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Sarah Brister Date

Association of Prenatal Stressful Life Events with Depression and Post-Traumatic Stress 6-36 Months After Stillbirth

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Epidemiology

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By

Sarah Brister

Bachelor of Arts
Baylor University
2016

Faculty Thesis Advisor: Carol Hogue, MPH, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2018

Abstract

Association of Prenatal Stressful Life Events with Depression and Post-Traumatic Stress 6-36 Months After Stillbirth

By Sarah Brister

Stillbirth, death of a fetus after 20 weeks gestation, is an emotionally devastating pregnancy outcome and occurs at a rate of 5.96 per 1,000 livebirths in the United States. This traumatic event may have a lasting impact on the mental health of women who experience it. Although research provides evidence that stressful life events may increase post-traumatic stress symptoms after a traumatic event, no analysis has examined the association of pre-pregnancy stressful life events and post-traumatic stress symptoms after experiencing a stillbirth. To investigate this question, data from 238 women who had experienced a singleton stillbirth enrolled in the Stillbirth Collaborative Research Network (SCRN), a population-based case-control study, and follow up in the SCRN-Outcomes after Study Index Stillbirth (OASIS) were used. Post-traumatic stress was measured by the Impact of Events Scale-15 item version, current depression by the Edinburgh Depression Scale, and stressful life events by the PRAMS 13-item list. Post-traumatic stress symptoms were strongly associated with current depression (Adjusted Odds Ratio (aOR) [95% Confidence Interval (CI)]: 10.55 [3.93, 28.37]). When adjusted for insurance status, marital status, and experiencing a mental health condition before the pregnancy, the relationship between Stressful Life Events and Impact of Events Score was not significant among women with current depression (aOR [95% CI]: 1.02 [0.13, 7.79]) and was not able to be calculated among women without current depression. Mediation analyses were performed to examine stressful life events as a potential mediator, and no results were significant. Consistent with past research, this study found that depression is strongly related to post-traumatic stress symptoms. No significant relationship between stressful life events and post-traumatic stress among women who experienced a stillbirth existed in this data. Due to stratification on stillbirth status and presence of current depression, sample sizes were small and further study can investigate the impact of stressful life events as an exposure for mental health outcomes in a larger sample.

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Table of Contents

Chapter I: Background and Literature Review

One of the most emotionally devastating outcomes that can occur during pregnancy is stillbirth, or loss of a fetus after 20 weeks gestation. In the United States, stillbirth remains a common occurrence, with the 23,595 stillbirths occurring in the United Stated in 2013 resulting in a rate of 5.96 stillbirths per 1,000 livebirths (1). Although the emotional aftermath of this event can resolve after a normal period of grief, some mothers may be at an elevated risk for serious long-term mental health outcomes resulting from the trauma of experiencing a stillbirth.

Two of these potentially long-term mental health outcomes are depression and post-traumatic stress disorder. Depression is a mental health outcome that is commonly studied in its relationship to pregnancy, and this review will begin by looking at its association with pregnancy in general and stillbirth in particular. Due to the intense trauma and stress related to experiencing stillbirth, post-traumatic stress disorder is another mental health outcome for which mothers who have experienced a stillbirth may be at risk (2). This review will examine post-traumatic stress and its presence after both livebirths and stillbirths. Stressful life events before pregnancy, whether partner-related, financial, emotional or traumatic, may impact the mental health of mothers who experience stillbirth through possible associations with depression and post-traumatic stress. This review will examine research related to the distribution of stressful life events in the population and its potential impact on mental health outcomes after stillbirth.

Depression and Pregnancy

Even in the case of a healthy livebirth, postpartum depression is a potential health outcome for mothers that can have grave consequences. Data from the United States Pregnancy Risk Assessment Monitoring System (PRAMS) found that among mothers who had a livebirth, the prevalence of postpartum depression was 9.8% (3). Native American or Asian race, young age, single marital status, low education, smoking, stressful life events in the year before the birth, and giving birth to a low-birth weight infant or an infant that has to be transferred to the

NICU were risk factors for post-partum depression (3). When comparing mothers who had a livebirth to mothers who experienced a stillbirth, 8.3% of mothers of livebirths reported depressive symptoms six to 36 months after giving birth, while 14.8% of mothers who experienced a stillbirth reported depressive symptoms (4). While depression is an outcome that impacts many women after giving birth, experiencing a stillbirth appears to increase the number of women who experience this outcome.

Post-traumatic Stress and Pregnancy

Similar to depression, post-traumatic stress is a metal health issue faced by women after giving birth. A prospective study of mothers of livebirths found the prevalence of post-traumatic stress symptoms among mothers six months after a livebirth was 1.5% (5), while a cross-sectional study found a 1.7% prevalence of PTSD symptoms among mothers of livebirths one to 13 months after the birth (6).

Measures of prevalence of post-traumatic stress symptoms among mothers who experienced a loss during pregnancy are more variable, but overall find a higher prevalence than that among mothers of livebirths. A study of parents who had experienced infant death in the past 1.2 months to 18 years found a 12.3% prevalence of post-traumatic stress as measured by Harvard Trauma Questionnaire (2). Mothers had higher post-traumatic stress symptom scores than fathers but the prevalence of symptoms did not vary by whether the loss was pre-, peri-, or postnatal. A study of 110 parents who had lost an infant found a 9% prevalence of post-traumatic stress symptoms among mothers 12 to 21 months after their loss as measured by Harvard Trauma Questionnaire (7). The authors did not discuss whether this prevalence varied by type of infant death and the specific prevalence of post-traumatic stress symptoms after a stillbirth was not stated. A study of mothers who experienced a stillbirth, defined as loss of a pregnancy after 24 weeks gestation, found that 35.9% of women reported having two or more of symptoms of post-traumatic stress three to nine months after the loss (8). However, presence of post-traumatic

stress symptoms was defined by positively answering two out of four questions, and this more informal definition, low response rate, narrower definition of stillbirth, and closer temporal proximity to the event may explain the higher prevalence. These studies provide evidence that variation in characteristics of the study sample as well as different definitions of stillbirth and post-traumatic stress can lead to widely varying estimates of post-traumatic stress symptoms after stillbirth.

Several studies have compared post-traumatic stress symptoms after birth among women who had a livebirth and women who experienced a stillbirth to see if this outcome is a caused by experiencing the loss or by the stress of giving birth itself with conflicting results. A cohort study used DSM-IV criteria to identify post-traumatic stress among of 53 pregnant women who had experienced a stillbirth 10 months to 15 years before their current delivery date and 53 women who had had a previous livebirth. There was no significant difference in prevalence of post-traumatic stress symptoms between mothers who had had a stillbirth and those who had not. The current prevalence among mothers who had a stillbirth was 4% and their lifetime prevalence was 6% (9, 10). However, a case-control study found that the odds of PTSD defined using the PTSD checklist, civilian version among bereaved mothers were 7.08 times the odds for non-bereaved mothers nine months after delivery (OR [95% CI]: 7.08 [3.95, 12.69]) (11). The category of bereavement included both mothers who experienced stillbirth and infant death, as there was no significant difference in post-traumatic stress symptoms between the two groups. Stillbirth appears to have an association with post-traumatic stress among mothers, but the evidence includes wide variation in the estimate of prevalence in this population and the estimate of the excess burden among bereaved mothers.

Co-Occurrence of PTSD and Depression

Depression and post-traumatic stress disorder may occur at the same time and have overlapping symptoms, but evidence still points to separate etiologies and courses for these

outcomes. The DSM-V provides several symptoms of PTSD, stating that "[Individuals with PTSD may] blame themselves or others…[and have] A persistent negative mood state...The individual may experience markedly diminished interest or participation in previously enjoyed activities…or a persistent inability to feel positive emotions…(12)" Symptoms of depression similar to those of post-traumatic stress are a subjectively reported "sad" mood, no pleasure in usually pleasurable tasks, weight loss, insomnia or hypersomnia, fatigue, loss of energy, feelings of worthlessness or guilt, diminished ability to think or concentrate, or suicidal ideation (12). Substance abuse, self-harm, and suicidal behaviors are common in both individuals with PTSD and individuals with depression. However, unlike post-traumatic stress symptoms, the symptoms of depression are not necessarily tied to a particular thought or experience and these symptoms cause impairment in daily life. Additionally, post-traumatic stress can involve hyper-arousal, disassociation from body, and paranoia, and may have delayed expression some time after the traumatic event, all of which are unique symptoms of post-traumatic stress.

Several studies have compared the experiences of individuals with depression to those with post-traumatic stress disorder. In a small sample of veterans with PTSD and men with major depressive disorder, a visual analogue scale measured hourly self-reports of mood and anxiety. Although averages of these scores were similar between the two groups, individuals with PTSD had significantly more variation in mood over time compared to those with major depressive disorder (13). A systematic review and meta-analysis considered 57 studies of PTSD and major depressive disorder (MDD) found that the mean prevalence of co-occurring PTSD and MDD was 52% among those with PTSD (14). This was not found to vary significantly by sex or type of trauma. The authors were not able to consider the co-occurrence of PTSD among people with MDD or co-occurrence of these conditions in the general population. Another non-systematic review considered if relationship between PTSD a depression is an artifact of common symptoms or if comorbidity of the two conditions is a unique phenotype. The evidence of separate risk factors and unique biological factors lead to the conclusion that co-occuring PTSD and

depression reflects a unique condition (15). Depression and post-traumatic stress share several common symptoms, but each has distinguishing causes and symptoms that set it apart.

Stressful Life Events and Pregnancy

Stressful life events are fairly common among women, with 14% of women in the North Carolina PRAMS survey who had livebirths experiencing five or more stressful events in the year before her delivery (16). The following were considered as potential stressful events: moving to a new address, arguing with her husband or partner more than usual, having a close family member become hospitalized, having many bills she could not pay, having someone very close to her die, having someone very close to her with severe alcohol or drug problems, having her husband or partner tell her that he did not want her to be pregnant, becoming separated or divorced from her husband or partner, losing her job even though she wanted to continue working, having her husband or partner lose a job, being involved in a physical fight, having her husband or partner incarcerated or being incarcerated herself, and experiencing homelessness.

In a random sample of over 8,000 women who had had a livebirth, 17% of women reported having three or more stressful life events defined using a using modified Newton and Hunt scale in the year before their baby was born (17). In a case-control sample of over 3,000 women, 14.2% of women with major depressive disorder and 6.3% of controls reported four or more stressful life events in their lifetime (18). 72% of the women diagnosed with major depressive disorder and 60% of controls reported experiencing at least one of 16 stressful life events.

The most common stressful life events in the sample from the North Carolina PRAMS survey were moving residence, increasing arguments with a partner, hospitalization of a family member, financial hardship, and death of a loved one (16). These include all four of the subgroups of stressful life events, which divide these events into financial, emotional, traumatic, or partner-relate categories.

Stressful life events have been found to impact depression among mothers after pregnancy. 2009-2011 PRAMS data reported that mothers who experienced stressors from all four possible categories had five times the odds of postpartum depression symptoms compared to mothers who had experienced fewer stressful life event categories (19). This association had a dose-response relationship, with increasing number of stressful events leading to an increase in postpartum depression (20).

The relationship between stressful life events and post-traumatic stress symptoms appears to be more complicated and has not been examined in relation to pregnancy outcomes. Among a group of men and women, when using DSM-V criteria to diagnose post-traumatic stress and the Life Events Scale to identify stressful events, the odds ratio comparing post-traumatic stress among those who had experienced stressful life events and those who had not was 3.76 (95% CI: 2.04, 6.71) (21). Among survivors of two separate traumatic events, those with post-traumatic stress had significantly more stressful life events after the disaster in question compared to those without post-traumatic stress, but they did not report experiencing a significantly different number of stressful life events before the event (22). This analysis used the Diagnostic Interview Schedule, Disaster Supplement to assess stressful life events and the Composite International Diagnostic Interview, Post-Traumatic Stress Module to assess post-traumatic stress. Stressful life events could increase post-traumatic stress symptoms among individuals who experience traumatic events, but more evidence, especially among pregnant women, is needed.

Although research has given evidence that stressful life events may have an influence on post-traumatic stress symptoms after a traumatic event, no analysis has directly examined the association of pre-pregnancy stressful life events and post-traumatic stress symptoms after experiencing a stillbirth. Additionally, the connection between depression and post-traumatic stress also bears increased investigation. The aim of this thesis is to begin to fill this gap by using data from the Stillbirth Collaborative Research Network to assess the relationship between the number of stressful life events that occurred before pregnancy and post-traumatic stress

symptoms in mothers who experienced stillbirth. Stillbirth is a devastating event, and recognizing risk factors for mental health consequences will help identify vulnerable populations for increased screening and assistance.

Chapter II: Manuscript

Association of Prenatal Stressful Life Events with Depression and Post-Traumatic Stress 6-36 Months After Stillbirth

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Stillbirth, death of a fetus after 20 weeks gestation, is an emotionally devastating pregnancy outcome and occurs at a rate of 5.96 per 1,000 livebirths in the United States. This traumatic event may have a lasting impact on the mental health of women who experience it. Although research provides evidence that stressful life events may increase post-traumatic stress symptoms after a traumatic event, no analysis has examined the association of pre-pregnancy stressful life events and post-traumatic stress symptoms after experiencing a stillbirth. To investigate this question, data from 238 women who had experienced a singleton stillbirth enrolled in the Stillbirth Collaborative Research Network (SCRN), a population-based case-control study, and follow up in the SCRN-Outcomes after Study Index Stillbirth (OASIS) were used. Post-traumatic stress was measured by the Impact of Events Scale-15 item version, current depression by the Edinburgh Depression Scale, and stressful life events by the PRAMS 13-item list. Depression was strongly associated with post-traumatic stress symptoms (Adjusted Odds Ratio (aOR) [95% Confidence Interval (CI)]: 10.55 [3.93, 28.37]) and Stressful Life Events (aOR [95% CI]: 3.37 [1.40, 8.12]). The relationship between Stressful Life Events and Impact of Events Score was not significant among women with current depression (aOR [95% CI]: 1.02 [0.13, 7.79]) and was not able to be calculated among women without current depression. Mediation analyses were performed to examine stressful life events as a potential mediator, and no results were significant. Consistent with past research, this study found that depression is strongly related to post-traumatic stress symptoms. No significant relationship between stressful life events and post-traumatic stress among women who experienced a stillbirth existed in this data. Due to stratification on stillbirth status and presence of current depression, sample sizes were small and further study can investigate the impact of stressful life events as an exposure for mental health outcomes in a larger sample.

Introduction

One of the most emotionally devastating outcomes that can occur during pregnancy is stillbirth, or loss of a fetus after 20 weeks gestation. In the United States, stillbirth remains a common occurrence, with the 23,595 stillbirths occurring in the United Stated in 2013 resulting in a rate of 5.96 stillbirths per 1,000 livebirths (1). Although the emotional aftermath of this event can resolve after a normal period of grief, some mothers may be at an elevated risk for serious long-term mental health outcomes resulting from the trauma of experiencing a stillbirth, including depression and post-traumatic stress disorder. Stressful life events before pregnancy, whether partner-related, financial, emotional or traumatic, may impact the mental health of mothers who experience stillbirth through possible associations with depression and post-traumatic stress.

Even in the case of a healthy livebirth, postpartum depression is a potential health outcome for mothers that can have grave consequences. Data from the United States Pregnancy Risk Assessment Monitoring System (PRAMS) found that among mothers who had a livebirth, the prevalence of postpartum depression was 9.8% (3). When comparing mothers who had a livebirth to mothers who experienced a stillbirth, 8.3% of mothers of livebirths reported depressive symptoms six to 36 months after giving birth, while 14.8% of mothers who experienced a stillbirth reported depressive symptoms (4). While depression is an outcome that impacts many women after giving birth, experiencing a stillbirth appears to increase the number of women who experience this outcome.

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Methods

Stillbirth Collaborative Research Network Methods

The Stillbirth Collaborative Research Network (SCRN) consisted of five areas of recruitment based in clinical sites that served women in Rhode Island, Massachusetts, Georgia, Texas, and Utah. The goal was to enroll mothers of livebirths and stillbirths at the time of delivery. A woman was considered to have a stillbirth if she had a fetal death occur at 18 weeks gestation or later. Mothers of livebirths were eligible if they delivered a living infant at 20 weeks gestation of later. All women were required to be 13 years of age or older and a current resident of the catchment area served by the clinical site.

After identification of birth outcome, a sample of mothers of livebirths and all mothers of stillbirths were approached for consent and recruitment into the study. Mothers of livebirths between 20 and 31 weeks gestation and women of African descent were oversampled in the livebirths to account for the known differences in stillbirth by gestational age and race. Two

maternal interviews were conducted in the hospital and/or by telephone after discharge and gathered information on the mother's demographic information, social environment, health history, and psychosocial factors before and during pregnancy. In addition, hospital records were used to gather information on diagnoses and treatments during pregnancy and delivery and pathology information and biospecimens were collected during autopsies of stillborn infants.

A pilot test of the recruitment, maternal interview, and chart abstraction methods was conducted and feedback was obtained to ensure the quality of these methods. All study coordinators and staff members received extensive training on all parts of the data collection process, including how to interact with bereaved mothers. In order to account for oversampling and differential participation in the study, weights for each observation were calculated for use in future analyses. A more comprehensive description of study design methods of the population-based case-control Stillbirth Collaborative Research Network study is detailed elsewhere (23).

SCRN-Outcomes after Study Index Stillbirth Methods (OASIS)

Mothers who had provided consent for further contact during the initial SCRN procedures were contacted again six months to three years after the study birth. Initially, a letter was sent requesting a telephone interview, and if no response was forthcoming the mother was contacted by telephone. Once telephone contact was initiated, further consent was recorded for this follow up interview.

The focus of this interview was subsequent pregnancy outcomes and psychosocial factors. The Impact of Events Scale-15 item version was used to measure symptoms of post-traumatic stress. To measure stressful life events, the 13-item list used by the Pregnancy Risk Assessment Monitoring System (PRAMS) was used. The Edinburgh Depression Scale, Spielberger Trait Anxiety Scale (STAI), and Spielberger Trait Anger Scale (STAXI-2) were used to gather additional psychosocial variables. A woman was considered to have a history of

depression in this analysis if in the initial SCRN maternal interview she stated ever having depressive symptoms and seeking help for these symptoms.

Because this interview asked questions related to the outcome of the index birth, interviewers knew the outcome of the index pregnancy during this follow up. They also received training on recognition and response to signs of distress pointing to the possibility of harm to the woman or others. All psychosocial instruments were chosen because of their validity in phone interviews, validated Spanish translation, applicability to multiple racial and ethnic groups, and previous use in studies of perinatal loss. As in the original SCRN data, analysis of this data required the use of weights to account for oversampling and differential participation.

Methods of this Analysis

This study required use of data from the SCRN and the OASIS studies to gather complete information on baseline demographic factors as well as social and psychological variables before, during, and after pregnancy. Data on the outcome of post-traumatic stress, as measured by the Impact of Events Scale score, were collected only in the OASIS study. Consequently, inclusion in this analysis was conditional on completing that interview. Additionally, because of concerns of low sample sizes leading to problems with generalizability, women with non-singleton births and women who stated they were of a race or ethnicity other than non-Hispanic White, non-Hispanic black, and Hispanic were also excluded from the analysis.

The 13 possible Stressful Life Events were categorized at the time of collection into four overarching categories: financial, emotional, traumatic, and partner related. The number of stressful life event categories that a women experienced before her pregnancy was calculated, ranging from zero (no stressful life events experienced) to four (at least one stressful life event in all four categories experienced). For this analysis women who experienced three or four of the possible stressful life event factors were considered exposed and women who experienced stressful events from fewer than three factors were considered unexposed.

The Impact of Events Scale-15 item version leads to a score that can range from zero to 60, with higher scores corresponding to higher indication of symptoms of post-traumatic stress symptoms. For this analysis, a score of 40 or higher was considered a serious indicator of post-traumatic stress symptoms and was used as the definition of a case in this analysis. Education was categorized into less than secondary school completion, completion of secondary school, and some college or higher. Marital status was considered in three categories: not married or cohabiting, cohabiting, or married, which was further categorized into partnered and not partnered. Insurance status was dichotomized into no insurance or any public or private assistance and VA, commercial, or HMO insurance. The STAI trait-anxiety score ranges from 20 to 80 and were categorized in two ways: four categories, with breaks at scores of 25.8, 32.1, and 38.9 and a dichotomized variable with a cutpoint of 38.9. STAXI-2 trait-anger scores ranges from 10 to 40 and were considered in four categories with cutpoints of 12.7, 15.4, and 18.9. A woman was considered as having a history of depression if she stated ever having experienced depressive symptoms and seeking help for these symptoms. Women were considered as having current depression if they received a score greater than 12 on the Edinburgh Depression Scale, which has a range of possible scores of 0 to 30.

To adjust for the differences between women followed in OASIS and those lost to follow up, stabilized inverse probability weights were created. Several factors related to OASIS participation were used: race/ethnicity, education, marital status, insurance type, and having moved during the index pregnancy. These stabilized inverse probability weights were multiplied by the original SCRN study weights in order to continue adjusting for initial sampling methods. Analyses were conduced in SAS version 9.4 and SUDAAN 11.0.1.

Results

Sample Size

2,430 women completed both the maternal interview and chart abstraction in the Stillbirth Collaborative Research Network study. 614 of these women experienced stillbirth, of whom 280 were followed in the OASIS study. 34 women were not eligible due to a multiple birth or stating "other" as their race/ethnicity. Eight women were missing data for the outcome, leaving 69 women with high Impact of Events Scale Score and 169 women with a low Impact of Events Scale Score (Figure 1).

Characteristics of Women Lost to Follow Up

To examine differences between mothers with stillbirth who were followed in the OASIS study and mothers who experienced a stillbirth and were not followed, distributions of demographic and psychosocial factors were calculated for each group and compared by a Wald chi-square test (Table 1). These tests gave evidence of significant differences between the two groups in several key factors, including race, education, marital status, insurance type, moving during pregnancy, and number of stressful life events experienced. Consequently, stabilized inverse probability weights were calculated and used in addition to the primary SCRN analysis weights during the following analysis.

Characteristics of Included Women

In this sample, women were most likely to be 20-34 years old, college educated, in possession of no insurance or using private insurance, and nulliparous (Table 1). Women in this sample were fairly equally spread between the three racial and marital status categories. Most women had not had a mental health condition before pregnancy, had a STAI trait-anxiety scale score greater than 38.9, a STAXI-2 trait-anger scale score greater than 18.9, and had experienced stressful life events from fewer than three of the possible categories.

Characteristics Related to Post-Traumatic Stress, Depression, and Stressful Life Events

Women differed significantly between Impact of Events Scale categories in marital status, insurance type, and current depression as measured by the Edinburgh Depression Sale score (Table 2). Women with high Impact of Event Scale scores were slightly more likely to have experienced a high number of stressful life event factors (p=0.10).

Women with and without current depression differed significantly in Impact of Event Scale scores, number of stressful life event factors, and STAI trait-anxiety scale score (Table 3). In addition, mothers currently experiencing depression were slightly more likely to have experienced more than three stressful life events (p=0.07), have fewer years of education (p=0.08), have no insurance or receive assistance (p=0.10) than mothers who were not currently experiencing depression.

Women who experienced a high number of differed stressful life event factors were significantly more likely to state they had experienced a mental health condition before pregnancy and to have higher STAI trait-anxiety scale scores than women who experienced fewer stressful life event categories (Table 4). Impact of Events Scale score, insurance status, ever wanting a pregnancy, and Edinburgh Depression Scale score differed slightly between women in the two categories of stressful life event factors (p=0.10).

Because this analysis and previous literature raised concerns about strong correlation between current depression as measured by the Edinburg Depression Scale and post-traumatic stress symptoms as measured by the Impact of Events Scale, women with an Edinburg Depression Scale score greater than 12 were analyzed separately for the remainder of this analysis.

When categorized into women not experiencing current depression or post-traumatic stress, women experiencing post-traumatic stress but not depression, and all women experiencing current depression, women who experienced a stillbirth in these categories differed significantly in several sociodemographic variables (Table 5). Women experiencing depression reported experiencing a higher number of stressful life event factors than both women with post-traumatic

stress only and women who did not report either of those outcomes (p=0.05). Additionally, women currently experiencing depression and women reporting post-traumatic stress symptoms were more likely to have no insurance or use public or private assistance for insurance than women without these mental health outcomes (p=0.03). Women with current depression also had higher STAI train-anxiety scale scores than both women experiencing post-traumatic stress and women with neither depression nor post-traumatic stress.

Regression Analysis

The crude odds ratios for the association of Impact of Events Scale score and stressful life event factor categories pointed to non-significant but detrimental impact of high stressful life events factors on post-traumatic stress symptoms after experiencing a stillbirth in both women with and without current depression (Table 6). However, this crude association was neither significant among women who were currently depressed (OR [95% Confidence Interval]: 1.61 [0.26, 10.12]) nor women who were not currently depressed (1.09 [0.37, 3.23]). When controlling for insurance status, marital status, and mental health condition before pregnancy, the relationship between Impact of Events Score and stressful life event factors among mothers who experienced stillbirth with current depression remained insignificant (1.02 [0.13, 7.79]). Due to cells with zero observations, the presence of interaction could not be assessed for women with current depression and an adjusted odds ratio could not be calculated.

In contrast, the number of stressful life event factors a woman experienced was significantly associated with current depression among women who had experienced a stillbirth. With an adjusted odds ratio of 3.37 (95% CI: 1.55, 8.20), women who experienced stressful life events from three or more factors before their pregnancy were significantly more likely to report current depression after experiencing a stillbirth (Table 7).

The crude odds ratio of Impact of Events Scale score and current depression pointed to a strong association between current depression and post-traumatic stress symptoms among

mothers who had experienced a stillbirth (OR [95% CI]: 11.33 [4.40, 29.16]). When adjusted for Stressful Life Events factor categories, partner status, insurance status, and experiencing a mental health condition before the pregnancy, this association remained significant (10.55 [3.93, 28.37]). A strong association between depression and post-traumatic stress symptoms existed in mothers who experienced a stillbirth, but the lack of temporality in this measure prevents this association from giving rise to any causal inferences (Table 7).

Mediation Analysis

Two mediation analyses were conducted to consider the possibility of mediation in the relationship between stressful life events, post-traumatic stress, depression, and demographic and psychological factors. The first analysis considered insurance status, marital status, and experiencing a mental health condition before pregnancy as independent predictors of post-traumatic symptoms after stillbirth, and stressful life event factors as a mediator of this relationship. Mediation analyses were conducted separately by current depression status. None of the total effects, indirect effects, or direct effects were statistically significant (Table 8).

Among women with current depression, the percent mediated by stressful life events in these relationships ranged from 0% in the relationship between insurance status and IES score to 44.27% in the relationship between partner status and IES score. Among women without current depression, the percent mediated by stressful life events in these relationships ranged from 2.67% in the relationship between insurance status and IES score to 8.86% in the relationship between experiencing a previous mental heath condition and IES score. The strength of stressful life events as a mediator differed by current depression status and by the exposure variable of interest, but overall was not a powerful mediator as only two relationships were mediated by more than 10%. None of the effects in this analysis were statistically significant, but the mediation analysis provided evidence that the three sociodemographic factors have more influence on post-traumatic

stress symptoms directly than through increasing the number of stressful life event factors experienced by the woman.

The second mediation analysis considered current depression as the predictor of post-traumatic stress after stillbirth. Stressful life event factors, partner status, insurance status and experiencing a mental health condition were all separately considered as potential mediators of this relationship. As in the previous mediation analysis, none of the total effects, indirect effects, or direct effects were statistically significant (Table 9). The percent of the relationship between depression and IES score mediated by the four sociodemographic factors ranged from 0% mediated by partner status to 4.11% mediated by insurance status. Consequently, none of the four sociodemographic factors meaningfully mediated the relationship of depression and post-traumatic stress in this data.

Discussion

This study found that the relationship between stressful life events and mental health outcomes among women who recently experienced a stillbirth is complicated. Several sociodemographic factors were commonly associated with post-traumatic stress, depression, and stressful life events, namely marital status and insurance status. Although race and education did not differ significantly between women, the fact that insurance and marital status differed between women points to the impact socioeconomic and demographic factors can have on stressful life events and mental health after a stillbirth.

Because of the strong correlation between depression and post-traumatic stress, women with and without current depression were analyzed separately to parse out the added burden stressful life events may have on post-traumatic stress. The crude estimates for this relationship were different between the two groups and found a stronger association in those with current depression compared to those without current depression, though adjustment moved this estimate close to the null. Even though the confidence intervals surrounding these estimates were not

statistically significant, the data point to an increase in post-traumatic stress symptoms after stillbirth among women who experienced stressful life events from several factors before delivery, and that this relationship has a stronger impact on women who also are experiencing depression.

Depression after a stillbirth was strongly statistically associated with both experiencing a high number of stressful life event factors and high post-traumatic stress symptoms in this analysis. Women with depression and women with symptoms of post-traumatic stress had different relationships with sociodemographic variables. Individuals experiencing depression had a larger burden of stressful life event factors and higher STAI train-anxiety scale scores than women experiencing post-traumatic stress only and women without mental health outcomes and women experiencing depression and post-traumatic stress were more likely to have inadequate insurance when compared to women who did not have symptoms of either mental health outcome. These findings appear consistent with the connections and unique variations between these two health outcomes found in previous studies (13-15). The mediation analyses attempted to illuminate the relationship between these outcomes, and although it was not statistically significant pointed toward the supremacy of the direct relationship of depression and post-traumatic stress symptoms as compared to the mediating impact of stressful life events.

The study had several strengths, including a well-chosen sample drawn from several parts of the United States. The SCRN enrollment processes made every effort to capture a large, representative sample of mothers of stillbirths and livebirths to an extent not frequently reached by other studies. The oversampling allowed for sufficient sample sizes to accurately investigate the relationships in small but vulnerable groups. Additionally, the comprehensive questions asked as part of the SCRN maternal interview and OASIS follow up interview give information on a wide variety of demographic, social, and psychological covariates which enable detailed investigation of the complex relationships surrounding stillbirth.

Limitations of this analysis include a small final sample size. The research question investigated required limiting the sample a specific group of women stratified on factors such as stillbirth status and presence of current depression, which ultimately resulted in a small number of women in most of the analysis groups. Consequently, a resulting lack of statistical power made inference around and between these groups difficult and raises uncertainties that would need a larger sample size to fully put to rest. Also, due to the nature of the SCRN and OASIS interviews, diagnosis of post-traumatic stress, current and past depression, and other maternal health conditions relied on self-report, which presents a possibility of misclassification. Validated instruments were used when available to collect this information from women, but the potential for resulting misclassification and bias remains.

In conclusion, future studies can continue to distinguish the risk factors and burden of depression and post-traumatic stress disorder after stillbirth. These mental health conditions have serious consequences individually and societal and further research can parse out the similarities and differences between these conditions, as well as the unique factors leading to comorbidity of these two conditions. To prevent and treat these outcomes more accurately and effectively among women who experience stillbirth, more research can be done to understand how they are connected and what makes them distinct.

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Tables/ Figures

Table 1. Characteristics of Women who Experienced a Stillbirth in the SCRN Study by Inclusion Status in the SCRN-Outcomes After Study Index Stillbirth (OASIS) Study

	Included in OASIS	Not Included in OASIS	Wald Chi-Square P-Value
Unweighted Sample Size, n	280	334	
Weighted Sample Size, n_w	274.62	339.58	
Characteristic, Weighted %			
Sociodemographic Variables			
Age at delivery, years			
<20	9.95	16.23	0.12
20-34	70.92	68.52	
35-39	14.35	10.93	
40+	4.79	4.33	
Race/ethnicity			
Non-Hispanic white	45.69	23.5	0.00*
Non-Hispanic black	18.82	26.61	
Hispanic	29.45	41.92	
Other	6.03	7.97	
Education, grade			
0-11 (None/primary/some secondary)	13.51	31.57	0.00*
12 (completed secondary)	29.31	30.11	
13+ (college)	57.18	38.32	
Marital status/cohabiting			
Not married or cohabiting	18.26	31.23	0.00*
Cohabiting	23.21	28.03	
Married	58.53	40.74	
Insurance/method of payment			
No insurance	2.99	7.62	0.00*
Any public/private assistance	43.26	63.42	
VA/commercial health ins/ HMO	53.75	28.96	
Pregnancy-Associated Variables			
Moved during pregnancy			
Yes	25.01	33.75	0.02*
No	74.99	66.25	
Pregnancy wanted ever, before pregnancy			
Yes	94.63	92.75	0.35
No	5.37	7.25	
Gestational age at delivery, weeks			
18-19	1.58	3.02	0.06**
20-23	37.73	30.24	
24-27	17.41	14.5	

28-3	8.97	15.66	
32-36	18.6	20.05	
37+	15.71	16.54	
Psychosocial Variables			
Mental Health Condition Prior to Pregnancy			
Yes	10.51	12.14	0.52
No	89.49	87.86	
STAI trait-anxiety scale score			
<25.8	12.77	6.52	0.0001*
25.8-32.1	18.18	8.81	
32.1-38.9	20.12	19.02	
>38.9	48.92	65.65	
STAXI-2 trait-anger scale score			
≤ 12.6	19.93	18.09	0.21
12.6-15.4	28.01	23.47	
15.4-18.9	20.5	18.29	
>18.9	31.55	40.15	
Number of Stressful Life Events			
0	23.04	13.49	0.0001*
1	24.86	18.32	
2	20.61	19.99	
3	9.25	18.66	
>3	22.24	29.54	
Stressful Life Events: # of factors			
0	22.86	13.46	0.002*
1	30.54	24.93	
2	23.62	27.77	
3	16.44	20.62	
4	6.54	13.22	

*Significant at alpha = 0.05
**Significant at alpha = 0.10

Table 2: Distribution of Demographic and Psychosocial Factors by Categories of Impact of Event Scale (IES) Score Categories Among Women who Experienced a Stillbirth Included in OASIS

	High IES (≥ 40)	Low IES (< 40)	Wald Chi-Square P-Value
Unweighted Sample Size, n	69	169	
Weighted Sample Size, n_w	72.67	159.03	
Characteristic, Weighted %			
Stresssful Life Events, Sum			
High (≥ 3)	39.25	29.80	0.24
Low (< 3)	60.75	70.20	

Stressful Life Events, Factors			
High (≥ 3)	32.69	20.09	0.10**
Low (< 3)	67.31	79.91	
Sociodemographic Variables			
Maternal age at delivery, years			
<20	24.01	13.57	0.40
20-34	60.11	71.01	
35-39	11.07	12.94	
40+	4.80	2.48	
Maternal race/ethnicity			
Non-Hispanic white	28.55	37.52	0.43
Non-Hispanic black	26.44	23.01	
Hispanic	45.00	39.47	
Maternal education, grade			
0-11 (None/primary/some secondary)	35.66	21.42	0.26
12 (completed secondary)	25.49	31.71	
13+ (college)	38.84	46.87	
Marital status/cohabiting			
Not married or cohabiting	25.36	23.86	0.03*
Cohabiting	39.90	21.90	
Married	34.74	54.24	
Insurance/method of payment			
No insurance/ Any public/private assistance	73.95	56.56	0.10**
VA/commercial health ins/ HMO	26.05	43.44	
Pregnancy-Associated Variables			
Pregnancy history			
Nulliparous; never pregnant or only elective terminations	30.17	40.81	0.47
Nulliparous with previous losses	11.55	11.54	
Multiparous with no previous losses at <20 weeks or stillbirths	29.84	31.45	
Multiparous with no stillbirth but previous losses at <20 weeks	20.90	10.70	
Multiparous with stillbirth	7.54	5.50	
Pregnancy wanted ever, before pregnancy			
Yes	88.71	95.08	0.22
No	11.28	4.92	
Gestational age at delivery, weeks			
18-19	0.00	3.68	0.24
20-23	43.67	35.73	
24-27	17.19	13.57	
28-31	6.71	7.84	
32-36	14.55	23.56	
37+	17.88	15.63	
Psychosocial Variables			
Mental health condition before pregnancy			

Yes	12.94	9.31	0.45
No	87.06	90.69	
STAI trait-anxiety scale score			
<25.8	10.91	8.66	0.38
25.8-32.1	16.39	15.53	
32.1-38.9	12.58	22.03	
>38.9	60.12	53.78	
STAXI-2 trait-anger scale score			
< 12.7	18.23	22.54	0.26
12.7-15.4	22.85	28.54	
15.5-18.9	32.41	16.77	
>18.9	26.51	32.14	
Feelings of blame about stillbirth			
Yes	21.29	14.10	0.25
No	78.71	85.90	
History of Depression			
Yes	19.96	16.45	0.53
No	80.04	83.55	
Edinburgh Depression Scale Score			
> 12	44.43	6.59	0.00*
≤ 12	55.57	93.41	

*Significant at alpha = 0.05
**Significant at alpha = 0.10

Table 3. Distribution of Demographic and Psychosocial Factors by Categories of Current Depression Among Women who Experienced a Stillbirth Included in OASIS

	Current Depression	No Current depression	Wald Chi-Square P-Value
Unweighted Sample Size, n	39	202	
Weighted Sample Size, n_w	43.4	193.9	
Characteristic, Weighted %			
Impact of Events Scale Score			
High (≥ 12)	75.25	21.16	0.00*
Low (< 12)	24.75	78.84	
Stressful Life Events, Sum			
High (≥ 3)	47.49	29.16	0.07**
Low (< 3)	67.44	70.84	
Stressful Life Events, Factors			
High (≥ 3)	45.33	18.89	0.01*
Low (< 3)	54.67	81.11	
Sociodemographic Variables			
Maternal age at delivery, years			
<20	17.76	16.47	0.74
20-34	71.04	67.20	

35-39	7.73	13.22	
40+	3.47	3.12	
Maternal race/ethnicity			
Non-Hispanic white	33.93	34.71	0.98
Non-Hispanic black	22.53	23.96	
Hispanic	43.54	41.33	
Maternal education, grade			
0-11 (None/primary/some secondary)	42.62	22.56	0.08**
12 (completed secondary)	29.54	20.43	
13+ (college)	27.84	48.02	
Marital status/cohabiting			
Not married or cohabiting	25.00	23.32	0.95
Cohabiting	29.55	27.94	
Married	45.45	48.74	
Partnered			
Not partnered	25.00	23.32	0.85
Partnered	7.50	76.68	
Insurance/method of payment			
No insurance/Any public/private assistance	75.79	59.17	0.05*
VA/commercial health ins/ HMO	24.21	40.83	
Pregnancy-Associated Variables			
Nulliparous; never pregnant or only elective terminations	32.00	38.21	0.55
Nulliparous with previous losses	9.63	11.26	
Multiparous with no previous losses at <20 weeks or stillbirths	26.40	33.08	
Multiparous with no stillbirth but previous losses at <20 weeks	15.72	13.65	
Multiparous with stillbirth	16.26	3.80	
Pregnancy wanted ever, before pregnancy			
Yes	85.50	94.86	0.22
No	14.50	5.14	
Gestational age at delivery, weeks			
18-19	0.00	3.05	0.54
20-23	34.98	38.87	
24-27	13.20	14.87	
28-31	8.90	7.90	
32-36	25.11	19.78	
37+	17.81	15.54	
Psychosocial Variables			
Mental health condition before pregnancy			
Yes	14.36	9.44	0.41
No	85.64	90.56	
STAI trait-anxiety scale score			
<25.8	10.35	10.08	0.0002*
25.8-32.1	11.16	16.77	
32.1-38.9	1.17	22.60	
>38.9	77.33	50.56	
STAXI-2 trait-anger scale score			
< 12.7	21.85	20.98	0.99

12.7-15.4	27.61	26.76	
15.5-18.9	22.19	21.85	
>18.9	28.35	30.42	
Feelings of blame about stillbirth			
Yes	28.66	13.42	0.11
No	71.34	86.58	
History of Depression			
Yes	23.70	15.93	0.26
No	76.30	84.07	
Social support-Someone to talk to			
Yes	89.16	97.98	0.21
No	10.84	2.02	
Was stillbirth the most traumatic event			
Yes	42.34	57.09	0.15
No	57.66	42.91	

*Significant at alpha = 0.05
**Significant at alpha = 0.10

Table 4. Distribution of Demographic and Psychosocial Factors by Categories of Stressful Life Event (SLE) Factors Among Women who Experienced a Stillbirth Included in OASIS

	High SLE Factors (≥ 3)	Low SLE Factors (< 3)	Wald Chi-Square P-Value
Unweighted Sample Size, n	54	188	
Weighted Sample Size, n_w	58.58	181.35	
Characteristic, Weighted %			
Impact of Events Scale Score			
High (≥ 40)	42.39	27.56	0.10**
Low (< 40)	57.61	72.42	
Sociodemographic Variables			
Maternal age at delivery, years			
<20	26.58	13.27	0.31
20-34	62.30	69.52	
35-39	7.96	14.07	
40+	3.17	3.14	
Maternal race/ethnicity			
Non-Hispanic white	35.74	34.85	0.60
Non-Hispanic black	29.03	21.92	
Hispanic	35.23	43.23	
Maternal education, grade			
0-11 (None/primary/some secondary)	28.29	25.94	0.47
12 (completed secondary)	34.02	27.00	
13+ (college)	37.69	47.06	
Marital status/cohabiting			
Not married or cohabiting	32.91	20.89	0.11

Cohabiting	32.43	26.69	
Married	34.66	52.42	
Partnered			
Not partnered	32.91	20.89	0.17
Partnered	67.09	79.11	
Insurance/method of payment			
No insurance/Any public/private assistance	71.50	59.13	0.10**
VA/commercial health ins/ HMO	28.50	40.87	
Pregnancy-Associated Variables			
Pregnancy history			
Nulliparous; never pregnant or only elective terminations	48.45	33.18	0.24
Nulliparous with previous losses	5.52	13.17	
Multiparous with no previous losses at <20 weeks or stillbirths	29.96	32.53	
Multiparous with no stillbirth but previous losses at <20 weeks	10.89	14.84	
Multiparous with stillbirth	5.17	6.29	
Pregnancy wanted ever, before pregnancy			
Yes	85.23	96.16	0.10**
No	14.77	3.84	
Gestational age at delivery, weeks			
18-19	4.53	1.79	0.51
20-23	33.50	40.50	
24-27	13.54	14.68	
28-31	12.18	6.31	
32-36	25.75	18.84	
37+	10.50	17.87	
Psychosocial Variables			
Mental health condition before pregnancy			
Yes	20.78	8.24	0.03*
No	79.22	91.76	
STAI trait-anxiety scale score			
<25.8	3.71	12.04	0.00*
25.8-32.1	6.42	18.46	
32.1-38.9	2.53	23.80	
>38.9	87.34	45.71	
STAXI-2 trait-anger scale score			
< 12.7	14.55	22.88	0.42
12.7-15.4	23.95	28.30	
15.5-18.9	22.23	21.35	
>18.9	39.28	27.47	
Feelings of blame about stillbirth			
Yes	20.47	14.53	0.39
No	79.53	85.47	
History of Depression			
Yes	25.14	15.92	0.14
No	74.86	84.08	
Social support-Someone to talk to			
Yes	93.77	97.26	0.45
No	6.23	2.74	

Was stillbirth the most traumatic event			
Yes	44.75	57.75	0.14
No	55.25	42.25	
Edinburgh Depression Scale Score			
> 12	25.13	13.20	0.10**
≤ 12	64.87	86.80	

*Significant at alpha = 0.05
**Significant at alpha = 0.10

Table 5. Distribution of Demographic and Psychosocial Factors by Categories of Combined Post-Traumatic Stress (PTS) and Depression Categories Among Women who Experienced a Stillbirth and Were Included in OASIS

	No Current Depression, No PTS	No Current Depression, PTS	Current Depression	Wald Chi-Square P-Value
Unweighted Sample Size, n	159	37	39	
Weighted Sample Size, n_w	150.10	40.30	43.40	
Characteristic, Weighted %				
Stressful Life Events, Sum				
High (≥ 3)	29.04	28.55	47.49	0.20
Low (< 3)	70.96	71.45	52.51	
Stressful Life Events, Factors				
High (≥ 3)	18.97	20.27	45.33	0.05*
Low (< 3)	81.03	79.73	54.67	
Sociodemographic Variables				
Maternal age at delivery, years				
<20	13.00	30.81	17.76	0.50
20-34	70.49	52.09	71.04	
35-39	13.85	11.98	7.73	
40+	2.65	5.11	3.47	
Maternal race/ethnicity				
Non-Hispanic white	38.26	23.06	33.93	0.48
Non-Hispanic black	22.96	27.95	22.53	
Hispanic	38.78	48.98	43.54	
Maternal education, grade				
0-11 (None/primary/some secondary)	20.49	28.91	42.62	0.17
12 (completed secondary)	31.83	23.04	29.54	
13+ (college)	47.68	48.05	27.84	
Marital status/cohabiting				
Not married or cohabiting	24.63	20.47	52,00	0.25
Cohabiting	22.53	45.10	29.55	
Married	52.85	34.43	45.45	
Partnered				
Not partnered	24.63	20.47	25.00	0.90
Partnered	75.37	79.53	75.00	
Insurance/method of payment				
No insurance/Any public/private assistance	55.45	70.91	75.79	0.03*

VA/commercial health ins/ HMO	44.55	29.09	24.21	
Pregnancy-Associated Variables				
Pregnancy history				
Nulliparous; never pregnant or only elective terminations	40.16	34.30	32.00	0.76
Nulliparous with previous losses	11.86	9.99	9.63	
Multiparous with no previous losses at <20 weeks or stillbirths	32.75	29.87	26.40	
Multiparous with no stillbirth but previous losses at <20 weeks	11.46	21.58	15.72	
Multiparous with stillbirth	3.77	4.26	16.26	
Pregnancy wanted ever, before pregnancy				
Yes	94.73	94.92	85.50	0.47
No	5.27	5.08	14.50	
Gestational age at delivery, weeks				
18-19	3.94	0.00	0.00	0.11
20-23	36.17	49.00	34.98	
24-27	12.75	24.04	13.20	
28-31	8.39	2.79	8.90	
32-36	23.55	7.46	25.11	
37+	15.20	16.72	17.81	
Psychosocial Variables				
Mental health condition before pregnancy				
Yes	9.13	11.38	14.36	0.67
No	90.87	88.62	85.64	
STAI trait-anxiety scale score				
<25.8	8.73	12.63	10.35	0.002*
25.8-32.1	16.33	19.62	11.16	
32.1-38.9	23.60	19.80	1.17	
>38.9	51.34	47.95	77.33	
STAXI-2 trait-anger scale score				
< 12.7	22.60	15.50	21.85	0.61
12.7-15.4	28.44	16.91	27.61	
15.5-18.9	17.50	39.64	22.19	
>18.9	31.46	27.94	28.35	
Feelings of blame about stillbirth				
Yes	13.42	14.59	28.66	0.29
No	86.58	85.41	71.34	
History of Depression				
Yes	15.86	17.60	23.70	0.54
No	84.14	82.40	76.30	
Social support-Someone to talk to				
Yes	97.39	100.00	89.16	0.10**
No	2.61	0.00	10.84	
Was stillbirth the most traumatic event				
Yes	57.22	55.02	42.34	0.37
No	42.78	44.98	57.66	

*Significant at alpha = 0.05
**Significant at alpha = 0.10

Table 6. Crude and Adjusted Odds Ratios for impact of Event Scale Score Categories and Stressful Life Events Factors

	Women with current depression	Women without current depression
OR type	OR [95% CI]	OR [95% CI]
Crude	1.61 [0.26, 10.12]	1.09 [0.37, 3.23]
Adjusted[1]	1.02 [0.13, 7.79]	Can not assess interaction due to empty cells

[1]Adjusted for insurance status, marital status, and mental health condition before pregnancy

Table 7. Crude and Adjusted Odds Ratios for Association of Current Depression with Impact of Event Scale Score Categories and Stressful Life Event Factor Categories

	Impact of Events Scale	Stressful Life Event Factors
OR type	OR [95% CI]	OR [95% CI]
Crude	11.33 [4.40, 29.16]	3.56 [1.55, 8.20]
Adjusted	10.55 [3.93, 28.37][1]	3.37 [1.40, 8.12][2]

[1]Adjusted for partner status, insurance status, mental health condition before pregnancy, and stressful life event factors

[2]Adjusted for partner status, insurance status, and mental health condition before pregnancy

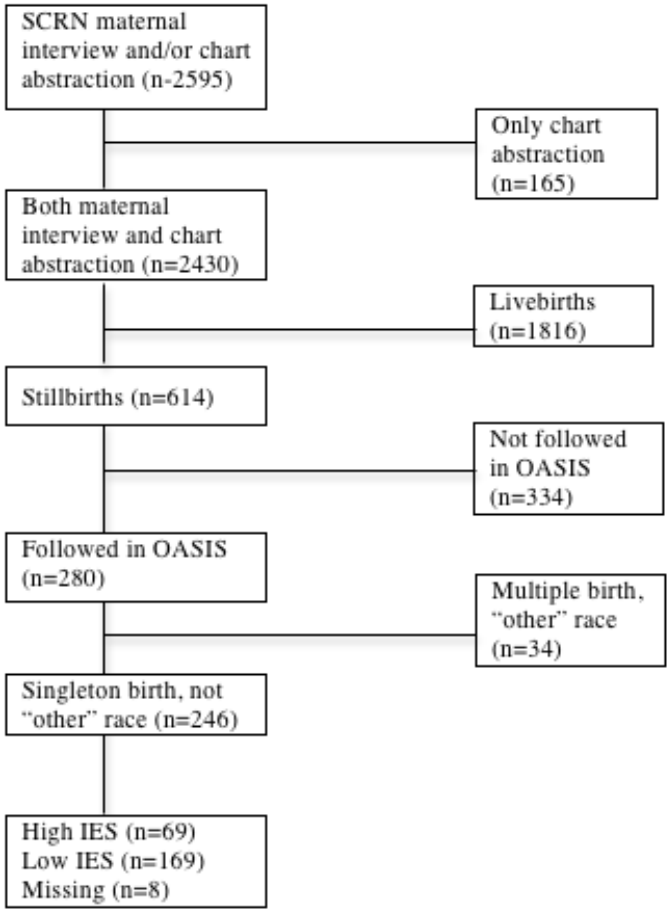
Table 8. Mediation Analysis of the Relationship Between Sociodemographic Factors and IES Score Categories, Mediated by Stressful Life Event Factor Category

Women with Current Depression			
	Partner Status	Insurance Status	Mental Health Condition
Direct Effect	1.22 [0.17, 8.66]	1.15 [0.16, 8.13]	1.06 [0.15, 7.54]
Indirect Effect	0.94 [0.13, 6.67]	1.00 [0.14, 7.08]	1.01 [0.14, 7.14]
Total Effect	1.15 [0.16, 8.14]	1.14 [0.16, 8.11]	1.07 [0.15, 7.59]
Percent Mediated	44.27	0.00	14.71
Women without Current Depression			
	Partner Status	Insurance Status	Mental Health Condition
Direct Effect	0.65 [0.09, 4.60]	2.17 [0.31, 15.38]	1.45 [0.20, 10.32]
Indirect Effect	0.98 [0.14, 6.97]	0.98 [0.14, 6.98]	0.97 [0.14, 6.91]
Total Effect	0.64 [0.09, 4.52]	2.13 [0.30, 15.12]	1.41 [0.20, 10.04]
Percent Mediated	4.53	2.67	8.86

Table 9. Mediation Analysis of the Relationship of Depression and IES Score Categories, Mediated by Sociodemographic Factors

	Partner Status	Insurance Status	Mental Health Condition	SLE factors
Direct Effect	3.13 [0.44, 22.20]	3.13 [0.44, 22.20]	3.13 [0.44, 22.20]	3.13 [0.44, 22.20]
Indirect Effect	1.00 [0.14, 7.09]	1.05 [0.15, 7.44]	1.02 [0.14, 7.21]	1.01 [0.14, 7.19]
Total Effect	3.12 [0.44, 22.16]	3.28 [0.46, 23.27]	3.18 [0.45, 22.55]	3.17 [0.45, 22.49]
Percent Mediated	0.00	4.11	1.71	0.86

Figure 1. Flow Chart of Sample Size in SCRN and OASIS Studies



Chapter III: Public Health Implications

This study found that the relationship between stressful life events, depression, and post-traumatic stress symptoms among mothers who recently experienced a stillbirth is complicated. Mental health is influenced by a host of internal and external factors and there is still much to learn related to etiology of common mental health conditions. Although the estimate for the association of stressful events in the period before birth and symptoms of post-traumatic stress did were not statistically significant, the estimates were different between women with and without current depression, pointing to a stronger detrimental impact of stressful life events among women with depressive symptoms after stillbirth than among those without. Adjustment for marital status, insurance status, and experiencing a mental health condition before the index pregnancy reduced this value towards the null among women with current depression. These factors may represent the fact that variations in social support, economic status, and mental health may be more responsible for protecting the leaving women exposed to the turmoil of stressful life events. This points to the possibility that the presence of social, financial, and personal resources are both causes of stressful life events themselves and also are associated with post-traumatic symptoms after a stillbirth.

One of the significant findings of this study was that depression and post-traumatic stress were strongly associated in women after experiencing stillbirth, which was consistent with previous studies on the co-occurrence of these outcomes. Additionally, stressful life events were strongly associated with depression after experiencing a stillbirth and also significantly differentiated women experiencing depression from women experiencing post-traumatic stress alone. These results support the idea that reducing the number of stressful life event factors a woman experiences before her pregnancy could reduce her risk of depression after experiencing a stillbirth. Creating interventions based on this information would present challenges but could be a successful way to improve mental health among women.

The impact of stressful events on mental health after a stillbirth, particularly the

relationship between post-traumatic stress and depression has further nuances to be examined. This study calculated associations using a small sample that involved small or non-existent subgroups when performing analyses involving stratification that contributed to wide, imprecise confidence intervals. Additional studies that involve a larger sample size may be able to more clearly distinguish the impact of social and environmental exposures and mental health outcomes among women who experience a stillbirth. Such analyses could give more informative results that might have an impact on how providers screen for mental health risks among women during pregnancy and postpartum.

A potential area of continued study of stressful events and mental health could involve analyses to clarify the impact of stressful life events as compared to other sociodemographic risk factors. Women with depression in this study were more likely to have experienced stressful life events from a high number of factors, and several sociodemographic factors were associated with depression and post-traumatic stress. A larger study could identify with more certainty the contributions of each of these exposures. The results of further analysis similar to the mediation analysis in this study may determine the most effective point of public health intervention that will have the largest impact. If stressful life events are independently and strongly associated with detrimental mental health outcomes, interventions might focus on women who experience these events and on reducing the prevalence of these events in the community. However, if sociodemographic factors such as social support and economic scarcity are more causally related to mental health after a stillbirth, interventions could be tailored to women exposed to these individual factors and to reducing these factors in the community. To create interventions and strategies that can reduce detrimental mental health outcomes after stillbirth, further evidence must clarify the true risks for post-traumatic stress and depression.

In conclusion, future studies can continue to distinguish the risk factors and burden of depression and post-traumatic stress disorder after stillbirth. These mental health conditions have serious consequences individually and societal and further research can parse out the similarities

and differences between these conditions, as well as the unique factors leading to comorbidity of these two conditions. To prevent and treat these outcomes more accurately and effectively among women who experience stillbirth, more research can be done to understand how they are connected and what makes them distinct.