealth

reflects cases of induced abortions or volunteer termination of pregnancy (coded as 1 versus live birth coded as 0). The pregnancy loss variable was created to reflect the involuntary loss of a baby (coded as 1 versus live birth coded as 0), including cases of miscarriages, stillbirths, and ectopic pregnancy.

2.5.3.2 Independent variable

To assess ACEs, this study utilized two scales: the Conventional ACE scale and the extended ACE scale.

The Conventional ACE scale included 10 categories, while the extended ACE scale included 14 categories for this study. The studies utilized the addition of health data to assess ACEs using Kaiser or extended ACE scales using different items or categories. So, this study made an effort to make the scales inclusive, so I included maximum items/questions used by previous studies using Add Health data to measure the categories in both types of ACE scales. To read a complete list of items and how it is recorded, please see Appendix A: Items for Scale Adverse Childhood Experiences.

A cumulative measure (or continuous level of measurement) of exposure to ACEs was constructed by utilizing the recommended procedure detailed in prior research (Brumley, Jaffee, and Brumley 2017; Evans, Li, and Whipple 2013). This includes several steps. First, a series of composite variables were created, indicating whether a female respondent had exposure (coded as 1) to or little/no exposure (coded as 0). Second, these variables were summed to create cumulative ACE indexes. From this summed variable, a binary variable is designed to reflect whether the women respondents experienced any type of ACE (coded as 1) or did not have history of experiencing ACEs (coded as 0). A categorical count of ACEs was also constructed including 0, 1, 2, 3, or 4 or more ACEs.

Prior research has found relatively good reliability in retrospective reports of ACEs during adulthood (Dube et al. 2004; Hardt and Rutter 2004; Reuben et al. 2016).

2.5.3.3 Confounders

Adjusted analysis requires reporting the variables as covariates and confounders. The covariates are variables associated with the dependent variable (DV) but not the primary variables of interest. While confounders are variables associated with the independent variable (IV) and the dependent variable (DV). The study results could be biased if confounders are not considered. Such as, omitted variable bias may occur when a confounding variable is not considered in a study (Greenland, Daniel, and Pearce 2016; VanderWeele 2019; Wilms et al. 2021). This can lead to an incorrect estimate of the effect of the IV on the DV. However, it is not feasible to add every relevant variable in the study, so I used the guidelines discussed in academic scholarship and selected a set of confounders accordingly. First, I used a Directed Acyclic Graph (DAG), which is considered the most basic structure for selecting confounders, reflecting that the relationship of selected confounders should be depicted through directing arrows that should point out toward IV and DV (VanderWeele 2019). Secondly, considering the previous role of confounders, it suggests that confounders are the linked to IV or DV and may not suggest any other pathway or consequence; if it does, then they may not be confounders but might be mediators, colliders, or instrumental variables (VanderWeele 2019). Thirdly, the temporal order of the confounders matters, and it is advised to "refrain from adjusting for covariates that occur temporally subsequent to the exposure" (VanderWeele 2019). In consideration of this point, a study discussed while exploring the ACEs relationship with adult outcomes by utilizing a causal framework that adjusting analysis based on post-date childhood

variables might block mediated pathways and can also create biased results. The same study suggests avoiding time-varying variables as confounders, such as education, income, marital status, smoking behaviors, and alcohol intake (Jaen et al. 2023). These above-mentioned principles only require a theoretically informed approach, while there are several statistical-based approaches available to finalize a list of confounders after substantial knowledge (VanderWeele 2019), which is beyond the scope of this study.

A list of socio-demographics was selected as confounders for this study, and data on all selected confounding variables were assessed at wave I. Only those variables were chosen as confounders that influence dependent (pregnancy outcome) and independent variables (ACEs) and are informed by academic scholarship. Any variable that can either mediate or affect dependent or independent variables was not added to the model for this chapter.

The confounding factors include race (non-Hispanic white, non-Hispanic black, Hispanics, and other races), childhood household income (Log: range from 0 to 6.8), parents' education (1 to 9, from less than 8^{th} grade to 9 professional degrees), parents' nativity (0=native or born in the United States, 1= non-native), and respondent's nativity (0=native, 1= non-native).

2.5.4 Statistical Methods

The outcome variable was dichotomized, so logistic regression was used for answering the research question using R. As the pregnancies were nested within women respondents. Thus, the study utilized multilevel modeling when running an analysis using all pregnancies. So, this study utilized Generalized Linear Mixed Models (or GLMMs), an extension of linear mixed models to allow outcome variables from different

distributions, such as binary responses. So, the GLMER command (within the LME4 package) was used with a logit link and binary family. When restricted analysis on first pregnancies, the GLM command with a logit link was used as data were not nested within women respondents.

Data were missing on some variables, and addressing missing data was one of the paramount tasks to avoid potential selection bias for this study. Complete case analysis is only good when data is missing completely at random (Enders 2017; Jakobsen et al. 2017). I noticed that data was somewhat random on some variables; thus, conducting a complete case analysis may lead to biased estimates. To determine whether data was missing at random, this study utilized "missing_compare" function from "finalfit" package, which utilized chi-square tests for categorical variables and t-test or anova for continuous variables. This function runs an analysis between each variable with missing observations and other variables in the data. The significant p-value reflected that missing values were associated with observed values of the different variables, confirming that data was missing at random.

Figure 2.6 reflects the percentage of missed values on variables used for this study. The outcome variable, pregnancy outcome, has 5.28 percent missing data. In comparison, data on independent ACE scale ranged between 1 to 59 percent, while data on confounders ranged from 0.2 (race) percent to 25 percent (childhood household income). All variables with missing data were imputed. To reiterate, this study excluded the cases with missing data on pregnancy outcomes, as mentioned in the above section, "study population." So, the data on pregnancy outcomes were not imputed.

Multiple imputations (MI) with chained analysis were performed using multivariate imputation by chained equation (mice package) and created 30 multiply imputed datasets with 15 iterations to address missing data on other variables. As mentioned above, multiple imputation was used only for independent and confounder variables. During the multiple imputation process, all study variables were included in the imputation model to determine the most likely distribution of missing values.

The unweighted descriptive statistics are presented in percentages, mean, and standard deviations. The bivariate and multivariate analyses represent weighted Odds Ratios (ORs) and Adjusted Odds Ratios (AORs). The sampling weight variable was rescaled to avoid convergence issues. This study utilized longitudinal weights from wave 1 to wave 4; the mean value from all available waves was used in case of missing values. To get national representative estimates, the Add Health study suggested using sampling weights; the information on the Add Health study design and sampling procedures can be found in the study by Harris (2013). For sensitivity analysis, I conducted analysis by dropping cases with missing values on longitudinal sampling weight and replacing the missing values with the mean of sampling weights; the association between variables was the same. So, this study presents an analysis based on the latter technique, as this way, the analytical sample was more significant than the dropped cases.

2.6 Results and Interpretation

Table 2.1 provides the descriptive statistics for the analytic sample. A total 15.3 women having their pregnancies ended in pregnancy loss and 14.7 percent terminated their pregnancies through abortions. On average, the women who experienced non-live births disclosed to experience at least 2.4 (SD =1.7) ACEs when ACEs were captured using a

conventional scale, however, mean exposure to ACEs was slightly higher (Mean=2.9; SD=2.0) when utilizing an extended ACEs scale. Still, it is pertinent to mention here that the extended ACE scale also exhibits greater variability in reported ACEs, as the extended ACE scale has a higher standard deviation as compared to the conventional ACE scale.

However, the women who terminated their pregnancies through abortions had slightly higher mean exposure to ACEs (M=3.1, SD=2.0) when assessed with the extended scale as compared to the conventional ACE scale (M=2.6, SD-1.7). On overall analysis, using non-live birth term, the computed binary version of both the conventional and extended scales reflected almost similar exposure differences to ACEs among women who had experienced non-live births, as nearly 90.6 percent of women reported having exposure to ACEs when assessed through the extended ACE scale as compared to conventional (87.6 percent) ACE scale (Table 2.1).

Among women who experienced non-live births, 34.2 percent reported suffering from four or more ACEs when assessed through the extended ACE scale, which was 7.5 percent higher as compared to when evaluated through the conventional ACE scale (26.7 percent). Similar patterns were noticed for disaggregated analysis by abortion and pregnancy loss (Table 2.1).

Among women who had pregnancy loss, emotional abuse was the most frequently occurring ACE (46.8 percent), whereas living in foster homes (4.3 percent) was the least frequently occurring ACE. A majority of the women (58.7 percent) identified themselves as non-Hispanic white, followed by 27.9 percent were non-Hispanic black, 3.4 were Hispanics, and 10.0 self-identified as other races (Table 2.1). Almost the similar characteristics were noted among women who had abortion, emotional abuse was the most

frequently occurring ACE (55.7 percent), whereas living in foster homes (1.4 percent) was the least frequently occurring ACE. However, among women who had an abortion, a majority 44.3 percent identified themselves as non-Hispanic black women, followed by 38.8 percent were non-Hispanic white, 12.0 self-identified as other races, and 5.3 percent were identified themselves as Hispanics (Table 2.1).

Figure 2.2 presents the multivariate analysis for the first pregnancy. Overall, the cumulative, binary, or count of the ACE scale, assessed through either conventional or extended ACE scales, was significantly associated with increased odds of abortion with or without the presence of confounders (for unadjusted analysis, see Table 2.2). However, none of the ACE scales with different levels of measurements was associated with pregnancy loss with or without the presence of confounders (Table 2.2).

For a first pregnancy, on overall analysis using the conventional ACE scale (see Figure 2.2), the findings illustrate that when using the cumulative score, each single increase in ACEs is associated with a 13% increase in the odds of non-live births (AOR=1.13; 95% CI: 1.07- 1.19); this association is similar when assessed through the extended ACE scale with the only difference being a slight decrease in the odds of non-live births (AOR=1.10; 95% CI: 1.05- 1.15). When using the ACE scale as a binary variable, experiencing ACEs is associated with statistically significant higher odds of non-live births. Women had 57% higher odds of non-live births (AOR = 1.57, 95% CI: [1.23 – 2.01) when assessed through conventional ACE scale and 62% higher odds when assessed through extended ACE scale (AOR = 1.62, 95% CI: [1.23 – 2.14). This reflects that the ACE measurement level gives variation in odds when assessed through continuous or binary functions. The extended ACE scale reflected lower odds than the conventional ACE

scale when the level of measurement was continuous. Still, when converted into binary, the extended ACE scale reflected a higher percentage of odds than the conventional ACE scale. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values were also lower for extended ACE scale (AIC= as compared to conventional ACE scale, representing a better fit model. A similar pattern was assessed for categorical variables of ACEs reflecting the number of ACEs for non-live births. However, the extended scale has higher odds than the conventional ACE scale, and the odds of experiencing non-live births increased as exposure to the number of ACEs (1 to 4+) increased, reflecting the effects of the accumulation of ACEs. However, women who had exposure to only one type of ACE, when assessed through an extended scale, no longer had significant association to non-live births and only showed significance on disaggregated analysis on experiencing an abortion [AOR=2.8, 95% CI: 1.28-6.13) (Figure 2.2).

In the independent effect of ACE type, maternal exposure to emotional abuse had a significant association with increased odds of non-live births (AOR=1.59; 95% CI: 1.33-1.90), abortion (AOR=1.99; 95% CI: 1.56-2.55), and pregnancy loss (AOR=1.34; 95% CI: 1.07-1.67), in the presence of confounders. The women who experienced physical were 1.24 times more likely to have a non-live birth and were 1.53 times more likely to have an abortion. The exposure to sexual abuse and emotional neglect were only associated with abortion, increasing 54 and 56 percent of odds of abortion, respectively. The exposure to violent crime victimization increased 32 percent odds of non-live births, and disaggregated analysis reflects that it is significantly associated with abortion but not with pregnancy loss. Maternal exposure to suicide in their home in their childhood increased 66 percent of the

likelihood of having an abortion when they get pregnant. The women who spent their lives in foster homes reflected 87 percent of the likelihood of experiencing pregnancy loss when controlling the effects of confounding variables (Figure 2.3).

Table 2.3 presents the analysis of the relationship between ACEs and non-live births by including all pregnancies by women. The relationship is almost similar in terms of distinct levels of measurement for ACE scores for non-live births. On disaggregated analysis, it reflected a similar pattern as having exposure to ACEs significantly increased the odds of reporting having an abortion, but it does not have a significant association for pregnancy loss (Figure 2.4 or Table 2.3).

However, the independent effect of ACE type reflected a slightly different pattern for pregnancy loss when analysis included all pregnancies. Such as, when analysis was restricted to first pregnancies only, living in foster home had a significant association (Figure 2.3), however, after inclusion of all pregnancies living in foster homes was no longer associated with pregnancy loss (Figure 2.5).

2.7 Discussion

This study tested three hypotheses to determine if there was a statistically significant association between exposure to ACEs after controlling for a set of confounders, and: (i) abortion; (ii) pregnancy loss; and (iii) non-live births. The study supported the hypotheses related to abortion and the overall analysis using the term non-live birth (referring to the third hypothesis). However, I found no association between ACEs and pregnancy loss.

On the overall analysis, using non-live births, my study found a significant association of ACEs with non-live births, whether measured through conventional or extended ACE scale. On the relationship of individual ACE with non-live births, I found an association only between emotional abuse and violent crime victimization with non-live births. The relationship between sexual abuse and non-live birth was significant on unadjusted analysis but it lost its significance on adjusted analysis. The overall analysis provides a glimpse on the association of ACEs with non-live births as compared to live births, it is particularly important with the context that this study did not find association of pregnancy loss with ACEs which does not align with extant research in the U.S. . This may suggest that there is a need to provide an overall analysis with disaggregated analysis on abortion and pregnancy loss, particularly until innovative approaches are utilized to get more accurate data on abortion count.

The accumulation of ACEs through various levels of measurements (cumulative, binary, or number of ACEs) assessed through either conventional or extended ACE scale, is not significantly associated with pregnancy loss. My study found no statistically significant association between ACE score and pregnancy loss during first or all pregnancies. This findings contradict previous research conducted in Wisconsin, United States, which found a strong association between ACE score and pregnancy loss, as measured by stillbirth and miscarriages (Mersky and Lee 2019). Moreover, this findings also contradict prior research on adolescent pregnancies which suggested that the cumulative score of ACEs was associated with fetal death after the first pregnancy (Hillis et al. 2004). However, my study did not find a significant association between ACEs and pregnancy loss on first or after first pregnancy. Another study found a significant

association between the ACEs cumulative score and miscarriage for first and any pregnancy; however, although they used the term ACEs, they only accounted for child maltreatment which only includes five items in the ACEs scale (Kerkar et al. 2021). So, overall, the contradicting findings may be due to restricted sample size and different uses of ACE types, or it indicates the misreporting of pregnancy loss and abortion in Add Health data as highlighted by previous studies (Lindberg et al. 2020; Tierney 2019).

However, my study found that emotional abuse had a significant association with pregnancy loss in the first pregnancy or any pregnancy. The findings are consistent with a study conducted in Southern Louisiana, which reported that women experiencing four or more ACEs were at more risk of miscarriages as compared to those with no ACEs (Kerkar et al. 2021). An integrated review on ACEs and pregnancy loss also reflected the association between emotional abuse and pregnancy loss (Swift et al. 2024). A previous study that explored the relationship between child maltreatment and stillbirth found similar results as they did not find an association between child maltreatment and stillbirth with the exception of the emotional neglect subscale (Freedman et al. 2017). Moreover, living in foster homes and exposure to violent crime victimization were also found to be statistically significant with pregnancy loss.

Additionally, the accumulation of ACEs through various levels of measurements (cumulative, binary, or number of ACEs) assessed through either conventional or extended ACE scale have a statistically significant association with abortion. Similar findings were found when all pregnancies were included in the analysis. The findings of this study are aligned with studies reporting that exposure to ACEs was associated with repeated abortions, in the context of France (Haddad et al. 2021) and California, United

States (Bleil et al. 2011), as well as another study utilizing a nationally representative sample of the United States (Steinberg and Tschann 2013).

On the relationship of individual ACE, I found an association in this study between emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect, violent crime victimization, and suicide with abortion. Therefore, these findings reflect the importance of childhood phase that has long term impact on women's overall health and reproductive outcomes.

Prior research highlighted the plausible reasons for how exposure to maternal ACEs influences the pregnancy outcome. Among these, psychosocial, epigenetic and immunological pathways, along with psychological distress, and problematic behavior during young adulthood are important mechanisms to consider. People who experienced ACEs reported higher level of psychological distress than those with no exposure to ACEs (Manyema, Norris, and Richter 2018; Mersky, Janczewski, and Nitkowski 2018). Stress can also increase the risk of preeclampsia and placental abnormalities (Marinescu et al. 2014; Zhang et al. 2013) and substance abuse during pregnancy (Racine et al. 2022), which are risk factors for miscarriages or spontaneous abortions (Marinescu et al. 2014; Pedersen 2007). So, future studies can be used to explore such pathways between ACEs and non-live births.

There are some limitations to the study. One potential limitation is recall bias in the retrospectively self-reported pregnancy and ACEs estimates in Add Health. A study revealed that retrospective ACEs reflected stronger associations with life outcomes that were subjectively assessed, while they showed weaker associations when life outcomes were measured objectively (biomarkers or tests). Additionally, although Add Health

recommends that the Wave IV pregnancy table has the most accurate source of reproductive history information, this may reflect the misclassification bias across waves.

Extant literature is available on exploring the relationship of pre-pregnancy care in the context of reproductive health and birth outcome. Yet, few studies have examined the role of ACEs on non-live births, abortion, or pregnancy loss, especially by utilizing national longitudinal datasets. Future studies can consider including the synergetic pairing of ACEs for analysis as suggested by meta-analysis (Briggs et al. 2021; LaNoue et al. 2020; Olsen 2018). Moreover, future studies may include the history of ACEs combined with more recent adverse life events (such as intimate partner violence, financial hardships, etc.) as it significantly increases the risk for adverse mental health in adulthood (Morgan et al. 2014). Moreover, some pathways between ACEs and non-live births need to be explored, such as health risk behavior, chronic health conditions, spousal violence, and socio-economic conditions before pregnancy, etc.

2.8 Conclusion

This study highlighted the importance of how conceptualization and measurement of ACEs can have different impacts on assessing abortion, or pregnancy loss. Though both conventional and extended scales predicted a statistically significant relationship with abortion, yet using an extended scale shows higher odds than the conventional scale. Moreover, some variables, such as having lived in foster homes are associated with pregnancy loss, and foster home living is a type of ACE included in the extended ACE scale, which reflects the benefits of including additional adverse experiences that might be considered to be experienced by small groups of people as they seem to have a significant effect in estimates. Therefore, I would suggest considering the expanded ACE

scale for future studies. Furthermore, this study demonstrates that ACEs reflect greater predictive power for abortion when the data is disaggregated compared to pregnancy loss.

My study adds to a growing interest in applying the life-course approach to the pre-pregnancy care continuum and maternal and child health by considering childhood phase as an important phase of women's health care. The findings highlighted the importance to consider and care for women's health throughout the life course as opposed to just right before and during pregnancy for positive health outcomes. The study reveals the need for early intervention and support for women with a history of ACEs rather than just focusing on women's health right before and during pregnancy (Dean et al. 2014). Screening for ACEs should be conducted prospectively in schools or healthcare settings to identify individuals in need of care and support. The childhood phase represents a crucial window of opportunity to mitigate the long-term effects of ACEs and prevent future health disparities. Moreover, the study adds and validates the importance of ACEs in assessing adverse health outcomes. Both conventional and extended scales, whatever their level of measurement was, were found to be associated with non-live births, particularly abortion. This study validated that the conceptualization of ACEs and their screening must not be used as a "diagnostic tool but as a powerful surveillance tool that can facilitate healthcare culture to provide trauma-informed care" (Dube 2018; Oral et al. 2016). Dube (2018) argued taking action rather than waiting for evidence-based interventions to address and prevent ACEs in contrast to Finkelhor (2018), who did not favor universal screening and warned to be cautious before endorsing screening programs without doing a comprehensive cost-benefit analysis. The results of this study also suggested taking action rather than waiting for ACE-related interventions in order to

reduce the burden of non-live births. In this regard, medical and allied healthcare professionals should have access to more training to support women with a history of ACEs. To reiterate, ACE research should be utilized to assess childhood trauma prospectively, and evidence of ACEs (Dube 2018) should be used to create policies that yield safer environment for children and ameliorate structural inequalities, as well as promoting a culture of trauma-informed care for adults who experienced traumatic childhoods. This could potentially reduce the future health disparities burden, while enacting measures to counter the effects of ACEs and the structural mechanisms associated with them.

My study found that women with a history of ACEs are more likely to have abortions, reflecting the significance of a life-course perspective. The life-course perspective goes beyond mere consideration of women's pre-pregnancy conditions, emphasizing the cumulative impact of adversities across different life stages on reproductive health outcomes. This suggests that ACEs may contribute to cumulative disadvantages, as disparities in abortion are influenced by "larger structural inequities such as racism and poverty, along with coercive reproductive health policies" (Dehlendorf, Harris, and Weitz 2013). In addition, to break the chain of ACEs and reduce their intergenerational effects, it is crucial to ensure safe access to abortion. Previous research indicates that a significant proportion of children who experienced poor maternal bonding (a part of ACEs, including neglect) and lived in subjective poverty, were born to women who were denied abortions compared to those born to women from subsequent pregnancies after receiving abortion (Foster et al. 2018). Therefore, access to safe abortion, that is only possible when it is legal, enables women to "choose to have

children when they have greater financial and emotional resources to devote to them" (Foster et al. 2018) hence having children who will have a lower risk of experiencing ACEs and the many negative outcomes associated with them.

2.9 Tables and Figures: Chapter II

Table 2.1: Descriptive Statistics of Add Health Sample (N=4213)*

Variables	Live Births	Non–Live Births (NLBs)		
		Pregnancy Loss	Abortion	Total NLBs
	(N=2950)	(N=644)	(N=619)	(N=1263)
	% or mean (SD)	% or mean (SD)	% or mean (SD)	% or mean (SD)
Pregnancy Outcome	70.0	15.3	14.7	30.0
Adverse Childhood Experiences (ACEs)				
Conventional ACE scale - Continuous	2.1 (1.7)	2.2 (1.7)	2.6 (1.7)	2.4 (1.7)
Conventional ACE scale – Binary	81.6	83.2	92.1	87.6
Extended ACE Scale -Continuous	2.6 (2.0)	2.6 (1.9)	3.1 (2.0)	2.9 (2.0)
Extended ACE Scale - Binary	86.2	86.8	94.5	90.6
Number of ACEs**				
1	24.2 [20.7]	21.6 [18.3]	23.1 [17.8]	22.3 [18.1]
2	20.4 [19.3]	24.2 [20.8]	22.3 [22.6]	23.3 [21.7]
3	15.3 [16.5]	14.6 [16.3]	16.0 [17.0]	15.3 [16.6]
4+	21.7 [29.7]	22.8 [31.4]	30.7 [37.2]	26.7 [34.2]
Emotional Abuse	42.3	46.8	55.7	51.2
Physical Abuse	21.5	23.3	29.2	26.2
Sexual Abuse	12.1	13.1	15.7	14.4
Violent Crime Victimization	19.8	22.2	25.0	23.6
Substance Abuse	19.0	16.8	19.8	18.3
Parental Divorce	23.1	21.2	29.9	25.5
Suicide	6.4	5.6	9.7	7.6
Incarceration	24.2	26.9	24.6	25.8
Emotional Neglect	24.6	22.1	29.8	25.9
Physical Neglect	30.4	32.6	37.2	34.8
Foster Home	3.3	4.3	1.4	2.9
School Disadvantage	37.5	34.4	33.7	34.1
Neighborhood Disadvantage	29.2	26.6	29.1	27.8
Social Services Involvement	6.7	8.1	8.7	8.4
Socio-Demographics				
Race				
Non-Hispanic White	56.5	58.7	38.4	48.8
Non-Hispanic Black	27.6	27.9	44.3	35.9
Hispanics	4.4	3.4	5.3	4.4
Other	11.6	10.0	12.0	10.9
Parents Education- [reflecting completed GED]	5.0 (2.3)	5.0 (2.3)	5.6 (2.3)	5.3 (2.3)
Childhood Household Income [Log: 0 – 6.8]	3.4 (0.8)	3.4 (0.9)	3.5 (0.8)	3.5 (0.9)
Parents Nativity	13.1	10.2	16.2	13.1
Respondent Nativity	5.4	2.6	6.5	4.5

*unweighted descriptive statistics,

**The percentage for the Conventional ACE scale is presented outside the brackets, while the percentage for the extended ACE scale is enclosed within the brackets.

Table 2.2: Logistic regression of pregnancy outcome on adverse childhood experiences (ACE) scale for first pregnancies

Variable Description	Non-Live Birth		Abortion		Pregnancy Loss	
	OR [95% CI]	AOR [95% CI]	OR [95% CI]	AOR [95% CI]	OR [95% CI]	AOR[95% CI]
Conventional ACE scale (10 cat.)	**1.11 [1.05 - 1.17]**	**1.13 [1.07 - 1.19]**	**1.18 [1.10 - 1.26]**	**1.24 [1.15 - 1.34]**	1.05 [0.99 - 1.12]	1.05 [0.98 - 1.12]
Conventional ACE Binary [ref=LB]	**1.57 [1.23 – 1.99]**	**1.57 [1.23 – 2.01]**	**2.42 [1.66 – 3.54]**	**2.55 [1.73 – 3.76]**	1.19 [0.90 – 1.57]	1.17[0.88 - 1.56]
Count ACE [ref=no exposure]						
1	**1.34 [1.00 - 1.78]**	1.31 [0.98 - 1.74]	**2.00 [1.29 - 3.10]**	**1.94 [1.25 - 3.03]**	1.04 [0.74 - 1.47]	1.04 [0.74 - 1.47]
2	**1.70 [1.28 - 2.26]**	**1.70 [1.27 - 2.27]**	**2.58 [1.68 - 3.97]**	**2.70 [1.73 - 4.20]**	1.31 [0.94 - 1.84]	1.3 [0.92 - 1.83]
3	**1.46 [1.07 - 1.99]**	**1.49 [1.08 - 2.04]**	**2.25 [1.42 - 3.58]**	**2.45 [1.52 - 3.93]**	1.11 [0.76 - 1.62]	1.10 [0.75 - 1.62]
4+	**1.78 [1.34 - 2.37]**	**1.87 [1.39 - 2.51]**	**2.89 [1.89 - 4.42]**	**3.45 [2.21 - 5.39]**	1.30 [0.92 - 1.82]	1.27 [0.89 - 1.81]
Extended ACE Scale (14 cat.)	**1.08 [1.04 - 1.13]**	**1.10 [1.05 - 1.15]**	**1.14 [1.07 - 1.20]**	**1.19 [1.12 - 1.27]**	1.04 [0.99 - 1.10]	1.04 [0.98 - 1.10]
Extended ACE Binary [ref=LB]	**1.60 [1.22 - 2.10]**	**1.62 [1.23 - 2.14]**	**3.07 [1.91 - 4.93]**	**3.32 [2.04 - 5.40]**	1.12 [0.83 - 1.53]	1.11 [0.81 - 1.52]
Count ACE [ref=no exposure]						
1	1.34 [0.97 - 1.85]	1.33 [0.96 - 1.84]	**2.39 [1.40 – 4.08]**	**2.43 [1.41 – 4.18]**	0.99 [0.68 - 1.45]	0.99 [0.68 - 1.44]
2	**1.70 [1.24 - 2.34]**	**1.72 [1.24 - 2.37]**	**3.35 [1.99 – 5.64]**	**3.58 [2.10 - 6.10]**	1.17 [0.81 - 1.69]	1.15 [0.79 - 1.68]
3	**1.56 [1.12 - 2.17]**	**1.59 [1.13 - 2.22]**	**3.14 [1.84 – 5.37]**	**3.41 [1.97 – 5.91]**	1.04 [0.71 - 1.55]	1.05 [0.70 - 1.57]
4+	**1.75 [1.30 - 2.36]**	**1.85 [1.36 - 2.52]**	**3.33 [2.01 – 5.51]**	**4.03 [2.39 – 6.80]**	1.24 [0.88 - 1.75]	1.22 [0.85 - 1.74]
Emotional Abuse [ref=no exposure]	**1.53 [1.28 - 1.83]**	**1.59 [1.33 - 1.90]**	**1.8 [1.42 - 2.29]**	**1.99 [1.56 - 2.55]**	**1.35 [1.08 - 1.67]**	**1.34 [1.07 - 1.67]**
Physical Abuse [ref=no exposure]	1.20 [0.97 - 1.47]	**1.24 [1.01 - 1.53]**	**1.36 [1.04 - 1.78]**	**1.53 [1.16 - 2.01]**	1.07 [0.83 - 1.38]	1.05 [0.81 - 1.37]
Sexual Abuse [ref=no exposure]	**1.31 [1.00 - 1.71]**	1.31 [1.00 - 1.71]	**1.5 [1.07 - 2.11]**	**1.54 [1.09 - 2.19]**	1.16 [0.83 - 1.63]	1.15 [0.82 - 1.63]
Emotional Neglect [ref=no exposure]	1.22 [1.00 - 1.48]	1.21 [0.99 - 1.48]	**1.56 [1.21 - 2.01]**	**1.56 [1.19 - 2.03]**	0.97 [0.75 - 1.25]	0.97 [0.75 - 1.26]
Physical Neglect [ref=no exposure]	1.13 [0.93 - 1.38]	1.14 [0.93 - 1.40]	1.25 [0.96 - 1.63]	1.29 [0.97 - 1.70]	1.04 [0.81 - 1.35]	1.02 [0.79 - 1.33]
Victimization [ref=no exposure]	**1.34 [1.08 - 1.66]**	**1.32 [1.05 - 1.66]**	**1.39 [1.04 - 1.85]**	**1.38 [1.02 - 1.86]**	1.30 [0.99 - 1.70]	1.3 [0.98 - 1.72]
Substance Abuse [ref=no exposure]	0.98 [0.78 - 1.22]	1.04 [0.83 - 1.31]	1.07 [0.80 - 1.44]	1.26 [0.93 - 1.71]	0.90 [0.68 - 1.20]	0.89 [0.67 - 1.19]
Parental Divorce [ref=no exposure]	1.07 [0.85 - 1.34]	1.10 [0.86 - 1.40]	1.21 [0.89 - 1.65]	1.36 [0.97 - 1.90]	0.96 [0.72 - 1.27]	0.94 [0.70 - 1.27]
Suicide [ref=no exposure]	1.22 [0.87 - 1.71]	1.25 [0.89 - 1.76]	1.48 [0.97 - 2.26]	**1.66 [1.07 - 2.56]**	1.02 [0.66 - 1.57]	0.99 [0.64 - 1.53]
Incarceration [ref=no exposure]	1.03 [0.84 - 1.28]	1.06 [0.85 - 1.31]	0.9 [0.67 - 1.21]	0.98 [0.72 - 1.34]	1.15 [0.89 - 1.48]	1.12 [0.86 - 1.46]
Foster Home [ref=no exposure]	1.24 [0.72 - 2.15]	1.30 [0.74 - 2.27]	0.46 [0.15 - 1.44]	0.51 [0.16 - 1.62]	**1.90 [1.05 - 3.42]**	**1.87 [1.02 - 3.43]**
School Disadvantage [ref=no exposure]	0.97 [0.72 - 1.29]	0.99 [0.73 - 1.34]	1.00 [0.67 - 1.47]	1.07 [0.71 - 1.62]	0.94 [0.65 - 1.36]	0.94 [0.65 - 1.36]
Neighborhood Disadvantage [ref=no]	0.95 [0.77 - 1.18]	0.96 [0.77 - 1.19]	1.06 [0.79 - 1.41]	1.09 [0.80 - 1.47]	0.87 [0.67 - 1.14]	0.86 [0.65 - 1.13]
Social Services Involvement [ref=no]	1.39 [0.96 - 2.02]	1.43 [0.99 - 2.08]	1.38 [0.86 - 2.22]	1.52 [0.93 - 2.47]	1.40 [0.88 - 2.23]	1.37 [0.86 - 2.20]

Notes: OR=Odds Ratio; AOR: Adjusted Odds Ratio; cat=categories; LB=Live Births; Bold values indicate significant relationship at $p < 0.05$; CI: 95% Confidence Interval; *Adjusted for confounders: race, parental education, parents and respondents' nativity ; childhood household income.

Table 2.3: Logistic regression of pregnancy outcome on adverse childhood experiences (ACE) scale including all pregnancies

Variable Description	Non-Live Birth		Abortion		Pregnancy Loss	
	OR [95% CI]	AOR [95% CI]	OR [95% CI]	AOR [95% CI]	OR [95% CI]	AOR[95% CI]
Conventional ACE scale (10 cat.)	**1.12 [1.06 - 1.18]**	**1.14 [1.08 - 1.21]**	**1.25 [1.13 - 1.37]**	**1.33 [1.21 - 1.47]**	1.03 [0.96 - 1.11]	1.03 [0.96 - 1.12]
Conventional ACE Binary [ref=LB]	**1.67 [1.30 - 2.15]**	**1.7 [1.31 - 2.20]**	**3.05 [1.74 – 5.34]**	**3.30 [1.91 – 5.71]**	1.16 [0.84 – 1.61]	1.19 [0.85 -1.66]
Count ACE [ref=no exposure]						
1	**1.42 [1.06 - 1.92]**	**1.38 [1.02 - 1.87]**	**2.46 [1.31 - 4.63]**	**2.36 [1.29 - 4.33]**	1.02 [0.68 - 1.51]	1.04 [0.70 - 1.55]
2	**1.82 [1.35 - 2.45]**	**1.83 [1.35 - 2.48]**	**3.18 [1.70 - 5.98]**	**3.45 [1.88 - 6.33]**	1.37 [0.92 - 2.03]	1.39 [0.93 - 2.07]
3	**1.50 [1.08 - 2.07]**	**1.56 [1.12 - 2.17]**	**2.52 [1.28 - 4.94]**	**2.88 [1.50 - 5.52]**	1.11 [0.72 - 1.72]	1.15 [0.74 - 1.78]
4+	**1.94 [1.44 - 2.60]**	**2.09 [1.54 - 2.84]**	**4.04 [2.18 - 7.48]**	**5.07 [2.76 - 9.31]**	1.18 [0.79 - 1.75]	1.21 [0.80 - 1.82]
Extended ACE Scale (14 cat.)	**1.09 [1.04 - 1.14]**	**1.11 [1.06 - 1.16]**	**1.18 [1.09 - 1.28]**	**1.24 [1.14 - 1.36]**	1.02 [0.96 - 1.09]	1.02 [0.96 - 1.09]
Extended ACE Binary [ref=LB]	**1.69 [1.27 - 2.26]**	**1.74 [1.30 - 2.32]**	**3.88 [1.90 - 7.90]**	**4.28 [2.16 - 8.51]**	1.08 [0.75 - 1.55]	1.11 [0.77 - 1.60]
Count ACE [ref=no exposure]						
1	1.35 [0.97 - 1.90]	1.34 [0.95 - 1.88]	**2.8 [1.28 - 6.13]**	**2.76 [1.30 - 5.85]**	0.94 [0.61 - 1.46]	0.96 [0.62 - 1.49]
2	**1.89 [1.36 - 2.64]**	**1.90 [1.36 - 2.66]**	**4.66 [2.17 - 10.0]**	**4.88 [2.33 - 10.2]**	1.17 [0.76 - 1.81]	1.19 [0.77 - 1.85]
3	**1.68 [1.19 - 2.37]**	**1.73 [1.21 - 2.45]**	**3.91 [1.78 - 8.59]**	**4.26 [2.00 - 9.09]**	1.08 [0.69 - 1.71]	1.15 [0.72 - 1.81]
4+	**1.82 [1.33 - 2.49]**	**1.99 [1.44 - 2.74]**	**4.17 [1.98 - 8.78]**	**5.30 [2.57 - 10.9]**	1.13 [0.75 - 1.69]	1.16 [0.76 - 1.76]
Emotional Abuse [ref=no exposure]	**1.60 [1.33 - 1.91]**	**1.66 [1.38 - 1.99]**	**2.19 [1.56 - 3.06]**	**2.40 [1.73 - 3.33]**	**1.36 [1.06 - 1.74]**	**1.35 [1.05 - 1.74]**
Physical Abuse [ref=no exposure]	**1.27 [1.03 - 1.56]**	**1.34 [1.09 - 1.66]**	**1.63 [1.12 - 2.37]**	**1.86 [1.29 - 2.67]**	1.01 [0.75 - 1.36]	1.01 [0.74 - 1.36]
Sexual Abuse [ref=no exposure]	1.26 [0.96 - 1.65]	1.26 [0.96 - 1.66]	1.6 [0.99 - 2.58]	**1.64 [1.02 - 2.62]**	1.10 [0.75 - 1.61]	1.11 [0.75 - 1.63]
Emotional Neglect [ref=no exposure]	1.16 [0.95 - 1.43]	1.15 [0.93 - 1.42]	**1.62 [1.13 - 2.34]**	**1.61 [1.13 - 2.31]**	0.91 [0.67 - 1.22]	0.89 [0.66 - 1.20]
Physical Neglect [ref=no exposure]	1.22 [0.99 - 1.50]	**1.26 [1.02 - 1.55]**	1.39 [0.97 - 2.00]	**1.47 [1.03 - 2.11]**	1.07 [0.80 - 1.43]	1.07 [0.80 - 1.44]
Victimization [ref=no exposure]	**1.4 [1.12 - 1.74]**	**1.41 [1.12 - 1.77]**	**1.53 [1.03 - 2.29]**	**1.51 [1.02 - 2.25]**	1.30 [0.96 - 1.77]	**1.38 [1.00 - 1.90]**
Substance Abuse [ref=no exposure]	0.95 [0.76 - 1.20]	1.05 [0.83 - 1.32]	1.08 [0.71 - 1.65]	1.34 [0.88 - 2.03]	0.85 [0.61 - 1.18]	0.85 [0.61 - 1.19]
Parental Divorce [ref=no exposure]	1.06 [0.84 - 1.33]	1.11 [0.87 - 1.42]	1.29 [0.84 - 1.98]	1.51 [0.96 - 2.36]	0.9 [0.66 - 1.24]	0.93 [0.66 - 1.30]
Suicide [ref=no exposure]	1.11 [0.78 - 1.59]	1.15 [0.80 - 1.65]	1.64 [0.89 - 3.04]	**1.87 [1.03 - 3.40]**	0.78 [0.46 - 1.34]	0.76 [0.44 - 1.30]
Incarceration [ref=no exposure]	1.04 [0.84 - 1.28]	1.08 [0.86 - 1.34]	0.93 [0.62 - 1.40]	1.04 [0.69 - 1.56]	1.08 [0.80 - 1.44]	1.09 [0.81 - 1.48]
Foster Home [ref=no exposure]	1.00 [0.56 - 1.77]	1.07 [0.60 - 1.92]	0.31 [0.06 - 1.52]	0.38 [0.08 - 1.78]	1.65 [0.81 - 3.35]	1.65 [0.80 - 3.41]
School Disadvantage [ref=no exposure]	0.93 [0.69 - 1.26]	0.96 [0.70 - 1.31]	0.93 [0.58 - 1.49]	1.00 [0.62 - 1.63]	0.93 [0.62 - 1.39]	0.93 [0.62 - 1.40]
Neighborhood Disadvantage [ref=no]	0.90 [0.72 - 1.13]	0.91 [0.72 - 1.14]	0.98 [0.66 - 1.45]	1.01 [0.68 - 1.51]	0.80 [0.58 - 1.09]	0.81 [0.59 - 1.11]
Social Services Involvement [ref=no]	1.24 [0.84 - 1.83]	1.27 [0.86 - 1.89]	1.25 [0.66 - 2.39]	1.41 [0.75 - 2.65]	1.28 [0.73 - 2.24]	1.26 [0.72 - 2.21]

Notes: OR=Odds Ratio; AOR: Adjusted Odds Ratio; cat=categories; LB=Live Births; Bold values indicate significant relationship at $p < 0.05$; CI: 95% Confidence Interval; *Adjusted for confounders: race, parental education, parents and respondents' nativity; childhood household income

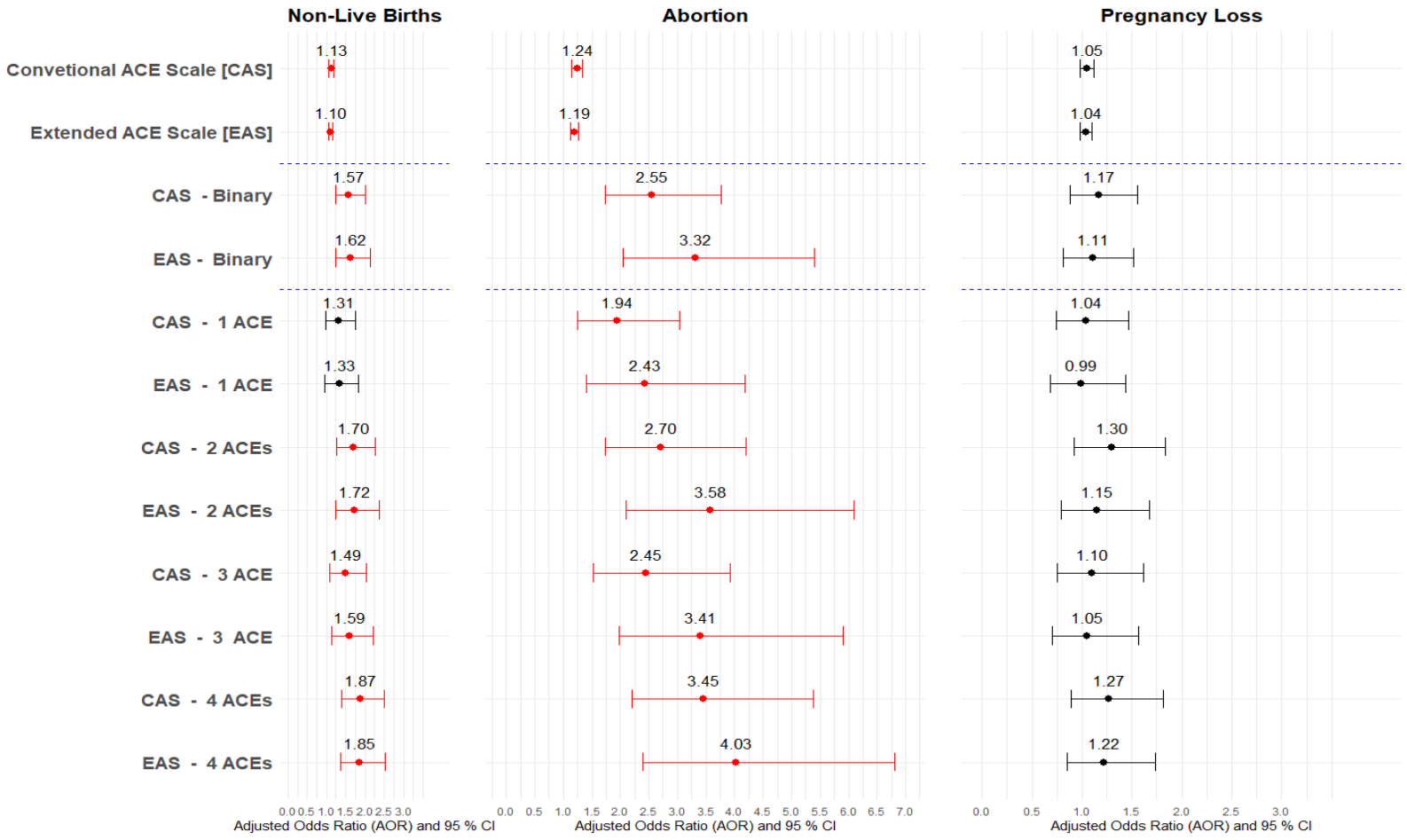

Figure 2.2: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and ACEs - – First Pregnancies (Reproduce AOR Columns from Table 2.2)

Notes: Red error bars reflect significant association.

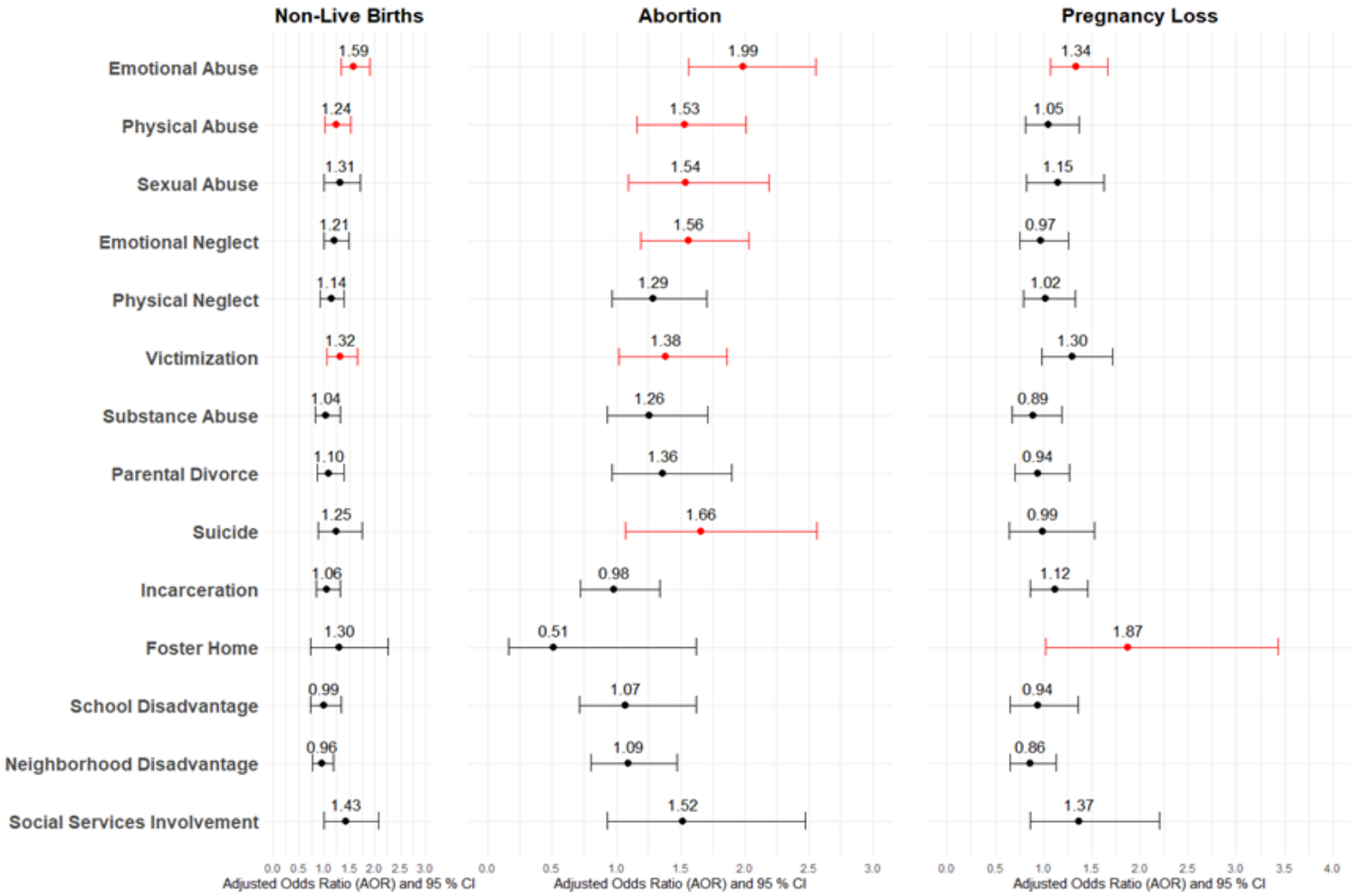

Figure 2.3: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and Type of ACE – First Pregnancies (Reproduce AOR Columns from Table 2.2)

Notes: Red error bars reflect significant association.

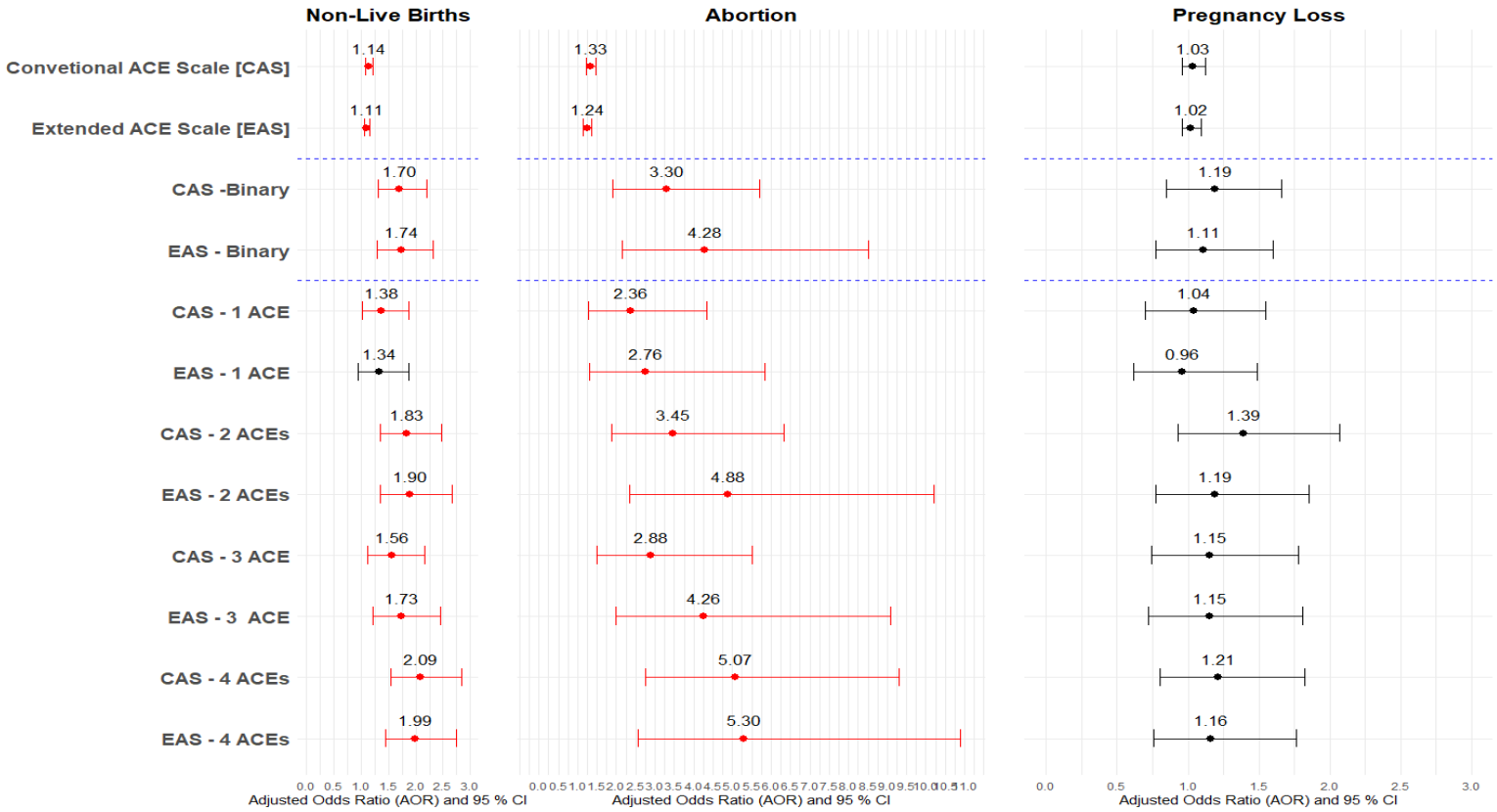

Figure 2.4: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and ACEs – All Pregnancies (Reproduce AOR Columns from Table 2.3)

Notes: Red error bars reflect significant association

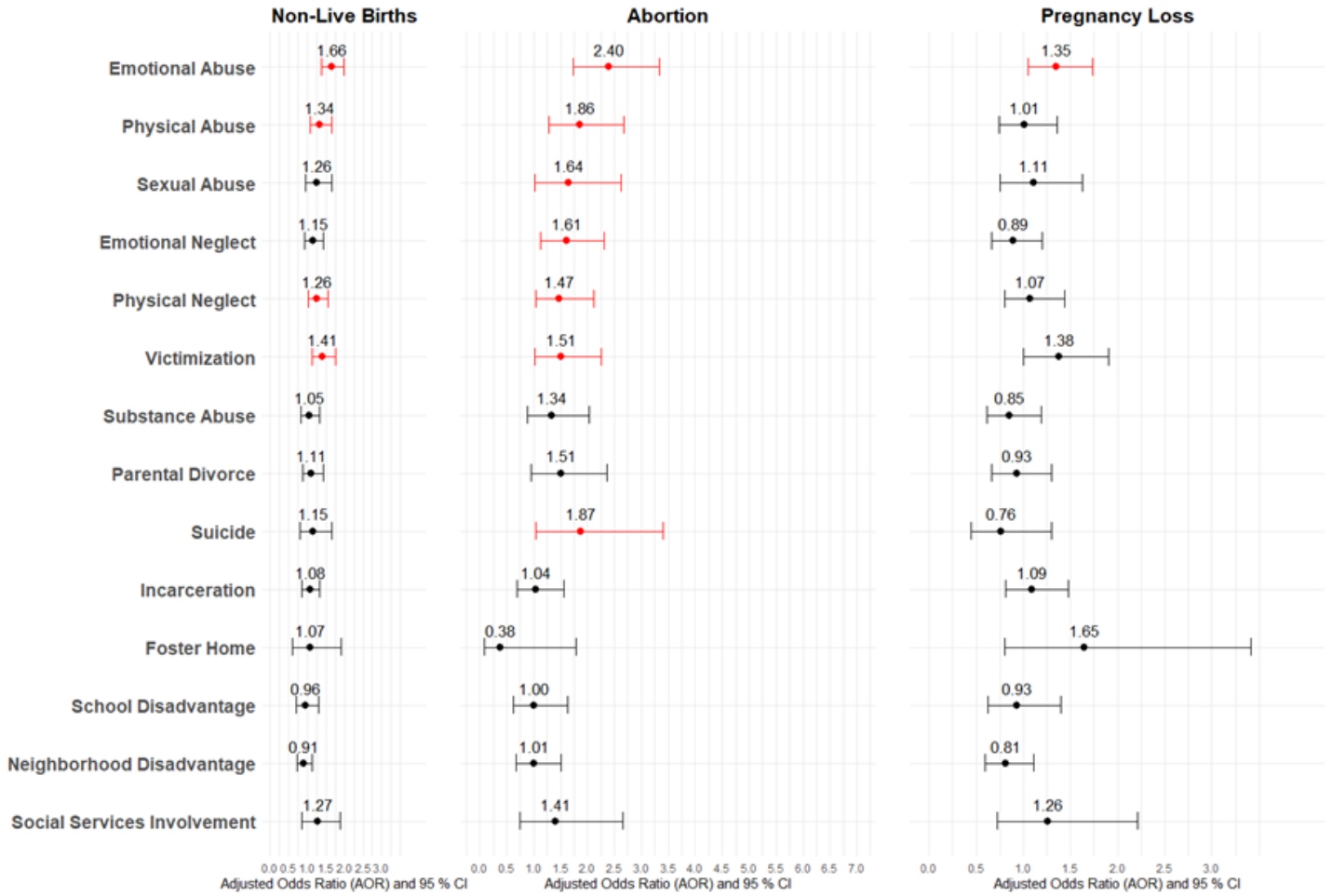

Figure 2.5: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and Type of ACE – All Pregnancies (Reproduce AOR Columns from Table 2.3)

Notes: Red error bars reflect significant association

Figure 2.6: Missing Data Overview

2.10 References

Acevedo-Garcia, Dolores, Lindsay E. Rosenfeld, Erin Hardy, Nancy McArdle, and Theresa L. Osypuk. 2013. “Future Directions in Research on Institutional and Interpersonal Discrimination and Children’s Health.” *American Journal of Public Health* 103(10):1754–63. doi: 10.2105/AJPH.2012.300986.

Anda, Robert F., Laura E. Porter, and David W. Brown. 2020. “Inside the Adverse Childhood Experience Score: Strengths, Limitations, and Misapplications.” *American Journal of Preventive Medicine* 59(2):293–95. doi: 10.1016/j.amepre.2020.01.009.

Bellis, Mark A., Karen Hughes, Kat Ford, Gabriela Ramos Rodriguez, Dinesh Sethi, and Jonathon Passmore. 2019. “Life Course Health Consequences and Associated Annual Costs of Adverse Childhood Experiences across Europe and North America: A Systematic Review and Meta-Analysis.” *The Lancet Public Health* 4(10):e517–28. doi: 10.1016/S2468-2667(19)30145-8.

Bleil, Maria E., Nancy E. Adler, Lauri A. Pasch, Barbara Sternfeld, Renee A. Reijo-Pera, and Marcelle I. Cedars. 2011. “Adverse Childhood Experiences and Repeat Induced Abortion.” *American Journal of Obstetrics and Gynecology* 204(2):122.e1-122.e6. doi: 10.1016/j.ajog.2010.09.029.

Briggs, Ernestine C., Lisa Amaya-Jackson, Karen T. Putnam, and Frank W. Putnam. 2021. “All Adverse Childhood Experiences Are Not Equal: The Contribution of Synergy to Adverse Childhood Experience Scores.” *American Psychologist* 76(2):243–52. doi: 10.1037/amp0000768.

Bronfenbrenner, Urie. 1979. *The Ecology of Human Development: Experiments by Nature and Design*. Harvard university press.

Brumley, Lauren D., Benjamin P. Brumley, and Sara R. Jaffee. 2019. “Comparing Cumulative Index and Factor Analytic Approaches to Measuring Maltreatment in the National Longitudinal Study of Adolescent to Adult Health.” *Child Abuse & Neglect* 87:65–76. doi: 10.1016/j.chiabu.2018.08.014.

Brumley, Lauren D., Sara R. Jaffee, and Benjamin P. Brumley. 2017. “Pathways from Childhood Adversity to Problem Behaviors in Young Adulthood: The Mediating Role of Adolescents’ Future Expectations.” *Journal of Youth and Adolescence* 46(1):1–14. doi: 10.1007/s10964-016-0597-9.

CDC, (Center for Disease and Control). 2023. “Behavioral Risk Factor Surveillance System ACE Data |Violence Prevention|Injury Center|CDC.” Retrieved September 19, 2023 (https://www.cdc.gov/violenceprevention/aces/ace-brfss.html).

Cronholm, Peter F., Christine M. Forke, Roy Wade, Megan H. Bair-Merritt, Martha Davis, Mary Harkins-Schwarz, Lee M. Pachter, and Joel A. Fein. 2015. “Adverse Childhood Experiences: Expanding the Concept of Adversity.” *American Journal of Preventive Medicine* 49(3):354–61. doi: 10.1016/j.amepre.2015.02.001.

Cundiff, J. M., T. W. Smith, B. N. Uchino, and C. A. Berg. 2013. "Subjective Social Status: Construct Validity and Associations with Psychological Vulnerability and Self-Rated Health." *International Journal of Behavioral Medicine* 20(1):148–58.

Danese, Andrea, Terrie E. Moffitt, HonaLee Harrington, Barry J. Milne, Guilherme Polanczyk, Carmine M. Pariante, Richie Poulton, and Avshalom Caspi. 2009. "Adverse Childhood Experiences and Adult Risk Factors for Age-Related Disease: Depression, Inflammation, and Clustering of Metabolic Risk Markers." *Archives of Pediatrics & Adolescent Medicine* 163(12):1135–43. doi: 10.1001/archpediatrics.2009.214.

Dean, Sohni V., Zohra S. Lassi, Ayesha M. Imam, and Zulfiqar A. Bhutta. 2014. "Preconception Care: Closing the Gap in the Continuum of Care to Accelerate Improvements in Maternal, Newborn and Child Health." *Reproductive Health* 11(S3):S1. doi: 10.1186/1742-4755-11-S3-S1.

Dehlendorf, Christine, Lisa H. Harris, and Tracy A. Weitz. 2013. "Disparities in Abortion Rates: A Public Health Approach." *American Journal of Public Health* 103(10):1772–79. doi: 10.2105/AJPH.2013.301339.

Dong, Maxia, Robert F. Anda, Vincent J. Felitti, Shanta R. Dube, David F. Williamson, Theodore J. Thompson, Clifton M. Loo, and Wayne H. Giles. 2004. "The Interrelatedness of Multiple Forms of Childhood Abuse, Neglect, and Household Dysfunction." *Child Abuse & Neglect* 28(7):771–84.

Donley, Greer, and Jill Wieber Lens. 2022. "Abortion, Pregnancy Loss, Subjective Fetal Personhood." 1649–1728.

Dube, Shanta R. 2018. "Continuing Conversations about Adverse Childhood Experiences (ACEs) Screening: A Public Health Perspective." *Child Abuse & Neglect* 85:180–84. doi: 10.1016/j.chiabu.2018.03.007.

Dube, Shanta R., David F. Williamson, Ted Thompson, Vincent J. Felitti, and Robert F. Anda. 2004. "Assessing the Reliability of Retrospective Reports of Adverse Childhood Experiences among Adult HMO Members Attending a Primary Care Clinic." *Child Abuse & Neglect* 28(7):729–37. doi: 10.1016/j.chiabu.2003.08.009.

Eckenrode, John, Elliott G. Smith, Margaret E. McCarthy, and Michael Dineen. 2014. "Income Inequality and Child Maltreatment in the United States." *Pediatrics* 133(3):454–61. doi: 10.1542/peds.2013-1707.

Elder, Glen H. 1998. "The Life Course as Developmental Theory." *Child Development* 69(1):1–12. doi: 10.2307/1132065.

Elder, Glen H., Monica Kirkpatrick Johnson, and Robert Crosnoe. 2003. "The Emergence and Development of Life Course Theory." Pp. 3–19 in *Handbook of the Life Course*, edited by J. T. Mortimer and M. J. Shanahan. Boston, MA: Springer US.

Evans, Gary W., Dongping Li, and Sara Sepanski Whipple. 2013. "Cumulative Risk and Child Development." *Psychological Bulletin* 139(6):1342–96. doi: 10.1037/a0031808.

Felitti, Vincent J., Robert F. Anda, Dale Nordenberg, David F. Williamson, Alison M. Spitz, Valerie Edwards, Mary P. Koss, and James S. Marks. 1998. "Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults." *American Journal of Preventive Medicine* 14(4):245–58. doi: 10.1016/S0749-3797(98)00017-8.

Finkelhor, David, Anne Shattuck, Heather Turner, and Sherry Hamby. 2013. "Improving the Adverse Childhood Experiences Study Scale." *JAMA Pediatrics* 167(1):70. doi: 10.1001/jamapediatrics.2013.420.

Finkelhor, David, Anne Shattuck, Heather Turner, and Sherry Hamby. 2015. "A Revised Inventory of Adverse Childhood Experiences." *Child Abuse & Neglect* 48:13–21. doi: 10.1016/j.chiabu.2015.07.011.

Finlay, Sabine, Cody Roth, Tiansha Zimsen, Tahnee Lee Bridson, Zoltan Sarnyai, and Brett McDermott. 2022. "Adverse Childhood Experiences and Allostatic Load: A Systematic Review." *Neuroscience & Biobehavioral Reviews* 136:104605.

Foster, Diana Greene, M. Antonia Biggs, Sarah Raifman, Jessica Gipson, Katrina Kimport, and Corinne H. Rocca. 2018. "Comparison of Health, Development, Maternal Bonding, and Poverty among Children Born after Denial of Abortion vs after Pregnancies Subsequent to an Abortion." *JAMA Pediatrics* 172(11):1053–60.

Freedman, Alexa A., Alison L. Cammack, Jeff R. Temple, Robert M. Silver, Donald J. Dudley, Barbara J. Stoll, Michael W. Varner, George R. Saade, Deborah Conway, Robert L. Goldenberg, and Carol J. Hogue. 2017. "Maternal Exposure to Childhood Maltreatment and Risk of Stillbirth." *Annals of Epidemiology* 27(8):459-465.e2. doi: 10.1016/j.annepidem.2017.07.005.

Gavin, Amelia R., Elaine Thompson, Tessa Rue, and Yuqing Guo. 2012. "Maternal Early Life Risk Factors for Offspring Birth Weight: Findings from the Add Health Study." *Prevention Science* 13(2):162–72. doi: 10.1007/s11121-011-0253-2.

Greenland, Sander, Rhian Daniel, and Neil Pearce. 2016. "Outcome Modelling Strategies in Epidemiology: Traditional Methods and Basic Alternatives." *International Journal of Epidemiology* 45(2):565–75. doi: 10.1093/ije/dyw040.

Gregory, ECW, CP Valenzuela, and DL Hoyert. 2022. *Fetal Mortality: United States, 2020*. *National Vital Statistics Reports*. vol 71 no 4. Hyattsville, MD: National Center for Health Statistics.

Hardt, Jochen, and Michael Rutter. 2004. "Validity of Adult Retrospective Reports of Adverse Childhood Experiences: Review of the Evidence." *Journal of Child Psychology and Psychiatry* 45(2):260–73. doi: 10.1111/j.1469-7610.2004.00218.x.

Harris, Kathleen Mullan. 2013. "The Add Health Study: Design and Accomplishments." doi: 10.17615/C6TW87.

Hawks, Rebecca Mahn, Aileen P. McGinn, Peter S. Bernstein, and Jonathan N. Tobin. 2018. "Exploring Preconception Care: Insurance Status, Race/Ethnicity, and Health in the Pre-

Pregnancy Period." *Maternal and Child Health Journal* 22(8):1103–10. doi: 10.1007/s10995-018-2494-1.

Hillis, Susan D., Robert F. Anda, Shanta R. Dube, Vincent J. Felitti, Polly A. Marchbanks, and James S. Marks. 2004. "The Association between Adverse Childhood Experiences and Adolescent Pregnancy, Long-Term Psychosocial Consequences, and Fetal Death." *Pediatrics* 113(2):320–27. doi: 10.1542/peds.113.2.320.

Jaen, Jocelyn, Sharonda M. Lovett, Martín Lajous, Katherine M. Keyes, and Dalia Stern. 2023. "Adverse Childhood Experiences and Adult Outcomes Using a Causal Framework Perspective: Challenges and Opportunities." *Child Abuse & Neglect* 143:106328. doi: 10.1016/j.chiabu.2023.106328.

Kalmakis, Karen A., and Genevieve E. Chandler. 2015. "Health Consequences of Adverse Childhood Experiences: A Systematic Review." *Journal of the American Association of Nurse Practitioners* 27(8):457–65. doi: 10.1002/2327-6924.12215.

Kane, Jennifer B., Kathleen Mullan Harris, and Anna Maria Siega-Riz. 2018. "Intergenerational Pathways Linking Maternal Early Life Adversity to Offspring Birthweight." *Social Science & Medicine* 207:89–96. doi: 10.1016/j.socscimed.2018.04.049.

Karatekin, Canan, and Maria Hill. 2019. "Expanding the Original Definition of Adverse Childhood Experiences (ACEs)." *Journal of Child & Adolescent Trauma* 12(3):289–306. doi: 10.1007/s40653-018-0237-5.

Karatekin, Canan, Susan M. Mason, Amy Riegelman, Caitlin Bakker, Shanda Hunt, Bria Gresham, Frederique Corcoran, and Andrew Barnes. 2022. "Adverse Childhood Experiences: A Scoping Review of Measures and Methods." *Children and Youth Services Review* 136:106425. doi: 10.1016/j.childyouth.2022.106425.

Kelly-Irving, Michelle, and Cyrille Delpierre. 2019. "A Critique of the Adverse Childhood Experiences Framework in Epidemiology and Public Health: Uses and Misuses." *Social Policy and Society* 18(3):445–56. doi: 10.1017/S1474746419000101.

Kerkar, Shweta, Arti Shankar, Renee Boynton-Jarrett, and Emily W. Harville. 2021. "Adverse Childhood Experiences Are Associated with Miscarriage in Adulthood: The GROWH Study." *Maternal and Child Health Journal* 25(3):479–86. doi: 10.1007/s10995-020-03079-y.

Krinner, Lisa M., Jan Warren-Findlow, Jessamyn Bowling, L. Michele Issel, and Charlie L. Reeve. 2021. "The Dimensionality of Adverse Childhood Experiences: A Scoping Review of ACE Dimensions Measurement." *Child Abuse & Neglect* 121:105270. doi: 10.1016/j.chiabu.2021.105270.

Kuh, D. 2003. "Life Course Epidemiology." *Journal of Epidemiology & Community Health* 57(10):778–83. doi: 10.1136/jech.57.10.778.

Lacey, Rebecca E., and Helen Minnis. 2020. "Practitioner Review: Twenty Years of Research with Adverse Childhood Experience Scores – Advantages, Disadvantages and Applications to Practice." *Journal of Child Psychology and Psychiatry* 61(2):116–30. doi: 10.1111/jcpp.13135.

LaNoue, Marianna D., Brandon J. George, Deborah L. Helitzer, and Scott W. Keith. 2020. "Contrasting Cumulative Risk and Multiple Individual Risk Models of the Relationship between Adverse Childhood Experiences (ACEs) and Adult Health Outcomes." *BMC Medical Research Methodology* 20(1):239. doi: 10.1186/s12874-020-01120-w.

Lassi, Zohra S., Ayesha M. Imam, Sohni V. Dean, and Zulfiqar A. Bhutta. 2014. "Preconception Care: Caffeine, Smoking, Alcohol, Drugs and Other Environmental Chemical/Radiation Exposure." *Reproductive Health* 11(3):S6. doi: 10.1186/1742-4755-11-S3-S6.

Leppälahti, Suvi, Oskari Heikinheimo, Reija Paananen, Päivi Santalahti, Marko Merikukka, and Mika Gissler. 2016. "Determinants of Underage Induced Abortion – the 1987 Finnish Birth Cohort Study." *Acta Obstetricia et Gynecologica Scandinavica* 95(5):572–79. doi: 10.1111/aogs.12879.

Lindberg, Laura, Kathryn Kost, Isaac Maddow-Zimet, Sheila Desai, and Mia Zolna. 2020. "Abortion Reporting in the United States: An Assessment of Three National Fertility Surveys." *Demography* 57(3):899–925. doi: 10.1007/s13524-020-00886-4.

Lindberg, Laura, and Rachel H. Scott. 2018. "Effect of ACASI on Reporting of Abortion and Other Pregnancy Outcomes in the US National Survey of Family Growth." *Studies in Family Planning* 49(3):259–78. doi: 10.1111/sifp.12068.

Lopez, Marcela, Monica O. Ruiz, Cynthia R. Rovnaghi, Grace K. Y. Tam, Jitka Hiscox, Ian H. Gotlib, Donald A. Barr, Victor G. Carrion, and Kanwaljeet J. S. Anand. 2021. "The Social Ecology of Childhood and Early Life Adversity." *Pediatric Research* 89(2):353–67. doi: 10.1038/s41390-020-01264-x.

Mann, Laura M., Kristen Kreisel, Eloisa Llata, Jaeyoung Hong, and Elizabeth A. Torrone. 2020. "Trends in Ectopic Pregnancy Diagnoses in United States Emergency Departments, 2006–2013." *Maternal and Child Health Journal* 24(2):213–21. doi: 10.1007/s10995-019-02842-0.

Manyema, Mercy, Shane A. Norris, and Linda M. Richter. 2018. "Stress Begets Stress: The Association of Adverse Childhood Experiences with Psychological Distress in the Presence of Adult Life Stress." *BMC Public Health* 18(1):835. doi: 10.1186/s12889-018-5767-0.

Marinescu, Ileana P., Maria Camelia Foarf, Mihail-Cristian Pîrlog, and Adriana Turculeanu. 2014. "Prenatal Depression and Stress – Risk Factors for Placental Pathology and Spontaneous Abortion." 6.

McEwen, Craig A., and Scout F. Gregerson. 2019. "A Critical Assessment of the Adverse Childhood Experiences Study at 20 Years." *American Journal of Preventive Medicine* 56(6):790–94. doi: 10.1016/j.amepre.2018.10.016.

McEwen, Craig A., and Bruce S. McEwen. 2017. "Social Structure, Adversity, Toxic Stress, and Intergenerational Poverty: An Early Childhood Model." *Annual Review of Sociology* 43(Volume 43, 2017):445–72. doi: 10.1146/annurev-soc-060116-053252.

Merrick, Melissa T., Derek C. Ford, Katie A. Ports, and Angie S. Guinn. 2018. "Prevalence of Adverse Childhood Experiences From the 2011-2014 Behavioral Risk Factor

Surveillance System in 23 States." *JAMA Pediatrics* 172(11):1038. doi: 10.1001/jamapediatrics.2018.2537.

Mersky, Joshua P., and Colleen E. Janczewski. 2018. "Racial and Ethnic Differences in the Prevalence of Adverse Childhood Experiences: Findings from a Low-Income Sample of U.S. Women." *Child Abuse & Neglect* 76:480–87. doi: 10.1016/j.chiabu.2017.12.012.

Mersky, Joshua P., Colleen E. Janczewski, and Jenna C. Nitkowski. 2018. "Poor Mental Health among Low-Income Women in the U.S.: The Roles of Adverse Childhood and Adult Experiences." *Social Science & Medicine (1982)* 206:14–21. doi: 10.1016/j.socscimed.2018.03.043.

Mersky, Joshua P., and ChienTi Plummer Lee. 2019. "Adverse Childhood Experiences and Poor Birth Outcomes in a Diverse, Low-Income Sample." *BMC Pregnancy and Childbirth* 19(1):387. doi: 10.1186/s12884-019-2560-8.

Morgan, Craig, Ulrich Reininghaus, Abraham Reichenberg, Souci Frissa, SELCoH study Team, Matthew Hotopf, and Stephani L. Hatch. 2014. "Adversity, Cannabis Use and Psychotic Experiences: Evidence of Cumulative and Synergistic Effects." *The British Journal of Psychiatry* 204(5):346–53. doi: 10.1192/bjp.bp.113.134452.

Mukherjee, Sudeshna, Digna R. Velez Edwards, Donna D. Baird, David A. Savitz, and Katherine E. Hartmann. 2013. "Risk of Miscarriage Among Black Women and White Women in a US Prospective Cohort Study." *American Journal of Epidemiology* 177(11):1271–78. doi: 10.1093/aje/kws393.

Mullany, Kellie, Madeline Minneci, Ryan Monjazeb, and Olivia C. Coiado. 2023. "Overview of Ectopic Pregnancy Diagnosis, Management, and Innovation." *Women's Health* 19:17455057231160349. doi: 10.1177/17455057231160349.

NCHS, (National Center for Health Statistics). 2020. *National Survey of Family Growth Public-Use Data and Documentation*.

Nurius, Paula S., Edwina Uehara, and Douglas F. Zatzick. 2013. "Intersection of Stress, Social Disadvantage, and Life Course Processes: Reframing Trauma and Mental Health." *American Journal of Psychiatric Rehabilitation* 16(2):91–114. doi: 10.1080/15487768.2013.789688.

Olsen, Jeanette M. 2018. "Integrative Review of Pregnancy Health Risks and Outcomes Associated With Adverse Childhood Experiences." *Journal of Obstetric, Gynecologic & Neonatal Nursing* 47(6):783–94. doi: 10.1016/j.jogn.2018.09.005.

Oral, Resmiye, Marizen Ramirez, Carol Coohey, Stephanie Nakada, Amy Walz, Angela Kuntz, Jenna Benoit, and Corinne Peek-Asa. 2016. "Adverse Childhood Experiences and Trauma Informed Care: The Future of Health Care." *Pediatric Research* 79(1–2):227–33. doi: 10.1038/pr.2015.197.

Pearlin, Leonard I. 1989. "The Sociological Study of Stress." *Journal of Health and Social Behavior* 30(3):241–56. doi: 10.2307/2136956.

Pearlin, Leonard I., Scott Schieman, Elena M. Fazio, and Stephen C. Meersman. 2005. "Stress, Health, and the Life Course: Some Conceptual Perspectives." *Journal of Health and Social Behavior* 46(2):205–19. doi: 10.1177/002214650504600206.

Pedersen, Willy. 2007. "Childbirth, Abortion and Subsequent Substance Use in Young Women: A Population-Based Longitudinal Study." *Addiction (Abingdon, England)* 102(12):1971–78. doi: 10.1111/j.1360-0443.2007.02040.x.

Pouta, Anneli, Marjo-Riitta Järvelin, Elina Hemminki, Ulla Sovio, and Anna-Liisa Hartikainen. 2005. "Mothers and Daughters: Intergenerational Patterns of Reproduction." *European Journal of Public Health* 15(2):195–99. doi: 10.1093/eurpub/cki078.

Racine, Nicole, Hannah Byles, Teresa Killam, Whitney Ereyi-Osas, and Sheri Madigan. 2022. "Asking About Childhood Adversity in the Prenatal Care Setting: Cross-Sectional Associations with Maternal Health and Mental Health Outcomes." *Maternal and Child Health Journal* 26(5):994–1004. doi: 10.1007/s10995-021-03301-5.

Racine, Nicole, Andre Plamondon, Sheri Madigan, Sheila McDonald, and Suzanne Tough. 2018. "Maternal Adverse Childhood Experiences and Infant Development." *Pediatrics* 141(4):e20172495. doi: 10.1542/peds.2017-2495.

Reuben, Aaron, Terrie E. Moffitt, Avshalom Caspi, Daniel W. Belsky, Honalee Harrington, Felix Schroeder, Sean Hogan, Sandhya Ramrakha, Richie Poulton, and Andrea Danese. 2016. "Lest We Forget: Comparing Retrospective and Prospective Assessments of Adverse Childhood Experiences in the Prediction of Adult Health." *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 57(10):1103–12. doi: 10.1111/jcpp.12621.

Robbins, Cheryl L., Denise D'Angelo, Lauren Zapata, Sheree L. Boulet, Andrea J. Sharma, Alys Adamski, Jennifer Farfalla, Caroline Stampfel, Sarah Verbiest, and Charlan Kroelinger. 2018. "Preconception Health Indicators for Public Health Surveillance." *Journal of Women's Health* 27(4):430–43. doi: 10.1089/jwh.2017.6531.

Roberts, Brian. 2010. "Ahead of Its Time?": The Legacy and Relevance of WI Thomas and F. Znaniecki (1918-20) The Polish Peasant in Europe and America." *The Legacy of the Chicago School of Sociology* 74–104.

Robinson, Gail Erlick. 2014. "Pregnancy Loss." *Best Practice & Research Clinical Obstetrics & Gynaecology* 28(1):169–78. doi: 10.1016/j.bpobgyn.2013.08.012.

Rossen, Lauren, Brady Hamilton E., Joyce Abma, Elizabeth C.W., Vladislav Beresovsky, Andriana Resendez, Anjani Chandra, and Joyce Martin. 2023. *Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States*. National Center for Health Statistics (U.S.). doi: 10.15620/cdc:124395.

Scorza, Pamela, Cristiane S. Duarte, Seonjoo Lee, Haotian Wu, Jonathan Posner, Andrea Baccarelli, and Catherine Monk. 2023. "Epigenetic Intergenerational Transmission: Mothers' Adverse Childhood Experiences and DNA Methylation." *Journal of the American Academy of Child & Adolescent Psychiatry*. doi: 10.1016/j.jaac.2023.02.018.

Singh, G. K., and S. M. Yu. 1996. “Adverse Pregnancy Outcomes: Differences between US- and Foreign-Born Women in Major US Racial and Ethnic Groups.” *American Journal of Public Health* 86(6):837–43. doi: 10.2105/AJPH.86.6.837.

Solazzo, Alexa L. 2019. “Different and Not Equal:The Uneven Association of Race, Poverty, and Abortion Laws on Abortion Timing.” *Social Problems* 66(4):519–47. doi: 10.1093/socpro/spy015.

Steinberg, Julia R., and Jeanne M. Tschann. 2013. “Childhood Adversities and Subsequent Risk of One or Multiple Abortions.” *Social Science & Medicine* 81:53–59. doi: 10.1016/j.socscimed.2012.11.011.

Swift, Alison, Madison Berry, Madeline Fernandez-Pineda, and Amanda Haberstroh. 2024. “An Integrative Review of Adverse Childhood Experiences and Reproductive Traumas of Infertility and Pregnancy Loss.” *Journal of Midwifery & Women’s Health* 69(2):258–78. doi: 10.1111/jmwh.13585.

Thomas, William Isaac, and Florian Znaniecki. 1919. *The Polish Peasant in Europe and America: Monograph of an Immigrant Group*. Vol. 3. University of Chicago Press.

Tierney, Katherine I. 2019. “Abortion Underreporting in Add Health: Findings and Implications.” *Population Research and Policy Review* 38(3):417–28. doi: 10.1007/s11113-019-09511-8.

VanderWeele, Tyler J. 2019. “Principles of Confounder Selection.” *European Journal of Epidemiology* 34(3):211–19. doi: 10.1007/s10654-019-00494-6.

Wachs, Theodore D., and Gary W. Evans. 2010. “Chaos in Context.” Pp. 3–13 in *Chaos and its influence on children’s development: An ecological perspective.*, edited by G. W. Evans and T. D. Wachs. Washington: American Psychological Association.

Walsh, David, Gerry McCartney, Michael Smith, and Gillian Armour. 2019. “Relationship between Childhood Socioeconomic Position and Adverse Childhood Experiences (ACEs): A Systematic Review.” *Journal of Epidemiology and Community Health* 73(12):1087–93. doi: 10.1136/jech-2019-212738.

Weintraub, William S., Stephen R. Daniels, Lora E. Burke, Barry A. Franklin, David C. Goff, Laura L. Hayman, Donald Lloyd-Jones, Dilip K. Pandey, Eduardo J. Sanchez, Andrea Parsons Schram, and Laurie P. Whitsel. 2011. “Value of Primordial and Primary Prevention for Cardiovascular Disease.” *Circulation* 124(8):967–90. doi: 10.1161/CIR.0b013e3182285a81.

Wilms, R., E. Mäthner, L. Winnen, and R. Lanwehr. 2021. “Omitted Variable Bias: A Threat to Estimating Causal Relationships.” *Methods in Psychology* 5:100075.

Witt, Whitney P., Lauren E. Wisk, Erika R. Cheng, John M. Hampton, and Erika W. Hagen. 2012. “Preconception Mental Health Predicts Pregnancy Complications and Adverse Birth Outcomes: A National Population-Based Study.” *Maternal and Child Health Journal* 16(7):1525–41. doi: 10.1007/s10995-011-0916-4.

Woolner, Andrea M. F., Edwin Amalraj Raja, Siladitya Bhattacharya, Peter Danielian, and Sohinee Bhattacharya. 2019. "Inherited Predisposition to Stillbirth: An Intergenerational Analysis of 26,788 Mother-Daughter Pairs." *American Journal of Obstetrics and Gynecology* 220(4):393.e1-393.e7. doi: 10.1016/j.ajog.2019.01.215.

Zarei, Kasra, Lisa Kahle, Dennis W. Buckman, Kelvin Choi, and Faustine Williams. 2022. "Parent-Child Nativity, Race, Ethnicity, and Adverse Childhood Experiences among U.S. Children." *The Journal of Pediatrics* 251:190-195.e4. doi: 10.1016/j.jpeds.2022.07.050.

Zhang, Shanchun, Zheyuan Ding, Hui Liu, Zexin Chen, Jinhua Wu, Youding Zhang, and Yunxian Yu. 2013. "Association between Mental Stress and Gestational Hypertension/Preeclampsia: A Meta-Analysis." *Obstetrical & Gynecological Survey* 68(12):825–34. doi: 10.1097/ogx.0000000000000001.

Zhu, Yanmin, Brian T. Bateman, Sonia Hernandez-Diaz, Kathryn J. Gray, Loreen Straub, Rebecca M. Reimers, Beryl Manning-Geist, Elizabeth Yoselevsky, Lockwood G. Taylor, Rita Ouellet-Hellstrom, Yong Ma, Yandong Qiang, Wei Hua, and Krista F. Huybrechts. 2023. "Validation of Claims-Based Algorithms to Identify Non-Live Birth Outcomes." *Pharmacoepidemiology and Drug Safety* 32(4):468–74. doi: 10.1002/pds.5574.

CHAPTER III
Association between Non-Live Births and Adverse Childhood Experiences: Role of Socio-Demographics and Health-Related Risk Factors

3.1 Introduction

3.1.1 Non-Live Births and Adverse Childhood Experiences (ACEs)Brief Overview

Adverse Childhood Experiences (ACEs): Reducing exposure to the number of ACEs is set as one of the national health priorities under Healthy People 2030 Objective IVP-D03 in the United States (NCHS 2021). According to a nationally representative survey, 25 percent of respondents reported exposure to three or more ACEs, while around 62 percent reported experiencing at least one type of ACE (Merrick et al. 2018). There are different types of scales to measure ACEs, this study focused on extended ACE scale reflects a broader range of ACEs, which consist of emotional abuse, physical abuse, sexual abuse, community violence, substance abuse, suicide, divorce, parental incarceration, low parental warmth, physical neglect, foster care, social services involvement, school and neighborhood disadvantages (Greeson et al. 2014).

Pregnancy loss is a distressing pregnancy outcome that is influenced by a multifaceted set of complex, interrelated biological (Chaithra, Malini, and Kumar 2011; Dimitriadis et al. 2020), environmental (Krieg, Shahine, and Lathi 2016), socio-psychological, socio-economic and structural related factors (Quenby et al. 2021). Pregnancy loss is a substantial public health issue in the United States, with 20 percent of pregnancies ending in pregnancy loss- miscarriages or stillbirths in 2023 (Rossen et al. 2023). Within socio-psychological related factors, ACEs, social adversities, lifestyle stressors, and behavioral choices are reported as considerable predictors of involuntary pregnancy loss (Finer et al. 2005; Quenby et al. 2021; Souch et al. 2022; Swift et al. 2024).

Prior research has established an association between ACEs or types of ACE with pregnancy loss by utilizing cross-sectional data conducted in either one or a few states of the United States (Freedman et al. 2017; Hillis et al. 2004; Kerkar et al. 2021; Mersky and Lee 2019).

In 2023, 13.1 percent of women opted for abortion in the United States. There are several reasons reported in the literature for opting for abortion, including socio-economic reasons, personal circumstances, and childhood adversities (Bleil et al. 2011; Boden, Fergusson, and Horwood 2009; Dehlendorf, Harris, and Weitz 2013; Kirkman et al. 2009; Steinberg and Tschann 2013). Regarding childhood adversities, a study conducted in California reported that a higher number of ACEs, measured through the Conventional ACE scale, increased the likelihood of having abortion (Bleil et al. 2011). Using the US National Comorbidity Survey-Replication data, a study reported that women's exposure to at least one type of ACE- out of ten distinct types of childhood adversities- was related to repeated abortions as compared to one abortion (Steinberg and Tschann 2013).

As discussed in previous Chapter as well that there is issue of reporting of abortion in the United State, particularly when women shared their abortion information in social surveys (Lindberg et al. 2020; Tierney 2019), previous scholarship has cautioned against relying solely on abortion data (Lindberg et al. 2020; Lindberg and Scott 2018). Additionally, the studies suggested that only birth data from social surveys can provide accurate population-based estimates (Lindberg et al. 2020). Hence, this study is an effort to provide the overall analysis by using the term "non-live births" versus live births by combining all the pregnancies that do not end as live births. Therefore, in addition to assessing the association between non-live births and ACEs, this study provides a

comparison of how this approach of presenting an overall analysis can provide a more holistic set of factors for pregnancy loss or abortion.

In sum, there is limited literature examining this association with a nationally representative sample, as well as providing a comprehensive understanding of the impact of ACEs on pregnancy loss, abortion, and overall analysis through the concept of non-live births by utilizing the same dataset.

3.1.2 Factors of Non-Live Births: Health conditions and Health Risk Factors

This section provides a list of factors for non-live births, including modifiable lifestyle health risk behaviors and health conditions.

Regarding modifiable lifestyle health risk behaviors, alcohol consumption is widely reported as a potential risk factor for miscarriages; a meta-analysis of 24 articles with data from 231,808 pregnant women synthesized this information (Sundermann et al. 2019) . However, there is a variation in the risk of pregnancy loss by number of drinks per week, type of alcohol used, and consumption before pregnancy (Aliyu et al. 2008; Avalos et al. 2014; Sundermann et al. 2019). Another widely reported risk factor is smoking; a systematic review based on 98 articles concluded that smoking exposure increases the risk of miscarriage with some variation by amount smoked (Pineles, Park, and Samet 2014). In addition, another systematic review based on 96 articles reported that maternal smoking is also linked with stillbirth (Flenady et al. 2011). Most studies primarily focus on assessing the impact of smoking and alcohol use during pregnancy. For instance, the systematic review by Sundermann et al. (2019) noted that only 11 studies out of 24 explored the use of alcohol before pregnancy. Therefore, there is limited

research highlighting the influence of smoking and alcohol consumption before pregnancy.

Chronic health conditions increase the risk of pregnancy loss. For instance, chronic hypertension can increase the chances of having preeclampsia (a type of high blood pressure) during pregnancy and is associated with poor maternal and fetal outcomes (Sibai 2002). The other behavioral and demographic factors are also interrelated with chronic health conditions. Smoking and pre-existing medical conditions such as diabetes are determinants of preeclampsia (Hutcheon, Lisonkova, and Joseph 2011). Depression or depressive symptoms are also considered a risk factor of pregnancy loss (Quenby et al. 2021). Based on a review of 96 population-based studies from high-income countries, a study reported that hypertension and pre-existing diabetes are significant predictors of stillbirth in high-income countries (Flenady et al. 2011).

A limited body of scholarship discussed pre-pregnancy care among childbearing-age women. A study conducted on non-pregnant women aged 18-44 reported pre-pregnancy risk factors such as drinking, cigarette smoking, obesity, diabetes, and frequent mental distress (Denny et al. 2012). The study highlighted that a majority of women have at least one risk factor, and around 19 percent have two or more risk factors (Denny et al. 2012). These findings suggest the importance of prioritizing pre-pregnancy care, particularly for those who experienced childhood adversities, within a life-course framework.

Women reporting reasons for abortion rarely provide a single factor for abortion; there are several personal, structural, and biological or health-related factors (Biggs, Gould, and Foster 2013; Finer et al. 2005; Kirkman et al. 2009). Regarding factors related

to health conditions, around 12 percent reported opting for abortion due to their health concerns, such as cancer, cystic fibrosis, and diabetes (Finer et al. 2005). Regarding modifiable lifestyle health risk behaviors, smoking while pregnant increases the likelihood of undergoing repeat abortions (Bleil et al. 2011; Haddad et al. 2021; Kalmakis and Chandler 2015).

3.1.3 Consequences of Exposure to ACEs: Health and Behavioral Issues

The body of research on ACEs with a focus on maternal exposure has garnered substantial attention in the last couple of decades due to its identification of a dose-response association between the number of ACEs and an extensive array of physical or biological, psychological, reproductive, health, and risk behavior outcomes (Kelly-Irving and Delpierre 2019; Olsen 2018a).

The ACEs may lead to an increase in the chances of having poor health conditions. Such as, biologically, maternal exposure to ACEs is associated with DNA methylation (DNAm) in offspring, indicating the intergenerational biological embedding of mothers' childhood adversity (Scorza et al. 2023). Additionally, women with a history of ACEs are more susceptible to autoimmune diseases and chronic medical conditions such as respiratory disease, somatic pain/headache, inflammation, and multiple metabolic risk markers (Danese et al. 2009) . These biological or physical health issues may lead to adverse birth outcomes (Racine et al. 2018). On the psychological front, conditions such as anxiety and depression can be more prevalent among women who have experienced ACE (Bellis et al. 2019; Danese et al. 2009; Kalmakis and Chandler 2015). ACEs also lead to post-traumatic stress disorder or symptoms in adulthood (McRae et al. 2021).

The adults having ACEs have been reported to be more inclined toward risky health behaviors, including substance misuse and smoking (Bellis et al. 2019; Kalmakis and Chandler 2015), and alcohol abuse (Lee and Chen 2017). Some studies have revealed the interconnectedness between health conditions and health-related risk factors, for instance, a study that found that psychological distress mediated substantial proportions of alcohol problems with ACEs measured through the conventional ACE scale among women (Strine et al. 2012). Another study utilizing the conventional ACE scale conducted in 10 states and the District of Columbia concluded that ACEs were associated with both depression and excessive alcohol use (Lee and Chen 2017). Moreover, this constellation of health challenges inevitably leads to increased healthcare utilization, with women who experienced ACEs relying more heavily on prescription medications and medical services to address their complex health needs (Bellis et al. 2019; Kalmakis and Chandler 2015).

Hence, the consequences of ACEs lead to deteriorated health conditions (chronic health conditions, and depressive symptoms), and health risk factors (smoking and alcohol drinking). Therefore, this study included these factors as covariates while analyzing the relationship between ACEs and non-live births.

3.1.4 Role of Socio-Demographics: Time Variant and Invariant Variables

The scholarship reported the variation in the association between ACEs and pregnancy loss by controlling the relationship on socio-demographic variables (Olsen 2018b; Swift et al. 2024). Among demographic-related risk factors, age at the time of pregnancy is considered an important factor for pregnancy loss (Andersen et al. 2000; Quenby et al. 2021; Reddy, Ko, and Willinger 2006). There is variation in the age limit reporting as the risk for pregnancy loss (Olsen 2018b; Swift et al. 2024). However, a

study that conducted a review of literature to understand the factors for pregnancy loss reported that women having pregnancies less than 20 years of age and above 35 are considered at risk of pregnancy loss (Quenby et al. 2021). In addition, a study conducted an integrative review to understand the relationship of ACEs and reproductive traumas - defined as "distressing and traumatic events during the prenatal, intra-natal, and postnatal periods, such as complicated births, premature births, infertility, and pregnancy loss"- reported variation in relationship when analysis was adjusted by socio-demographic variables (Swift et al. 2024). The same study asserted that some studies found an association between socioeconomic hardships (referring to income) and pregnancy loss, while several studies did not find any association between ACEs and reproductive traumas including pregnancy loss after controlling for race, education, income, and social class (Swift et al. 2024). Another study found an association of ACEs with depression and alcohol consumption, but race was found as a moderated variable in exploring the relationship between ACEs and alcohol drinking (Lee and Chen 2017).

Maternal exposure to ACEs has been associated with low socioeconomic status, such as low educational attainment, which leads to poor birth outcomes, such as pre-term birth (Ruiz et al. 2015). The similar relationship of low educational attainment were found with pregnancy loss (Hegelund, Poulsen, and Mortensen 2019). A study conducted in the United States found maternal age and maternal education as potential covariates for examining the relationship between childhood adversities (only measuring 5 types of ACEs) and stillbirths (Freedman et al. 2017). Another study conducted outside of the United States, in Denmark, also highlighted the importance of educational level, and reported that the women with low educational attainment had a higher risk of stillbirth,

while having a lower risk of miscarriage. Therefore, maternal education was found to be an important predictor of miscarriage.

The US Abortion Surveillance Report 2019 reported that 85 percent of those who seek abortion were unmarried, and 15 percent were married (Kortsmit 2021). Nevertheless, a study reported that unmarried women terminated their pregnancies primarily due to financial constraints (Finer et al. 2005). A substantial percentage of women reported several other factors associated with those constraints , including unemployment, inability to afford childcare, interference with their education, etc. (Biggs et al. 2013; Finer et al. 2005; Kirkman et al. 2009). This suggests there is a complex, interwoven relationship between socio-economic status, educational level, and marital status (Biggs et al. 2013; Finer et al. 2005; Kirkman et al. 2009). For example, in 2019, 59% of Black adults aged 25 to 54 were unpartnered, a higher proportion than among Hispanic (38%), White (33%), and Asian (29%) adults (Parker 2021). Additionally, individuals from lower socioeconomic backgrounds are reported to be more likely to cohabit and have children before marriage, and are less likely to marry altogether (Karney 2021). These patterns reflect how structural inequalities related to race and economic status influence life choices and reproductive outcomes, rather than being solely a matter of personal circumstances or decisions. Given the variations and complexities of education and marital status in relation to abortion, I have included these factors in the analysis.

Time Invariant Variables:

A detailed discussion about time invariant variables, used as confounders, is given in chapter II under the section “Role of Socio-Demographics” and “Confounders”. However, this section also briefly explained the reason for selecting a list variable as

confounders in this study. The variables included race, parental education, parental income or childhood household income, parents' and respondents' nativity. One of the main reasons was that these variables were related to both DV and IV. For instance, parents' education and income were significant predictors of ACEs, according to a systematic review based on 18 articles (Walsh et al. 2019). Both parents' education and income are reported to be important factors linked to pregnancy loss (Pouta et al. 2005; Woolner et al. 2019) and abortion (Leppälahti et al. 2016). Therefore, this study included both variables as confounders in the study as both parents' education and income influence the pregnancy outcome.

Another potential confounder was race, as it was related to ACEs, pregnancy loss, and abortion. Such as, previous studies noted that exposure to ACEs varies by race and socio-economic status (Maguire-Jack, Lanier, and Lombardi 2020; Mersky and Lee 2019). Race is also a determinant of pregnancy loss (Mukherjee et al. 2013) and abortion decisions also vary by race and low socioeconomic status (Solazzo 2019). Hence, race was added in the study as a one of the potential confounders.

In addition, exposure to ACEs also varied by nativity or foreign-born status (Zarei et al. 2022). Foreign-born status is also associated with lowering the risk of low birth weight or infant mortality (Acevedo-Garcia et al. 2013; Singh and Yu 1996). However, the relationship also varied by racial group and educational attainment (Acevedo-Garcia et al. 2013). Given the link between foreign-born status with ACEs, infant mortality, and its variation with race and educational attainment, this study aims to extend this link to pregnancy loss or abortion by incorporating the parents' and respondents' nativity as confounding variables.

In nutshell, the above review of literature indicates a need to consider a set of socio-demographic variables while investigating the factors for non-live births. Building on this, the study considers adding a list of socio-demographic variables. The study divided the set of socio-demographic variables into confounders and covariates. Confounders are not time-varying variables; covariates can be time-varying variables (Lee and Burstyn 2016). After a careful review of the literature, the confounders for this study included race, parental education, childhood household income, and parents' and respondents' nativity status. The covariates also included age at the time of pregnancy, education before pregnancy, and marital status before pregnancy.

3.2 Theoretical Framework

This study is guided by ecological system theory and life-course theory. The ecological system aided in focusing on an expanded version of the ACEs scale to capture a more comprehensive understanding of early life adversities. The life-course theory guided about how childhood experiences can influence adulthood and guided this study to explore the relationship between ACEs and pregnancy outcome and pregnancy decisions. A complete detail about these theoretical frameworks has been provided in Chapter II under the heading of "Theoretical Framework". However, it is briefly discussed here.

3.2.1 Ecological System Theory

Ecological system theory is introduced by Bronfenbrenner (1979). Bronfenbrenner discussed four systems that function like layers in society, including the microsystem, mesosystem, exosystem, and macrosystem. All four are further embedded in a chronosystem representing an era in which an individual grows up, reflecting the

changes over time. It entails how child development is affected by specific time points or events, such as parent divorce, which may influence significant changes in a child's family structure, impacting their development over time.

3.2.2 Social Stress Theory

Social stress theory within sociology highlights how social conditions induce stress, particularly affecting disadvantaged groups (Nurius et al. 2013; Pearlin et al. 2005). Stress from life events falls into two categories: acute, short-term adversities, and chronic, recurring traumas. Stress proliferation theory posits that initial stressors can lead to more challenges over time. For instance, ACEs increase susceptibility to secondary stressors, compounding adverse health outcomes independently or cumulatively. Low SES exacerbates childhood adversity, impacting long-term health and potentially spanning generations. These chronic stressors affect biological and psychosocial development influencing health outcomes and potentially leading to non-live births (Cundiff et al. 2013; McEwen and Gregerson 2019).

In addition to incorporating variables capturing respondents' socioeconomic status, this study also included measures of depressive symptoms, beyond clinical diagnoses of depression. Not all individuals experiencing depressive symptoms receive a formal diagnosis. Depressive symptoms and ACEs are known to affect health outcomes, including those related to pregnancy. Therefore, given the correlation between chronic stress and ACEs, the study ensured to account for these factors in its model.

3.2.3 Life-Course Theory: Health Development

The Life-Course Theory emphasizes the changes in individual life over time, focusing on the timing and temporal context of individuals' lived experiences and how

these experiences can influence personal development and well-being over time (Elder 1998; Elder, Johnson, and Crosnoe 2003). To read the life course theory in detail, please see Chapter II, heading “Theoretical Framework”. .

The life course theory introduced by Elder was further expanded by Halfon and Hochstein (2002) to incorporate the health development trajectory with life. This theory is known as Life Course Health Development (LCHD). In addition, LCHD also resembles the social determinant perspective of health and ecological system theory. The LCHD framework describes four main principles. The first principle denotes that health is influenced by multiple determinants including genetic, biological, and socio-economic determinants. Health changes over time and with the age of a person. The second principle emphasizes that health development is an adaptive process. The adaptive process depends on multiple interactions of different contexts, including micro and macro contexts. The third principle discusses that health trajectories are shaped by cumulative protective and risk factors. The last principle discusses how individual health is influenced by timing and order of life events including biological, psychological, cultural, and historical events.

So, the four principles of LCHD suggest that early life experiences have a direct effect on individual short-and long-term health, particularly it can be summarized or grouped into: (i) contextual factors; (ii) risk factors behaviors; and (iii) biological and psychological health conditions (Halfon and Hochstein 2002). So, based on these, this study explored the relationship of ACEs with the inclusion of socio-demographics contextual variables (age and time of pregnancy, marital life, educational attainment),

risk factors (smoking and alcohol drinking), and health conditions (chronic health conditions and depressive symptoms) to predict pregnancy loss and abortion.

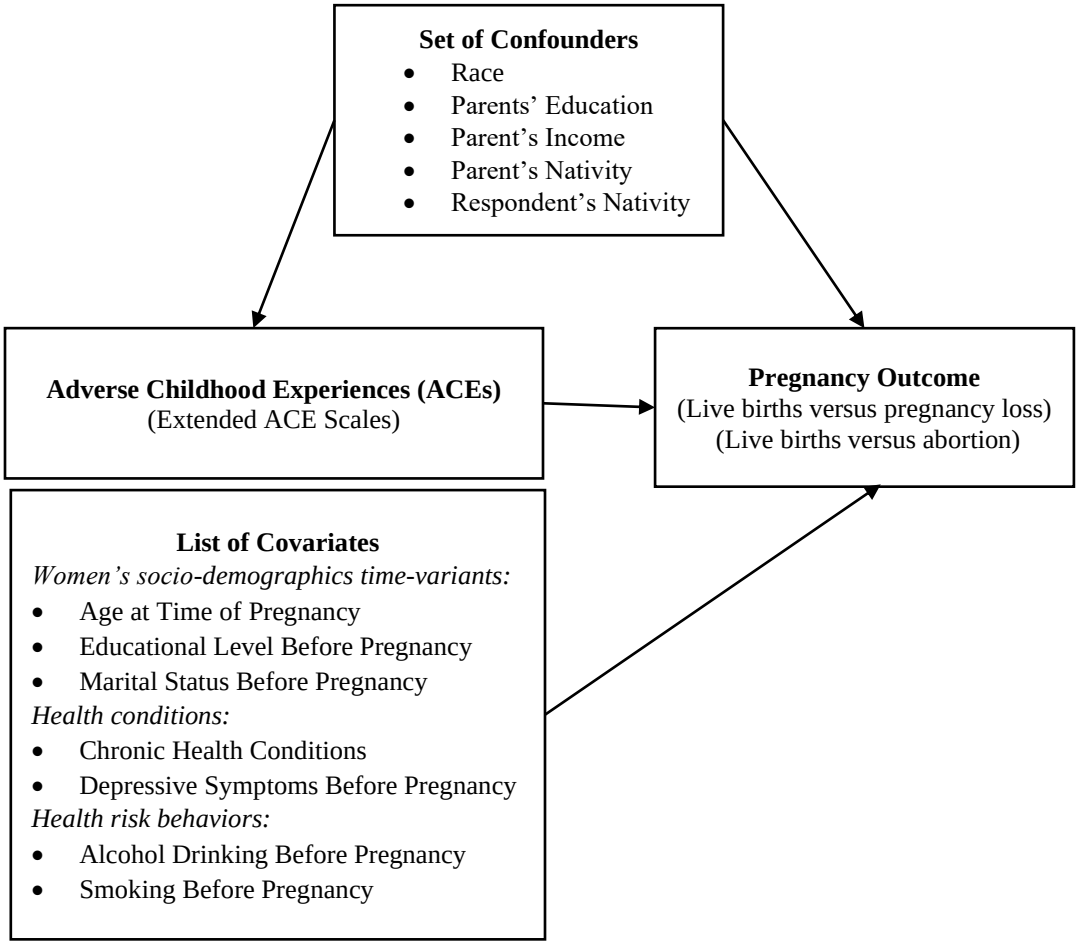

Figure 3.1: Conceptual Framework of the Study - Association between Non-Live Births and Adverse Childhood Experiences: Role of Socio-Demographics and Health related Risk Factors

To summarize, building on the aforementioned literature and theoretical framework, this study aims to explore the association of ACEs, measured using an extended ACE scale, with a list of covariates, and a set of confounders, as shown in Figure 3.1. A list of covariates included women's socio demographic time-variant factors (age at time of pregnancy, educational level before pregnancy, and marital status before pregnancy); health conditions (chronic health conditions, depressive symptoms before

pregnancy); and health risk behaviors (alcohol drinking before pregnancy, and smoking before pregnancy). A set of confounders included race, childhood household income, parents' education, parents and respondents' nativity (referring to being born in the United States or in another country).

3.3 Research Hypotheses

Leveraging the previously discussed studies and theoretical concepts, the alternative hypotheses of this study are:

- H_1: With the incremental inclusion of covariates such as women's socio-demographic characteristics, health conditions, and health behaviors, the association between ACEs and ***pregnancy loss*** persists, even when adjusting for confounders.
- H_2: With the incremental inclusion of covariates such as women's socio-demographics characteristics, health conditions, and health behaviors, the association between ACEs and ***abortion*** persists, even in the presence of confounders.
- H_3: With the incremental inclusion of covariates such as women's socio-demographics characteristics, health conditions, and health behaviors, the association between ACEs and ***non-live births*** persists, even in the presence of confounders.

In addition to testing the third hypothesis (H_3), the study provides a comparative view of how non-live birth hypothesis can provide a more holistic set of factors predicting pregnancy loss and abortion, especially when utilizing data from social

surveys that are prone to abortion stigma, subsequently distort survey data or information on both abortion and miscarriage.

3.4 Methods

3.4.1 Data

This study utilized a nationally representative secondary data analyses of the "National Longitudinal Study of Adolescent to Adult Health (known as Add Health)", United States This study utilized publicly available dataset of Add Health from wave I (1994-1995) to wave IV (2008-2009). Pregnancy related information is used from wave IV dataset, while all other covariates data was used from wave I to wave IV. The documentation of the Add Health implementation procedures for all waves is available on the Add Health website[2].

3.4.2 Study Population

After applying exclusion criteria to filter data to get first pregnancies, as discussed in Chapter 1, the analytical sample had data for 1794 women with a history of 4213 pregnancies, of which only 2420 were first pregnancies. However, in this chapter, I was using time-variant variables. Thus, I dropped cases to avoid temporality issues (Grimes and Schulz 2002; Hennekens and Buring 1987). For example, if measuring the effect of smoking, assessed in 1995, on pregnancy outcomes from 1990, this temporal disparity may lead to causal ambiguity, as smoking behavior was measured after the pregnancy. Thus, all pregnancies and their corresponding IDs reported before 1995 were excluded

[2] www.cpc.unc.edu/addhealth

from the dataset. As a result, the final sample for this study consisted of 2291 first pregnancies.

3.4.3 Measures

3.4.3.1 Dependent variable

The dependent variable was pregnancy outcome (live versus non-live birth, pregnancy loss, and abortion) measured based on the question, “How did this pregnancy end”? For disaggregated analysis, it is divided into two variables: pregnancy loss and abortion. Pregnancy loss includes cases of miscarriages, stillbirth, and ectopic or tubal pregnancy. While abortion represents volunteer termination of pregnancy. Non-live births represent total cases of pregnancy loss and abortion. The details are given in chapter 1.

3.4.4 Independent variable

ACEs were measured through an extended ACE scale (1=exposure to ACE, 0=no exposure), which includes 14 categories. To read details about ACE composition, please see Chapter II, method section.

3.4.5 Covariates

The selected covariates reflected three types of information: (i) Individual time-variant characteristics include age at the time of pregnancy, education before pregnancy, and marital status before pregnancy; (ii) health condition includes chronic health conditions and depressive symptoms before pregnancy; and (iii) health risk behaviors including alcohol drinking and smoking before pregnancy. The details about these variables are given below.

Age at Time of Pregnancy: The year of pregnancy is given in the wave 4 pregnancy file. To calculate the age at the time of pregnancy, I used the birth dates given in wave IV and

then traced back to wave 1 to check accuracy. This is because, according to Add health guidelines, the birth dates were corrected during wave IV[3] . After that, the birth year was subtracted from the reported year of pregnancy to get the age at the time of pregnancy. The age at the time of pregnancy was categorized into three intervals: 11-17 years, 18-28, and 29-33 years.

Married before Pregnancy: For each pregnancy, the women were asked to report whether they were "married to each other at the time of (pregnancy/birth)," coded 1 as married, and 0 as not married.

Education before Pregnancy: In every wave, the women were asked to report either which grade they were in or what were the highest grades or years of regular school they completed. The categories started from 8th grade or less (coded as 1) to completed post baccalaureate professional education (coded as 13). In this study, education was treated as categorical variable, representing: (i) less than high school; (ii) high school, (iii) some college, and (iv) bachelor and more education. The exact educational status of respondents at the time or within a few months before pregnancy was not directly queried. Therefore, the most recent available information prior to the pregnancy year was utilized as a proxy- substitute for the exact education status before pregnancy.

Chronic Health Conditions: In wave III and wave IV, several questions were added to gauge the chronic health conditions of the respondents; they were asked whether they have ever been diagnosed with (1) asthma, chronic bronchitis, or emphysema; (ii) cancer or leukemia; (iii) depression; (iv) diabetes; (v) high cholesterol, triglycerides or lipids;

[3] check website for details: https://addhealth.cpc.unc.edu

(vi) high blood pressure or hypertension; and (vii) post-traumatic stress disorder or PTSD. The responses were recorded as binary- "Yes" (coded as 1) and "No" (coded as 0). Then, a summative score was created to count the number of chronic diseases diagnosed in respondents . Finally, a binary variable is created to represent the two groups of women, (i) who were never diagnosed with any type of chronic health condition (coded as 0), and (ii) the women having at least one or more diagnosed conditions (coded as 1). This binary variable is used as a proxy for chronic health conditions before pregnancy.

Depressive Symptoms before Pregnancy: In each wave, a list of questions resembling the depressive symptomatology scale was developed by the Centers for Epidemiologic Studies-Depression Scale (CES-D). The data was dichotomized at the clinically relevant cut-points: a 24 or above score for wave 1 and wave II reflecting moderate to severe symptoms, while a score of 11 or more for wave III and IV reflecting moderate to severe symptoms was used as suggested in previous studies (Nkansah-Amankra 2018; Rushton 2002). The most recent available information about depressive symptoms prior to the pregnancy year was utilized as a proxy- substitute for the exact depressive symptoms before pregnancy.

Alcohol Drinking Before Pregnancy: In each wave, the respondents were asked, "How many days did they drink alcohol during the past 12 months?" The responses "none" and "1 or 2 days in the past 12 months" were considered as no alcohol use for this study, while two or three days a month to drink it every day is considered as "yes they drink alcohol (coded as 1)." The exact drinking alcohol behavior was not measured so the most

recently available information was utilized as a proxy- substitute for the precise alcohol drinking before pregnancy.

Smoking before Pregnancy: To assess the smoking behaviors, the respondents were asked in each wave, “how many days did they smoke cigarettes during the past 30 days?” The responses were categorized into” no smoking (coded as 0), and smoke more than one day to every day of the month (coded as 1). The exact smoking behavior was not measured, so the most recent available information was utilized as a proxy- substitute for the precise smoking behavior before pregnancy.

3.4.6 Confounders

The confounding variables included race (non-Hispanic white, non-Hispanic black, Hispanics, and other races), childhood household income (Log: range from 0 to 6.8), parents education (1 to 9, from less than 8^{th} grade to 9 professional degrees), parents foreign-born (0=native, 1= non-native), respondent foreign born (0=native, 1= non-native).

3.4.7 Sensitivity Analysis

As exact data prior to pregnancy on key measures - education, chronic health conditions, depressive symptoms, alcohol consumption, and smoking - were unavailable, two options were considered: the first was to utilize data from Wave I (1994-1995) to consider it as measuring teenage factors influencing pregnancies occurring later until wave IV (2007-2008); the second was to use data from each wave on the mentioned measures as a proxy for pre-pregnancy information on these factors. Analyses were conducted to make a final decision. So, the model fits, including the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), were calculated. The model incorporating pre-pregnancy information (AIC= 2631.33; BIC= 2723.12) on the

mentioned variables demonstrated lower AIC and BIC values, indicating a better fit than the teenage-related information (AIC=2637.64; BIC=2729.43) model. Consequently, I opted to utilize the variables containing information from before pregnancies in our analysis.

In addition, the chronic health condition was not representing information before pregnancy rather reporting “ever diagnosed” conditions. Thus, a sensitivity analysis was conducted to assess whether it changes the association between variables with or without adding “chronic health conditions” in the model. A change in estimates were noticed but the statistical significance remained the same for all covariates, Figure 3.3 presents the findings of logistic regression without adding variable chronic health conditions. It reflects that this study has robust findings.

3.4.8 Statistical Analysis

The outcome variable was dichotomized, so logistic regression was used to answer the research question using the R and Generalized Linear Models (GLM) package. Data on covariates and confounders has some missing values (Figure 2.6), so, the Multiple imputations (MI) with chained analysis were performed using multivariate imputation by chained equation (mice package) and created 30 multiply imputed datasets with 15 iterations to address missing data on other variables. Multiple imputation was used only for independent and confounder variables, the cases having missing data on pregnancy outcomes were removed as it does not have information on other variables as well, such as year and marital status at time of pregnancy. During the multiple imputation process, all study variables were included in the imputation model to determine the most likely distribution of missing values.

The unweighted descriptive statistics are presented in percentages, mean, and standard deviations. The bivariate and multivariate analyses represent weighted Odds Ratios (ORs) and Adjusted Odds Ratios (AORs). Univariate and multivariate logistic regression was used to gauge the association between non-live births (also disaggregated into pregnancy loss and abortion) and the independent variables ACE, individual time-variant characteristics, health conditions, and health risk behaviors. A list of confounders was also included in the model. Variables were inserted stepwise, manually, and model-wise.

3.5 Results and Interpretations

Table 3.1 describes descriptive statistics for the analytical sample. A total of 18.7 women had their pregnancies ended in pregnancy loss, and 16.6 percent terminated their pregnancies through abortions. So, overall, a total of 35.3 percent of women experienced non-live births during their first pregnancies. Among women who reported abortion, a majority (93.7 percent) reported to have history of ACEs. In comparison, a slightly smaller percentage (85.3 percent) of women who had pregnancy loss had history of ACEs. On average, the women were exposed to almost three types of ACEs, reported by women who experienced pregnancy loss [Mean=2.6; SD=2.0] and those who opted for abortion [Mean=2.9; SD=1.9].

Emotional abuse was the most frequently occurring ACE, with 54.6 percent reported by those who had abortions, and a slightly smaller percentage (47.4) reported by the women who had pregnancy loss. Living in foster homes (2.0 percent) was the least frequently occurring ACE. A majority of the women (51.1 percent) identified themselves as non-Hispanic white, followed by 32.8 percent who were non-Hispanic black (Table 3.1).

Among those who reported pregnancy loss, a majority (85.7 percent) of them had their first pregnancy between 18 and 28 years old, 63.0 percent completed their high school education, 69.3 percent were married, 51.2 percent had at least one chronic health condition, 35.2 percent had depressive symptoms, 67.0 percent reported alcohol consumption, and 81.8 percent reported smoking (Table 3.1).

Among those who had abortion, a majority (86.4 percent) of them had their first pregnancy between 18 and 28 years old, 55.4 percent completed their high school education, 38.8 percent were married, 33.2 percent had at least one chronic health condition, 33.2 percent had depressive symptoms, 74.1 percent reported alcohol consumption, and 80.2 percent reported smoking (Table 3.1).

Table 3.2 presents model-wise logistic regression analysis for pregnancy loss. Model 1 presents OR for all independent variables. Model-2 to model-9 depicts adjusted analysis with stepwise inclusion of independent variables after controlling with a list of confounders. The findings reflect that the exposure to ACEs as an independent factor or adjusted for covariates and confounders was not significantly associated with pregnancy loss. However, women aged between 29-33 years at the time of pregnancy [OR=2.33; 95% CI: 1.28- 4.25] and chronic health conditions [OR=1.21 95% CI: 1.08- 1.36] were found to be significantly associated with an increasing risk of pregnancy loss. The relationship persisted and the effect of both variables increased on the adjusted models.

Table 3.3 illustrates the relationship between exposure to ACEs and covariates with abortion. The exposure to ACEs increased the likelihood of opting for abortion by 3.15 [95% CI: 1.94-5.13] times on univariate analysis, and the relationship persisted [AOR=2.51; 95% CI: 1.49- 4.21] ever after controlling effects of covariates and

confounders. To be married before pregnancy lowered the likelihood of having an abortion by 0.30 times [95% CI: 0.19- 048] on univariate analysis and by 0.31 times [95% CI: 0.18- 0.54] on adjusted analysis. Drinking alcohol before pregnancy could also increase the likelihood of having abortion 1.68 [95% CI: 1.19- 2.39], as appeared in univariate analysis, the relationship persisted [AOR=1.78; 95% CI: 1.20- 2.65] even after controlling the effect of covariates and confounders. Women aged 29-33 years and women with a bachelor's degree or higher before pregnancy had a statistically significant association on the univariate analysis for abortion but lost their significance on adjusted analysis.

The overall analysis (see Table 3.4) by utilizing the term non-live birth provided a good overview for exploring the relationship of ACEs with pregnancies that were not ended as live births. Overall, all the covariates that had appeared to be significant on disaggregated analysis on abortion and pregnancy loss, appeared to be significantly associated in predicting non-live births but it reflected variation in effect size and model-wise. Such as, the exposure to ACEs was reported to be a significant predictor [OR=1.59; 95% CI: 1.21- 2.09] of non-live birth as an independent factor, though estimates attenuated [AOR=1.40; 95% CI: 1.05- 1.88] but remained statistically significant even after adjusting with individual level time-variant variable, health conditions, health risk behaviors, and list of confounders (time-invariant variables). On univariate analysis, the relationship between women aged 29-33 at the time of pregnancy and non-live birth appeared insignificant [OR=1.18; 95% CI: 0.73- 1.93]. However, it turned out to be a significant predictor [AOR=1.86; 95% CI: 1.05- 3.31] when education before pregnancy was added to the model and remained significant [AOR=2.21; 95% CI: 1.21- 4.01] in the

final model adjusted with all covariates and confounders. Educational level, bachelor's and more before pregnancy was significantly associated with lower odds of non-live birth [OR=0.48; 95% CI: 0.27-0.88] and when adjusted for the first time in in model-4 it remained significant [AOR=0.36; 95% CI: 0.18-0. 72], but it lost significance in the final model adjusted for all covariates and confounders. Marriage before pregnancy significantly decreased the likelihood of non-live births [OR=0.60; 95% CI: 0.47- 0.78] on univariate analysis, and the association remained after adjusting for all covariates and confounders. Similarly, having chronic health conditions increased [95% CI: 1.04- 1.26] the likelihood of having non-live births on univariate analysis by 15 percent, and it remained significant in the final model. Drinking alcohol before pregnancy increased the likelihood [OR=1.29; 95% CI: 1.00- 1.66] of having non-live births on univariate analysis but was not statistically significant in the final adjusted model (Table 3.4).

In brief, to conduct a comparative analysis among pregnancy outcomes using the final model with covariates and confounders, I reproduced the results into OR plots, as depicted in Figure 3.2, mirroring the data presented in the three tables [0.2, 0.3, and 0.4]. Figure 3.2 illustrates that reporting ACEs was associated with a 1.40-fold [95% CI: 1.05-1.89] increase in the odds of non-live births after adjusting for covariates and confounders. The disaggregated analysis suggests that women who reported ACEs did not have a significant risk of pregnancy loss, but they were 2.51 times [95% CI: 1.50-4.26] more likely to have an abortion compared to women with no ACEs. Moreover, overall, in the adjusted analysis, women aged 29-33 years at the time of pregnancy were associated with a 2.21-fold [95% CI: 1.14- 3.84] increase in the likelihood of having a non-live birth. In the disaggregated analysis, women aged 29-33 years at the time of

pregnancy were 3.41 times [95% CI: 1.55- 6.68] more likely to experience pregnancy loss than women in younger age group (11-17 years old) and none of the age groups was significantly associated with abortion. Similarly, on overall analysis, reporting chronic health conditions was associated with 1.22 times increase in the [95% CI: 1.04- 1.27] likelihood of having a non-live birth, while on disaggregated analysis, chronic health conditions were associated with a 1.36 [95% CI: 1.08- 1.37] times increase in the likelihood of pregnancy loss on disaggregated analysis, but the association was insignificant with abortion. Being married decreased the likelihood of non-live births by a factor of 0.61. On disaggregated analysis, being marriage decreased the likelihood of having an abortion by 69% [95% CI: 0.18- 0.54] but it had an insignificant association with pregnancy loss. Drinking alcohol before pregnancy was found to be only relevant to abortion, increasing the risk of having an abortion by 78 percent [AOR 1.78; 95% CI: 1.20- 2.65].

3.6 Discussion

This study tested three hypotheses to determine if there was a statistically significant association between exposure to ACEs after controlling for a list of covariates and confounders, and: (i) abortion; (ii) pregnancy loss; and (iii) non-live births. The study supported the hypotheses related to abortion and the overall analysis using the term non-live births (referring to the third hypothesis). However, My study found no association between ACEs and pregnancy loss.

My study found that having a history of ACEs is significantly associated with abortion compared to women with no ACEs. Marital status and alcohol drinking were predictors of abortion in adjusted models. It is important to recognize that marital status and

alcohol consumption are not merely individual behaviors or choices; they are deeply intertwined with structural inequalities. For instance, data shows that 85% of those seeking abortions were unmarried (Kortsmit 2021), and statistics on marital status described that 59% of Black adults aged 25 to 54 were unpartnered or unmarried in 2019, a higher proportion compared to other racial groups in the US (Parker 2021). It illustrates how certain groups are disproportionately affected by societal and economic pressures that shape their marital status and, consequently, their reproductive decisions. Additionally, alcohol consumption, often linked to stress and trauma, is influenced by socioeconomic factors (Collins 2016; Pabayo et al. 2021). Research indicates that adolescents in urban areas with significant neighborhood income disparities are more likely to consume alcohol (Pabayo et al. 2021), highlighting how these behaviors are shaped by broader social and economic environments. These findings suggest the need to view reproductive choices and health behaviors within the context of structural inequalities rather than as purely individual decisions. It suggests that financial and resource constraints significantly influence reproductive behavior, reinforcing the importance of addressing these systemic issues to understand and support women's health choices more effectively.

However, my study did not find any association between women with a history of ACEs and pregnancy loss. However, chronic health conditions before pregnancy and women aged 29-33 years at the time of pregnancy were associated with an increased risk of pregnancy loss on adjusted analysis compared to women with no health conditions and women aged 11-17 years respectively. Nevertheless, on overall analysis, my study found that exposure to ACEs increased the likelihood of non-live births, but it did not provide a more holistic set of predictors. and

The finding related to pregnancy loss is contrary to the study conducted by Kerkar et al. (2021) in the United Sates as their study reported an association between ACEs and

pregnancy loss. However, the findings are partially aligned with a study conducted in the United States, which explored child maltreatment (similar to 5 types of ACEs used in this study) in relation to stillbirth (Freedman et al. 2017). Regarding abortion, the findings are aligned with a study conducted by Bleil et al. (2011) in the United States and Haddad et al. (2021) in France, reporting the positive association between ACEs and abortion after adjusting the analysis for confounders.

In univariate analysis, the relationship between women aged 29-33 years at the time of pregnancy showed a significant decrease: (i) in the risk of pregnancy loss; and (ii) the likelihood of having abortion compared to women as compared to women in younger age 11-17 years old . This association persisted after adjusting for all other variables in the model with pregnancy loss, but it was not significantly associated with abortion. However, in the overall analysis of non-live births, a noteworthy pattern emerged. Initially, the relationship between women aged 29-33 years and non-live births appeared insignificant. However, it emerged as a significant predictor and remained so in the final adjusted model (model-9).

Being married before pregnancy was statistically significant in lowering the likelihood of non-live births on univariate analysis, and the association remained persistent even after adjusting for all covariates and confounders. However, the disaggregated analysis reflects that it was significantly associated with abortion, but not to pregnancy loss. The analysis for marital status was adjusted by previous studies exploring the relationship between ACEs with pregnancy loss (Freedman et al. 2017; Kerkar et al. 2021) and abortion (Bleil et al. 2011) , but they just used it as confounder and did not present its estimates.

In this study, I found that exposure to chronic health conditions increased the risk of pregnancy loss after adjusted for all covariates and confounders, however it showed no association with abortion. These findings are aligned with previous studies that explored an independent link of chronic health conditions with pregnancy loss (Quenby et al. 2021; Sibai 2002). However, these findings should be interpreted cautiously, as chronic health conditions are sensitive to temporal order. This study used chronic health conditions as a proxy for health conditions preceding pregnancy. Therefore, while the results provide valuable insights, their interpretation should consider the inherent limitations of using proxy measures. The significant association suggests it is worthwhile to include chronic health conditions in the model to examine their impact on pregnancy loss while exploring the relationship between ACEs and pregnancy loss. Nevertheless, in overall analysis, exposure to chronic health conditions also appeared to be significantly associated with non-live births in both univariate and multivariate analyses.

Drinking alcohol before pregnancy increased the chances of having non-live births on univariate analysis, but it lost significance on the final adjusted model for non-live births. The findings are aligned with Freedman et al. (2017) who reported that alcohol use was not associated with stillbirths compared to women with live births on adjusted analysis with ACEs. However, alcohol use was found to be associated with abortion. A study conducted in Russia found similar results, they found that drinking alcohol is associated with repeated abortions (Keenan et al. 2014). Another study conducted in Spain explored the relationship of alcohol consumption availability in the

region and its relationship with abortion rates, and found a positive correlation between them (Gil-Lacruz, Gil-Lacruz, and Bernal-Cuenca 2012).

Smoking appeared insignificant in all models. The findings are partially aligned with previous studies. The study by Freedman et al. (2017) did not include smoke in the adjusted model for confounding, but it did provide an insignificant association (P = .69) between smoking stillbirth and women with healthy live births.

One of the objectives of this study was to determine if overall data analysis (referring to non-live births) could provide holistic information applicable to both pregnancy loss and abortion. On one side, the findings of this study suggest that data from social surveys may need an additional step: providing both overall and disaggregated analyses to detect variations in predictors and provide recommendations accordingly. For instance, this study did not find a relationship between ACEs and pregnancy loss, contrary to four studies conducted in the United States reporting a partial or full association of ACEs with pregnancy loss (Freedman et al. 2017; Hillis et al. 2004; Kerkar et al. 2021; Merrick et al. 2018). However, ACEs appeared to be significantly associated with non-live births in the overall analysis, which signals that this approach might provide a chance to determine whether this association is influenced by potential misreporting of abortion and pregnancy loss –miscarriages and stillbirths. Another noteworthy finding was related to chronic health conditions. The chronic health conditions appeared significant in overall analysis (non-live births); while the health conditions did not show a significant association with abortion in disaggregated analysis. Though previous studies conducted in United States have indicated that a substantial percentage of women seek abortion due to their poor mental, physical, or chronic health

conditions (Biggs et al. 2013; Finer et al. 2005). So, one of the reasons for this insignificance of chronic health conditions with abortion in this study suggests that it might happened due to underreporting of abortion. In contrast, in the overall analysis of non-live births, the results suggest that this outcome is not significantly associated with many of the predictors that were found significant in disaggregated analysis, which suggests that the overall analysis may not be a best approach to follow in future studies. Rather, there is need to test different data methods and reduce abortion stigma in order to obtain accurate reporting on abortion.

To effectively reduce both pregnancy loss and support informed abortion choices, reproductive health care policies must adopt a comprehensive strategy. This strategy should focus on improving pre-pregnancy factors such as health and socio-economic conditions, which play a crucial role in maternal and fetal health. Additionally, the healthcare policies must address and aim to reduce the structural inequalities that children face, which can have long-lasting impacts on their health and well-being. Creating a more equitable society and providing robust healthcare support systems can improve reproductive health outcomes and empower individuals to make informed decisions about their pregnancies.

There are some limitations in this study. The results should be interpreted considering certain methodological features of the study, such as the measured variable being used as a proxy variable due to not having exact data a year or two years before pregnancy. This study utilized binary variables of ACE based on an extended ACE scale. Still, cumulative or binary variables are imprecise instruments that do not provide the additive ACE score, ignoring the severity and timings, pairing, and type of ACE. Future

research may explore the timings and synergetic pairing of ACEs with pregnancy loss and abortion. In addition to the retrospective ACE measure, as discussed in Chapter 1, the self-reported data may introduce measurement errors due to underreporting or misreporting. Considering reporting gaps in abortion data, this study aimed to investigate the factors contributing to all pregnancies that did not result in live births by using the term 'non-live birth', thereby avoiding erroneous reporting of factors related to abortion and pregnancy loss. However, this approach also has limitations, as it may introduce ambiguity in understanding specific factors associated with abortion and pregnancy loss, especially in cases where disaggregated analysis is not provided. So, the findings should be generalized cautiously and considered as prevalence of ACEs in order to create policies to counter their negative effects. Finally, the statistical models in this study did not include variables that could otherwise account for the observed effects of ACEs, including biomarkers, genetic, epigenetic, and biological factors.

3.7 Conclusion

My study found a significant association between ACEs and abortion but did not find a significant association between ACEs and pregnancy loss, after adjusting analysis with a list of covariates and confounders. However, the overall analysis, using the term non-live birth, showed a statistically significant association between ACEs and non-live births. Marital status and alcohol drinking were significant predictors of abortion in adjusted models. However, reporting chronic health conditions before pregnancy and being ages 29-33 years at the time of pregnancy were associated with an increased risk of pregnancy loss on adjusted analysis compared to women with no health conditions and women aged 11-17 years old). Nevertheless, on overall analysis, my study did not

provide a more holistic set of predictors therefore, it may not be a good methodology to follow in future studies. However, the age at the time of pregnancy, chronic health condition, marital status before pregnancy, and drinking alcohol before pregnancy were significantly associated with non-live births.

The findings suggest the need to broaden the scope of pre-pregnancy care beyond childbearing age to encompass childhood (Dean et al. 2014). Thus, this study emphasizes the need to create safer environments for children, particularly girls, given that the effects of childhood adversities influence pregnancy outcomes. The findings suggest screening for ACEs in healthcare settings and schools. However, the study also reinforced that screening for ACEs may not be used as a "diagnostic tool but as a powerful surveillance tool that can facilitate healthcare culture to provide trauma-informed care" (Dube 2018; Oral et al. 2016). Furthermore, it highlights the necessity of screening women during adolescence for chronic health conditions and negative health behavior to tailor early interventions that can reduce subsequent risks of negative pregnancy outcomes.

My study found that ACEs are associated with a higher risk of having an abortion in adjusted analysis. The findings of this study highlight the importance of accounting for childhood experiences by employing a life-course perspective and their interconnectedness of social, psychological, and biological factors in shaping reproductive outcomes, advocating for comprehensive approaches that consider the entirety of individuals' life experiences. The findings of this study suggest that access to safe abortion is crucial, especially for women with a history of social adversities and complex backgrounds, who might be experiencing cumulative disadvantages that they do not want to transmit to the next generation. Previous studies found that many women

seek abortion due to socio-economic hardships and several other complex but interrelated factors (Biggs et al. 2013; Chae et al. 2017; Finer et al. 2005; Foster et al. 2022). Extant scholarship suggests that women who were denied abortion faced increased economic hardship compared to those who received an abortion (Biggs et al. 2013; Foster et al. 2022), and also exacerbated present health, including chronic, conditions (Gerdts et al. 2016; Ralph et al. 2019). Additionally, a significant proportion of children who experienced poor maternal bonding (a part of ACEs, involving neglect) and lived in subjective poverty were born to women who were denied abortions compared to those born to women from subsequent pregnancies after receiving abortion (Foster et al. 2018). Previous literature has already explored that abortion bans can lead to increased pregnancy related-mortality, pregnancy complications, and maternal morbidity (Harper, Riddell, and King 2021; Pribilsky 2007; Stevenson 2021; Stevenson and Coleman-Minahan 2023). Therefore, ensuring access to safe abortion is crucial not only to meet the needs of women seeking such services but also to break the cycle of cumulative disadvantage women with a history of ACEs already faced, and promoting reproductive health equity.

3.8 Tables and Figures: Chapter III

Table 3.1: Descriptive Statistics of Add Health Sample (N=2291*)

Variables	Live Births (N=1482) % or mean (SD)	Non–Live Births (NLBs)		
		Pregnancy Loss (N=428) % or mean (SD)	Abortion (N=381) % or mean (SD)	Total NLBs (N=809) % or mean (SD)
Pregnancy Outcome	64.7	18.7	16.6	35.3
Adverse Childhood Experiences (ACEs)				
Extended ACE Scale -Continuous	2.4 (1.9)	2.6 (2.0)	2.9 (1.9)	2.7 (1.9)
Extended ACE Scale - Binary	83.7	85.3	93.7	89.2
Emotional Abuse	40.4	47.4	54.6	50.8
Physical Abuse	20.5	21.3	26.5	23.8
Sexual Abuse	10.2	11.9	14.0	12.9
Violent Crime Victimization	17.8	22.4	22.0	22.2
Substance Abuse	18.1	16.8	17.8	17.3
Parental Divorce	21.4	21.0	27.1	23.8
Suicide	6.1	7.3	8.8	8.0
Incarceration	21.3	25.5	20.8	23.3
Emotional Neglect	24.4	22.6	32.4	27.2
Physical Neglect	29.7	29.1	34.4	31.6
Foster Home	1.9	3.4	0.3	2.0
School Disadvantage	36.0	35.5	37.1	36.2
Neighborhood Disadvantage	27.1	25.9	26.4	26.1
Social Services Involvement	5.6	7.0	8.3	7.6
Covariates				
Age at Time of Pregnancy				
11-17 years	7.4	4.6	10.2	7.2
18-28 years	87.3	85.7	86.4	86.1
29-33 years	5.3	9.7	5.3	6.8
Educational Level Before Pregnancy				
Less than High School	32.3	30.4	40.2	34.9
High School	60.4	63.0	55.4	59.5
Some College	3.0	2.8	3.3	3.0
Bachelor and more	4.3	3.7	1.1	2.5
Married Before Pregnancy	70.4	69.3	38.8	61.3
Chronic Health Conditions	44.9	51.2	46.2	51.2
Depressive Symptoms Before Pregnancy	34.6	35.2	33.2	34.3
Alcohol Drinking Before Pregnancy	65.2	67.0	74.1	70.3
Smoking Before Pregnancy	78.1	81.8	80.2	81.0

Table 3.1: Descriptive Statistics of Add Health Sample (N=2291*)

Variables	Live Births (N=1482) % or mean (SD)	Non–Live Births (NLBs)		
		Pregnancy Loss (N=428) % or mean (SD)	Abortion (N=381) % or mean (SD)	Total NLBs (N=809) % or mean (SD)
Socio-Demographics				
Race				
Non-Hispanic White	59.3	58.3	43.8	51.1
Non-Hispanic Black	25.8	27.9	38.3	32.8
Hispanics	3.7	3.5	6.6	5.0
Other	11.2	10.3	11.3	10.8
Parents Education- [reflecting completed GED]	5.1(2.3)	5.1(2.3)	5.8(2.3)	5.4(2.3)
Childhood Household Income [Log: 0 – 6.8]	3.4(0.8)	3.4(0.9)	3.6(0.8)	3.5(0.9
Parents Nativity	12.9	11.4	16.3	13.7
Respondent Nativity	5.6	2.5	7.7	4.9

*unweighted descriptive statistics

**Percentage for the Kaiser ACE scale is presented outside the brackets, while the percentage for the extended ACE scale is enclosed within the brackets.

Table 3.2: Logistic regression model-wise for pregnancy loss

Variables	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6	Model-7	Model-8	Model-9
	OR	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^
ACE – Extended Scale [ref =0]	1.10 (0.81-1.50)	1.09 (0.80-1.50)	1.17 (0.85-1.61)	1.11 (0.80-1.53)	1.11 (0.80-1.54)	1.06 (0.77-1.47)	1.06 (0.76-1.47)	1.06 (0.76-1.47)	1.05 (0.75-1.46)
Age at TP [ref =<17]									
18-28 years	1.34 (0.83-2.17)		1.41 (0.86- 2.31)	1.48 (0.88- 2.48)	1.46 (0.87- 2.46)	1.48 (0.87- 2.49)	1.48 (0.87- 2.49)	1.47 (0.87- 2.49)	1.44 (0.85- 2.43)
29-33 years	2.33** (1.28-4.25)		2.63** (1.40- 4.93)	3.45*** (1.72- 6.92)	3.39*** (1.67- 6.86)	3.54*** (1.74- 7.18)	3.55*** (1.75- 7.21)	3.53*** (1.74- 7.19)	3.41*** (1.67- 6.99)
Education [ref =less than high school]									
High School	1.04 (0.79- 1.36)			0.94 (0.69- 1.28)	0.93 (0.68- 1.28)	0.94 (0.69- 1.29)	0.94 (0.68- 1.28)	0.93 (0.68- 1.28)	0.95 (0.69- 1.30)
Some College	0.63 (0.26- 1.53)			0.47 (0.19- 1.20)	0.46 (0.18- 1.19)	0.48 (0.19- 1.24)	0.48 (0.19- 1.23)	0.48 (0.19- 1.24)	0.52 (0.20- 1.35)
Bachelor and more	0.82 (0.43- 1.55)			0.49 (0.23- 1.04)	0.48 (0.23- 1.03)	0.50 (0.23- 1.06)	0.50 (0.23- 1.06)	0.50 (0.23- 1.06)	0.57 (0.25- 1.28)
Married [ref =not married]	1.05 (0.81-1.35)				1.06 (0.79-1.41)	1.05 (0.79-1.41)	1.05 (0.79-1.40)	1.05 (0.79-1.40)	1.06 (0.79-1.41)
Chronic Health Conditions [ref =no]	1.21*** (1.08-1.36)					1.35** (1.08- 1.70)	1.35* (1.07- 1.70)	1.35* (1.07- 1.70)	1.36** (1.08- 1.71)
Depressive Symptoms[ref =no]	1.06 (0.82-1.38)						1.03 (0.79-1.35)	1.03 (0.79-1.35)	1.0 (0.75-1.32)
Alcohol Drinking [ref =0]	1.06 (0.78-1.44)							1.03 (0.75-1.41)	1.00 (0.72-1.38)
Smoking [ref =0]	1.29 (0.87-1.93)								1.25 (0.78-1.99)

Notes: [1]*p<0.05; **p<0.01; ***p<0.001 … OR = Odds Ratio … AOR= Adjusted Odds Ratio -- CI: 95% Confidence Interval; ^Additionally adjusted for confounders: race, parental education, parents and respondents' nativity; childhood household income.

Table 3.3: Logistic regression model-wise for abortion

Variables	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6	Model-7	Model-8	Model-9
	OR	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^
ACE – Extended Scale [ref =0]	3.15*** (1.94- 5.13)	3.39*** (2.06- 5.58)	3.26*** (1.98- 5.38)	3.02*** (1.83- 5.00)	2.68*** (1.60- 4.49)	2.66*** (1.59- 4.46)	2.66*** (1.59- 4.46)	2.53*** (1.50- 4.25)	2.51*** (1.49- 4.24)
Age at TP [ref =<17]									
18-28 years	0.73 (0.47- 1.13)		0.69 (0.43- 1.08)	0.82 (0.50- 1.35)	1.02 (0.62- 1.67)	1.01 (0.62- 1.67)	1.01 (0.62- 1.67)	0.99 (0.60- 1.63)	0.98 (0.59- 1.63)
29-33 years	0.42* (0.20- 0.91)		0.40)* (0.18- 0.89	0.70 (0.29- 1.71)	1.21 (0.47- 3.09)	1.22 (0.48- 3.11)	1.22 (0.48- 3.12)	1.15 (0.45- 2.94)	1.14 (0.44- 2.93)
Education [ref =less than high school]									
High School	0.79 (0.60- 1.04)			0.74 (0.53- 1.03)	0.92 (0.64- 1.33)	0.93 (0.64- 1.33)	0.92 (0.64- 1.33)	0.89 (0.62- 1.28)	0.89 (0.62- 1.28)
Some College	0.61 (0.25- 1.48)			0.55 (0.21- 1.45)	0.86 (0.31- 2.37)	0.86 (0.31- 2.38)	0.86 (0.31- 2.37)	0.83 (0.30- 2.29)	0.84 (0.30- 2.36)
Bachelor and more	0.14* (0.03- 0.65)			0.14* (0.03- 0.76)	0.23 (0.04- 1.27)	0.23 (0.04- 1.28)	0.23 (0.04- 1.28)	0.21 (0.04- 1.21)	0.23 (0.04- 1.28)
Married [ref =not married]	0.30*** (0.19- 0.48)				0.32*** (0.18- 0.55)	0.32*** (0.18- 0.55)	0.32*** (0.18- 0.55)	0.31*** (0.18- 0.54)	0.31*** (0.18- 0.54)
Chronic Health Conditions [ref =no]	1.06 (0.93- 1.21)					1.08 (0.83- 1.40)	1.08 (0.83- 1.40)	1.09 (0.84- 1.42)	1.09 (0.84- 1.43)
Depressive Symptoms[ref =no]	0.99 (0.74- 1.34)						1.03 (0.75- 1.43)	1.02 (0.73- 1.42)	1.00 (0.72- 1.40)
Alcohol Drinking [ref =0]	1.68** (1.19- 2.39)							1.80** (1.22- 2.67)	1.78** (1.19- 2.64)
Smoking [ref =0]	1.21 (0.81- 1.81)								1.13 (0.67- 1.91)

Notes: [1]*p<0.05; **p<0.01; ***p<0.001 … OR = Odds Ratio … AOR= Adjusted Odds Ratio -- CI: 95% Confidence Interval; ^Additionally adjusted for confounders: race, parental education, parents and respondents' nativity; childhood household income.

Table 3.4: Logistic regression model-wise for non-live births

Variables	Model-1	Model-2	Model-3	Model-4	Model-5	Model-6	Model-7	Model-8	Model-9
	OR	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^	AOR^
ACE – Extended Scale [ref =0]	1.59*** (1.21-2.09)	1.61*** (1.22-2.13)	1.65*** (1.24-2.18)	1.54*** (1.16-2.05)	1.48** (1.11-1.98)	1.45* (1.09-1.93)	1.44* (1.08-1.93)	1.41* (1.06-1.89)	1.40* (1.05-1.88)
Age at TP [ref =<17]									
18-28 years	0.97 (0.68-1.38)		0.97 (0.68-1.39)	1.08 (0.73, 1.59)	1.21 (0.81- 1.79)	1.21 (0.82- 1.80)	1.21 (0.82- 1.80)	1.19 (0.81- 1.77)	1.17 (0.79- 1.75)
29-33 years	1.18 (0.73-1.93)		1.25 (0.76-2.08)	1.86* (1.05- 3.31)	2.30** (1.27- 4.15)	2.34** (1.29- 4.22)	2.34** (1.30- 4.24)	2.25 ** (1.25- 4.07)	2.21** (1.21- 4.01)
Education [ref =less than high school]									
High School	0.92 (0.74-1.14)			0.85 (0.66- 1.09)	0.94 (0.72- 1.22)	0.95 (0.73- 1.23)	0.94 (0.72- 1.23)	0.93 (0.71- 1.20)	0.93 (0.72- 1.21)
Some College	0.62 (0.32-1.21)			0.49 (0.24- 1.01)	0.59 (0.29- 1.23)	0.61 (0.29- 1.26)	0.60 (0.29- 1.25)	0.60 (0.29- 1.24)	0.63 (0.30- 1.31)
Bachelor and more	0.48* (0.27- 0.88)			0.36 ** (0.18- 0.72)	0.44 * (0.22- 0.88)	0.45 * (0.22- 0.90)	0.45 * (0.22- 0.91)	0.45* (0.22- 0.90)	0.49 (0.24- 1.02)
Married [ref =not married]	0.60*** (0.47-0.78)				0.62** (0.46-0.83)	0.61** (0.46-0.83)	0.61** (0.45-0.83)	0.61** (0.45-0.83)	0.62** (0.46-0.83)
Chronic Health Conditions [ref =no]	1.15** (1.04-1.26)					1.21** (1.01-1.46)	1.21** (1.00-1.45)	1.21** (1.00-1.46)	1.22** (1.01-1.47)
Depressive Symptoms[ref =no]	1.03 (0.83-1.28)						1.04 (0.83-1.31)	1.04 (0.83-1.30)	1.01 (0.80-1.28)
Alcohol Drinking [ref =0]	1.29* (1.02-1.63)							1.29* (1.00-1.66)	1.26 (0.98-1.62)
Smoking [ref =0]	1.25 (0.92-1.70)								1.18 (0.81-1.72)

Notes: [1]*p<0.05; **p<0.01; ***p<0.001 … OR = Odds Ratio … AOR= Adjusted Odds Ratio -- CI: 95% Confidence Interval; ^Additionally adjusted for confounders: race, parental education, parents and respondents' nativity; childhood household income.

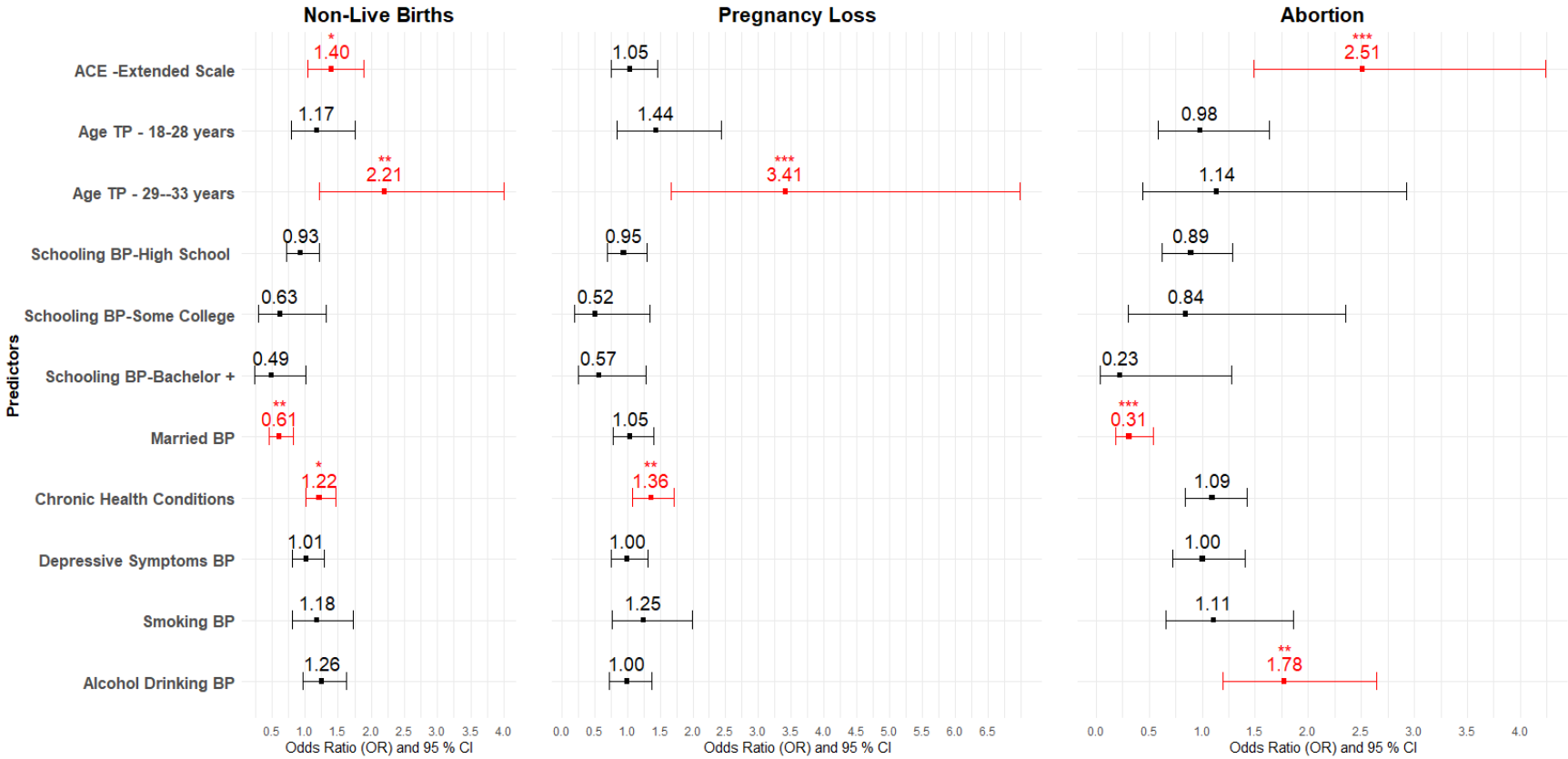

Figure 3.2: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and ACEs (reproduced Model-9)

Notes: ACE= Adverse Childhood Experiences, TP= Time at Pregnancy, BP=Before Pregnancy

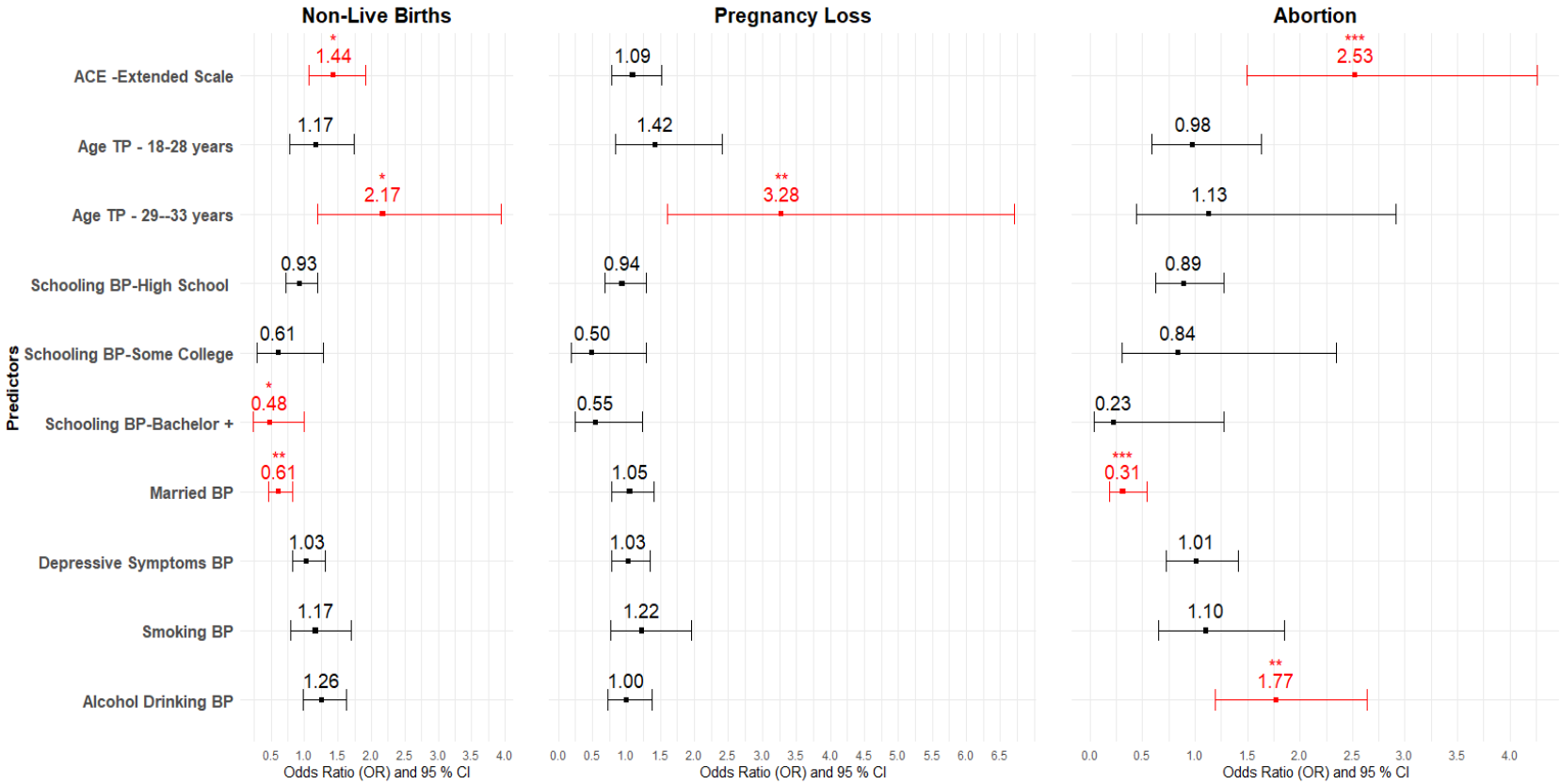

Figure 3.3: Adjusted Odds Ratio (AOR) Plots between Non-Live Births and ACEs (Without Chronic Health Conditions)

Notes: ACE= Adverse Childhood Experiences, TP= Time at Pregnancy, BP=Before Pregnancy

3.9 References

Acevedo-Garcia, Dolores, Lindsay E. Rosenfeld, Erin Hardy, Nancy McArdle, and Theresa L. Osypuk. 2013. "Future Directions in Research on Institutional and Interpersonal Discrimination and Children's Health." *American Journal of Public Health* 103(10):1754–63. doi: 10.2105/AJPH.2012.300986.

Aliyu, Muktar H., Roneé E. Wilson, Roger Zoorob, Sangita Chakrabarty, Amina P. Alio, Russell S. Kirby, and Hamisu M. Salihu. 2008. "Alcohol Consumption during Pregnancy and the Risk of Early Stillbirth among Singletons." *Alcohol* 42(5):369–74. doi: 10.1016/j.alcohol.2008.04.003.

Andersen, Anne-Marie Nybo, Jan Wohlfahrt, Peter Christens, Jørn Olsen, and Mads Melbye. 2000. "Maternal Age and Fetal Loss: Population Based Register Linkage Study." *BMJ* 320(7251):1708–12. doi: 10.1136/bmj.320.7251.1708.

Avalos, Lyndsay Ammon, Sarah CM Roberts, Lee Ann Kaskutas, Gladys Block, and De-Kun Li. 2014. "Volume and Type of Alcohol During Early Pregnancy and the Risk of Miscarriage." *Substance Use & Misuse* 49(11):1437–45. doi: 10.3109/10826084.2014.912228.

Bellis, Mark A., Karen Hughes, Kat Ford, Gabriela Ramos Rodriguez, Dinesh Sethi, and Jonathon Passmore. 2019. "Life Course Health Consequences and Associated Annual Costs of Adverse Childhood Experiences across Europe and North America: A Systematic Review and Meta-Analysis." *The Lancet Public Health* 4(10):e517–28. doi: 10.1016/S2468-2667(19)30145-8.

Biggs, M. Antonia, Heather Gould, and Diana Greene Foster. 2013. "Understanding Why Women Seek Abortions in the US." *BMC Women's Health* 13(1):29. doi: 10.1186/1472-6874-13-29.

Bleil, Maria E., Nancy E. Adler, Lauri A. Pasch, Barbara Sternfeld, Renee A. Reijo-Pera, and Marcelle I. Cedars. 2011. "Adverse Childhood Experiences and Repeat Induced Abortion." *American Journal of Obstetrics and Gynecology* 204(2):122.e1-122.e6. doi: 10.1016/j.ajog.2010.09.029.

Boden, Joseph M., David M. Fergusson, and L. John Horwood. 2009. "Experience of Sexual Abuse in Childhood and Abortion in Adolescence and Early Adulthood." *Child Abuse & Neglect* 33(12):870–76. doi: 10.1016/j.chiabu.2009.04.006.

Bronfenbrenner, Urie. 1979. *The Ecology of Human Development: Experiments by Nature and Design*. Harvard university press.

Chae, Sophia, Sheila Desai, Marjorie Crowell, and Gilda Sedgh. 2017. "Reasons Why Women Have Induced Abortions: A Synthesis of Findings from 14 Countries." *Contraception* 96(4):233–41. doi: 10.1016/j.contraception.2017.06.014.

Chaithra, P. T., Suttur S. Malini, and C. Sharath Kumar. 2011. "An Overview of Genetic and Molecular Factors Responsible for Recurrent Pregnancy Loss." *International Journal of Human Genetics* 11(4):217–25. doi: 10.1080/09723757.2011.11886145.

Collins, Susan E. 2016. "Associations Between Socioeconomic Factors and Alcohol Outcomes." *Alcohol Research : Current Reviews* 38(1):83–94.

Cundiff, J. M., T. W. Smith, B. N. Uchino, and C. A. Berg. 2013. “Subjective Social Status: Construct Validity and Associations with Psychological Vulnerability and Self-Rated Health.” *International Journal of Behavioral Medicine* 20(1):148–58.

Danese, Andrea, Terrie E. Moffitt, HonaLee Harrington, Barry J. Milne, Guilherme Polanczyk, Carmine M. Pariante, Richie Poulton, and Avshalom Caspi. 2009. “Adverse Childhood Experiences and Adult Risk Factors for Age-Related Disease: Depression, Inflammation, and Clustering of Metabolic Risk Markers.” *Archives of Pediatrics & Adolescent Medicine* 163(12):1135–43. doi: 10.1001/archpediatrics.2009.214.

Dean, Sohni V., Zohra S. Lassi, Ayesha M. Imam, and Zulfiqar A. Bhutta. 2014. “Preconception Care: Closing the Gap in the Continuum of Care to Accelerate Improvements in Maternal, Newborn and Child Health.” *Reproductive Health* 11(S3):S1. doi: 10.1186/1742-4755-11-S3-S1.

Dehlendorf, Christine, Lisa H. Harris, and Tracy A. Weitz. 2013. “Disparities in Abortion Rates: A Public Health Approach.” *American Journal of Public Health* 103(10):1772–79. doi: 10.2105/AJPH.2013.301339.

Denny, Clark H., R. Louise Floyd, Patricia P. Green, and Donald K. Hayes. 2012. “Racial and Ethnic Disparities in Preconception Risk Factors and Preconception Care.” *Journal of Women’s Health* 21(7):720–29. doi: 10.1089/jwh.2011.3259.

Dimitriadis, Evdokia, Ellen Menkhorst, Shigeru Saito, William H. Kutteh, and Jan J. Brosens. 2020. “Recurrent Pregnancy Loss.” *Nature Reviews Disease Primers* 6(1):1–19. doi: 10.1038/s41572-020-00228-z.

Dube, Shanta R. 2018. “Continuing Conversations about Adverse Childhood Experiences (ACEs) Screening: A Public Health Perspective.” *Child Abuse & Neglect* 85:180–84. doi: 10.1016/j.chiabu.2018.03.007.

Elder, Glen H. 1998. “The Life Course as Developmental Theory.” *Child Development* 69(1):1–12. doi: 10.2307/1132065.

Elder, Glen H., Monica Kirkpatrick Johnson, and Robert Crosnoe. 2003. “The Emergence and Development of Life Course Theory.” Pp. 3–19 in *Handbook of the Life Course*, edited by J. T. Mortimer and M. J. Shanahan. Boston, MA: Springer US.

Finer, Lawrence B., Lori F. Frohwirth, Lindsay A. Dauphinee, Susheela Singh, and Ann M. Moore. 2005. “Reasons U.S. Women Have Abortions: Quantitative and Qualitative Perspectives.” *Perspectives on Sexual and Reproductive Health* 37(3):110–18. doi: 10.1111/j.1931-2393.2005.tb00045.x.

Flenady, Vicki, Laura Koopmans, Philippa Middleton, J. Frederik Frøen, Gordon C. Smith, Kristen Gibbons, Michael Coory, Adrienne Gordon, David Ellwood, Harold David McIntyre, Ruth Fretts, and Majid Ezzati. 2011. “Major Risk Factors for Stillbirth in High-Income Countries: A Systematic Review and Meta-Analysis.” *The Lancet* 377(9774):1331–40. doi: 10.1016/S0140-6736(10)62233-7.

Foster, D. G., M. A. Biggs, L. Ralph, C. Gerdts, S. Roberts, and M. M. Glymour. 2022. “Socioeconomic Outcomes of Women Who Receive and Women Who Are Denied Wanted Abortions in the United States.” *American Journal of Public Health* 112(9):1290–96. doi: 10.2105/AJPH.2017.304247.

Foster, Diana Greene, M. Antonia Biggs, Sarah Raifman, Jessica Gipson, Katrina Kimport, and Corinne H. Rocca. 2018. “Comparison of Health, Development, Maternal Bonding, and Poverty among Children Born after Denial of Abortion vs after Pregnancies Subsequent to an Abortion.” *JAMA Pediatrics* 172(11):1053–60.

Freedman, Alexa A., Alison L. Cammack, Jeff R. Temple, Robert M. Silver, Donald J. Dudley, Barbara J. Stoll, Michael W. Varner, George R. Saade, Deborah Conway, Robert L. Goldenberg, and Carol J. Hogue. 2017. “Maternal Exposure to Childhood Maltreatment and Risk of Stillbirth.” *Annals of Epidemiology* 27(8):459-465.e2. doi: 10.1016/j.annepidem.2017.07.005.

Gerdts, Caitlin, Loren Dobkin, Diana Greene Foster, and Eleanor Bimla Schwarz. 2016. “Side Effects, Physical Health Consequences, and Mortality Associated with Abortion and Birth after an Unwanted Pregnancy.” *Women’s Health Issues* 26(1):55–59. doi: 10.1016/j.whi.2015.10.001.

Gil-Lacruz, Ana I., Marta Gil-Lacruz, and Estrella Bernal-Cuenca. 2012. “Socio-Economic Determinants of Abortion Rates.” *Sexuality Research and Social Policy* 9(2):143–52. doi: 10.1007/s13178-011-0056-z.

Greeson, Johanna K. P., Ernestine C. Briggs, Christopher M. Layne, Harolyn M. E. Belcher, Sarah A. Ostrowski, Soeun Kim, Robert C. Lee, Rebecca L. Vivrette, Robert S. Pynoos, and John A. Fairbank. 2014. “Traumatic Childhood Experiences in the 21st Century: Broadening and Building on the ACE Studies With Data From the National Child Traumatic Stress Network.” *Journal of Interpersonal Violence* 29(3):536–56. doi: 10.1177/0886260513505217.

Grimes, David A., and Kenneth F. Schulz. 2002. “Bias and Causal Associations in Observational Research.” *The Lancet* 359(9302):248–52. doi: 10.1016/S0140-6736(02)07451-2.

Haddad, Sami, Laetitia Martin-Marchand, Mathilde Lafaysse, and Marie-Josèphe Saurel-Cubizolles. 2021. “Repeat Induced Abortion and Adverse Childhood Experiences in Aquitaine, France: A Cross-Sectional Survey.” *The European Journal of Contraception & Reproductive Health Care* 26(1):29–35. doi: 10.1080/13625187.2020.1815697.

Harper, Sam, Corinne A. Riddell, and Nicholas B. King. 2021. “Declining Life Expectancy in the United States: Missing the Trees for the Forest.” *Annual Review of Public Health* 42(1):381–403. doi: 10.1146/annurev-publhealth-082619-104231.

Hegelund, Emilie Rune, Gry Juul Poulsen, and Laust Hvas Mortensen. 2019. “Educational Attainment and Pregnancy Outcomes: A Danish Register-Based Study of the Influence of Childhood Social Disadvantage on Later Socioeconomic Disparities in Induced Abortion, Spontaneous Abortion, Stillbirth and Preterm Delivery.” *Maternal and Child Health Journal* 23(6):839–46. doi: 10.1007/s10995-018-02704-1.

Hennekens, Charles H., and Julie E. Buring. 1987. “Epidemiology in Medicine.” Pp. 383–383 in *Epidemiology in medicine*.

Hillis, Susan D., Robert F. Anda, Shanta R. Dube, Vincent J. Felitti, Polly A. Marchbanks, and James S. Marks. 2004. “The Association between Adverse Childhood Experiences and Adolescent Pregnancy, Long-Term Psychosocial Consequences, and Fetal Death.” *Pediatrics* 113(2):320–27. doi: 10.1542/peds.113.2.320.

Hutcheon, Jennifer A., Sarka Lisonkova, and K. S. Joseph. 2011. "Epidemiology of Pre-Eclampsia and the Other Hypertensive Disorders of Pregnancy." *Best Practice & Research Clinical Obstetrics & Gynaecology* 25(4):391–403. doi: 10.1016/j.bpobgyn.2011.01.006.

Kalmakis, Karen A., and Genevieve E. Chandler. 2015. "Health Consequences of Adverse Childhood Experiences: A Systematic Review." *Journal of the American Association of Nurse Practitioners* 27(8):457–65. doi: 10.1002/2327-6924.12215.

Karney, Benjamin R. 2021. "Socioeconomic Status and Intimate Relationships." *Annual Review of Psychology* 72:391–414. doi: 10.1146/annurev-psych-051920-013658.

Keenan, Katherine, Emily Grundy, Michael G. Kenward, and David A. Leon. 2014. "Women's Risk of Repeat Abortions Is Strongly Associated with Alcohol Consumption: A Longitudinal Analysis of a Russian National Panel Study, 1994–2009." *PLOS ONE* 9(3):e90356. doi: 10.1371/journal.pone.0090356.

Kelly-Irving, Michelle, and Cyrille Delpierre. 2019. "A Critique of the Adverse Childhood Experiences Framework in Epidemiology and Public Health: Uses and Misuses." *Social Policy and Society* 18(3):445–56. doi: 10.1017/S1474746419000101.

Kerkar, Shweta, Arti Shankar, Renee Boynton-Jarrett, and Emily W. Harville. 2021. "Adverse Childhood Experiences Are Associated with Miscarriage in Adulthood: The GROWH Study." *Maternal and Child Health Journal* 25(3):479–86. doi: 10.1007/s10995-020-03079-y.

Kirkman, Maggie, Heather Rowe, Annarella Hardiman, Shelley Mallett, and Doreen Rosenthal. 2009. "Reasons Women Give for Abortion: A Review of the Literature." *Archives of Women's Mental Health* 12(6):365–78. doi: 10.1007/s00737-009-0084-3.

Kortsmit, Katherine. 2021. "Abortion Surveillance — United States, 2019." *MMWR. Surveillance Summaries* 70. doi: 10.15585/mmwr.ss7009a1.

Krieg, Sacha A., Lora K. Shahine, and Ruth B. Lathi. 2016. "Environmental Exposure to Endocrine-Disrupting Chemicals and Miscarriage." *Fertility and Sterility* 106(4):941–47. doi: 10.1016/j.fertnstert.2016.06.043.

Lee, Paul H., and Igor Burstyn. 2016. "Identification of Confounder in Epidemiologic Data Contaminated by Measurement Error in Covariates." *BMC Medical Research Methodology* 16:1–18.

Lee, Rosalyn D., and Jieru Chen. 2017. "Adverse Childhood Experiences, Mental Health, and Excessive Alcohol Use: Examination of Race/Ethnicity and Sex Differences." *Child Abuse & Neglect* 69:40–48. doi: 10.1016/j.chiabu.2017.04.004.

Leppälahti, Suvi, Oskari Heikinheimo, Reija Paananen, Päivi Santalahti, Marko Merikukka, and Mika Gissler. 2016. "Determinants of Underage Induced Abortion – the 1987 Finnish Birth Cohort Study." *Acta Obstetricia et Gynecologica Scandinavica* 95(5):572–79. doi: 10.1111/aogs.12879.

Lindberg, Laura, Kathryn Kost, Isaac Maddow-Zimet, Sheila Desai, and Mia Zolna. 2020. "Abortion Reporting in the United States: An Assessment of Three National Fertility Surveys." *Demography* 57(3):899–925. doi: 10.1007/s13524-020-00886-4.

Lindberg, Laura, and Rachel H. Scott. 2018. “Effect of ACASI on Reporting of Abortion and Other Pregnancy Outcomes in the US National Survey of Family Growth.” *Studies in Family Planning* 49(3):259–78. doi: 10.1111/sifp.12068.

Maguire-Jack, Kathryn, Paul Lanier, and Brianna Lombardi. 2020. “Investigating Racial Differences in Clusters of Adverse Childhood Experiences.” *American Journal of Orthopsychiatry* 90(1):106.

McEwen, Craig A., and Scout F. Gregerson. 2019. “A Critical Assessment of the Adverse Childhood Experiences Study at 20 Years.” *American Journal of Preventive Medicine* 56(6):790–94. doi: 10.1016/j.amepre.2018.10.016.

McRae, Elizabeth M., Laura Stoppelbein, Sarah E. O’Kelley, Paula Fite, and Shana B. Smith. 2021. “An Examination of Post-Traumatic Stress Symptoms and Aggression among Children with a History of Adverse Childhood Experiences.” *Journal of Psychopathology and Behavioral Assessment* 43(3):657–70. doi: 10.1007/s10862-021-09884-1.

Merrick, Melissa T., Derek C. Ford, Katie A. Ports, and Angie S. Guinn. 2018. “Prevalence of Adverse Childhood Experiences From the 2011-2014 Behavioral Risk Factor Surveillance System in 23 States.” *JAMA Pediatrics* 172(11):1038. doi: 10.1001/jamapediatrics.2018.2537.

Mersky, Joshua P., and ChienTi Plummer Lee. 2019. “Adverse Childhood Experiences and Poor Birth Outcomes in a Diverse, Low-Income Sample.” *BMC Pregnancy and Childbirth* 19(1):387. doi: 10.1186/s12884-019-2560-8.

Mukherjee, Sudeshna, Digna R. Velez Edwards, Donna D. Baird, David A. Savitz, and Katherine E. Hartmann. 2013. “Risk of Miscarriage Among Black Women and White Women in a US Prospective Cohort Study.” *American Journal of Epidemiology* 177(11):1271–78. doi: 10.1093/aje/kws393.

Nkansah-Amankra, Stephen. 2018. “Pre-Pregnancy Maternal Depressive Symptoms and Low Birth Weight and Preterm Birth Outcomes: Assessment of Adolescent Background Characteristics and Birth Outcomes in Adulthood.” *Midwifery* 58:120–29. doi: 10.1016/j.midw.2017.12.004.

Nurius, Paula S., Edwina Uehara, and Douglas F. Zatzick. 2013. “Intersection of Stress, Social Disadvantage, and Life Course Processes: Reframing Trauma and Mental Health.” *American Journal of Psychiatric Rehabilitation* 16(2):91–114. doi: 10.1080/15487768.2013.789688.

Olsen, Jeanette M. 2018a. “Integrative Review of Pregnancy Health Risks and Outcomes Associated With Adverse Childhood Experiences.” *Journal of Obstetric, Gynecologic & Neonatal Nursing* 47(6):783–94. doi: 10.1016/j.jogn.2018.09.005.

Olsen, Jeanette M. 2018b. “Integrative Review of Pregnancy Health Risks and Outcomes Associated With Adverse Childhood Experiences.” *Journal of Obstetric, Gynecologic & Neonatal Nursing* 47(6):783–94. doi: 10.1016/j.jogn.2018.09.005.

Oral, Resmiye, Marizen Ramirez, Carol Coohey, Stephanie Nakada, Amy Walz, Angela Kuntz, Jenna Benoit, and Corinne Peek-Asa. 2016. “Adverse Childhood Experiences and Trauma Informed Care: The Future of Health Care.” *Pediatric Research* 79(1–2):227–33. doi: 10.1038/pr.2015.197.

Pabayo, Roman, Daniel M. Cook, Gregory Farmer, and Beth E. Molnar. 2021. "Neighborhood Income Inequality and Alcohol Use among Adolescents in Boston, Massachusetts." *International Journal of Environmental Research and Public Health* 18(16):8484. doi: 10.3390/ijerph18168484.

Parker, Richard Fry and Kim. 2021. "Rising Share of U.S. Adults Are Living Without a Spouse or Partner." *Pew Research Center*. Retrieved August 6, 2024 (https://www.pewresearch.org/social-trends/2021/10/05/rising-share-of-u-s-adults-are-living-without-a-spouse-or-partner/).

Pearlin, Leonard I., Scott Schieman, Elena M. Fazio, and Stephen C. Meersman. 2005. "Stress, Health, and the Life Course: Some Conceptual Perspectives." *Journal of Health and Social Behavior* 46(2):205–19. doi: 10.1177/002214650504600206.

Pineles, Beth L., Edward Park, and Jonathan M. Samet. 2014. "Systematic Review and Meta-Analysis of Miscarriage and Maternal Exposure to Tobacco Smoke During Pregnancy." *American Journal of Epidemiology* 179(7):807–23. doi: 10.1093/aje/kwt334.

Pouta, Anneli, Marjo-Riitta Järvelin, Elina Hemminki, Ulla Sovio, and Anna-Liisa Hartikainen. 2005. "Mothers and Daughters: Intergenerational Patterns of Reproduction." *European Journal of Public Health* 15(2):195–99. doi: 10.1093/eurpub/cki078.

Pribilsky, Jason. 2007. *La Chulla Vida: Gender, Migration, and the Family in Andean Ecuador and New York City*. Syracuse University Press.

Quenby, Siobhan, Ioannis D. Gallos, Rima K. Dhillon-Smith, Marcelina Podesek, Mary D. Stephenson, Joanne Fisher, Jan J. Brosens, Jane Brewin, Rosanna Ramhorst, Emma S. Lucas, Rajiv C. McCoy, Robert Anderson, Shahd Daher, Lesley Regan, Maya Al-Memar, Tom Bourne, David A. MacIntyre, Raj Rai, Ole B. Christiansen, Mayumi Sugiura-Ogasawara, Joshua Odendaal, Adam J. Devall, Phillip R. Bennett, Stavros Petrou, and Arri Coomarasamy. 2021. "Miscarriage Matters: The Epidemiological, Physical, Psychological, and Economic Costs of Early Pregnancy Loss." *The Lancet* 397(10285):1658–67. doi: 10.1016/S0140-6736(21)00682-6.

Racine, Nicole, Andre Plamondon, Sheri Madigan, Sheila McDonald, and Suzanne Tough. 2018. "Maternal Adverse Childhood Experiences and Infant Development." *Pediatrics* 141(4):e20172495. doi: 10.1542/peds.2017-2495.

Ralph, Lauren J., Eleanor Bimla Schwarz, Daniel Grossman, and Diana Greene Foster. 2019. "Self-Reported Physical Health of Women Who Did and Did Not Terminate Pregnancy After Seeking Abortion Services." *Annals of Internal Medicine* 171(4):238–47. doi: 10.7326/M18-1666.

Reddy, Uma M., Chia-Wen Ko, and Marian Willinger. 2006. "Maternal Age and the Risk of Stillbirth throughout Pregnancy in the United States." *American Journal of Obstetrics and Gynecology* 195(3):764–70. doi: 10.1016/j.ajog.2006.06.019.

Rossen, Lauren, Brady Hamilton E., Joyce Abma, Elizabeth C.W., Vladislav Beresovsky, Andriana Resendez, Anjani Chandra, and Joyce Martin. 2023. *Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States*. National Center for Health Statistics (U.S.). doi: 10.15620/cdc:124395.

Ruiz, Milagros, Peter Goldblatt, Joana Morrison, Lubomír Kukla, Jan Švancara, Marjo Riitta-Järvelin, Anja Taanila, Marie-Josèphe Saurel-Cubizolles, Sandrine Lioret, Chryssa Bakoula, Alexandra Veltsista, Daniela Porta, Francesco Forastiere, Manon van Eijsden, Tanja G. M. Vrijkotte, Merete

Eggesbø, Richard A. White, Henrique Barros, Sofia Correia, Martine Vrijheid, Maties Torrent, Marisa Rebagliato, Isabel Larrañaga, Johnny Ludvigsson, Åshild Olsen Faresjö, Daniel Hryhorczuk, Youriy Antipkin, Michael Marmot, and Hynek Pikhart. 2015. "Mother's Education and the Risk of Preterm and Small for Gestational Age Birth: A DRIVERS Meta-Analysis of 12 European Cohorts." *J Epidemiol Community Health* 69(9):826–33. doi: 10.1136/jech-2014-205387.

Rushton, Jerry L. 2002. "Epidemiology of Depressive Symptoms in the National Longitudinal Study of Adolescent Health." *J. AM. ACAD. CHILD ADOLESC. PSYCHIATRY*.

Scorza, Pamela, Cristiane S. Duarte, Seonjoo Lee, Haotian Wu, Jonathan Posner, Andrea Baccarelli, and Catherine Monk. 2023. "Epigenetic Intergenerational Transmission: Mothers' Adverse Childhood Experiences and DNA Methylation." *Journal of the American Academy of Child & Adolescent Psychiatry*. doi: 10.1016/j.jaac.2023.02.018.

Sibai, Baha M. 2002. "Chronic Hypertension in Pregnancy12." *Obstetrics & Gynecology* 100(2):369–77. doi: 10.1016/S0029-7844(02)02128-2.

Singh, G. K., and S. M. Yu. 1996. "Adverse Pregnancy Outcomes: Differences between US- and Foreign-Born Women in Major US Racial and Ethnic Groups." *American Journal of Public Health* 86(6):837–43. doi: 10.2105/AJPH.86.6.837.

Solazzo, Alexa L. 2019. "Different and Not Equal:The Uneven Association of Race, Poverty, and Abortion Laws on Abortion Timing." *Social Problems* 66(4):519–47. doi: 10.1093/socpro/spy015.

Souch, Alistair J., Ian R. Jones, Katherine H. M. Shelton, and Cerith S. Waters. 2022. "Maternal Childhood Maltreatment and Perinatal Outcomes: A Systematic Review." *Journal of Affective Disorders* 302:139–59. doi: 10.1016/j.jad.2022.01.062.

Steinberg, Julia R., and Jeanne M. Tschann. 2013. "Childhood Adversities and Subsequent Risk of One or Multiple Abortions." *Social Science & Medicine* 81:53–59. doi: 10.1016/j.socscimed.2012.11.011.

Stevenson, AJ, and K. Coleman-Minahan. 2023. "P039 - ESTIMATED INCREASE IN SEVERE MATERNAL MORBIDITY DUE TO A TOTAL ABORTION BAN IN THE US." *Contraception* 127:110206. doi: 10.1016/j.contraception.2023.110206.

Stevenson, Amanda Jean. 2021. "The Pregnancy-Related Mortality Impact of a Total Abortion Ban in the United States: A Research Note on Increased Deaths Due to Remaining Pregnant." *Demography* 58(6):2019–28.

Strine, Tara W., Shanta R. Dube, Valerie J. Edwards, Angela Witt Prehn, Sandra Rasmussen, Morton Wagenfeld, Satvinder Dhingra, and Janet B. Croft. 2012. "Associations Between Adverse Childhood Experiences, Psychological Distress, and Adult Alcohol Problems." *American Journal of Health Behavior* 36(3):408–23. doi: 10.5993/AJHB.36.3.11.

Sundermann, Alexandra C., Sifang Zhao, Chantay L. Young, LeAnn Lam, Sarah H. Jones, Digna R. Velez Edwards, and Katherine E. Hartmann. 2019. "Alcohol Use in Pregnancy and Miscarriage: A Systematic Review and Meta-Analysis." *Alcoholism: Clinical and Experimental Research* 43(8):1606–16. doi: 10.1111/acer.14124.

Swift, Alison, Madison Berry, Madeline Fernandez-Pineda, and Amanda Haberstroh. 2024. “An Integrative Review of Adverse Childhood Experiences and Reproductive Traumas of Infertility and Pregnancy Loss.” *Journal of Midwifery & Women’s Health* 69(2):258–78. doi: 10.1111/jmwh.13585.

Tierney, Katherine I. 2019. “Abortion Underreporting in Add Health: Findings and Implications.” *Population Research and Policy Review* 38(3):417–28. doi: 10.1007/s11113-019-09511-8.

Walsh, David, Gerry McCartney, Michael Smith, and Gillian Armour. 2019. “Relationship between Childhood Socioeconomic Position and Adverse Childhood Experiences (ACEs): A Systematic Review.” *Journal of Epidemiology and Community Health* 73(12):1087–93. doi: 10.1136/jech-2019-212738.

Woolner, Andrea M. F., Edwin Amalraj Raja, Siladitya Bhattacharya, Peter Danielian, and Sohinee Bhattacharya. 2019. “Inherited Predisposition to Stillbirth: An Intergenerational Analysis of 26,788 Mother-Daughter Pairs.” *American Journal of Obstetrics and Gynecology* 220(4):393.e1-393.e7. doi: 10.1016/j.ajog.2019.01.215.

Zarei, Kasra, Lisa Kahle, Dennis W. Buckman, Kelvin Choi, and Faustine Williams. 2022. “Parent-Child Nativity, Race, Ethnicity, and Adverse Childhood Experiences among U.S. Children.” *The Journal of Pediatrics* 251:190-195.e4. doi: 10.1016/j.jpeds.2022.07.050.

CHAPTER IV
Intergenerational Pathways: Maternal Early Life Adversities, Unintentional Pregnancies and Non-Live Births

4.1 Introduction

Unintended pregnancies, referring to a pregnancy that was undesired or mistimed, are a global concern as the global rate of unintended pregnancies is 64 per 1000 women aged 15-49 years, including in high-income countries, such as the United States (Bearak et al. 2020). In the United States, according to the National Center for Health Statistics (NCHS), the Centers for Disease Control and Prevention (CDC), the percentage of unintended pregnancies was 51% in 2008, and around a 9 percent decline has been noticed after 11 years, as 41.6% of women were still experiencing unintended pregnancies in 2019 (Rossen et al. 2023). Decreasing unintended pregnancy is a national health priority in the United States under Healthy People 2030 Objective FP-01, with a target of a 36.5 percent decrease (NCHS 2021). However, despite previous efforts to avert the burden of unintended pregnancies by just improving access to family planning resources and services (such as education and access to contraceptives), there has been no significant improvement in reducing the percentage of unintended pregnancies (Birgisson et al. 2015; Torve and Hansen 2023). Due to this, there is growing criticism of the unintended pregnancy framework, which depicts it as an adverse outcome that should be prevented (Aiken et al. 2016; Auerbach et al. 2023; Potter et al. 2019).

Instead, there is a need to shift the focus from singular pregnancies to a more holistic life-course approach by addressing social and structural determinants of health (Auerbach et al. 2023). Pregnancy intentions are embedded in long-standing structural inequalities and the intergenerational transmission of inequalities (Auerbach et al. 2023; Testa et al. 2021). To reduce

the burden of unintended pregnancies, it is essential to expand to an approach that links improving birth outcomes with creating a better and safer childhood environment to reduce the cumulative disadvantage among youth/adult over the years (Auerbach et al. 2023; Dean et al. 2014; Hawks et al. 2018; Kane and Margerison-Zilko 2017). Hence, this study aims to capture the intergenerational transmission of childhood inequalities to understand their impact on pregnancy loss, abortion, or non-live births via the mediated pathway of unintended pregnancies.

4.1.1 Unintended Pregnancies and Non-Live Births

The pregnancy intentions are linked with prenatal or pregnancy-related behaviors (Dott et al. 2010), influencing pregnancy outcomes (Bearak et al. 2020; Gipson, Koenig, and Hindin 2008). The scholarship has established the association on how unintended pregnancies can affect pregnancy outcomes, particularly non-live births (Aztlan, Foster, and Upadhyay 2018; Bearak et al. 2020; Flink-Bochacki et al. 2017; Hall et al. 2017). Such as, a study utilized data from the National Survey of Family Growth that is a cross-sectional, nationally-representative United States-based survey found that 44.5 percent of miscarriages were related to unintended pregnancies (referring to occurring sooner than desired), while 15.3 percent of unwanted pregnancies ended in miscarriages (Flink-Bochacki et al. 2017).

A meta-analysis conducted by Hall et al. (2017) explored that there was limited data to investigate the relationship between unintended pregnancies and pregnancy loss or abortion. Only eight studies explored and confirmed the association with some variation between unintended pregnancies and pregnancy loss. The meta-analysis also reflected that a few studies also confirmed the association of unintended pregnancies with a higher likelihood of having abortion. The meta-analysis suggested exploring the pathways affecting unintended pregnancies utilizing a life-course framework, taking into account mechanisms established well before the

pregnancy occurs. This meta-analysis included research articles from the year 1975 to 2015, thus having just eight studies reflecting the need to work on exploring the relationship between unintended pregnancies and pregnancy loss (Hall et al. 2017)

Another study, by utilizing country-based surveys, official statistics, and a literature review, explored the association between unintended pregnancy and abortion (Bearak et al. 2020). The same study presented the analysis by income, region, and the legal status of abortion between 1990 to 2019. Moreover, the cited study revealed that 61 percent of unintended pregnancies ended in abortion, with an abortion rate of 39 abortions per 1000 women aged 15–49 years. This study highlighted that the proportion of unintended pregnancies ending in abortion had increased in the countries where abortion is banned, reflecting that punitive policies are not effective (Bearak et al. 2020).

Unintended pregnancy may be just a one-time phenomenon in a lifetime for some women, but it also may be a repeated phenomenon for many other women (Aztlan et al. 2018). Considering this, a study by Aztlan et al. (2018) investigated the effects of numerous factors on time to subsequent unintended pregnancy, specifically with women who received abortion services versus denied ones. This study utilized secondary data based on a 5-year prospective cohort study (2008-2010) conducted with women who sought an abortion at one of thirty abortion facilities across the United States. The same study found unintended pregnancies are linked with non-live births, as one-sixth of subsequent unintended pregnancies ended in miscarriage, and 25 percent ended in abortion (Aztlan et al. 2018).

To wrap up, the above-cited studies reflected that there is an association between unintended pregnancy and abortion or pregnancy loss (Aztlan et al. 2018; Bearak et al. 2020; Flink-Bochacki et al. 2017; Hall et al. 2017). Previous scholarship described that several studies

explored the direct relationship between unintended pregnancies and pregnancy loss or abortion, ignoring the effects of different pathways that may reflect unintended pregnancies as part of structural inequalities rather individual reproductive decision (Aiken et al. 2016; Auerbach et al. 2023; Hall et al. 2017; Potter et al. 2019). A meta-analysis covering 40 years of research between 1975 to 2015 concluded that there is need to conduct more research to explore the role of unintended pregnancy with abortion or pregnancy loss via exploring different pathways (Hall et al. 2017). Moreover, there is paucity of research to explore the relationship of unintended pregnancy with abortion and pregnancy loss using same nationally representative dataset of United States. Therefore, this study is an effort to contribute to growing research by exploring the relationship between unintended pregnancy and non-live birth, abortion, and pregnancy via some exploring a chain of pathways, as discussed below.

4.1.2 Intergeneration Effect: Early Life Adversities and Non-Live Births

This chapter describes how social conditions in childhood are linked with ACEs and how adversely they may impact adult socioeconomic prospects and health risk behaviors as an intergenerational process.

Recent research highlighted the importance of "shifting the narrative in ACEs research" from narrow focus on individuals to a broader examination of "social determinants of inequities or health" (Karatekin et al. 2022). One of the perspectives of this shift is that 'making healthy life choices' is not always feasible for many families due to systemic issues like poverty and the socio-economic status of parents (Karatekin et al. 2022; Solar and Irwin 2010).. These systemic issues are not just temporary obstacles; they have profound and lasting impacts that ripple across generations.(Karatekin et al. 2022; Solar and Irwin 2010). Previous studies have identified that "toxic stress" stems not only from direct exposure to ACEs but also from adverse social

conditions in childhood, which are closely interlinked with social structures and processes (McEwen and Gregerson 2019; McEwen and McEwen 2017). Therefore, ongoing exposure to adverse conditions, such as exposure to ACEs, childhood poverty, racism, leads to cumulative stressors- referring to stressors that build up over time.(Karatekin et al. 2022; McEwen and McEwen 2017). Viewing the effects of ACEs through the above-mentioned shifting paradigm in ACEs research emphasized that effects of ACEs are not merely as individual risk factors but as societal challenges that family's face (Kalmakis and Chandler 2015; Karatekin et al. 2022; McEwen and Gregerson 2019; McEwen and McEwen 2017; Scorza et al. 2023). These challenges arise from systemic inequalities and have far-reaching intergenerational consequences. Families affected by ACEs often find themselves trapped in cycles of poverty, as these adverse experiences can severely limit educational attainment and economic opportunities (Kalmakis and Chandler 2015; Karatekin et al. 2022; McEwen and Gregerson 2019; McEwen and McEwen 2017; Scorza et al. 2023).

Therefore, to fully grasp the effects of ACEs, it is vital to explore how socio-economic status and other social determinants interact with health outcomes. This exploration may help to understand the pathways through which these intergenerational effects are transmitted, providing insights into potential intervention points to mitigate these impacts of ACEs on health outcomes over the life-course. The concept of intergenerational effects is elucidated by the social determinants of health inequities framework. This framework involves a detailed analysis of structures, hierarchies, and health determinants. 2w (Karatekin et al. 2022; Solar and Irwin 2010). Structures refer to policies and laws that establish and maintain hierarchies based on race, gender, or income. These hierarchies create and sustain conditions that lead to intermediary health determinants, including stressors associated with ACEs, quality of working and living

conditions, and health-risk behaviors. However, the outcomes of these adversities are not uniform; they vary significantly among diverse groups within the social hierarchy. This variation is due to varying levels of stress, resources, choices, and opportunities, resulting in health inequities (Karatekin et al. 2022; Solar and Irwin 2010). Therefore, achieving equitable health outcomes for all, requires a concerted effort to address the structural factors (i.e., laws and policies) that unequally perpetuate health disparities in a society (Karatekin et al. 2022; Solar and Irwin 2010; Walsh et al. 2019).

In addition, there is a long debate that childhood socio-economic status (SES) is one of the significant factors producing inequalities in health and health behaviors (Adler and Rehkopf 2008; Braveman et al. 2005). According to a meta-analysis based on 35 studies, highlighted that SES is associated with an increasing risk of ACEs and suggested that there is need to introduced policies reducing socio-economic inequality to prevent further adversity (Walsh et al. 2019). Therefore, SES seems to be the first step of the intergenerational effect that influences the rest of life. The ACEs influence the life trajectories of both men and women, but women are more susceptible to poor future health outcomes (Merrick et al. 2018).

Such as the recognition of maternal early life adversities and their association with future birth outcomes is not new, and the inclusion of childhood adversities as part of women's and maternal health care is well-debated in the literature (Dean et al. 2014; Nesari et al. 2018; Olsen 2018; Swift et al. 2024). Several studies have explored the influence of childhood adversities on low birth weight and preterm births via different mediated pathways (Cammack et al. 2019; Gavin et al. 2012; Kane, Harris, and Siega-Riz 2018; Souch et al. 2022). For instance, the study by Kane et al. (2018) found that adolescent health risk factors were not only clustered by family SES but were also embedded within a chain of risk linking family SES to an increased risk of

prenatal smoking (a potential mediator); subsequently associated with lower offspring birthweight. The study by Gavin et al. (2012) also found that childhood SES and offspring birth weight is mediated by different pathways, highlighting the importance of family SES through mediators in lowering offspring birthweight. However, there is a scarcity of research examining its relationship of family SES with pregnancy loss or abortion through various mediating pathways.

Moreover, previous research suggested to examine different pathways that may mediate the effects of ACEs on reproductive health outcomes because reproductive health conditions have multifaceted risk factors, therefore the exploring direct pathway of ACEs to reproductive health outcomes may underestimate the complexity of the their relationship. (Anda, Porter, and Brown 2020; Briggs et al. 2021; Kelly-Irving and Delpierre 2019). Such as, studies indicated that women with history of ACEs are more likely to have unintended pregnancy (versus intended pregnancy) compared to women with no ACEs (Hall et al. 2019a; Testa et al. 2021). However, the specific pathways linking ACEs to unintended pregnancies and their effects on non-live births remain underexplored..

To cap it all, previous research explored the relationship between family SES and adverse birth outcomes (pre-term or low birth weight) through several mediated pathways, highlighting intergenerational inequality paradigms. However, there is a scarcity of research on the relationship between SES and abortion or pregnancy loss via different pathways to capture intergenerational inequality, if any. Therefore, this study aims to explore a chain of pathways from family SES to different socio-demographic mediators (discussed below) to assess how it influences pregnancy intentions and, subsequently, how pregnancy intentions influence pregnancy loss or abortion.

4.1.3 Socio-Demographics Variations: Unintended Pregnancies and Non-Live Births

Socio-demographic variables play a crucial role in pregnancy intentions. Additionally, there is variation in non-live births when socio-demographic variables control the effects. A study conducted by Flink-Bochacki et al. (2017) revealed an association between unintended and unwanted pregnancies ending in miscarriages, but with some variations in reporting by age and marital status. For example, women aged 30-44 years reported unintended pregnancies more frequently than younger women aged 15-19 years. The study also discovered that marital status is linked to the reporting of unintended pregnancies. Unmarried women who had miscarriages reported unintended pregnancies more often than married women who had miscarriages. However, this study did not find any association of race and socio-economic status with unwanted pregnancies ending in miscarriages.

Education, age, and nativity had variations concerning unintended pregnancies. Women in the older age category, between 35 and 46 years, as compared to women aged 20 to 24 years, were found to have a lower risk of experiencing subsequent unplanned pregnancies (Aztlan et al. 2018). In addition, the same study reported that women having higher education (college versus high school degree) had a lower risk of subsequent unplanned pregnancy. Moreover, foreign-born or non-native women also had a lower risk of unplanned pregnancy than native women (Aztlan et al. 2018).

Overall, the previous literature highlights the determinants of unintended pregnancy and how it varies by SES and other socio-demographic variables (marital status, education, age, women's nativity and race). The previous scholarship based on meta-analysis or systematic reviews also highlighted the scarcity of studies exploring unintended pregnancies on pregnancy loss or abortion and other health consequences (Gipson et al. 2008; Hall et al. 2017). The

previous studies highlighted the need to explore the factors of unintended pregnancies and their impact on pregnancy outcomes as such studies may provide an imperative role in making decisions for the provision of family planning services (Bearak et al. 2020; Gipson et al. 2008). Therefore, this study contributes to academic literature by exploring the factors of unintended pregnancies and their impact on pregnancy loss or abortion.

4.2 Theoretical Framework

This study is guided by an ecological systems theory framework, as discussed in Chapter I, which emphasizes the interconnectedness of various environmental systems that influence human development. By focusing on assessing ACEs, the study aims to capture the impacts at both the micro-level (such as the influence or impact of family and close relationships) and the meso-level (such as school environments and social service involvement). Therefore, an extended ACE scale was utilized for this study to provide a comprehensive assessment.

4.2.1 Life-Course Approach and Intergenerational Inequality

In the last two chapters, life course theory was utilized as an overall umbrella approach, proposed by Glen H. Elder (Elder 1998), In this chapter, I tried to explore the link of the socio-economic status of the family with the perspective of the intergenerational transition of inequality. This is because the life-course framework helps understand the intergenerational transmission of inequality.

In this connection, family background is essential for understanding social, economic, and shared culture between parents and children. (Baxter et al. 2022). Within intergenerational transmission of inequality, at least three indicators are widely reported: parent's education, parent's income, and parent's nativity (Baxter et al. 2022; Currie et al. 1997; Duncan et al. 2002; Ensminger and Fothergill 2002; Gavin et al. 2012; Kane et al. 2018). This study used the

"family-of-origin socioeconomic status (Family SES)" concept as a latent variable to reflect these three indicators. This study borrowed the concept of family SES introduced by Kane et al. (2018), highlighting the role of SES on offspring birthweight.

Moreover, racial disparities exist with exposure to ACEs, differs by income or socio-economic status of individuals; White children also report lower levels of ACEs compared to other racial and ethnic groups, (Maguire-Jack, Lanier, and Lombardi 2020; Mersky and Janczewski 2018)). Race is also a determinant of pregnancy loss and abortion, with racial disparities existing in the risk of pregnancy loss, and black women had a higher risk of miscarriage than white women (Mukherjee et al. 2013). In addition, abortion decisions also vary by race, particularly when analysis is based on state laws and women's income-to-poverty status (Solazzo 2019). In addition, race is another crucial factor in the intergenerational transmission of inequality and shaping life experiences, but as race becomes the identity of the children as well, which they carry all over their life course, so given the intersection of race with ACEs and pregnancy outcomes, this study includes race as a control variable. . In addition, variations in ACEs exposure also exist based on nativity, with differences observed between U.S.-born and foreign-born individuals. For instance, foreign-born status has been associated with better birth outcomes, such as lower risks of low birthweight and infant mortality, though these effects can vary by racial group and educational level (Singh and Yu 1996; Acevedo-Garcia et al. 2013). These findings underscore how structural inequalities—such as access to resources, healthcare, and social support—can lead to varying pregnancy outcomes across different demographic groups. Considering these factors, this study extends the analysis to non-live births, adjusting for the nativity of both parents and respondents.

Several studies highlighted that SES or family SES is linked with ACEs, reflecting it as the first intergenerational pathway. A meta-analysis of eighteen studies reflected that lower childhood SES is linked with a higher risk of ACEs (Walsh et al. 2019). In addition, childhood SES influenced educational levels, marital status, and early age at the time of pregnancy (Conger, Conger, and Martin 2010; Letourneau et al. 2019). I chose these indicators to examine pregnancy intentions (Hall et al. 2019; Testa et al. 2021) and birth or pregnancy outcomes (Hegelund, Poulsen, and Mortensen 2019).

Additionally, based on the life-course theory framework concerning the intergenerational process, particularly the accumulation of risk model with clustering and chain of risks, this study examines how family socioeconomic status (SES) is linked to ACEs, and how SES influences education, age at pregnancy, and marital status of women in adulthood. Using the chain of risk component, this study explores how these four factors affect pregnancy intention and how pregnancy intention, as a potential mediator, influences non-live births.

To conclude, this study developed a measurement model guided by the above-mentioned theoretical framework (see Figure 4.1). The study began by drawing a direct path connecting women's family-of-origin socioeconomic status (SES) to non-live births. Based on the literature, as discussed earlier, SES is linked with age at the time of pregnancy, educational level before pregnancy, marital status before pregnancy, and ACEs. In this chapter, the ACEs were represented as a latent variable based on fourteen types of ACEs. All these paths were further linked with potential mediators between these factors and non-live births. The final two paths included the direct effects of unintended pregnancy and ACEs on abortion, which were added to the model.

4.3 Research Question

Relying on the prior research and theoretical underpinnings, the main research question of this study is

- Is family-of-origin socio-economic status associated with non-live births, abortion or pregnancy loss, via mediated pathways? Pathways include the mother's age at the time of pregnancy, maternal educational level before pregnancy, marital status, and exposure to ACEs. How these pathways are further linked linking with pregnancy intentions, subsequently influencing abortion or pregnancy loss.

4.4 Methods

4.4.1 Data

This study utilized a nationally representative United States study known as Add Health. This study utilized the publicly available dataset of Add Health from wave I (1994-1995) to wave IV (2008-2009). Pregnancy related information is used from wave IV dataset, while all other covariates data was used from wave I to wave IV. The documentation of the Add Health implementation procedures for all waves is available on the Add Health website[4].

4.4.2 Study Population

After applying exclusion criteria to filter the data to include only first pregnancies, as discussed in Chapters I and II, the final sample for this study consisted of 2291 first pregnancies, comprising 1482 live births and 809 non-live births (i.e., 428 pregnancy losses and 381 induced abortions).

[4] www.cpc.unc.edu/addhealth

4.4.3 Measures

4.4.3.1 Endogenous Variables

Pregnancy Outcome: The dependent variable was pregnancy outcome (live versus non-live birth) measured based on the question, “How did this pregnancy end?” For disaggregated analysis, it is further divided into two variables: pregnancy loss and abortion. To read more detail about the development of the variables, please see Chapter I.

Adverse Childhood Experiences: For this study, a latent variable of ACE was created by utilizing an extended ACE scale based on 14 categories. Chapter I elaborates on measurement, construction of the scale, and categories.

Unintended Pregnancy: For every pregnancy, women were asked to report whether they “wanted to have a child” at the time just before their pregnancy. A response of "no" was considered an unintended pregnancy.

Age at Time of Pregnancy: The age at the time of pregnancy, on a continuous scale, was calculated by subtracting the birth year from the reported number of pregnancies.

Marital Status before Pregnancy: For each pregnancy, the women were asked to report whether they were “married to each other at the time of (pregnancy/birth),” coded 1 as married, and 0 as not married.

Education before Pregnancy: In every wave, women were asked to report either the grade they were in or the highest grade or year of regular school they completed. Education was measured on a continuous scale, with values ranging from 1 to 13. Lower values corresponded to lower educational levels, such as completing 8th grade or less, while higher values represented higher educational levels, such as completing post-baccalaureate professional education. The latest

available information on the educational level was used as a proxy or substitute for the exact education status before pregnancy, as the exact educational level was not inquired for each pregnancy.

4.4.3.2 Exogenous and Control Variables

Family of Origin Socio-economic Status (SES): Socioeconomic status (SES) was measured as a latent variable indicated by parental education, parental income, and parental nativity. Parental education was measured on a continuous scale, with higher values indicating higher levels of education. Parental income was collected during Wave I, and income variables were converted into log variables to avoid skewness in the data. Additionally, parents were asked whether they were born in the United State or outside – foreign-born. Further details about all these three variables are explained in Chapter I.

Contraceptive Use: For each pregnancy, the women were asked to share whether they were using any kind of birth control, including condoms before the month they got pregnant.

Race: For Structural Equation Modelling, the variable 'race' was dichotomized into non-Hispanic white (coded as 0) and people of color. People of color were defined as women who identified as non-Hispanic Black, Hispanic, or belonging to races other than non-Hispanic White. However, descriptive statistics are also presented utilizing a categorical variable approach.

Nativity. The women were asked to report their citizenship status; the responses were native (born in the United States) or non-native.

4.4.3.3 Statistical Analysis

Based on the study hypothesis regarding the intergenerational relationships between maternal adverse childhood experiences and socioeconomic status, Structural Equation Modeling (SEM) was utilized to gauge these relationships. As the study has path models (SES to mediators

to abortion or pregnancy loss), mediation models (unintended pregnancy, education, marital status, age at time of pregnancy), and latent variables (SES and ACEs), therefore, SEM was a good to handle both measurement and structural models for this study. The measurement model deals with observed to latent variables while the structural model relates latent to latent variables (e.g. SES to ACEs). Therefore, the study utilized SEM for answering the research question. In addition, the endogenous variables of this study were either measured on a continuous scale or binary. The SEM does not require any additional steps to handle continuous variables, but to handle binary variables requires additional methodological steps while setting up the model for analysis. Therefore, to handle the binary variables in the SEM, Weighted Least Squares Mean and Variance Adjusted (WLSMV) was used to get parameter estimates for the model by utilizing R, packages lavaan, and SemTools. There are many other software and packages to handle SEM analysis, but the benefit of lavaan is that it is open source, freely available, and it can handle data with multiple imputation using runMI packages as part of lavaan package.

In addition, to get population-based estimates, the model was measured using sampling weights as the Add Health study recommended. To assess whether the model fit, three goodness-of-fit indicators were used and reported: the Comparative Fit Index (CFI), the Tucker-Lewis Index, and the root mean square error of approximation (RMSEA). The cutoff values for CFI and TLI to deem the model as a good fit must be above 0.90, while an RMSEA value less than 0.05 indicates a good model fit (Bollen and Long 1993). I also used total, direct, and indirect effects of key pathways to see overall model effects as suggested by (Bollen 1989).Moreover, the correlation between exogenous variables or controls has been added to the model. The first factor loading for the latent variable was restricted to 1.

4.5 Results and Interpretations

Table 4.1 represents descriptive statistics for all types of pregnancy outcomes, including live and non-live births. A total of 16.6 percent terminated their pregnancies through abortions. Among them, a substantial majority, 93.7 percent, reported experiencing ACEs measured through an extended ACE scale. On average, they disclosed experiencing almost three types [Mean=2.9; SD=1.9] of ACEs. Among types of ACEs, emotional abuse was the most frequently occurring ACE (54.6 percent), whereas living in foster homes (0.3 percent) was the least frequently occurring ACE. A majority of the women (56.2 percent) were people of color, defined as those who identified themselves as non-Hispanic Black, Hispanic, or belonging to races other than non-Hispanic white (Table 4.1).

Among those who had abortions, a majority of them (85.2 percent) reported not having a child, referring to unintentional pregnancy. While only 35.5 percent of women were using any kind of contraceptives during the month they got pregnant. On average, the women terminated their first pregnancy at the age of 21.7 years, while on average, the women (Mean 3.1; SD=1.2) completed their high school graduation. Around 39 percent of women who had abortions were married (Table 4.1).

Figure 4.1 presents the path coefficient (estimates) and significance (asterisk based on p-values) from the SEM. Overall, the total effect of the model, the intergeneration effect on abortion, was statistically significant (β=63, p=.03, see Table 4.4). However, the direct effects of the SES and ACEs via SES on abortion were not significant. Two indirect pathways fully mediate the association between SES and abortion. First, a higher level of SES was associated with an older age at the time of pregnancy (β=.60, p<.001). Subsequently, this older age, in turn was associated (β=.17, p=.03) with reducing the risk of unintentional pregnancy. The second path indicated that

higher SES increased the likelihood of being married before pregnancy (β=.47, p<.001), which consequently decreased the chances of unintentional pregnancy (β=.42, p<.001). Overall, the unintentional pregnancies had a 53% likelihood (β=.53, p<.001) of resulting in abortion accounting for the effects on race, nativity, and contraceptive use.

The findings also illustrated that a higher level of SES increases the chances of attaining a higher educational level and lowers the likelihood of ACEs. However, neither pathway was statistically significant in mediating SES and unintentional pregnancy. Additionally, the effect of ACEs was neither linked with unintended pregnancy nor related to abortion (Figure 4.1).

The model goodness-of-fit indicates an excellent fit, with CFI and TLI above .95 and RMSEA below 0.05 (see Figure 4.1). The model's R-square for unintentional pregnancy provides insight into how well the model explains the pathways leading to unintentional pregnancy and subsequent abortion, accounting for 30 percent of the variance in unintentional pregnancy. Similarly, the R-square for abortion was 32 percent, indicating that the model captured 32 percent of the variance explained by all variables in the model (Table 4.3).

The intergenerational effects of SES and ACEs were also explored concerning pregnancy loss and overall non-live births. However, the goodness-of-fit for both the pregnancy loss and non-live births models did not appear significant. In the pregnancy loss model, the RMSEA was below 0.05, indicating model fit, but the values of CFI and TLI were below .90 (Table 4.5). While there is debate over whether TLI, CFI, and RMSEA may underestimate the model fit values for categorical data, there no acceptable rules for model fit for categorical data have been established so far as new approaches are still being tested (Cai, Chung, and Lee 2023; Lai 2021; Shi and Maydeu-Olivares 2020; Xia and Yang 2019). I have already utilized WLSMV, which is recommended for handling categorical data. Therefore, I followed the popular established rules

for CFI, TLI, and RMSEA to evaluate the model fit. Moreover, considering theoretical fit rather than just statistical grounds, I added depressive symptoms and health risk behavior indicators, with and without replacing unintentional pregnancies for pregnancy loss and non-live births. However, the model still did not achieve the model fit threshold.

4.6 Discussion

Pregnancy loss and abortion are recognized as outcomes influenced by multifaceted socio-economic inequalities across generations in the United States. Yet, there is still a need to fully understand critical social determinants of health (Braveman, Egerter, and Williams 2011; Crear-Perry et al. 2021; Maness et al. 2016). Relying on past empirical work that situates early-life adverse experiences within a life-course theory framework, this study employs structural equation modeling to analyze the chain of events originating from early-life adversities. These adversities impact later observed attitudes or behaviors in adolescence, adulthood, or even before pregnancy, subsequently influencing pregnancy outcomes. This study assesses these pathways using a normative timed birth population-based sample in the U.S., aiming to shed light on the complex interplay of factors contributing to pregnancy outcomes.

The results demonstrated that childhood adversities (measured through the ACE extended scale) and factors established prior to pregnancy such as educational level, marital status, and age at the time of pregnancy are not only influenced by family-of-origin SES but also contribute to an increased risk of unintentional pregnancy, which in turn is associated with an increased likelihood of having abortion. Specifically, two pathways fully mediated the association between maternal family SES and abortion. The first pathway suggests that lower family SES is associated with an early age at the time of pregnancy, which in turn increases the chances of having an unintentional pregnancy, leading to a propensity to seek abortion. The second pathway

suggests that lower SES is linked to the likelihood of non-marital pregnancies, which increases the chances of unintended pregnancies, subsequently increasing the likelihood of seeking abortion. Marital status and age at the time of pregnancy are linked with unintended pregnancies (Hall et al. 2019b; Testa et al. 2021). Overall, the age at pregnancy is relevant to birth outcomes such. as a study highlighted that age at pregnancy found a mediator between childhood adversity and total fertility (Sheppard, Pearce, and Sear 2016).

This study did not find a statistical association between ACEs and unintentional pregnancies. These results are contrary to those of previous studies, suggesting a need for further investigation into the underlying mechanisms. For instance, Testa et al. (2021) found a significant relationship between ACEs and unintended pregnancies. Another study utilizing the adverse life experiences concept found its association with an increasing rate of unintended pregnancies.

Additionally, the study did not find any association between educational level and unintended pregnancies. The previous literature exploring the relationship of childhood adversities also reported similar results that adolescent education is not associated with pregnancy intentions (Hall et al. 2019b; Testa et al. 2021).

One interpretation of the study is that unintentional pregnancies are situated in the chain of increasing the likelihood of seeking abortion, suggesting that prevention efforts could target breaking this chain. There are several pathways that can be explored by future studies. Such as, considering that contraceptive use and unintentional pregnancies are correlated. Although this study adjusted the analysis by including contraceptive use as a control variable, further exploration is needed to understand how it may reduce the likelihood of unintentional pregnancies. In this study, descriptive statistics indicate a lower uptake of contraceptive methods,

with only 35 percent of women reporting their utilization. While this study initially included contraceptive use as a potential mediator in the model by exploring the causal relationship between unintended pregnancy and contraceptive use, it was ultimately removed due to poor model fit. Several explanations may account for this, including perceived stigma towards abortion, incomplete reporting of abortion cases, and social desirability bias in reporting terminated pregnancies (Lindberg et al. 2020; Tierney 2019). Beyond the scope of this study is investigating the relationship between women's pre-health status and seeking abortion, which is another potential factor influencing contraceptive use and abortion decisions. Another pathway that needs to be explored is the working conditions of women before pregnancy.

This study aligns with fundamental cause theory, advanced by Link and Phelan (1995), which argued that only limited progress could be made in improving health outcomes without addressing the social conditions underlying health problems. Link and Phelan (1995) identify SES as a fundamental cause of health inequalities, creating disparities through various risk-factor mechanisms that change over time. They further emphasized that the people with high-SES use their resources like power, prestige, money, knowledge, and social connections to avoid health risks and mitigate disease consequences. While, on the other side, the people with low-SES with their poor resources are hardly able to avert health risk and its consequences. They explained the role of resources in maintaining health disparities as health inequalities that persist due to the stable socio-economic structure ensuring unequal access to these resources, regardless of changing medical and societal conditions (Link and Phelan 1995; Phelan and Link 2013). So, the findings of the study underscore the importance of successful interventions to create a better childhood environment as well as provide women’s autonomy to make their reproductive

decision in order to disrupt the intergenerational transmission of inequality at the population level.

There are a few limitations to the study. The first limitation of the study was the assumption, imposed by data constraints, that marital status only focused on whether individuals were married, overlooking the reality of cohabitation patterns. With the rise in cohabitation, there is a new form of legitimization based on co-residential partnerships rather than legal marriage (Lichter, Sassler, and Turner 2014; Rackin and Gibson-Davis 2012). For pregnant women, the boundaries between singlehood, cohabitation, and marriage are highly fluid. Thus, this study used the term 'marital status' as asked in the data, 'whether you or your partner were married to each other at the time of pregnancy/birth. Marital status at time of pregnancy was approximated to marital status at birth. However, non-marital status presents technical and conceptual challenges in making assumptions about non-marital fertility or legal pregnancy (Lichter 2013; Lichter et al. 2014). Moreover, there was 48 percent missing data on marital status, highlighting the importance of questionnaire wording and also suggesting reading the conclusion of study with caution.

Another limitation of the study is the inclusion of primiparous (first pregnancy) women, and the mean age of respondents was 22 years old; the women aged between 20 to 29 years accounted for the highest percentage of abortions (Kortsmit 2021). Future research may run a similar analysis on multiparous women. However, the analysis explained 30 percent of the variance in unintentional pregnancy, also suggesting a targeting, reflecting a meaningful association, and suggesting focus intervention to both childhood environment as well as on primiparous women under 30 years of age.

Lastly, assessing pregnancy intention by utilizing a dichotomous definition, such as whether you wanted a child when you got pregnant or not, is another limitation of the study. This limitation is again inherited from the way Add Health data is collected as the Add Health questionnaire did not have subsequent questions to verify whether they wanted a baby earlier or soon (referring to mistimed), or they did not want to have a baby at that time (known as unwanted pregnancy). This limitation is often cited by meta-analysis, as both mistimed and unwanted have different impacts on pregnancy outcomes and make it challenging to have cross-comparison. There is also a debate about reframing the definition so that future studies may utilize a new approach to collect and analyze data. This approach suggests distinguishing between unintended pregnancies that women find acceptable and those that women find unacceptable (Aiken et al. 2016).

4.7 Conclusion

This study shed light on the importance of unpacking long-term, intergenerational processes- the effect of low-income family socio-economic status spills over into low educational level, early pregnancies, non-marital status, and exposure to ACEs. The two pathways fully mediate the relationship between SES to early age at the time of pregnancy and non-marital status leading to having unintentional pregnancies, subsequently increasing the likelihood of having abortion. This study did not find a direct effect of ACEs on abortion, reflecting the importance of intergenerational pathways from SES to intention of pregnancies via their current socio-demographic determinants (marital status and age at the time of pregnancy). This reflects that to break the chain of unintended pregnancies to impact non-live births; there is a need to improve the focus on childhood socio-economic environments.

The findings suggest focusing on childhood circumstances, as lower family-of-origin socioeconomic status reflects structural and systemic inequalities, with parents' education and childhood household income being core factors. Income and educational inequalities result from structural inequalities, leading to low SES in adulthood. With increasing access to contraceptives and prenatal care services, this study provides evidence that there is also a need to change the current unintended pregnancies framework, which limited our focus of attention from structural inequalities to blaming individual reproductive decisions (Aiken et al. 2016; Auerbach et al. 2023; Potter et al. 2019). Otherwise, women with poor childhood socioeconomic status will remain a challenge for the success of family planning and contraceptive efforts to reduce unintended pregnancies. Moreover, it is crucial to ensure safe access to abortion in order to break the chain of intergenerational inequalities with low SES. Previous research indicates that a significant proportion of children that lived in subjective poverty were born to women who were denied abortions compared to those born to women from subsequent pregnancies after receiving abortion (Foster et al. 2018). Therefore, access to safe abortion, that is only possible when it is legal, enables women to “choose to have children when they have greater financial and emotional resources to devote to them”, and can break chain of poor SES intergenerational effects (Foster et al. 2018).

4.8 Tables and Figures: Chapter IV

Table 4.1: Descriptive Statistics of Add Health Sample (N= 2291)*

Variables	Live Births (N=1482) % or mean (SD)	Non–Live Births (NLBs)		
		Pregnancy Loss (N=428) % or mean (SD)	Abortion (N=381) % or mean (SD)	Total NLBs (N=809) % or mean (SD)
Pregnancy Outcome	64.7	18.7	16.6	35.3
Adverse Childhood Experiences (ACEs)				
Extended ACE Scale -Continuous	2.4 (1.9)	2.6 (2.0)	2.9 (1.9)	2.7 (1.9)
Extended ACE Scale - Binary	83.7	85.3	93.7	89.2
Emotional Abuse	40.4	47.4	54.6	50.8
Physical Abuse	20.5	21.3	26.5	23.8
Sexual Abuse	10.2	11.9	14.0	12.9
Violent Crime Victimization	17.8	22.4	22.0	22.2
Substance Abuse	18.1	16.8	17.8	17.3
Parental Divorce	21.4	21.0	27.1	23.8
Suicide	6.1	7.3	8.8	8.0
Incarceration	21.3	25.5	20.8	23.3
Emotional Neglect	24.4	22.6	32.4	27.2
Physical Neglect	29.7	29.1	34.4	31.6
Foster Home	1.9	3.4	0.3	2.0
School Disadvantage	36.0	35.5	37.1	36.2
Neighborhood Disadvantage	27.1	25.9	26.4	26.1
Social Services Involvement	5.6	7.0	8.3	7.6
Covariates				
Unintended Pregnancy	46.8	49.4	85.2	66.3
Contraceptive Use	25.1	27.7	35.5	31.4
Age at Time of Pregnancy	22.4 (3.6)	23.6 (3.8)	21.7 (3.6)	22.7 (3.8)
Education Before Pregnancy	3.3 (1.5)	3.4 (1.6)	3.1 (1.2)	3.2[1.4]
Married Before Pregnancy	70.4	69.3	38.8	61.3
Socio-Demographics				
Race				
Non-Hispanic White	59.3	58.3	43.8	51.1
Non-Hispanic Black	25.8	27.9	38.3	32.8
Hispanics	3.7	3.5	6.6	5.0
Other	11.2	10.3	11.3	10.8
Parents Education- [reflecting completed GED]	5.1(2.3)	5.1(2.3)	5.8(2.3)	5.4(2.3)
Childhood Household Income [Log: 0 – 6.8]	3.4(0.8)	3.4(0.9)	3.6(0.8)	3.5(0.9
Parents Nativity	12.9	11.4	16.3	13.7
Respondent Nativity	5.6	2.5	7.7	4.9

*unweighted descriptive statistics --- **Percentage for the Kaiser ACE scale is presented outside the brackets, while the percentage for the extended ACE scale is enclosed within the brackets.

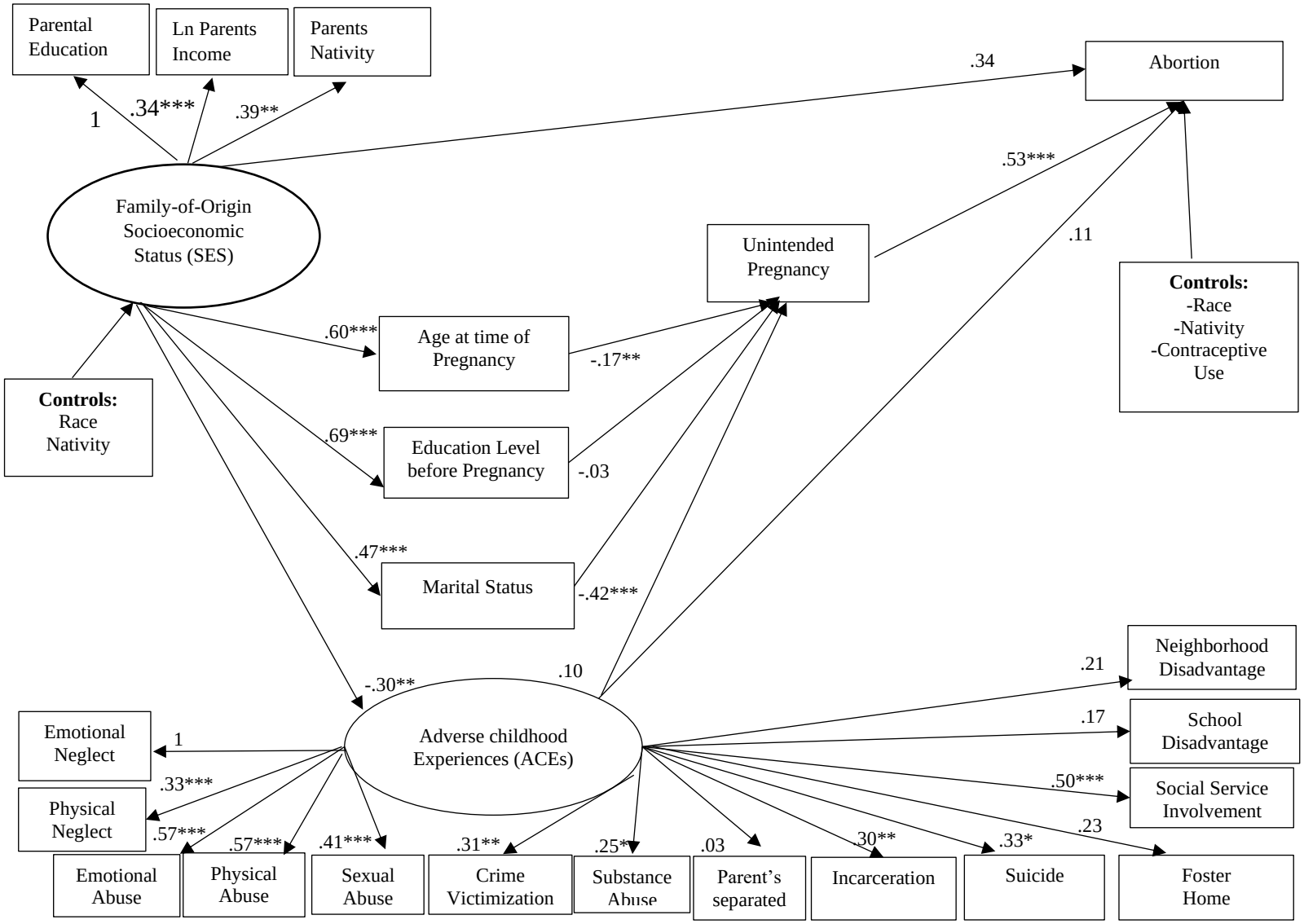

Figure 4.1: Parameter Estimates from the Structural Equation Model of Family-of-Origin Socioeconomic Status, Adverse Childhood Experiences, Socio-Demographics Factors, and Abortion

Notes: ***p < .001, **p < .01, *p < .05 (two-tailed). N = 1863. RMSEA < 0.001, CFI = 1.00, TLI = 1.05. Analyses are weighted and standardized regression estimates were presented. --Correlation between all exogenous variables were included in the analysis but is not shown here (see Table 3.2).

Table 4.2: Covariance between exogenous/control variables from the Structural Equation Model

Variables	Estimates (significance-p value*)
Socioeconomic Status (SES) ~~ Nativity	-0.42**
SES ~~ Race	-0.44***
Race ~~ Nativity	0.52**
SES ~~ Contraceptive Use	0.52*
Race ~~ Contraceptive Use	0.08
Nativity ~~ Contraceptive Use	0.04

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

Table 4.3: R-Square from the Structural Equation Model of Family-of-Origin Socioeconomic Status, Adverse Childhood Experiences, Socio-Demographics Factors, and Abortion

Variables	R-Square
Abortion	0.325
Unintended Pregnancy	0.307
Contraceptive Use	0.001
Age at Time of Pregnancy	0.363
Education Before Pregnancy	0.476
Married Before Pregnancy	0.274
Race	0.000
Parents Education-	0.199
Childhood Household Income	0.177
Parents Nativity	0.161
Respondent Nativity	0.000
ACE-extend scale	0.072
Emotional Neglect –[factor loading 1]	NA
Physical Neglect	0.134
Emotional Abuse	0.387
Physical Abuse	0.385
Sexual Abuse	0.214
Violent Crime Victimization	0.119
Substance Abuse	0.081
Parental Divorce	0.015
Suicide	0.130
Incarceration	0.126
Foster Home	0.077
School Disadvantage	0.039
Neighborhood Disadvantage	0.059
Social Services Involvement	0.301

Table 4.4: Model Effects from the Structural Equation Model

Effects	Description	Estimates (Significance)
Indirect Effect 1	SES -> ACE -> Unintended Pregnancy	.029(p=.375)
Indirect Effect 2	SES -> Education before Pregnancy -> Unintended Pregnancy	.022(p=.813)
Indirect Effect 3	SES -> Marital Status before Pregnancy -> Unintended Pregnancy	.197(p=.002)**
Indirect Effect 4	SES -> Age at time of Pregnancy -> Unintended Pregnancy	.103(p=086)
Total		.632 (p=.035)*

Notes: Standardized estimates are presented

Table 4.5: Results from the Structural Equation Model for Pregnancy Loss and Non-Live Births

Parameters	Pregnancy loss β*	Non-Live Births β*
Pregnancy Outcome ← SES	0.061	0.227***
Pregnancy Outcome ← Unintended Pregnancy	0.028	0.305***
Pregnancy Outcome ← ACE	0.040	0.088**
Unintended Pregnancy ← ACE	0.094	0.103**
Unintended Pregnancy ← Age at Time of Pregnancy	**-0.239*** **	-0.180
Unintended Pregnancy ← Education Before Pregnancy	**-0.046*** **	-0.044
Unintended Pregnancy ← Married Before Pregnancy	**-0.324*** **	-0.380***
ACE ← SES	**-0.255** **	-0.278***
Age at Time of Pregnancy ← SES	**0.696*** **	0.650***
Education Before Pregnancy ← SES	**0.768*** **	0.746***
Married Before Pregnancy ← SES	**0.580*** **	0.530***
Total Effects	0.280	**0.117*** **
CFI	0.658	0.506
TLI	0.610	0.437
RMSEA	**0.046**	0.057

Notes: ***p < .001, **p < .01, *p < .05. … Bold fonts indicate significance…..For CFI, TLI, and RMSEA, standard values are presented. All other estimates are standardized. The analysis is weighted…..Control variables were included in the model, but the estimates are not presented in this table.

4.9 References

Adler, Nancy E., and David H. Rehkopf. 2008. "U.S. Disparities in Health: Descriptions, Causes, and Mechanisms." *Annual Review of Public Health* 29(1):235–52. doi: 10.1146/annurev.publhealth.29.020907.090852.

Aiken, Abigail R. A., Sonya Borrero, Lisa S. Callegari, and Christine Dehlendorf. 2016. "Rethinking the Pregnancy Planning Paradigm: Unintended Conceptions or Unrepresentative Concepts?" *Perspectives on Sexual and Reproductive Health* 48(3):147–51. doi: 10.1363/48e10316.

Anda, Robert F., Laura E. Porter, and David W. Brown. 2020. "Inside the Adverse Childhood Experience Score: Strengths, Limitations, and Misapplications." *American Journal of Preventive Medicine* 59(2):293–95. doi: 10.1016/j.amepre.2020.01.009.

Auerbach, Samantha L., Kate Coleman-Minahan, Amy Alspaugh, E. Angel Aztlan, Lisa Stern, and Katherine Simmonds. 2023. "Critiquing the Unintended Pregnancy Framework." *Journal of Midwifery & Women's Health* 68(2):170–78. doi: 10.1111/jmwh.13457.

Aztlan, Evelyn Angel, Diana Greene Foster, and Ushma Upadhyay. 2018. "Subsequent Unintended Pregnancy Among US Women Who Receive or Are Denied a Wanted Abortion." *Journal of Midwifery & Women's Health* 63(1):45–52. doi: 10.1111/jmwh.12723.

Baxter, Janeen, Jack Lam, Jenny Povey, Rennie Lee, and Stephen R. Zubrick, eds. 2022. *Family Dynamics over the Life Course: Foundations, Turning Points and Outcomes*. Vol. 15. Cham: Springer International Publishing.

Bearak, Jonathan, Anna Popinchalk, Bela Ganatra, Ann-Beth Moller, Özge Tunçalp, Cynthia Beavin, Lorraine Kwok, and Leontine Alkema. 2020. "Unintended Pregnancy and Abortion by Income, Region, and the Legal Status of Abortion: Estimates from a Comprehensive Model for 1990–2019." *The Lancet Global Health* 8(9):e1152–61. doi: 10.1016/S2214-109X(20)30315-6.

Birgisson, Natalia E., Qiuhong Zhao, Gina M. Secura, Tessa Madden, and Jeffrey F. Peipert. 2015. "Preventing Unintended Pregnancy: The Contraceptive CHOICE Project in Review." *Journal of Women's Health* 24(5):349–53. doi: 10.1089/jwh.2015.5191.

Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables*. Vol. 210. John Wiley & Sons.

Bollen, Kenneth A., and J. Scott Long. 1993. *Testing Structural Equation Models*. Vol. 154. Sage.

Braveman, Paula A., Catherine Cubbin, Susan Egerter, Sekai Chideya, Kristen S. Marchi, Marilyn Metzler, and Samuel Posner. 2005. "Socioeconomic Status in Health Research: One Size Does Not Fit All." *JAMA* 294(22):2879–88. doi: 10.1001/jama.294.22.2879.

Braveman, Paula, Susan Egerter, and David R. Williams. 2011. "The Social Determinants of Health: Coming of Age." *Annual Review of Public Health* 32(1):381–98. doi: 10.1146/annurev-publhealth-031210-101218.

Briggs, Ernestine C., Lisa Amaya-Jackson, Karen T. Putnam, and Frank W. Putnam. 2021. "All Adverse Childhood Experiences Are Not Equal: The Contribution of Synergy to Adverse Childhood Experience Scores." *American Psychologist* 76(2):243–52. doi: 10.1037/amp0000768.

Cai, Li, Seung Won Chung, and Taehun Lee. 2023. "Incremental Model Fit Assessment in the Case of Categorical Data: Tucker–Lewis Index for Item Response Theory Modeling." *Prevention Science* 24(3):455–66. doi: 10.1007/s11121-021-01253-4.

Cammack, Alison L., Carol J. Hogue, Carolyn D. Drews-Botsch, Michael R. Kramer, and Brad D. Pearce. 2019. "Associations Between Maternal Exposure to Child Abuse, Preterm Birth, and Very Preterm Birth in Young, Nulliparous Women." *Maternal and Child Health Journal* 23(6):847–57. doi: 10.1007/s10995-018-02709-w.

Conger, Rand D., Katherine J. Conger, and Monica J. Martin. 2010. "Socioeconomic Status, Family Processes,and Individual Development." *Journal of Marriage and Family* 72(3):685–704. doi: 10.1111/j.1741-3737.2010.00725.x.

Crear-Perry, Joia, Rosaly Correa-de-Araujo, Tamara Lewis Johnson, Monica R. McLemore, Elizabeth Neilson, and Maeve Wallace. 2021. "Social and Structural Determinants of Health Inequities in Maternal Health." *Journal of Women's Health* 30(2):230–35. doi: 10.1089/jwh.2020.8882.

Currie, Candace E., Rob A. Elton, Joanna Todd, and Stephen Platt. 1997. "Indicators of Socioeconomic Status for Adolescents: The WHO Health Behaviour in School-Aged Children Survey." *Health Education Research* 12(3):385–97. doi: 10.1093/her/12.3.385.

Dean, Sohni V., Zohra S. Lassi, Ayesha M. Imam, and Zulfiqar A. Bhutta. 2014. "Preconception Care: Closing the Gap in the Continuum of Care to Accelerate Improvements in Maternal, Newborn and Child Health." *Reproductive Health* 11(S3):S1. doi: 10.1186/1742-4755-11-S3-S1.

Dott, Mary, Sonja A. Rasmussen, Carol J. Hogue, and Jennita Reefhuis. 2010. "Association Between Pregnancy Intention and Reproductive-Health Related Behaviors Before and After Pregnancy Recognition, National Birth Defects Prevention Study, 1997–2002." *Maternal and Child Health Journal* 14(3):373–81. doi: 10.1007/s10995-009-0458-1.

Duncan, Greg J., Mary C. Daly, Peggy McDonough, and David R. Williams. 2002. "Optimal Indicators of Socioeconomic Status for Health Research." *American Journal of Public Health* 92(7):1151–57. doi: 10.2105/AJPH.92.7.1151.

Elder, Glen H. 1998. "The Life Course as Developmental Theory." *Child Development* 69(1):1–12. doi: 10.2307/1132065.

Ensminger, Margaret E., and Kate E. Fothergill. 2002. "A Decade of Measuring SES: What It Tells Us and Where to Go From Here." in *Socioeconomic Status, Parenting, and Child Development*. Routledge.

Flink-Bochacki, Rachel, Leslie A. Meyn, Beatrice A. Chen, Sharon L. Achilles, Judy C. Chang, and Sonya Borrero. 2017. "Examining Intendedness among Pregnancies Ending in

Spontaneous Abortion." *Contraception* 96(2):111–17. doi: 10.1016/j.contraception.2017.05.010.

Foster, Diana Greene, M. Antonia Biggs, Sarah Raifman, Jessica Gipson, Katrina Kimport, and Corinne H. Rocca. 2018. "Comparison of Health, Development, Maternal Bonding, and Poverty among Children Born after Denial of Abortion vs after Pregnancies Subsequent to an Abortion." *JAMA Pediatrics* 172(11):1053–60.

Gavin, Amelia R., Elaine Thompson, Tessa Rue, and Yuqing Guo. 2012. "Maternal Early Life Risk Factors for Offspring Birth Weight: Findings from the Add Health Study." *Prevention Science* 13(2):162–72. doi: 10.1007/s11121-011-0253-2.

Gipson, Jessica D., Michael A. Koenig, and Michelle J. Hindin. 2008. "The Effects of Unintended Pregnancy on Infant, Child, and Parental Health: A Review of the Literature." *Studies in Family Planning* 39(1):18–38. doi: 10.1111/j.1728-4465.2008.00148.x.

Hall, Jennifer A., Lorna Benton, Andrew Copas, and Judith Stephenson. 2017. "Pregnancy Intention and Pregnancy Outcome: Systematic Review and Meta-Analysis." *Maternal and Child Health Journal* 21(3):670–704. doi: 10.1007/s10995-016-2237-0.

Hall, Kelli Stidham, Jennifer L. Beauregard, Shelby T. Rentmeester, Melvin Livingston, and Kathleen Mullan Harris. 2019a. "Adverse Life Experiences and Risk of Unintended Pregnancy in Adolescence and Early Adulthood: Implications for Toxic Stress and Reproductive Health." *SSM - Population Health* 7:100344. doi: 10.1016/j.ssmph.2018.100344.

Hall, Kelli Stidham, Jennifer L. Beauregard, Shelby T. Rentmeester, Melvin Livingston, and Kathleen Mullan Harris. 2019b. "Adverse Life Experiences and Risk of Unintended Pregnancy in Adolescence and Early Adulthood: Implications for Toxic Stress and Reproductive Health." *SSM - Population Health* 7:100344. doi: 10.1016/j.ssmph.2018.100344.

Hawks, Rebecca Mahn, Aileen P. McGinn, Peter S. Bernstein, and Jonathan N. Tobin. 2018. "Exploring Preconception Care: Insurance Status, Race/Ethnicity, and Health in the Pre-Pregnancy Period." *Maternal and Child Health Journal* 22(8):1103–10. doi: 10.1007/s10995-018-2494-1.

Hegelund, Emilie Rune, Gry Juul Poulsen, and Laust Hvas Mortensen. 2019. "Educational Attainment and Pregnancy Outcomes: A Danish Register-Based Study of the Influence of Childhood Social Disadvantage on Later Socioeconomic Disparities in Induced Abortion, Spontaneous Abortion, Stillbirth and Preterm Delivery." *Maternal and Child Health Journal* 23(6):839–46. doi: 10.1007/s10995-018-02704-1.

Kalmakis, Karen A., and Genevieve E. Chandler. 2015. "Health Consequences of Adverse Childhood Experiences: A Systematic Review." *Journal of the American Association of Nurse Practitioners* 27(8):457–65. doi: 10.1002/2327-6924.12215.

Kane, Jennifer B., Kathleen Mullan Harris, and Anna Maria Siega-Riz. 2018. "Intergenerational Pathways Linking Maternal Early Life Adversity to Offspring Birthweight." *Social Science & Medicine* 207:89–96. doi: 10.1016/j.socscimed.2018.04.049.

Kane, Jennifer B., and Claire Margerison-Zilko. 2017. “Theoretical Insights into Preconception Social Conditions and Perinatal Health: The Role of Place and Social Relationships.” *Population Research and Policy Review* 36(5):639–69. doi: 10.1007/s11113-017-9430-8.

Karatekin, Canan, Susan M. Mason, Amy Riegelman, Caitlin Bakker, Shanda Hunt, Bria Gresham, Frederique Corcoran, and Andrew Barnes. 2022. “Adverse Childhood Experiences: A Scoping Review of Measures and Methods.” *Children and Youth Services Review* 136:106425. doi: 10.1016/j.childyouth.2022.106425.

Kelly-Irving, Michelle, and Cyrille Delpierre. 2019. “A Critique of the Adverse Childhood Experiences Framework in Epidemiology and Public Health: Uses and Misuses.” *Social Policy and Society* 18(3):445–56. doi: 10.1017/S1474746419000101.

Kortsmit, Katherine. 2021. “Abortion Surveillance — United States, 2019.” *MMWR. Surveillance Summaries* 70. doi: 10.15585/mmwr.ss7009a1.

Lai, Keke. 2021. “Fit Difference Between Nonnested Models Given Categorical Data: Measures and Estimation.” *Structural Equation Modeling: A Multidisciplinary Journal* 28(1):99–120. doi: 10.1080/10705511.2020.1763802.

Letourneau, N., D. Dewey, B. J. Kaplan, H. Ntanda, J. Novick, J. C. Thomas, A. J. Deane, B. Leung, K. Pon, G. F. Giesbrecht, and the APrON Study Team. 2019. “Intergenerational Transmission of Adverse Childhood Experiences via Maternal Depression and Anxiety and Moderation by Child Sex.” *Journal of Developmental Origins of Health and Disease* 10(1):88–99. doi: 10.1017/S2040174418000648.

Lichter, Daniel T. 2013. “Integration or Fragmentation? Racial Diversity and the American Future.” *Demography* 50(2):359–91. doi: 10.1007/s13524-013-0197-1.

Lichter, Daniel T., Sharon Sassler, and Richard N. Turner. 2014. “Cohabitation, Post-Conception Unions, and the Rise in Nonmarital Fertility.” *Social Science Research* 47:134–47. doi: 10.1016/j.ssresearch.2014.04.002.

Lindberg, Laura, Kathryn Kost, Isaac Maddow-Zimet, Sheila Desai, and Mia Zolna. 2020. “Abortion Reporting in the United States: An Assessment of Three National Fertility Surveys.” *Demography* 57(3):899–925. doi: 10.1007/s13524-020-00886-4.

Link, Bruce G., and Jo Phelan. 1995. “Social Conditions As Fundamental Causes of Disease.” *Journal of Health and Social Behavior* 80–94. doi: 10.2307/2626958.

Maguire-Jack, Kathryn, Paul Lanier, and Brianna Lombardi. 2020. “Investigating Racial Differences in Clusters of Adverse Childhood Experiences.” *American Journal of Orthopsychiatry* 90(1):106.

Maness, Sarah B., Eric R. Buhi, Ellen M. Daley, Julie A. Baldwin, and Jeffrey D. Kromrey. 2016. “Social Determinants of Health and Adolescent Pregnancy: An Analysis From the National Longitudinal Study of Adolescent to Adult Health.” *Journal of Adolescent Health* 58(6):636–43. doi: 10.1016/j.jadohealth.2016.02.006.

McEwen, Craig A., and Scout F. Gregerson. 2019. “A Critical Assessment of the Adverse Childhood Experiences Study at 20 Years.” *American Journal of Preventive Medicine* 56(6):790–94. doi: 10.1016/j.amepre.2018.10.016.

McEwen, Craig A., and Bruce S. McEwen. 2017. “Social Structure, Adversity, Toxic Stress, and Intergenerational Poverty: An Early Childhood Model.” *Annual Review of Sociology* 43(Volume 43, 2017):445–72. doi: 10.1146/annurev-soc-060116-053252.

Merrick, Melissa T., Derek C. Ford, Katie A. Ports, and Angie S. Guinn. 2018. “Prevalence of Adverse Childhood Experiences From the 2011-2014 Behavioral Risk Factor Surveillance System in 23 States.” *JAMA Pediatrics* 172(11):1038. doi: 10.1001/jamapediatrics.2018.2537.

Mersky, Joshua P., and Colleen E. Janczewski. 2018. “Racial and Ethnic Differences in the Prevalence of Adverse Childhood Experiences: Findings from a Low-Income Sample of U.S. Women.” *Child Abuse & Neglect* 76:480–87. doi: 10.1016/j.chiabu.2017.12.012.

NCHS, (National Center for Health Statistics). 2021. “Reduce the Proportion of Unintended Pregnancies — FP-01 - Healthy People 2030 | Health.Gov.” Retrieved June 21, 2024 (https://health.gov/healthypeople/objectives-and-data/browse-objectives/family-planning/reduce-proportion-unintended-pregnancies-fp-01).

Nesari, Maryam, Joanne K. Olson, Ben Vandermeer, Linda Slater, and David M. Olson. 2018. “Does a Maternal History of Abuse before Pregnancy Affect Pregnancy Outcomes? A Systematic Review with Meta-Analysis.” *BMC Pregnancy and Childbirth* 18(1):404. doi: 10.1186/s12884-018-2030-8.

Olsen, Jeanette M. 2018. “Integrative Review of Pregnancy Health Risks and Outcomes Associated With Adverse Childhood Experiences.” *Journal of Obstetric, Gynecologic & Neonatal Nursing* 47(6):783–94. doi: 10.1016/j.jogn.2018.09.005.

Phelan, Jo C., and Bruce G. Link. 2013. “Fundamental Cause Theory.” Pp. 105–25 in *Medical Sociology on the Move: New Directions in Theory*, edited by W. C. Cockerham. Dordrecht: Springer Netherlands.

Potter, Joseph E., Amanda Jean Stevenson, Kate Coleman-Minahan, Kristine Hopkins, Kari White, Sarah E. Baum, and Daniel Grossman. 2019. “Challenging Unintended Pregnancy as an Indicator of Reproductive Autonomy.” *Contraception* 100(1):1–4. doi: 10.1016/j.contraception.2019.02.005.

Rackin, Heather, and Christina M. Gibson-Davis. 2012. “The Role of Pre- and Postconception Relationships for First-Time Parents.” *Journal of Marriage and Family* 74(3):526–39. doi: 10.1111/j.1741-3737.2012.00974.x.

Rossen, Lauren, Brady Hamilton E., Joyce Abma, Elizabeth C.W., Vladislav Beresovsky, Andriana Resendez, Anjani Chandra, and Joyce Martin. 2023. *Updated Methodology to Estimate Overall and Unintended Pregnancy Rates in the United States*. National Center for Health Statistics (U.S.). doi: 10.15620/cdc:124395.

Scorza, Pamela, Cristiane S. Duarte, Seonjoo Lee, Haotian Wu, Jonathan Posner, Andrea Baccarelli, and Catherine Monk. 2023. “Epigenetic Intergenerational Transmission:

Mothers' Adverse Childhood Experiences and DNA Methylation." *Journal of the American Academy of Child & Adolescent Psychiatry*. doi: 10.1016/j.jaac.2023.02.018.

Sheppard, Paula, Mark S. Pearce, and Rebecca Sear. 2016. "How Does Childhood Socioeconomic Hardship Affect Reproductive Strategy? Pathways of Development." *American Journal of Human Biology* 28(3):356–63. doi: 10.1002/ajhb.22793.

Shi, Dexin, and Alberto Maydeu-Olivares. 2020. "The Effect of Estimation Methods on SEM Fit Indices." *Educational and Psychological Measurement* 80(3):421–45. doi: 10.1177/0013164419885164.

Solar, Orielle, and Alec Irwin. 2010. *A Conceptual Framework for Action on the Social Determinants of Health*. WHO Document Production Services.

Souch, Alistair J., Ian R. Jones, Katherine H. M. Shelton, and Cerith S. Waters. 2022. "Maternal Childhood Maltreatment and Perinatal Outcomes: A Systematic Review." *Journal of Affective Disorders* 302:139–59. doi: 10.1016/j.jad.2022.01.062.

Swift, Alison, Madison Berry, Madeline Fernandez-Pineda, and Amanda Haberstroh. 2024. "An Integrative Review of Adverse Childhood Experiences and Reproductive Traumas of Infertility and Pregnancy Loss." *Journal of Midwifery & Women's Health* 69(2):258–78. doi: 10.1111/jmwh.13585.

Testa, Alexander, Dylan B. Jackson, Kyle T. Ganson, and Jason M. Nagata. 2021. "Maternal Adverse Childhood Experiences and Pregnancy Intentions." *Annals of Epidemiology* 64:47–52. doi: 10.1016/j.annepidem.2021.09.011.

Tierney, Katherine I. 2019. "Abortion Underreporting in Add Health: Findings and Implications." *Population Research and Policy Review* 38(3):417–28. doi: 10.1007/s11113-019-09511-8.

Torve, Megan, and Keith Hansen. 2023. "Preventing Unintended Pregnancies: A Review of Long-Acting Reversible Contraception." *South Dakota Medicine: The Journal of the South Dakota State Medical Association* 76(3):132–36.

Walsh, David, Gerry McCartney, Michael Smith, and Gillian Armour. 2019. "Relationship between Childhood Socioeconomic Position and Adverse Childhood Experiences (ACEs): A Systematic Review." *Journal of Epidemiology and Community Health* 73(12):1087–93. doi: 10.1136/jech-2019-212738.

Xia, Yan, and Yanyun Yang. 2019. "RMSEA, CFI, and TLI in Structural Equation Modeling with Ordered Categorical Data: The Story They Tell Depends on the Estimation Methods." *Behavior Research Methods* 51(1):409–28. doi: 10.3758/s13428-018-1055-2.

CHAPTER V
Discussion and Conclusion

A substantial body of research has explored the effect of Adverse Childhood Experiences (ACEs) and family socioeconomic status (SES) on birth outcomes such as pre-term birth or low birth weight infants (Cammack et al. 2019; Gavin et al. 2012; Hall et al. 2019; Kane and Margerison-Zilko 2017; Walsh et al. 2019). This body of research suggests that pre-pregnancy conditions may result from structural inequalities via SES or ACEs rather than individual choices alone (Aiken et al. 2016; Dehlendorf, Harris, and Weitz 2013; Karatekin et al. 2022; Potter et al. 2019; Steinberg et al. 2016). However, limited literature has explored the effects of ACEs and family SES on the risk of pregnancy loss and the likelihood of abortion by utilizing a nationally representative dataset. In addition, given the data limitations related to reporting of abortion and pregnancy loss due to abortion stigma in social surveys (Lindberg et al. 2020; Lindberg and Scott 2018; Tierney 2019), this research aimed to explore how an overall analysis using the term "non-live births" can facilitate providing holistic information compared to disaggregated data on pregnancy loss and abortion.

Considering the social stress, life-course and intergenerational transmission of inequality frameworks, this study assessed the extent to which maternal exposure to ACEs were associated with non-live births and how unintended pregnancy modulate the effects of SES and ACEs on non-live births? Within the remits of the primary research inquiry, the study answers three research questions by utilizing the National Longitudinal Study Adolescent to Adulthood (known as Add Health). This study utilized two popular scales to measure ACEs. The ACE scale is based on a score concept, and the most

popular ACE scale is renowned as the conventional ACE scale or Kaiser ACE study (reflecting 10 types of ACEs) and the extended ACE scale (capturing 14 types of ACEs).

The first research question was formulated to answer whether there was a statistically significant association between exposure to ACEs, assessed through both conventional and extended ACE scales with different levels of measurements, after controlling for a set of confounders, and (i) abortion; (ii) pregnancy loss; and (iii) non-live births. In this study, I found that the accumulation of ACEs through different levels of measurements (cumulative, binary, or number of ACEs) assessed through either conventional or extended ACE scale indicates an association with abortion. In addition, my study found no relationship between ACEs and pregnancy loss during their first or all pregnancies. On one side,, the aggregated analysis using term non-live births provides a glimpse of the association of ACEs with non-live births as compared to live births. This is particularly important in the context that this study did not find an association of pregnancy loss with ACEs which is contradictory to fully or partially with four previously conducted studies in the USA (Freedman et al. 2017; Hillis et al. 2004; Mersky and Lee 2019).. Though both conventional and extended scales predicted a statistically significant relationship with non-live births and abortion, using an extended scale provided a higher percentage of odds than the conventional scale. Therefore, the study suggests considering the expanded ACE scale for future studies.

The second research question answered whether there is a statistically significant association between exposure to ACEs after controlling for a list of covariates and confounders, and: (i) abortion; (ii) pregnancy loss; and (iii) non-live births. I found no association between ACEs and pregnancy loss. While women with a history of ACEs had

a higher likelihood of having an abortion compared to women with no ACEs. Being married and alcohol drinking were found as predictors of abortion in adjusted models. Nevertheless, in overall analysis, this study provided a set of predictors and found that exposure to ACEs increased the likelihood of non-live births. For instance, the chronic health conditions appeared significant in overall analysis (non-live births); while the health conditions did not show a significant association with abortion in disaggregated analysis. However, previous studies conducted in the United States have indicated that a substantial percentage of women seek abortion due to their poor mental, physical, or chronic health conditions (Biggs et al. 2013; Finer et al. 2005). Therefore, one of the reasons for this insignificance of chronic health conditions with abortion in this study might happened due to underreporting of abortion. Thus, these variations suggest that future studies utilizing social survey data should consider providing "overall analysis (non-live births)", to avoid erroneous reporting and interpretations of factors influencing pregnancy loss and abortion. Though non-live births provide a set of factors that are appeared significant in disaggregated analysis on abortion and pregnancy loss, it did not provide a holistic set of predictors. This may suggest that providing analysis by non-live births alongside disaggregated analysis on abortion and pregnancy loss may partially provide a set of predictors, however this may not be the best approach to follow in future studies. So, the findings emphasize a need to improve methods for obtaining quality data on abortion count.

The third research question focused on the intergenerational effects of family-of-origin Socio-Economic Status (SES) on pregnancy loss or abortion via pathways of unintentional pregnancy through other mediators such as the mother's age at the time of

pregnancy, maternal educational level before pregnancy, and marital status. The results demonstrated that childhood adversities (measured through the ACE extended scale) and pre-pregnancy factors such as educational level, marital status, and age at the time of pregnancy are not only influenced or clustered by family-of-origin SES but also contribute to an increased risk of unintentional pregnancy, which in turn is associated with an increased risk of abortion. Specifically, two pathways fully mediated the association between maternal family SES and abortion. The first pathway posits that lower family SES leads to pregnancies at an earlier age, which raises the chances of unintentional pregnancies and a subsequent increase in seeking abortions. The second pathway suggests that lower SES is tied to non-marital pregnancies, which tend to be unintended, thus elevating the likelihood of seeking abortion .

This study adds to a growing interest in applying the life-course and intergenerational approaches to the pre-pregnancy care continuum to reduce pregnancy loss; and improve overall maternal and child health. The findings suggest the need to broaden the scope of pre-pregnancy care beyond childbearing age to encompass maternal childhood (Dean et al. 2014). Along with improving prenatal care to enhance pre-pregnancy conditions, this study also emphasizes the need to create safer environments for children, particularly girls, given that the effects of childhood adversities influence pregnancy loss. To effectively address reproductive health disparities, it is crucial to implement policies that not only improve pre-pregnancy factors such as health and socio-economic conditions but also actively work to reduce structural inequalities faced by children. This holistic approach ensures that both immediate health concerns and long-term societal inequities are addressed, fostering better outcomes for future generations.

The findings suggest to continue screening for ACEs in healthcare settings and schools to measure the prevalence of ACEs. (Dube 2018; Oral et al. 2016). In addition, there is also a need to screen adolescents for chronic health condition.

This study identified a significant association between ACEs and the likelihood of having an abortion, adjusting for pre-pregnancy conditions and childhood socio-demographics. These findings emphasize the crucial role of childhood experiences, viewed through a life-course lens, in shaping reproductive outcomes by interconnecting social, psychological, and biological factors. . This study adopts comprehensive approaches that encompass the entirety of an individual's life experiences to better understand and tackle reproductive health disparities . It highlights that pre-pregnancy conditions are outcomes of cumulative stressors and disadvantages unfolding across life stages. Therefore, effective reproductive health interventions must address broader societal inequalities and establish support systems to mitigate the effects of early adversities. In terms of abortion, the study indicates that safe access is essential for women with complex backgrounds and histories of social adversity, helping to prevent the transmission of disadvantages to future generations.(Biggs et al. 2013; Chae et al. 2017; Finer et al. 2005; Foster et al. 2022). Furthermore, the study provides evidence for revising the current unintended pregnancies framework, urging a shift from blaming individual reproductive decisions to addressing structural inequalities. (Aiken et al. 2016; Auerbach et al. 2023; Potter et al. 2019). Failure to make this shift will leave women with poor childhood socioeconomic status as a persistent challenge for successful family planning and contraceptive efforts to reduce unintended pregnancies and non-live births.

5.1 References

Aiken, Abigail R. A., Sonya Borrero, Lisa S. Callegari, and Christine Dehlendorf. 2016. "Rethinking the Pregnancy Planning Paradigm: Unintended Conceptions or Unrepresentative Concepts?" *Perspectives on Sexual and Reproductive Health* 48(3):147–51. doi: 10.1363/48e10316.

Auerbach, Samantha L., Kate Coleman-Minahan, Amy Alspaugh, E. Angel Aztlan, Lisa Stern, and Katherine Simmonds. 2023. "Critiquing the Unintended Pregnancy Framework." *Journal of Midwifery & Women's Health* 68(2):170–78. doi: 10.1111/jmwh.13457.

Biggs, M. Antonia, Heather Gould, and Diana Greene Foster. 2013. "Understanding Why Women Seek Abortions in the US." *BMC Women's Health* 13(1):29. doi: 10.1186/1472-6874-13-29.

Cammack, Alison L., Carol J. Hogue, Carolyn D. Drews-Botsch, Michael R. Kramer, and Brad D. Pearce. 2019. "Associations Between Maternal Exposure to Child Abuse, Preterm Birth, and Very Preterm Birth in Young, Nulliparous Women." *Maternal and Child Health Journal* 23(6):847–57. doi: 10.1007/s10995-018-02709-w.

Chae, Sophia, Sheila Desai, Marjorie Crowell, and Gilda Sedgh. 2017. "Reasons Why Women Have Induced Abortions: A Synthesis of Findings from 14 Countries." *Contraception* 96(4):233–41. doi: 10.1016/j.contraception.2017.06.014.

Dean, Sohni V., Zohra S. Lassi, Ayesha M. Imam, and Zulfiqar A. Bhutta. 2014. "Preconception Care: Closing the Gap in the Continuum of Care to Accelerate Improvements in Maternal, Newborn and Child Health." *Reproductive Health* 11(S3):S1. doi: 10.1186/1742-4755-11-S3-S1.

Dehlendorf, Christine, Lisa H. Harris, and Tracy A. Weitz. 2013. "Disparities in Abortion Rates: A Public Health Approach." *American Journal of Public Health* 103(10):1772–79. doi: 10.2105/AJPH.2013.301339.

Dube, Shanta R. 2018. "Continuing Conversations about Adverse Childhood Experiences (ACEs) Screening: A Public Health Perspective." *Child Abuse & Neglect* 85:180–84. doi: 10.1016/j.chiabu.2018.03.007.

Finer, Lawrence B., Lori F. Frohwirth, Lindsay A. Dauphinee, Susheela Singh, and Ann M. Moore. 2005. "Reasons U.S. Women Have Abortions: Quantitative and Qualitative Perspectives." *Perspectives on Sexual and Reproductive Health* 37(3):110–18. doi: 10.1111/j.1931-2393.2005.tb00045.x.

Foster, D. G., M. A. Biggs, L. Ralph, C. Gerdts, S. Roberts, and M. M. Glymour. 2022. "Socioeconomic Outcomes of Women Who Receive and Women Who Are Denied Wanted Abortions in the United States." *American Journal of Public Health* 112(9):1290–96. doi: 10.2105/AJPH.2017.304247.

Freedman, Alexa A., Alison L. Cammack, Jeff R. Temple, Robert M. Silver, Donald J. Dudley, Barbara J. Stoll, Michael W. Varner, George R. Saade, Deborah Conway, Robert L. Goldenberg, and Carol J. Hogue. 2017. "Maternal Exposure to Childhood Maltreatment

and Risk of Stillbirth." *Annals of Epidemiology* 27(8):459-465.e2. doi: 10.1016/j.annepidem.2017.07.005.

Gavin, Amelia R., Elaine Thompson, Tessa Rue, and Yuqing Guo. 2012. "Maternal Early Life Risk Factors for Offspring Birth Weight: Findings from the Add Health Study." *Prevention Science* 13(2):162–72. doi: 10.1007/s11121-011-0253-2.

Hall, Kelli Stidham, Jennifer L. Beauregard, Shelby T. Rentmeester, Melvin Livingston, and Kathleen Mullan Harris. 2019. "Adverse Life Experiences and Risk of Unintended Pregnancy in Adolescence and Early Adulthood: Implications for Toxic Stress and Reproductive Health." *SSM - Population Health* 7:100344. doi: 10.1016/j.ssmph.2018.100344.

Hillis, Susan D., Robert F. Anda, Shanta R. Dube, Vincent J. Felitti, Polly A. Marchbanks, and James S. Marks. 2004. "The Association between Adverse Childhood Experiences and Adolescent Pregnancy, Long-Term Psychosocial Consequences, and Fetal Death." *Pediatrics* 113(2):320–27. doi: 10.1542/peds.113.2.320.

Kane, Jennifer B., and Claire Margerison-Zilko. 2017. "Theoretical Insights into Preconception Social Conditions and Perinatal Health: The Role of Place and Social Relationships." *Population Research and Policy Review* 36(5):639–69. doi: 10.1007/s11113-017-9430-8.

Karatekin, Canan, Susan M. Mason, Amy Riegelman, Caitlin Bakker, Shanda Hunt, Bria Gresham, Frederique Corcoran, and Andrew Barnes. 2022. "Adverse Childhood Experiences: A Scoping Review of Measures and Methods." *Children and Youth Services Review* 136:106425. doi: 10.1016/j.childyouth.2022.106425.

Lindberg, Laura, Kathryn Kost, Isaac Maddow-Zimet, Sheila Desai, and Mia Zolna. 2020. "Abortion Reporting in the United States: An Assessment of Three National Fertility Surveys." *Demography* 57(3):899–925. doi: 10.1007/s13524-020-00886-4.

Lindberg, Laura, and Rachel H. Scott. 2018. "Effect of ACASI on Reporting of Abortion and Other Pregnancy Outcomes in the US National Survey of Family Growth." *Studies in Family Planning* 49(3):259–78. doi: 10.1111/sifp.12068.

Mersky, Joshua P., and ChienTi Plummer Lee. 2019. "Adverse Childhood Experiences and Poor Birth Outcomes in a Diverse, Low-Income Sample." *BMC Pregnancy and Childbirth* 19(1):387. doi: 10.1186/s12884-019-2560-8.

Oral, Resmiye, Marizen Ramirez, Carol Coohey, Stephanie Nakada, Amy Walz, Angela Kuntz, Jenna Benoit, and Corinne Peek-Asa. 2016. "Adverse Childhood Experiences and Trauma Informed Care: The Future of Health Care." *Pediatric Research* 79(1–2):227–33. doi: 10.1038/pr.2015.197.

Potter, Joseph E., Amanda Jean Stevenson, Kate Coleman-Minahan, Kristine Hopkins, Kari White, Sarah E. Baum, and Daniel Grossman. 2019. "Challenging Unintended Pregnancy as an Indicator of Reproductive Autonomy." *Contraception* 100(1):1–4. doi: 10.1016/j.contraception.2019.02.005.

Steinberg, Julia R., Jeanne M. Tschann, Dorothy Furgerson, and Cynthia C. Harper. 2016. "Psychosocial Factors and Pre-Abortion Psychological Health: The Significance of Stigma." *Social Science & Medicine* 150:67–75. doi: 10.1016/j.socscimed.2015.12.007.

Tierney, Katherine I. 2019. "Abortion Underreporting in Add Health: Findings and Implications." *Population Research and Policy Review* 38(3):417–28. doi: 10.1007/s11113-019-09511-8.

Walsh, David, Gerry McCartney, Michael Smith, and Gillian Armour. 2019. "Relationship between Childhood Socioeconomic Position and Adverse Childhood Experiences (ACEs): A Systematic Review." *Journal of Epidemiology and Community Health* 73(12):1087–93. doi: 10.1136/jech-2019-212738.

Appendix A: Items for Scale Adverse Childhood Experiences

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no. Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
Abuse					
1. Emotional Abuse	(Testa and Jackson 2020) (Kim, Lee, and Park 2020)	Wave IV Main Respondent (Adolescent) H4MA1	"Before your 18th birthday, how often did a parent or other adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?"	0 or 6 = never happened, 5 = more than 10 times	0 = never or once, 1 = more than once
2.Physical Abuse	(Testa and Jackson 2020) (Kim et al. 2020) (Brumley et al. 2019) (Schwartz, Wright, and Valgardson 2019)	Wave IV Main Respondent (Adolescent) H4MA3	"Before your 18th birthday, how often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on the floor, into a wall, or down-stairs?"	0 or 6 = never happened, 5 = more than 10 times	0 = never or once, 1 = more than once
		Wave III Main Respondent (Adolescent) H3MA3	By six grades, how often had your parents or other adult caregivers slapped, hit, or kicked you?"	6 = never happened, 1= once to 5 = more than 10 times	Using Brumley method for sexual abuse: : 0 = never ("never"' at both waves, Wave III with missing values on Wave IV, or Wave IV with missing values at Wave III), 1 = at least once (reported at both waves and only Wave IV
3.Sexual Abuse	(Testa and Jackson 2020) (Kim et al. 2020)	Wave IV Main Respondent (Adolescent)	Wave IV: "Before your 18th birthday how often had one of your parents or other adult care-givers touched you in a sexual way, forced you	0 or 6 = never happened, 5 = more than 10 times	0 = never at both waves, 1 = at least once

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no. Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
	(Brumley et al. 2019) (Schwartz et al. 2019)	 H4MA5	to touch him or her in a sexual way, or forced you to have sexual relations?"		Using Brumley: 0 = never ("never"' at both waves, Wave III with missing values on Wave IV, or Wave IV with missing values at Wave III), 1 = at least once (reported at both waves and only Wave IV)
	(Testa and Jackson 2020) (Brumley et al. 2019)	Wave III Main Respondent (Adolescent) H3MA4	"Before 6th grade, how often had one of your parents or other adult care-givers touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations?"	0 = never happened, 5 = more than 10 times	0 = never at both waves, 1 = at least once
Household Challenges					
4.Community Violence	(Testa and Jackson 2020) (Brumley et al. 2019) (Anto et al. 2021)	Wave 1 H1FV1 H1FV2 H1FV3 H1FV4	Wave I: "During the past 12 months, how often did you see someone shoot or stab another person" Wave I: "During the past 12 months, how often did someone pull a knife or gun on you" Wave I: "During the past 12 months, how often did someone shoot or stab you"	0 = never, 2 = more than once	0 = no exposure, 1 = any exposure
	(Testa and Jackson 2020)		Wave I: "During the past 12 months, how often did someone cut or stab you"		
	(Anto et al. 2021)	Wave 1 H1FV6	Anto: During the past 12 months, did the following happen? If so, how often? You were jumped or beaten up.	0 = never, 1 & 2 = more than once	0 = no exposure, 1 = any exposure

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no.** **Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
5.Substance Abuse in the Household	(Testa and Jackson 2020) (Kim et al. 2020) (Brumley et al. 2019) (Anto et al. 2021) (Schwartz et al. 2019)	Wave 1 Parent Survey Bio_mother PC49E_2 Bio_Dad PC49E_3	"Does respondent's biological mother currently have the following health problem: Alcoholism" "Does respondent's biological mother currently have the following health problem: Alcoholism" [note, Kim used these question, one for mother and one for father, so please check either there are two questions for mother, or one is for father and one for mother, mother question as two time, may be typo mistake in Testa and Jackson article Appendix A]	Parent Survey: Yes/No Wave I: Yes/No	0 = no, 1 = yes
	(Testa and Jackson 2020)	Wave 1 Main Respondent (Adolescent) H1TO52	Wave I: "Are illegal drugs easily available to you in your home"		
6. Parental separation or divorce	(Testa and Jackson 2020) (Kim et al. 2020)	Wave 1 Parent Survey PA10	"What is your current marital status"	1 = single, never married; 2 = married; 3 = widowed, 4 = divorced, 5 = separated	0 = not divorced or separated. 1 = divorced or separated (Kim et al. 2020)… used. 1 = if parent had never married, divorced or widowed. 0= if a respondent had married parents

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no.** **Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
7.Suicide exposure	(Testa and Jackson 2020) (Anto et al. 2021)	Wave I family H1SU7	"Have any of your family members succeeded in committing suicide in the past 12 months?"	Yes/No	0 = no, 1 = yes
	(Kim et al. 2020) (Anto et al. 2021)	Wave I Main Respondent (Adolescent) Family attempted. suicide H1SU6	Have any of your family members tried to kill themselves during the past 12 months?	Yes/No	0 = no, 1 = yes
8.Incarcerated household member (adult)	(Testa and Jackson 2020) (Kim et al. 2020) (Brumley et al. 2019) (Schwartz et al. 2019)	Wave IV Main Respondent (Adolescent) H4WP3 H4WP9 H4WP16 H4WP30	"(Has/did) your (biological mother/ biological father/mother figure/father figure) ever (spent/spend) time in jail or prison?" These are four questions… each question for each..	Yes/No	0 = no parent or guardian incarcerated prior to age 18. 1 = Yes, parent or guardian incarcerated prior to age 18
Neglect					
9.Emotional Neglect	(Testa and Jackson 2020) Only first two items are used by (Kim et al. 2020)	Wave I H1PF1 H1PF23	(average of relevant items): Do you agree or disagree with the following statement?	1 = strongly agree; 5 = strongly disagree	0 = bottom 80% of low warmth. 1 = top 20% of low warmth

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no.** **Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
	to measure emotional neglect (Brumley et al. 2019) used 80% of low warmth as 0) Only first two question used by (Anto et al. 2021) (Schwartz et al. 2019)	H1PF5 H1PF25 H1PF4 H1PF24	• "Most of the time, your mother is warm and loving toward you" • "Most of the time, your father is warm and loving toward you" • "Overall, you are satisfied with your relationship with your mother" • "Overall, you are satisfied with your relationship with your father" • "You are satisfied with the way your mother and you communicate with each other." • "You are satisfied with the way your father and you communicate with each other."		……. For two first questions, (Kim et al. 2020) used below coding 1=4 to 5 for disagrees" 0 = 1 to 3 "for agrees and neutral"
10.Physical Neglect	(Testa and Jackson 2020) (Brumley et al. 2019) (Schwartz et al. 2019)	Wave III Main Respondent (Adolescent) H3MA2	"How often had your parents or other adult care-givers not taken care of your basic needs, such as keeping you clean or providing food or clothing?"	0 = never happened, 5 = more than 10 times	0 = never or once, 1 = more than once
	(Kim et al. 2020)	Wave III Main Respondent (Adolescent) H3MA1	"By the time you started 6th grade, how often had your parents or other caregivers left you home alone when an adult should have been with you".	0 = never happened, 5 = more than 10 times	0=never Or 1= more than once
Expanded ACE Scale					
11. Foster Home	(Brumley et al. 2019)	Wave III	Did you ever live in a foster home?"	Yes/no	0-no 1=yes

Table Appendix A: ACEs Measure with reference to previous publication using Add Health Data					
Measure	**Citation [Studies that utilized ACEs before using Add Health Data]**	**Wave no.** **Variable Name**	**Wave Assessed and Item Description**	**Original Response Range**	**Recoded Response**
	(Schwartz et al. 2019)	Main Respondent (Adolescent) H3OD31			
12.Under-resourced school or School Disadvantage	(Brumley et al. 2019) (Schwartz et al. 2019)	Wave 1 Parent survey PC29A PC29B PC29C	(scores were summed): "Adolescent's school places a high priority on learning", "Adolescent's school is a safe place" and "Adolescent's school is a good school.	1 = strongly agree, 5 = strongly disagree	0 = bottom 80 % of under-resourced scores (i.e., less under-resourced), 1 = top ~20 % of under resourced scores
13.Neighborhood disadvantage	(Brumley et al. 2019) (Schwartz et al. 2019)	Wave 1 Parent survey PA33 PA34	(scores were summed): "In this neighborhood, how big a problem is litter or trash on the streets and sidewalks?" and "In this neighborhood, how big a problem are drug dealers and drug users?"	1 = no problem at all, 3 = a big problem	0 = bottom two tertiles of disadvantage, 1 = top tertile of disadvantage
15.Social services involvement as an indicator of maltreatment	(Brumley et al. 2019)	Wave III H3MA5	the number of times that social services "investigated how you were taken care of or tried to take you out of your living situation"	Continuous	presence = 1 or more times and absence = 0 times or missing data

Appendix B: Curriculum Vitae

MUDASIR MUSTAFA

EDUCATION

2020 – 2024	PhD Sociology, Utah State University, United States of America
2013 – 2015	MPhil Sociology, University of the Punjab, Lahore, Pakistan
2005 – 2007	Master of Arts in Sociology, University of the Punjab, Lahore, Pakistan
2002 – 2005	Bachelor of Arts Sociology, University of the Punjab, Lahore, Pakistan

SCHOLARSHIP

This section includes peer-reviewed journal articles, articles in preparation or under review, reports on funded projects, and conference presentations. If you are reading this CV on a computer, you can click on my name to access the relevant paper.

PEER-REVIEWED (PR) JOURNAL ARTICLES

- Rizvi Jafree, S., Ahsan, H., & **Mustafa, M**. (2023). The low odds of poor women with small business loans emerging from poverty: Critical social policy implications for Pakistan. *Poverty & Public Policy*, 15(3), 308-331.
- Marquez-Velarde, G., Miller, G. H., Hernandez, S. M., & **Mustafa, M**. (2023). Partial transition and mental health: Barriers to a full transition. *Sexuality Research and Social Policy*, 1-10.
- Miller, G. H., Marquez-Velarde, G., Mills, A. R., Hernandez, S. M., Brown, L. E., **Mustafa, M.,** & Shircliff, J. E. (2023). Patients' Perceived Level of Clinician Knowledge of Transgender Health Care, Self-rated Health, and Psychological Distress Among Transgender Adults. *JAMA Network Open*, 6(5), e2315083-e2315083.
- Jafree, S. R., & **Mustafa, M**. (2023). The triple burden of disease, destitution, and debt: Small business-women's voices about health challenges after becoming debt-ridden. *Health Care for Women International*, 44(1), 4-27.
- Batool, H., **Mustafa, M**., & Ahmad, S. (2022). A phenomenological analysis of adoption of coping strategies among survivors of acid violence in Pakistan. *Journal of Interpersonal Violence*, 37(11-12), NP8696-NP8723.
- Iram, A., **Mustafa, M**., Ahmad, S., Maqsood, S., & Maqsood, F. (2021). The effects of provision of instrumental, emotional, and informational support on psychosocial adjustment of involuntary childless women in Pakistan. *Journal of Family Issues*, 42(10), 2289-2318.
- Jafree, S. R., Zakar, R., Ahsan, H., **Mustafa, M.,** & Fischer, F. (2021). Impact of microfinance health interventions on health-related outcomes among female informal workers in Pakistan: a retrospective quasi-experimental study. *BMJ Open*, 11(1), e043544.
- Jafree, S. R., Zakar, R., **Mustafa, M.,** & Fischer, F. (2018). Mothers employed in paid work and their predictors for home delivery in Pakistan. *BMC Pregnancy and Childbirth*, 18, 1-9.
- Zakar, M. Z., Zakar, R., **Mustafa, M.,** Jalil, A., & Fischer, F. (2018). Underreporting of stillbirths in Pakistan: perspectives of the parents, community, and healthcare providers. *BMC Pregnancy and Childbirth*, 18, 1-9.
- Ahmad, S., Ishtiaq, S. M., & **Mustafa, M.** (2017). The role of socio-economic status in adoption of coping strategies among adolescents against domestic violence. *Journal of Interpersonal Violence*, 32(18), 2862-2881.

- Ahmad, S., **Mustafa, M.,** Ullah, A., Shoaib, M., Mushtaq, M., & Ali, W. (2017). Role of types of electoral rigging, socio-economic status, politics and voting behavior in the formation of attitudes toward electoral integrity. *Transforming Government: People, Process and Policy*, 11(2), 195-212.
- **Mustafa, M**., Zakar, R., Zakar, M. Z., Chaudhry, A., & Nasrullah, M. (2017). Under-five child mortality and morbidity associated with consanguineous child marriage in Pakistan: retrospective analysis using Pakistan Demographic and Health Surveys, 1990–91, 2006–07, 2012–13. *Maternal and Child Health Journal*, 21, 1095-1104.
- Ahmad, S., **Mustafa, M.,** & Ullah, A. (2016). Association of demographics, motives and intensity of using social networking sites with the formation of bonding and bridging social capital in Pakistan. *Computers in Human Behavior*, 57, 107-114.

RESEARCH REPORTS (R)

- **Mustafa, M.** (2018). The routine health information system in Punjab province, Pakistan – exploring the potential for integrating health information systems for family planning data. *MEASURE Evaluation, University of North Carolina, USA*, wp-18-210.
- Shams, S., **Mustafa, M.,** Mirza, A., Daud, Y., Mahmood, Q. K., & Hussain, S. (2012). Evaluation findings of pan localization project. Copyrights c PAN Localization Project 2012. Center for Language Engineering (CLE) Al-Khwarizmi Institute of Computer Science (KICS) *University of Engineering Technology (UET) Lahore*, Pakistan, ISBN:978-969-9690-02-2.

CONFERENCE PRESENTATIONS

2023. **Mustafa, M.,** Marquez-Velarde, G. Pregnancy outcome and adverse childhood experiences among ever-pregnant women living in the United States. RoundTable. *American Sociological Association.* Philadelphia, *PA.*

2023. **Mustafa, M**., Marquez-Velarde, G., Miller. Racial and sexual disparities: communication about HIV by healthcare providers who never tested for HIV. Oral presentation in paper session. *American Sociological Association.* Philadelphia, *PA.*

2022. **Mustafa, M**. Racial disparities and doctor talk about HIV with those who never tested for HIV in the United States. Oral Presentation. *Pacific Sociological Association Annual Meeting*, Sacramento, CA

2020. **Mustafa, M**., & Park, H. Recommendations about HIV/AIDS knowledge and stigma questions for a nationally representative survey. Oral presentation. *American Public Health Association*. (Virtual)

2020. **Mustafa, M**., & Ahmad, S. predictors of problematic use of mobile phone and sleeplessness: A cross sectional study in Pakistan. Poster presentation. *American Public Health Association*. (Virtual)

FUNDED PROJECTS

2016-17. Principal Investigator (PI), "Review of routine health information system in Punjab province of Pakistan: exploring the potential for organizing community health information system (CHIS) with regard to data on family planning". Funded by USAID through *Measure Evaluation Project, University of North Carolina*, Chapel Hill, United State of America. ($10,317)

2023. CHaSS Summer Graduate Student-Faculty Funding. Intersectionality of race and sexual orientation: Difference in communication about HIV by healthcare providers who never tested for HIV in United States. Utah State University ($4000).

2022. CHaSS Summer Graduate Student-Faculty Funding. Exploring the relationship between adverse birth outcomes and adverse childhood experiences moderated by unintended pregnancies. Utah State University ($3900).

2017. Principal Investigator (PI), "Cyber-defense and gender difference: impact and tactics to avoid of cyber-staking and cyber-bullying among female and male Facebook community creators". Funded by University of the Punjab, Lahore, Pakistan. ($200)

HONORS and AWARDS

2023. Creative Project Award. Rapid Fire Research: 4 minutes 4 slides, Utah State University.

2023. Intersections Graduate Fellowship, Utah State University ($1500).

2023. Graduate Enhancement Award, Utah State University Student Association ($4000).

2023. Distinguished Service Award, Student Affairs, Utah State University.

2013-15. Secured third position in Master of Philosophy (MPhil) in Sociology (Session 2013-2015), University of the Punjab, Lahore, Pakistan.

2005-07. Secured first position and awarded with Gold Medal in Master of Arts (M.A.) in Sociology (session 2005-07), University of the Punjab, Lahore, Pakistan.

EMPLOYMENT

Jan.2020 – present Graduate Research Assistant, Department of Sociology and Anthropology, Utah State University

Nov.2017 – Dec.2020. Assistant Professor, Department of Sociology, Higher Education Department Punjab, Pakistan.

Sep.2016 – Nov.2017 Lecturer, Department of Sociology, Institute of Social and Cultural Studies, University of the Punjab, Lahore, Pakistan.

Sep.2014 – Sep.2016 Program Coordinator - Research Officer, Department of Sociology, Institute of Social and Cultural Studies, University of the Punjab, Lahore, Pakistan.

Nov.2013 – Jun.2014 Senior Research Officer (Monitoring and Evaluation Wing), Center for Language Engineering (CLE), Al-Khwarizmi Institute of Computer Science, University of Engineering Technology (UET), Lahore, Pakistan.

Oct.2011 – Mar.2012 Research Officer (Monitoring and Evaluation Wing), Center for Language Engineering (CLE), Al-Khwarizmi Institute of Computer Science, University of Engineering Technology (UET), Lahore, Pakistan.

Jul.2008 – Dec.2010 Research Officer, (Monitoring and Evaluation Wing), Centre for Research in Urdu Language Processing (CRULP), National University of Computer and Emerging Sciences (NUCES), Lahore, Pakistan.

TEACHING

2023. Social Statistics, online, graduate instructor, Department of Sociology, Utah State University

2021. Social Inequality, online, teaching assistant with Dr. Mehmet Soyer, Department of Sociology, Utah State University

2020. Social Statistics, in-person and online, teaching assistant with Dr. Hyojun Park, Department of Sociology, Utah State University

2018. Community Development, in-person, assistant professor, Govt. College Women University, Faisalabad, Pakistan

2018. Introduction to Sociology, in-person, assistant professor, Govt. College Women University, Faisalabad, Pakistan

SERVICE TO THE DEPARTMENT | COLLEGE | UNIVERSITY

2023 – 24. Graduate Student Council Representative of College of Humanities and Social Sciences (CHaSS), Utah State University

2022- 23. Graduate Student Council Representative of College of Humanities and Social Sciences (CHaSS), Utah State University

2021- 22. Vice President of the Sociology Graduate Student Association (SGSA), Utah State University

2021- 22. Vice President of the International Graduate Student Council, Utah State University

PROFESSIONAL DEVELOPMENT

**Indicates a competitive opportunity*

2023. Uprooting white supremacy webinar with AORTA Coop, Dr. Eri Bentley in CAPS, training workshop, Center for Intersectional Gender Studies & Research, Utah State University

2022. Longitudinal data analysis, including categorical outcomes, taught by Donald Hedeker, ICPSR Summer Program in Quantitative Methods of Social Research.

2021. Causal inference in pediatric and perinatal epidemiologic research: from questions to methods by Jessica Young and Yu-Han Chiu, the Society for Pediatric and Perinatal Epidemiologic Research (SPER).

2020. *Bayesian hierarchical methods, 6th Annual Berkeley Workshop on Formal Demography, Berkeley Population Sciences, University of California, Berkeley.

2020. Longitudinal data analysis using structural equation model, taught by Paul D. Allison, Statistical Horizon.

LANGUAGE AND SKILLS

Fluent in English and Urdu; speaking, writing, listening, and reading. Basic in Arabic.

Proficient in Stata, SAS, IBM SPSS, R/RStudio, Basics in Mplus.

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