Interpersonal Violence, C-Reactive Protein, and Heart Health: A secondary analysis of the SWAN dataset

by

Kelly A. Kean

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Nursing)
in the University of Michigan
2016

Doctoral Committee:

Associate Professor Denise Saint Arnault, Chair
Clinical Assistant Professor Cynthia S. Darling-Fisher
Professor Timothy R.B. Johnson
Assistant Professor Erin M. Kahle

DEDICATION

This dissertation is dedicated to my family, and those friends who have become family to me. Without you, I would not be who I am, or where I am. There are more than I can list here who have a played a role, but the following individuals have done more than I can ever say.

To my grandparents, especially my Grandmother Florence Butrico, who was the first nurse in our family, and who's memory I carry with me always.

My parents, thank you Dad for suggesting a career in nursing. Mom, you are the best nurse I have ever known- thank you for all the help; with studying, papers, childcare, advice, and more than I can ever say.

My siblings, thank you for always keeping me grounded, and reminding me where I come from.

Jessica Shull: my oldest friend, who knows the whole story, and loves me anyways. Thank you for being there through it all.

Angela White: without her tutoring, friendship, and chemistry brilliance I would not be a nurse at all. Thank you for always keeping my line tight, and reminding me that sometimes you just need to "jump and flap".

Mollie Stapleton: for encouraging this crazy idea, and always knowing exactly what to say, and when to just say nothing.

Karen Petersen: for talking me off of all the ledges, and always being there to patch me up when I managed to stumble off of one. Without your help and support this dissertation would never have been completed.

My children, Bridget and Seamus: thank you for putting up with all of this, encouraging me, going to class with me (and behaving while there), helping me study, and for the endless joy and love. You are my inspiration.

My husband, Adam: I don't know how to thank you for all you've done. You've supported this journey, and me, in countless ways, and have filled my heart and life with love.

ACKNOWLEDGEMENTS

First, I would like to acknowledge my advisor and mentor, Denise Saint Arnault. Without your advice, encouragement, and willingness to stick with me this project would never have been completed, and I would likely be just another "all but dissertation" candidate floating around out there. Also, my committee members, thank you for your hard work, and encouragement through this process.

Additionally, I would like to thank Rosemary Ramey, who hired me to work in the Neonatal Intensive Care Unit as a new grad. Thank you for taking a chance on a new grad. And to the "Holdenettes" who taught me how to be a NICU nurse and demonstrated the finest nursing care I have ever seen. I carry your lessons with me in all that I do as a nurse in more ways than you will ever know.

Finally, I would like to acknowledge my patients. Thank you for letting me into your lives. You have taught me more than any textbook or lecture, and I have been humbled by your strength.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

ABSTRACT

Each year, interpersonal violence (IV) affects millions of women, causing devastating effects on them physically, mentally, emotionally, financially, and socially. Although mental health consequences have long been noted in the literature, the long-term physical health outcomes of women who have experienced IV have more recently become an area of interest. Many health conditions previously believed to be unrelated to IV are reported in disproportionate numbers in survivors. One of the most concerning is the increase in cardiovascular disease in women who have experienced IV, as cardiovascular disease is the leading cause of death in women worldwide. Of the mechanisms suggested to explain the increased prevalence of cardiovascular disease in IV survivors, C-reactive protein (CRP) is of particular interest because it has been found to be highly predictive of subclinical heart disease. We describe some of the long-term health consequences of IV and their proposed mechanisms of action. We then use secondary data analysis of the SWAN baseline dataset to examine the relationship between CRP and reported IV in the past 12 months. Specifically, we aimed to examine the relationships between CRP, depression, obesity, and smoking for women who indicated IV in the past year. We also aimed to describe the influence of social support and social negativity on CRP, and to explore the impact of perception of the severity of the abuse on CRP for these women. Controlling for age and income, our analyses revealed neither IV nor depression were related to elevated CRP, but smoking and BMI were. We also found that social support and social negativity did not significantly impact CRP levels. Clinical and research implications are discussed.

CHAPTER 1

INTRODUCTION TO THE PROBLEM

Each year, interpersonal violence (IV) affects millions of women worldwide, causing devastating effects on them physically, mentally, emotionally, financially, and socially (Black, 2010; Brown, Finkelstein, & Mercy, 2008; Coker, 2002; Campbell, 2002). However, numerous definitions and perspectives make discerning the impact of interpersonal violence difficult. Most research has focused on the concept of Intimate Partner Violence (IPV), and while definitions of intimate partner violence vary, they largely contain similar components. For example, Saltzman et al. defined IPV as completed or threatened physical, sexual, or psychological violence by a current or former partner, whereas the Center for Disease Control (CDC) uses IPV to include physical violence, sexual violence, stalking and psychological aggression (including coercive tactics) by a current or former intimate partner (i.e., spouse, boyfriend/girlfriend, dating partner, or ongoing sexual partner)" (Saltzman et al., 2002; Breiding, Smith, Black, Mahendra, 2015). However, research on the effects of violence on women's health also includes physical abuse (PA), sexual abuse (SA), psychological aggression/emotional abuse (EA), stalking (S), and rape (Lacey, McPherson, Samuel, Sears, & Head, 2013; Krebs, Breiding, Browne, Warner, 2011), and not all of these are carried out by Intimate Partners.

In this study, we will cast a broad net to examine violence and health by using the concept of interpersonal violence (IV). We follow the definition given used by the World Health Organization (WHO), who define IV as "acts of violence and intimidation that occur

between family members, between intimate partners or between individuals, whether or not they are known to one another, and where the violence is not specifically intended to further the aims of any group or cause" (Waters, Hyder, Rajkotia, Basu, & Rehwinkel, 2004).

Literature suggests that there is significant overlap among types of IV that women experience (Krebs, Breiding, Browne, & Warner, 2011), and these types abuse are associated with specific health outcomes. For example, increased rates of depression, and poor health perception were found for victims of PA and SA (Bennice, Resick, & Austin, 2003; Bonomi et al., 2006; Caetano & Cunradi, 2003, Campbell, 2002; Carbone-Lopez et al., 2006; Coker et al., 2002; Cortina & Kubiak, 2006; Temple, Weston, Rodriquez, & Marshall, 2007). Stalking has been less studied, but has been associated with depression (Cavanaugh, 2011; Mechanic, Weaver, & Resick, 2008). Furthermore, surviving multiple types of IV over the lifespan have been shown to be especially damaging to survivors, suggesting perhaps a cumulative effect in which more types of violence can lead to more negative health outcomes (Basile et al., 2004). This hidden interaction is critical because literature may focuse on specific types of IV, or may fail to address the impact of multiple traumas in a survivors, or may not account for the extensive overlap that can exist between types of violence. Research has shown that women may experience different types of IV within a single relationship, or with different perpetrators over the course of her lifetime (Basile et al., 2004; Coker et al. 2000; Garcia-Moreno et al., 2006; Miller, 2006; Monnier et al., 2002; Thompson et al., 2006). For example, in women who reported that they had experienced IV-PA as an adult, 31% had also experienced IV-SA and 23% had experienced stalking (Miller, 2006). Marshall et al. found in their study of married women, IV-PA and IV-EA were significantly associated with IV-SA (Marshall & Holtzworth-Munroe, 2002).

In the National Violence Against Women Survey (NVAWS), researchers found a significant relationship between all forms of IV (Basile et al., 2004). This was further demonstrated with the National Intimate Partner and Sexual Violence Survey (NISVS Pilot Study) (Krebs, Breiding, Browne, & Warner, 2011). In this study, 96.2 % of women who experienced IV-S also reported IV-EA (Krebs, Breiding, Browne, & Warner, 2011). Additionally, 86.9 % and 53.2% of women who experienced IV-S reported IV-PA and IV-SA respectively (Krebs, Breiding, Browne, & Warner, 2011).

Significant violence was also been demonstrated among women who experienced intimate partner from *non-partners* (Krebs, Breiding, Browne, & Warner, 2011). Thirty-one percent of women who experienced IV-S additionally experienced sexual violence by a non-partner, and 29.6% experienced stalking by a non-partner (Krebs, Breiding, Browne, & Warner, 2011). Among women who experienced IV-SA, 27.7% also experienced sexual violence by a non-partner (Krebs, Breiding, Browne, & Warner, 2011). Ultimately, Krebs and colleagues found that in women who experienced IV-S, SA, and/or PA, nearly all also reported IV-EA.

Although mental health consequences of IV have long been noted in the literature, the long-term physical health outcomes of women who have experienced IV have more recently become an area of interest (Jewkes, Dunkle, Nduna, & Shai, 2010; Beck, Elzevier, Pelger, Putter, & Voorham-van der Zalm, 2009; Beck et al., 2009; Jundt, Scheer, Schiessl, Pohl, Haertl, & Peschers, 2007; Lesserman, 2007; Frayne et al., 2003; Scott et al., 2013; Sumner et al., 2015). Many health conditions previously believed to be unrelated to IV are reported in disproportionate numbers in survivors (Beck, Elzevier, Pelger, Putter, & Voorham-van der Zalm, 2009; Woods, Hall, Campbell, & Angott, 2008; Lesserman, 2007; Woods et al., 2008). One of the most concerning is the increase in cardiovascular disease (CVD) in women who have experienced IV,

especially since CVD is the leading cause of death in women worldwide (NHLBI, 2013; Scott-Storey, K., Wuest, J., & Ford-Gilboe, M., 2009),

Some literature that has examined CVD in women with an IV history has shown that overlapping aspects of a woman's life can affect her risk of developing CVD (Burns et al., 2015; Coutinho et al., 2013; Mehta et al., 2016). Some research has found that experiencing IV itself can increase risk of CVD but also speculate that IV survivors may also develop poor eating habits and smoking, which may contribute to CVD (Frayne et al., 2003; Black & Breiding, 2008; Bonomi et al., 2006; Bonomi et al., 2009; Bermudez, Rifai, Buring, Manson, & Ridker, 2002; AHA, n.d.; CDC, 2008). Finally, depression has been shown to be a consequence of IV as well as a CVD risk factor (Elderon & Whooley, 2013; Glassman, 2008; Whooley, 2006; Nixon, Resick, & Nishith, 2004; Daniels, 2005). Major depression, as well as symptoms of depression, have been reported to be risk factors not only for CVD incidence, but also severity of the disease, and the outcomes of the disease (Elderon & Whooley, 2013)

Purpose

Chapter 2 will examine literature to describe some of the long-term health consequences of IV. Chapter 3 examines literature that explains the mechanisms by which IV and inflammation may interact to create risk for CVD. Of the mechanisms suggested to explain the increased prevalence of cardiovascular disease in IV survivors, C-reactive protein (CRP) is of particular interest because it has been found to be highly predictive of subclinical cardiovascular disease. Chapter 4 will present the theoretical model that guides this study. Inspired by Uri Bronfenbrenner's Ecological Systems Theory (EST) (1986). Though the conceptual model used here is different from the Bronfenbrenner EST model, it informed the development of our conceptual model for the study.

Next, Chapter 5 will describe the methods we used to conduct a secondary data analysis of a comprehensive women's health data set, the SWAN baseline dataset, to examine the relationship between CRP and reported IV (Sowers, 2000). The SWAN dataset assesses violence using the question "In the last 12 months have you experienced the following: slapped, kicked, or otherwise hurt by husband/partner or someone else important to you?" The addition of the phrase "or someone else important to you" supports our use of the WHO definition of IV because it takes into account individuals who might not be a current or previous intimate partner.

Because depression, BMI and smoking are known risk factors for CVD, and are also known to be associated with IV, we will use them as covariates (Frayne et al., 2003; Black & Breiding, 2008; Bonomi et al., 2006; Bonomi et al., 2009; Bermudez, Rifai, Buring, Manson, & Ridker, 2002; AHA, n.d.; CDC, 2008; Elderon & Whooley, 2013; Glassman, 2008; Whooley, 2006; Nixon, Resick, & Nishith, 2004; Daniels, 2005). Our secondary analysis will use CRP as our outcome. We hypothesize that elevated CRP will be associated with IV, depression, smoking, and obesity. Recognizing that not all women who experience IV develop elevated CRP, or CVD, we propose that the social context in which a woman lives might play a role in increasing or decreasing CRP levels. Therefore, we will also explore the roles of social support and social negativity. We hypothesize that women who indicate social support have lower CRP and women who have social negativity will have higher CRP.

The specific aims of this secondary analysis are:

Aim 1. To examine the relationships between CRP, depression, obesity, smoking, and in women who indicated IV in the past year who have an intact uterus, at least one functioning ovary, pre-menopausal, and no current use of exogenous hormone preparations that affected ovarian function.

Aim 2. To describe the influence of social support and social negativity on CRP in women reporting recent IV.

Exploratory Aim. To explore the influence of self-perception of IV on CRP.

In Chapter 6, the results of descriptive, hierarchical multiple regression and multicollinearity analyses for both the entire SWAN data set, as well as a subset that included only women reporting a recent history of IV are provided. Finally, in Chapter 7, we conclude with a discussion of these results, providing recommendations for future research and practice implications.

CHAPTER 2

LITERATURE REVIEW

Interpersonal Violence

The World Health Organization (WHO) has defined interpersonal violence as "acts of violence and intimidation that occur between family members, between intimate partners or between individuals, whether or not they are known to one another, and where the violence is not specifically intended to further the aims of any group or cause" (Waters, Hyder, Rajkotia, Basu, & Rehwinkel, 2004). Similarly, the International Classification of Diseases (ICD), used worldwide to code mortality and morbidity data, grouped together assault, sexual assault, neglect, abandonment, and maltreatment as "interpersonal violence" (WHO, 2003).

According to the Centers for Disease Control (CDC), a current or former spouse, cohabiting partner, boyfriend, girlfriend, or date has physically assaulted 22.1% of women in their lifetime (CDC, 2012). Further, researchers suspect that this number underestimates the actual number of assaults, because as many as 60% of sexual assaults are never reported to the police and underreporting of physical assaults is also extensive (Black et al., 2011). Researchers in the field have long known that IV survivors are at increased risk for depression, anxiety, and PTSD, but in the past 10-15 years, it has become increasingly evident that IV adversely affects a woman's physical as well as her mental health (Clum, Calhoun, & Kimerling, 2000). Current evidence suggests that IV may contribute to many chronic physical conditions, including cardiac

disease (Jewkes, Dunkle, Nduna, & Shai, 2010; Beck, Elzevier, Pelger, Putter, & Voorham-van der Zalm, 2009; Beck et al., 2009; Jundt, Scheer, Schiessl, Pohl, Haertl, & Peschers, 2007; Lesserman, 2007; Frayne et al., 2003; Scott et al., 2013; Sumner et al., 2015). The body of literature on the relationship between IV and physical health is vast. The review presented here is not a systematic review, but rather a selective representation of English language publications, generally carried out in larger samples, or those that were landmark studies. We excluded most studies outside of the US, those that are case studies, and qualitative studies.

Long-term physical health outcomes in Interpersonal Violence survivors

Multiple studies have shown an association between IV history and adverse physical health conditions, suggesting that the history of IV needs to be considered as a risk factor for many co-morbidities in women's health, including vague uro/genital and gastrointestinal complaints, severe premenstrual syndrome (PMS), and cardiovascular disease (CVD) (Jewkes, Dunkle, Nduna, & Shai, 2010; Beck, Elzevier, Pelger, Putter, & Voorham-van der Zalm, 2009; Beck et al., 2009; Jundt, Scheer, Schiessl, Pohl, Haertl, & Peschers, 2007; Lesserman, 2007; Frayne et al., 2003; Scott et al., 2013; Sumner et al., 2015). Additionally, some research has suggested that the impact of IV lasts far beyond the experience abuse and may last well after the violence has stopped (Dillon, Hussain, Loxton, & Rahman, 2013). Indeed, the United States Preventive Services Taskforce (USPSTF) updated screening recommendations in 2012, recommending that screening be done on all women of reproductive age (ages 14-46), and that screening can identify women experiencing IV with minimal adverse effects (Nelson, Bougatsos, & Blazina, 2012). The American College of Nurse Midwives has similar recommendations for screening asymptomatic women exist for other groups (Paterno & Draughon, 2016). Of particular note is the evidence that women with a history of IV are at greater risk for engaging in

risky health behaviors such as alcohol and drug use, unprotected sexual activity, and obesity, which put them at further risk for multiple co-morbidities (Wingood & DiClemente, 1998; Cloutier et al., 2002; Coker, 2007; Sullivan, Cavanaugh, Buckner, & Edmondson, 2009; Meyer, Springer, & Altice, 2011; Sullivan, McPartland, Armeli, Jaquier, & Tennen, 2012). IV history is also associated with a poorer self-perception of health, which can lead to increased utilization of health care services, a greater number of tests and procedures used to try to diagnose vague complaints, and increased time off from work for reasons other than illness (Frayne, Skinner, Sullivan, & Freund, 2003; Wittenberg, Joshi, Thomas, & McCloskey, 2007; Bonomi, Anderson, Reid, et al., 2009; Black & Breiding, 2008; CDC, 2008).

Urologic/Gynecologic Conditions

In Coker's 2007 systematic review of the literature, the focus was *only* on IV-PA. The literature from January 1966-2006 was reviewed and included only articles with a focus on sexual health and IV-PA, omitting articles about IV-SA, but acknowledged that various forms often co-occur. Coker cites multiple articles finding pelvic or abdominal pain to be associated with IV-PA (Campbell et al., 2002; Campbell & Soeken, 1999; Champion et al., 2001; Championet al., 2004; Chapman, 1989; Coker, Smith, et al.,2000; Eby et al., 1995; John et al., 2004; Schei &Bakketeig, 1989). Dyspareunia (pain during intercourse) was associated with IV-PA in eight studies (Campbell et al., 2002; Champion et al., 2004; Champion et al., 2001; Chapman, 1989; Golding, 1996; Letourneau et al., 1999; Schei & Bakketeig, 1989). Furthermore, many associations were found between dysmenorrheal and vaginal bleeding (Champion et al., 2001; Golding, 1996; John et al., 2004; Kovac et al., 2003; Letourneau et al., 1999; Campbell et al., 2002, and Schei & Bakketeig, 1989). Each of the studies that looked at IV-PA and sexual satisfaction or pleasure found that women who reported IV-PA were

significantly less likely to report sexual desire or satisfaction in their intimate relationships (Campbell & Soeken, 1999; Garcia-Moreno et al., 2006; Golding, 1996; Kovac et al., 2003).

Some research has shown that immediately after sexual assault, IV-SA survivors have increased problems with urologic and gynecologic health directly related to assault trauma, including sexually transmitted infections (STIs) such as human immunodeficiency virus (HIV) (Jewkes, Dunkle, Nduna, & Shai, 2010; Kennedy, 2013; Seyller, Denis, Dang, Boraud, Lepresle, Lefèvre, & Chariot, 2016). What is more, these health problems can continue years after the assault (Woods, Hall, Campbell, & Angott, 2008). In one study, researchers examined primarily African American female veterans for six gynecological health symptoms: pelvic pain, non-menstrual vaginal bleeding/discharge, painful intercourse, rectal bleeding, bladder infection, and painful urination. Of the 298 participants in the study, 104 women (39%) had a history of sexual assault, with only 39% of the most recent assaults occurring during military service (Campbell, Lichty, Sturza, & Raja, 2006). These survivors were found to have significantly more frequent symptoms of all six measures (pelvic pain, non-menstrual vaginal bleeding/discharge, painful intercourse, rectal bleeding, bladder infection, and painful urination) after controlling for other factors that could affect health status: age, race, education, income, reason for current visit, and time since last assault (Campbell, Lichty, Sturza, & Raja, 2006).

Hilden et al. (2004), in a cross-sectional, multicenter study in five Nordic countries, found that chronic pelvic pain and a history of laparoscopic surgery to evaluate pelvic complaints was significantly associated with a history of IV with six other conditions showing non-significant results. Despite limitations of the research (cross-sectional design, the inability to determine the extent to which the symptoms were either related to IV history or to other factors in the patient's life, and the timing of the surgery/symptoms in relationship to the violence

experienced), these findings emphasize that pelvic pain is an important concern for practitioners (Hilden et al., 2004).

Golding, Taylor, Menard, and King (2000) studied 42 women from a group of 77 women participating in a randomized controlled trial of non-pharmacological treatment for severe PMS. They found that 95% of the women had experienced at least one attempted or completed sexual assault (Golding et al., 2000). Though some might question the high rate of assault history in this study, Golding et al. (2000) suggested that the strong association can be largely explained by the knowledge that the study participants were already participating in a non-pharmacological treatment group for PMS and also that sexual assault survivors, as well as women experiencing IV, more frequently utilize health care services than non-survivors. Also, Golding et al. (2000) included women with a history of depression, while many other studies exclude people diagnosed with depression. Golding states that this inclusion is important because of the strong association between a history of sexual abuse and depression (Golding et al., 2000). Even though Golding et al.'s (2000) study lacked a control group of women without PMS, it still suggests that we need to explore IV history for women seeking care for severe PMS. In addition, it is of note that only 18% of participants in this study reported ever having discussed their sexual assault history with a health care provider; of those who did, it was the patient who brought the issue forth to the provider 73% of the time (Golding et al., 2000).

Past studies have also suggested bladder dysfunction as a health problem related to IV-SA. In a study of 58 sexual assault survivors and 51 controls attending a general gynecology clinic, 72% of IV-SA survivors reported ever experiencing urinary incontinence symptoms as compared to only 22% of the controls, even controlling for parity (commonly associated with incontinence) (Davila, Bernier, Franco, & Kopka., 2003). Researchers gave participants a self-

administered questionnaire, and of the 18 symptoms listed, 15 were reported by significantly more women who had experienced IV-SA (Davila, et al., 2003). An association between overactive bladder (OAB) and reported IV-SA and IV-PA has also been demonstrated, but no association was found for stress incontinence (Jundt, Scheer, Schiessl, Pohl, Haertl, & Peschers, 2007).

Interstitial cystitis (IC) has been shown to be associated with IV-PA, IV-SA, and IV-EA in a sample taken from 464 symptom free controls, 215 patients with known IC, and 121 participants with a health history suggestive of IC (Peters, Kalinowski, Carrico, Ibrahim, & Diokno, 2007). They found that overall, 37% of participants reporting *any type of* abuse had IC compared with 22% of participants who reported no abuse (P= <0.001) (Peters, Kalinowski, Carrico, Ibrahim, & Diokno, 2007). Of their participants, 17.7 % reported IV-SA, 31.6% reported IV-EA, and 17.2% IV-PA (P= <0.001) (Peters, Kalinowski, Carrico, Ibrahim, & Diokno, 2007).

Beck et al. (2008) evaluated female patients with pelvic floor complaints seen at a tertiary referral center for pelvic floor conditions in order to examine the prevalence of reported sexual assault in a large sample of patients with pelvic floor complaints, including complaints related to pelvic floor dysfunction, micturition, defecation, and sexual function (Beck, Elzevier, Pelger, Putter, & Voorham-van der Zalm, 2009). The researchers divided 185 patients into 2 groups: patients with a history of IV-SA and those without. The study showed that 23% of the examined patients reported a history of IV-SA. Patients with multiple pelvic floor complaints were shown to be significantly more likely to have a history of IV-SA than women with only one complaint (83% vs. 48%) (Beck et al., 2009).

In addition to these genitourinary complaints, some IV research has also reported

evidence of diminished sexual satisfaction, inhibited arousal, desire dysfunction, and a decrease in sexual contact (Van Berlo & Ensink, 2000; Campbell & Soeken, 1999; Garcia-Moreno et al., 2006; Golding, 1996; Kovac et al., 2003). Taken together, this body of work shows that genitourinary complaints are common among survivors of IV, and should be screened in routine primary care.

Gastrointestinal Conditions

Women with a history of IV may also experience higher rates of functional gastrointestinal impairment, including abdominal or stomach pain (Leserman, Li, Drossman, & Hu, 1996; Woods et al., 2008). For example, a random survey conducted in Minnesota county showed that IV survivors experienced twice the episodes of irritable bowel syndrome, dyspepsia, and heartburn (Leserman et al., 1998). These researchers also found that the odds of seeing a gastrointestinal specialist were greatest among IV-PA survivors. IV history was also significantly associated with more stomach pain (33% to 13%), nausea (37% to 24), abdominal pain (20% to 8%), and painful stools (26% to 14%) (Leserman et al., 1996; Lesserman, 2007).

Health Related Risk Behaviors Associated with IV

One of the most modifiable areas of health is risk-taking behavior. Many studies have demonstrated that women with a history of IV have increased rates of risk-taking sexual behavior (Cloutier, Martin, & Poole, 2002; Plichta & Falik, 2001; Resnick et al., 1997; Dichter, Cerulli, & Bossarte, 2011; Wittenberg, Joshi, Thomas, & McCloskey, 2007;). Two studies, in particular, showed that women with a history of IV-PA had two-three times more lifetime sexual partners than women without IV history (Brown, Wilson, & Kao, 2003; Lang et al., 2003). Brown et al. (2003) also showed that the women in their sample who had a history of IV were not only four times more likely to have sex with an intravenous drug user, these women also had consensual

intercourse for the first time at a significantly younger age. In a cross-sectional survey of 2823 nationally representative college undergraduates using the National College Health Risk Behavior Survey, Brenner, McMahon, and Warren (1999) found higher risk-taking behaviors, including sexual risk-taking. Their analyses showed that female undergraduate college students with a history of IV have higher percentages of the following: use of alcohol or drugs with last sexual encounter (22% vs. 12%); multiple sexual partners in the past three months (12% vs. 6%); and first sexual intercourse before the age of 15 (21% vs. 9%) (Brenner et al., 1999). Women who had experienced IV-SA were 3 times more likely to have never used condoms, and 2.8 times more likely to have "never negotiated safe sex" (Wingood & DiClemente, 1998). Coker (2007) found that nearly all studies in her systematic review found that inconsistent condom use and partner non-monogamy were significantly associated with IV-PA.

IV has been strongly associated with smoking, physical inactivity, obesity, and alcohol use (Resnick et al., 1997; Cloutier et al., 2002; Frayne et al., 2003; Black & Breiding, 2008; Bonomi et al., 2006; Bonomi et al., 2009; Scott-Storey, Wuest, & ford-Gilboe, 2009; McNutt et al., 2002; Wittenberg, Joshi, Thomas, & McCloskey, 2007). The 2008 CDC analysis of the Behavioral Risk Factor Surveillance System (BRFSS) for 2005 found positive associations linking lifetime IV-PA and high blood cholesterol, history of heart attack, heart disease, current smoking, and heavy or binge drinking (CDC 2008). In a survey of women seeking treatment at a San Diego Veterans Administration primary care clinic, the researchers found that a larger proportion of women with a history of IV-PA were smokers than non-abused women, additionally, women veterans have been shown to have higher rates of IV than the general population of women (Lang et al., 2003 Campbell et al., 2003; O'Campo et al., 2006; Dichter, Cerulli, & Bossarte 2011). In addition, these participants also tended to smoke more often

during pregnancy (Lang et al., 2003). Similar findings among women veterans were found by Frayne et al. (2003), who looked at the possible relationship between IV-PA during military service and cardiovascular risk behaviors. They studied a random sample of 3,632 women veterans attending any of 158 national Veterans Administration ambulatory care centers. Results from a self-administered questionnaire showed that women with a history of IV-PA had greater prevalence of obesity (31% vs. 27%); smoking (44% vs. 29%); problematic alcohol use (13% vs. 7%); sedentary lifestyle (79% vs. 72 %); and hysterectomy before age 40 (20% vs. 11%) (Frayne et al., 2003).

A telephone survey conducted in 1997 by the North Carolina Behavioral Risk Factor Surveillance System found that the likelihood of smoking cigarettes was also increased by IV-PA (Cloutier et al., 2002). College women with a history of IV-PA had cigarette smoking rates of 39% compared to women who had not experienced sexually assault who had a rate of 25% (Brenner et al., 1999).

Alcohol use may also be a risk behavior that is related to a history of IV. In the National Women's Study, researchers found that 67% of alcoholic women reported a history of abuse compared to 4%-20% of non-abused women (Resnick et al., 1997). Resnick et al. also found that drug use rates increased in women with a history of IV-PA, though not to the same extent as alcohol (14%-21% of abused women compared with 3%-12% of non-abused respectively). Increased alcohol use was also found in the North Carolina BRFSS survey, though alcohol use within the past month was not strongly related to IV (Cloutier et al., 2002). Although Brenner et al. (1999) did not find increased rates of binge alcohol drinking in college women with a history of IV, they did find increased rates of having driven an automobile or other vehicle after drinking (28% vs. 22%). This body of literature suggests that the history of IV has been linked to risk

behaviors, and that the presence of these risk behaviors may signal providers to diligently screen for history of IV.

Negative Health Perception Associated with IV

Some studies have shown that IV is associated with self-perceived poor health (Carbone-López, Kruttschnitt, & Macmillan, 2006; Tomasuloand & McNamara, 2007). Data from the 1998 national, cross-sectional Commonwealth Fund study examined self-rated health status for women who experienced IV. Results showed that women who had experienced IV were 2.8 times more likely to rate their health as fair or poor than women who had not experienced IV (Plichta & Falik, 2001). In their study of 221 female veterans, Stein et al. (2004) found similar results, showing that women with a history of assault had significantly more concerns about their health than women who had not been assaulted. They also found that women with a history of IV not only had greater health anxiety, but also had a significantly higher likelihood of having 10 or more sick days in the previous six months. Additionally, the women in their sample with a history IV were significantly more likely to have seen a health care provider more than six times in the previous six months (Stein et al., 2004). The North Carolina BRFSS also found that poor health perception was more evident in the women with an assault history than in their non-assault history counterparts (Cloutier et al., 2002). This research suggests that providers should screen general health perception as well as specific complaints.

Implications of IV on Cardiovascular Health

Although not immediately thought of as a consequence of IV, a growing body of research suggests that IV might increase a woman's cardiovascular health risks (Cloutier et al., 2002; Husarewycz et al., 2014; Scott et al., 2013; Sumner et al., 2015). The North Carolina BRFSS found that victims of IV-PA were more likely than non-victims to have hypertension, high

cholesterol, obesity, and smoke cigarettes, all known risk factors for cardiovascular disease in women (Cloutier et al., 2002; American Heart Association, n.d.). In Frayne et al.'s (1999) study of female veterans, 26% of female veterans with a history of IV-SA reported cardiovascular diseases or risk factors, including self-reported heart attacks, compared to only 11% of their non-assaulted female peers. Breiding, Black, and Ryan (2008) defined IV as being threatened, attempted, or completed physical or sexual violence, or emotional abuse by a current or former intimate partner (IV-PA, SA, or EA). They found that IV experience was significantly associated high cholesterol (adjusted odds ratio [aOR] = 1.26, 95% confidence interval [CI] 1.14–1.38), heart attack (aOR = 1.41, 95% CI: 1.13–1.76), heart disease (aOR = 1.75, 95% CI: 1.45–2.12), stroke (aOR = 1.79, 95% CI: 1.43–2.23)(Breiding, Black, & Ryan, 2008). Also of interest is their finding that while similar associations between IV and health were present in both men and women, the associations between IV and high cholesterol, heart disease, and stroke were only present in women (Breiding, Black, & Ryan, 2008).

Taken together, this literature demonstrates that IV is detrimental to women's health in many ways, including the prevalence of gastrointestinal, gynecological, urological conditions, as well as risk-taking behavior, poor health perception, and cardiovascular disease. Although some of the biological implications of IV have been well described in the literature, there are gaps in our understanding of the possible causal mechanisms underlying these relationships, why the negative impact is so far reaching, the extent of the detriment, how long these risks continue, the potential mediators of the harm, and the possible protective modifiers.

Because cardiovascular disease is the leading cause of death in women, causing one in three deaths each year (NHLBI, 2013), we will confine our review of possible mechanisms by which IV can increase the risk of cardiovascular disease (CVD). When looking at CVD in

women, much of the literature explored the inconsistencies between men and women looking at *sex-based* differences, as opposed to *gender-based* differences (Vaccarino et al. 2010). When examining women's health, there *are* sex differences (such as hormones, artery size, etc.) but there are *also* gender differences that capture social, interpersonal, communal, and societal expectations and roles. IV is a considerable gender-based issue impacting an estimated one-quarter to one-half of all women (Black et al., 2011)

In March 2016, the American Heart Association released a scientific statement about women and CVD in which they identified numerous gaps in our knowledge of women and CVD. Among them are questions about the mortality disadvantage among young women compared with young men; the unique pathophysiological atherosclerotic manifestations among women; the causal mechanisms for mechanical complications among women; and the biological, pathophysiological, and psychosocial risk factors on CVD development and progression among women (Mehta et al., 2016). Throughout this review, and the secondary data analysis to follow, we will begin to look at these gaps in our knowledge. Using history of IV as our focus area, our analysis will speak to these gaps because we examine the relative influences of biological, pathophysiological, and psychosocial risk factors among women's well as modifiable factors contributing CVD risk.

CHAPTER 3

MECHANISMS BY WHICH IV MAY LEAD TO CVD

Researchers have proposed several pathways to attempt to explain how IV can influence long-term cardiovascular health. One of the most compelling pathways by which IV might lead to cardiovascular disease is inflammation, and evidence is mounting that there might be a causal relationship between CVD and C-reactive protein (CRP), a marker of systemic inflammation (de Maat & Trion, 2004). Experts initially thought CVD to be a disease of plaque formation in coronary arteries that resulted largely from lipid levels in the blood, but half of all myocardial infarctions occur in people with normal lipid levels (Ross, 1999). During the past decade, it has become increasingly evident that inflammation plays a leading role in the development of CVD (Ross, 1999; Tracey 1998). Furthermore, inflammation may play a role not only in CVD, but in all stages of atherothrombosis, the pathology that underlies approximately 80% of all sudden cardiac deaths (Albert, Ma, Rifai, Stampfer, & Ridker, 2002).

The mechanism by which inflammation impacts cardiovascular health is complex. Low-density lipoprotein cholesterol (LDL-C), injury, or infection, trigger leukocytes to bind to monocytes at the site of a developing lesion. Once there, these leukocytes continue to consume lipids, lipoproteins, and the monocytes transition to macrophages, then foam cells, and then initiate fatty streaks. At the location of plaque ruptures, more than half of the cells found are macrophages—the primary atherosclerotic inflammatory cells (Moreno et al., 1994). Simultaneously, other inflammatory cells, including activated T-cells and mast cells, also adhere

to the endothelium and contribute to the formation of atherosclerotic lesions, consisting of a lipid pool protected by a fibrous cover. The monocyte-macrophages release proteolytic enzymes that degrade the collagen holding the fibrous cover together, making it more likely to rupture, thus exposing debris beneath the arterial blood supply, leading to thrombosis. Smooth muscle cells secrete factors that recruit additional monocyte cells to fight the lesion. This activation of smooth muscle cells in the arterial wall can augment the inflammatory response and lead to a procoagulant effect (Lefkowitz & Willerson, 2001; Libby & Simon, 2001). The combined activation of macrophages, T lymphocytes, and SMCs leads to further cellular mediation, including adhesion molecules, cytokines (interleukin-6), growth factors, and chemokines, all of which play an important part in atherogenesis (Libby & Ridker, 1999). Interleukin-6 (IL-6), the primary procoagulant cytokine, can lead to more inflammation and coagulation through increased plasma concentrations of fibrinogen plasminogen activator inhibitor type, and CRP (Devaraj, Xu, & Jialal, 2003). Interleukin-1 (IL-1), tumor necrosis factor (TNF), and CRP mediate the attachment of leukocytes to the endothelium (Pasceri, Willerson, & Yeh, 2000; Willerson & Ridker, 2004). Additionally, CRP can also cause monocytes to produce tissue factor, a glycoprotein involved in coagulation.

In addition to these functional pathways, Nitric oxide (NO) has been proposed as a vasoactive peptide that aids in the maintenance of vascular tone and is derived from the endothelium (Verma et. al. 2002). NO is reduced at the location of vascular injury, and is thought to play a role in all CVD because it inhibits platelet adherence and aggregation, suppresses vasoconstriction, reduces the adherence of leukocytes to the endothelium, and prevents the proliferation of vascular smooth muscle cells (Verma et al., 2002). These combined actions contribute both to inflammation and thrombotic pathologies, and some evidence suggests

that CRP is involved in suppressing NO production as well as bioavailability (Verma et al., 2002).

CRP: A Measurement of Inflammation and Indicator of future CVD

Of the available biomarkers of inflammation, CRP is the most predictive of future CVD (Ridker, Hennekens, Buring, & Rifai, 2000; Willerson & Ridker, 2004). Ridker et al. (2000) evaluated the predictive value of 12 biomarkers in the same cohort of 28,263 post-menopausal women: CRP; plasma levels of serum amyloid A; interleukin-6; sICAM-1; total cholesterol; low-density lipoprotein (LDL) cholesterol; high-density lipoprotein (HDL) cholesterol; the ratio of total cholesterol to HDL cholesterol; apolipoprotein A-I; apolipoprotein B-100; Lp(a) lipoprotein; and homocysteine. They found CRP to be the strongest independent predictor of future CVD in women, with a relative risk of 4.4 for women in the highest quartile compared to the lowest quartile (95% confidence interval) CVD, though serum amyloid A, interleukin-6, and sICAM-1 were also predictors (Ridker et al., 2000). CRP is primarily produced in the liver, in response to IL-6, and has historically been considered an inactive, downstream marker of the inflammatory cascade. More recently, however, it has been suggested that CRP may directly impact atherogenesis, as discussed above. CRP binds to and activates complement as well as mediates LDL uptake by macrophages (Torzewski et al., 1998; Zwaka, Hombach, & Torzewski, 2001). Researchers have also determined that arterial tissue produces both CRP and complement, and that together they substantially up-regulate atherosclerotic plaque formation, illustrating that CRP might be produced extra-hepatically (Yasojima, Schwab, McGeer, & McGeer, 2001).

Even in women with LDL levels below 130 mg/dl, the recommended levels in primary prevention, elevated CRP was a significant predictor of risk (Ridker et al., 2000). Although

during times of acute injury or illness there could be profound spikes in plasma CRP levels, in the absence of these spikes, the year to year within-person changes in CRP are similar to traditionally used markers such as total cholesterol and systolic blood pressure (Emberson et al., 2004).

Moreover, CRP has been found to be predictive of future CVD in both women with and without other CVD risk factors, with the effect being most profound among women appearing to be low risk at baseline, with elevated CRP demonstrating a four-fold increase in risk in analyses of non-smokers with no history of hyperlipidemia (RR=3.9, P= 0.002) (Ridker et al., 1998). High CRP was associated with an increased risk of CVD in women with no history of hypertension (RR=2.8), P= 0.03), no history of diabetes (RR=4.9), P=0.001), and no family history of early onset atherosclerosis (RR=6.6,P=0.001) (Ridker et al., 1998; Wong, Pio, Valencia, & Thakal, 2001).

CHAPTER 4

THEORETICAL FRAMEWORK

Ecological Systems Theory (EST), proposed by Urie Bronfenbrenner, provides a framework which helps us better understand the interaction between biological, psychosocial, and contextual pathways between IVP, elevated CRP and CVD (Bronfenbrenner, 1986). First introduced in 1979, Bronfenbrenner modified the EST over the past 30 years for use in many other disciplines and various populations. The ecological model illustrates the many levels of influence on an individual's behavior. Bronfenbrenner's model consists of concentric circles; with each circle influencing the circles within it; and the individual located at the center of all of the circles. Bronfenbrenner conceptualized individual behavior as being influenced by the circles surrounding him or her.

When viewed through the lens of EST, it is apparent that many areas or "circles" in a woman's life will impact her health. EST proposes five systems: microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Bronfenbrenner, 1986). The microsystem deals with the individuals, groups, and institutions with the most immediate impact on a person's life: their family, friends, neighborhood, religion, etc. The mesosystem is the interactions between the microsystems—for example, relationships between family and friends. The exosystem consists of links between a social setting in which an individual does not have an active role and an individual's immediate context, for example how a partner's work life can impact a woman's

life. The macrosystem describes the culture in which one lives and how it can impact one's life—for example how a society or culture views IV survivors, people struggling with obesity, smokers, mental illness, etc. The chronosystem explains the impact of the passage of time on one's life.

Using the EST perspective as an inspiration for understanding the influences of IV on the health of a survivor, we propose three pathways by which women might move from a healthy state to a state of inflammation and CVD: psychosocial/mental health; risk behaviors (smoking, unhealthy diet); and the experience IV itself. Given this perspective, the social context in which a woman lives may both mediate and moderate her CVD outcomes. Consideration of these variables in the secondary analysis will help better understand this inter-relationships.

Psychosocial/Mental Health

Research has shown a concerning relationship between depression and CVD. For example, Low, Thurston, and Matthews' 2010 review found that in 15 separate studies, depression was linked to CVD in women 75% of the time. Frighteningly, in the Nurses' Health Study (NHS), depression was associated with fatal (but *not* non-fatal) cardiovascular events in a fully adjusted model (Whang et al., 2009). Further, some literature has proposed a relationship between PTSD and/or depression and CVD in trauma survivors (Sumner et al., 2015). In addition, it has been suggested that women with a history of trauma who do not report PTSD symptoms might be utilizing coping strategies such as suppression, avoidance, or compartmentalization, all of which may cause physical distress and lead to negative health outcomes (D'Andrea, Sharma, Zelechoski, & Spinazola, 2011). While all the mechanisms connecting mental health conditions to CVD are not yet known, Kendall-Tackett (2007) suggested that the cardiovascular affects might be related to the sequela of depression, sleep

disturbance, and hostility associated with IV that cause a prolonged cytokine pro-inflammatory response resulting in increased risk. Marital stress may also be a factor, since some research has found that it may be atherogenic (Gallow et al., 2003). Woods et al. (2005) proposed a bio-psycho-immunologic theory similar to Kendall-Tackett (2007) linking trauma to an elevation of stress, which in turn triggers inflammatory responses in the body resulting in chronic pain. Further, several studies have shown that depression may play a role in subclinical CVD, with multiple studies confirming the association (Everson, Kaplan, Goldberg, Salonen, & Salonen, 1997; Matthews, Raikkonen, Sutton-Tyrrell, & Kuller, 2004; Stewart, Janicki, Muldoon, Sutton-Tyrrell, & Kamarck, 2007).

Risk Behaviors

As discussed above, a relationship exists between IV and health behaviors that are known to be cardiovascular risk factors, most notably smoking and obesity. In addition to the understanding that smoking and obesity are known to be cardiovascular risk factors, evidence is mounting that they are also involved in CRP elevation (Visser, Bouter, McQuillan, Wener, & Harris, 1999; Van Gaal, Mertens, & Christophe, 2006; Aronson et al. 2004; Ohsawa et al., 2005).

Cerhan and colleagues found that when women have no other identifiable risk factors for CVD, waist circumference was associated with a significantly greater risk of mortality compared with all other study variables (Cerhan et al., 2014). Women with metabolic syndrome have been shown to have higher prevalence of subclinical CVD as well as higher CVD mortality compared to women without metabolic syndrome (Shaw et al., 2006). More recently, it has been shown that people who are obese also have elevated CRP levels, even in the absence of metabolic syndrome (Visser, Bouter, McQuillan, Wener, & Harris, 1999; Van Gaal, Mertens, & Christophe, 2006; Aronson et al. 2004). There is a growing body of evidence suggesting that

adipose tissue itself is a significant regulator of inflammation, as it produces proinflammatory cytokines, including tumor necrosis factor and interleukin- 6, with interleukin-6 being the chief stimulator of CRP production (Yudkin, Stehouwer, Emeis, & Coppack, 1999; Heinrich, Castell, & Andus, 1990). Furthermore, research has shown an independent relationship between central adiposity and insulin resistance with CRP levels, thus suggesting that chronic inflammation is an important component of metabolic syndrome as well as a mediator of the cardiovascular effects of the syndrome (Pannacciulli et al., 2001).

In all age categories, one study found that women who smoke had a significantly higher risk of CVD than women who did not smoke, with the largest risk difference in women aged 40-49 (Tolstrup et al., 2014). An independent association between smoking and inflammatory markers has been demonstrated apart from other known cardiovascular risk factors (Bermudez, Rifai, Buring, Manson, & Ridker, 2002). In current smokers, significant CRP elevation has been demonstrated, but not in a dose-dependent way, which means that the number of cigarettes smoked per day did not change the analysis, nor did controlling for confounders (Ohsawa et al., 2005). Bermundez et al. (2002) conducted multivariate analyses adjusting for traditional cardiovascular risk factors and additional factors, including age, BMI, history of hypertension, diabetes, alcohol use, physical activity, parental history of myocardial infarction before age 60, hormone replacement therapy, HDL, and LDL. They found that, even after controlling for all those factors, inflammatory markers, including CRP, remained elevated in women who were smokers, suggesting a relationship between smoking and inflammation in otherwise healthy appearing women (Bermundez et al., 2002).

Interpersonal Violence

One study found that when traditional cardiovascular risk factors are controlled for, an association may still exists between IV and CVD (Frayne et al., 2003). Several studies have suggested that IV leads to CVD because of the sequela of psychosocial or mental health conditions a woman might experience as a result of an IV, but even in the absence of PTSD, IV history has been shown to negatively impact physical health—including CVD—and IV history is associated with physical health outcomes independent of psychopathology (Husarewycz et al., 2014; Scott et al., 2013). This was also demonstrated by Sumner et al. (2015), who showed increased CVD risk in women with IV history who reported *no* symptoms of PTSD. In women with a history of CVD, one study showed that among women aged 30-62 years who reported severe marital stress there was a three-fold greater likelihood of recurrent coronary event over a four-year follow up, compared to women not reporting marital stress, after other variables were controlled for (Orth-Gomer et al., 2000). Still, little work has been done on the relationship between trauma in adults and inflammation, when PTSD is controlled for (Sumner et al., 2015; Danese et al., 2007; Dekaris et al., 1993).

Many studies have focused on childhood trauma (Carpenter et al., 2010; Kiecolt-Glaser et al., 2011; Danese et al., 2007). Danese et al. (2007) demonstrated that, when exposed to two or more forms of severe maltreatment during childhood, participants had significantly higher levels of CRP in adulthood. Perhaps most significant to the current project is the 2012 work of O'Donovan and colleagues in the Heart and Soul Study, which looked at a prospective study of patients with stable CVD (N=979) and examined if higher lifetime trauma exposure was associated with elevated levels of inflammation (including CRP) at baseline and follow-up (O'Donovan, Neylan, Metzler, & Cohen, 2012). Even after adjusting for sociodemographic

factors and psychiatric disorders, their findings demonstrated that higher trauma exposure was associated with elevated inflammation both at baseline and at five-year follow-up (O'Donovan et al., 2012). Though types of trauma were not limited to IV-related trauma, a significant number of the measured traumas could be included in our definition of IV. Most strikingly, the Stockholm Female Coronary Risk Study demonstrated that reported marital stress, nearly tripled the risk for recurrent cardiac events in women (Orth-Gomer et al., 2000). While it is unknown whether marital stress is present in families that have IV, we believe that this is likely. Mason et al. used the Nurses' Health Study to study emotional abuse, finding a significant association between emotional abuse and hypertension, particularly when the abuse was most severe (Mason, Wright, Hibert, Spiegelman, Forman, & Rich-Edwards, 2012).

Social Context

Literature has beginning to explore what might moderate the relationship between women and CVD including social support or lack of social support (Low, Thurston, & Matthews 2010; Everson-Rose & Lewis, 2005; Kranz & McCeney, 2002; Suls & Bunde, 2005). In these studies, social support is defined to include not only the structure of a person's social life (family relationships, friendships, group membership), but also the functions that they serve (emotional support or assistance in times of illness) (Cohen, Underwood, & Gottlieb, 2000). Some of this literature suggests that, for women, social relationships that are positive and reciprocal may be an important part of primary and secondary CVD prevention, whereas stressful interpersonal relationships may be a chief risk factor (Low, Thurston, & Matthews, 2010; Suglia, Sapra, Doenen, 2015). Coker and colleagues found that social support moderated the impact of battering on women's mental and physical health, even in the absence of help seeking,

suggesting that emotional or social support is key to improved coping with IV (Coker, Watkins, Smith, & Brandt, 2003).

Research has proposed two major pathways to explain the association between social support and health. The first suggestion is that social support is health-promoting because it encourages healthier behaviors in regards to exercise, diet, smoking, physical activity, following healthcare provider advice, etc. (Uchino, 2004). The reasons for this positive effect might be direct (i.e. going for walks, sharing meals, or sharing information), or indirect, such as giving people a sense of meaning or purpose in life (DiMatteo, 2004; Lewis & Rook, 1999; Umberson, 1987). The second pathway focuses on psychological processes connected to emotions, thought processes, or moods, and feelings of control (Cohen, 1988; Gore, 1981; Lin, 1986). Though Barrera (2000) demonstrated the link between social support and psychological process, there is little evidence demonstrating their impact on health outcomes (House, 2001). It is important to keep in mind that there is significant interaction between these two pathways in that feelings of stress or depression might negatively impact health promoting practices, and health behaviors such as exercise can have considerable influence of depression and stress (Ng & Jeffery, 2003; Rejeski, Thompson, Brubaker, & Miller, 1992).

The mechanisms underlying the influence of social support or social negativity is still largely unknown, but here too, inflammation appears to play a role. For example, both human and animal models have shown that inflammatory markers such as IL-6 (a precursor to CRP) are increased with social stress, and are decreased with social support (Kiecolt-Glaser et al., 2003; Papanicolaou, Wilder, Manolagas, & Chrousos, 1998; Zhou, Kusnecov, Shurin, DePaoli, & Rabin, 1993). This was demonstrated again by Friedman et al. (2005), who reported that lower IL-6 levels were predicted by more positive social relations.

Taken together, we can appreciate the importance of social context on health. This understanding of the importance of social support in women's health in general, and its protective effects after IV, can aid not only in identification of women at risk for CVD, but might also foster the development of interventions to reduce risk. Studies have shown that low levels of social support were associated with increased risk for recurrent cardiovascular events as well as mortality (Horsten, Mittleman, Wamala, Schenck-Gustafsson, & Orth-Gomer, 2000; Rudlege et al., 2004). Emotionally supportive relationships have been shown to be cardioprotective, and conversely low levels of emotional support have been shown to increase risk of CVD (Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

Conceptual Model

As we have seen, this review supports the propositions that IV may play a role in the development of CVD in women, that this interaction may be related to increased levels of CRP, and social context may play a moderating role in these interactions. Our conceptual model depicts *only* the microsystem, or innermost ring, with social context being a component of the assumed outer rings because the social context scales used in our analysis include not only the mesosystem and exosystem, but also the macrosystem. To help understand these interactions, we have developed a conceptual model to illustrate the relationships between IV, risk behaviors, mental health, and social context impacting CRP and leading to CVD (see figure 1). Because the focus of our study was to explore how social support and social negativity influence CRP, we did not differentiate between which system the social support or social negativity might reside in. This figure illustrates that the progression from IV to CVD can take three paths, all of which involve CRP elevation. An IV survivor might move directly to elevated CRP, without any known mental health or risk behaviors. Or, an IV survivor might move from IV to mental health

conditions, to CRP elevation. Finally, she might develop unhealthy risk behaviors that lead to elevated CRP. Consistent with the EST, all of this happens within a specific social context; in other words, a woman's health is heavily influenced, in both positive and negative ways, by her environment.

Most importantly, the arrows between the social context and the pathologies involved in the progression are bi-directional, indicating significant interaction between them in both directions. For example, psychological distress may influence a woman's perception of social support or negative social interactions as well as impact her willingness to accept any social support that is offered. Similarly, society's perceptions of mental health, risk behaviors such as smoking or obesity, and IV might influence willingness to offer social support.

.

CHAPTER 5

METHODS

In this secondary analysis, we explore the relationship between IV and CRP, including various pathways through which IV might lead to elevated CRP. Further, we will explore the potential contribution of the social context in which a woman exists on CRP.

Hypothesis 1: There will be an elevated CRP associated with IV, depression, smoking, and obesity in the women in the SWAN study (intact uterus, at least one functioning ovary, pre-menopausal, no current use of exogenous hormone preparations that affected ovarian function).

Aim 1. To examine the relationships between CRP, depression, obesity, smoking, and in women who indicated IV in the past year who have an intact uterus, at least one functioning ovary, pre-menopausal, and no current use of exogenous hormone preparations that affected ovarian function.

Hypothesis 2: Social support is associated with lower CRP, social negativity is associated with higher CRP.

Aim 2. To describe the influence of social support and social negativity on CRP in women reporting recent IV.

Exploratory Aim . To explore the influence of self-perception of IV on CRP.

Study design

This is a secondary analysis of baseline data from the Study of Women's Health Across the Nation (SWAN), a multi-site longitudinal cohort, epidemiologic study developed to examine the health of women during their middle years. Enrolled women are followed annually.

Psychological, biological, and social variables are examined with the goal of helping scientists, health care providers, and women learn how experiences during this life stage impact health as well as quality of life. Specific areas of inquiry for SWAN include: bone mineral density and body composition; cardiovascular risk factors and measures; ovarian markers; vaginal, urogenital, and sexual health; physical functioning; sleep; psychosocial factors; pharmacoepidemiology; epidemiologic issues. After baseline, 15 follow-up visits have been held and take place approximately every year. Each annual visit includes: physical measures (weight, height, hip, waist, and blood pressure), fasting morning blood draw, interviewer-administered and self-administered questionnaires. Women are also given menstrual calendars to complete monthly over the next year, and all questionnaires are translated into Spanish, Cantonese, and Japanese and could be administered by bilingual interviewers. SWAN visits now additionally include two bone mineral density (BMD) measurements for women participating in the BMD protocol. In addition to the annual visit core components listed above, new measures of physical function, physical activity, sleep, cognition, and vaginal, urogenital, and sexual health have been added. SWAN is supported by the National Institute on Aging (NIA), the National Institute of Nursing Research (NINR), the National Institutes of Health (NIH), Office of Research on Women's Health, and the National Center for Complementary and Alternative Medicine (Sowers et al., 2000).

Sample

Study recruitment for the SWAN began in 1994, with recruitment from 1995-1997. Recruitment for the SWAN study was 2-stage, beginning with a 15-minute cross-sectional survey (utilizing both telephone and face-to-face interviewing) at seven research centers. Three sites used random-digit dialing and four sites used community census or lists of community

members such as voter registration lists. This wave of recruitment identified 16,065 potential participants and served as the sample population for the second stage of recruitment. In total, 3,302 participants were enrolled for prospective follow-up. Five racial/ethnic groups are represented, as well as a variety of socioeconomic backgrounds and cultures.

Inclusion criteria for study participation included age 42 to 52 years, intact uterus and ≥1 ovary, no current use of exogenous hormone preparations that affected ovarian function, ≥1 menstrual period in the 3 months before enrollment, and self-identification with the site's designated race/ethnic group. Three thousand three hundred two women formed the longitudinal cohort, with each clinical center expected to recruit ≥450 women in a proportion that included both non-Hispanic Caucasian women and women from 1 of the race/ethnic groups designated for specific sites. Each site also screened at least one racial/ethnic minority population (African Americans in Pittsburgh, PA; Boston, MA; Detroit, MI; and Chicago, IL; Japanese in Los Angeles, CA; Chinese in Oakland, CA; and Hispanics in Newark, NJ) and one Caucasian population (Sowers et al., 2000). Data were collected via protocols reviewed and endorsed by an appropriate institutional review board at each site.

The sample used in this study was 2,502 participants, after inclusion and exclusion criteria were met. The inclusion criterion for this secondary analysis was the same criteria for the SWAN study, discussed above. For our analysis, we excluded participants with a history of lupus or arthritis because they are known to be associated with elevated CRP (Williams, Harmon, Burlingame, & Du Clos, 2005; Windgassen, Funtowicz, Lunsford, Harris, & Mulvagh, 2015). In addition, cases with missing data were excluded. Further, we analyzed a subset data of women who reported IV in the last year.

Measures

As depicted in the conceptual model (figure 1), the study will look at the relationship between IV, mental health, and risk behaviors with CRP, as well as the influence of social support and social negativity.

Table 2 describing the variables and measures used in this analysis. In this study, IV was operationalized into a dichotomous variable of "yes" or "no" including all women who answered "yes" to the question "In the last 12 months have you experienced the following: slapped, kicked, or otherwise hurt by husband/partner or someone else important to you?" Response options included "no", "yes, I wasn't bothered by it", "yes, I was somewhat bothered by it", "yes, I was very bothered by it" (see Appendix C: *IV scale*). While not specified by the authors, this question might come from the Abuse Assessment Scale, which is a 5 question, validated scale that includes a question very similar to the question asked in the SWAN study "Within the last year, have you been hit, slapped, kicked, or otherwise physically hurt by someone? If yes, by whom? How many times?" (Rabin, Jennings, Campbell, & Bair-Merritt, 2009).

Mental health was operationalized as depression, and was measured using the CES-D depression scale, which is a 20-item validated measure that asks about frequency of depressive symptoms (see Appendix C for *CES-D scale)* (Radloff 1977). The CESD is the most commonly used measure of depression in studies of IV, and has good validity and reliability with women in the general population as well as with women with IV history (Davies, Ford-Gilboe, Willson, Varcoe, Wuest, Campbell, & Scott-Storey, 2015). The scale measures depressive symptoms during the past week, with participants giving responses ranging from zero ("rarely" or "none of

the time") to three ("most of the time"). Scores are summed, with a range from 0-60. A score of 16 or higher indicates potential clinical depression, therefore depression was operationalized as a CES-D score of 16 or higher.

In this study, risk behaviors were operationalized as BMI and self reported smoking. BMI was calculated using height (centimeters) and weight (kilograms) and was calculated by dividing weight by the square of height in meters. (kilograms/square meters). Normal BMI is considered to be between 18.5-24.9, with individuals lower than 18.5 considered underweight. People with a BMI between 25-29.9 are considered overweight, and greater than 30 is considered obese (Coutinho et al., 2013). For our analysis, we used BMI as a continuous variable to more clearly look at associations between CRP and BMI.

Smoking was self-reported, by answering "yes" to both "have you ever smoked regularly" and " do you currently smoke". Participants who answered "yes" to both questions were recoded into "smokers" and participants who answered "no" to both questions, or only answered "yes" to one question were recoded as "non-smokers".

Social support was operationalized using four items from the Modified Medical Outcomes Study (mMOS) Social Support Survey subscale that assessed how often each of four kinds of support was available, if needed (see Appendix C: *social support scale*) (Sherbourne & Stewart, 1991; Moser, Stuck, Silliman, Ganz, & Clough-Gorr, 2012). The scale ranges from 1-5 indicating how frequently someone might be available to assist a participant and included questions about things like having someone to confide in. The items were recoded to a 0-4 range.

Social Negativity operationalized using a ten-item questionnaire (see Appendix C: *social negativity scale*) assessing the frequency of negative experiences a woman might encounter in

daily life and included questions about things like "you are treated with less respect than other people". Items were recoded so that lower frequency ("never") was scored 0 and higher frequency ("often") was scored 4. To the best of our knowledge, this scale was developed by the SWAN study team.

CRP was operationalized using an ultra-sensitive rate immunophelometry (Dade-Behring, Marburg, Germany) test on serum collected during the SWAN intake visit and measured in mg/L (Burns et al., 2015). The American Heart Association uses CRP levels <1, 1-3, and >3 to indicate low, moderate, and high-risk groups for future cardiovascular disease, though we kept CRP continuous for our analysis to allow us to look at correlations more closely (Ridker, 2003).

We determined our covariate variables based on the literature *a priori* , controlling for race/ethnicity, age, and income level in all of our analyses, because they have all been demonstrated to elevate CRP (Albert, Buring, & Ridker, 2004; Wener, Daum, & McQuillan, 2000).

Statistical Analysis

Descriptive, hierarchical multiple regressions, and multicollinearity analyses were performed using SPSS for Windows Version 23. We performed independent t-tests to compare means of continuous variables and chi-square tests for categorical variables. We controlled for age, race/ethnicity, and income in all analyses. To test both hypotheses, analyses were done on both the entire SWAN data set, as well as a subset that included only women reporting a recent history of IV. For hypothesis 1, hierarchical multiple regressions were done looking at the relationships between IV, depression, BMI, and smoking on CRP for the entire sample as well as the IV subsample. We tested each variable individually and then in a single model to look for a

combined effect. To test hypothesis 2, we used hierarchical multiple regressions to look at the influence that social support and social negativity had on CRP for the entire sample as well as the IV subsample. We will also use a subset of the SWAN data, including only women who report recent (within the previous 12 months) IV. Finally, for our exploratory aim, we looked at the SWAN participant's perception of IV, and the impact of that perception on CRP.

CHAPTER 6

RESULTS

Sample Characteristics

The data used for this secondary analysis came from the public-use SWAN baseline dataset, and initially included information from 3,302 women from seven clinical sites participating in the SWAN longitudinal study (Boston, MA; Pittsburgh, PA; Oakland and Los Angeles, CA; Detroit, MI; Newark, NJ; and Chicago, IL). For our analysis, we eliminated 659 women who reported an arthritis diagnosis and 18 women who reported a lupus diagnosis, because of their known association with CRP elevation (Williams, Harmon, Burlingame, & Du Clos, 2005; Windgassen, Funtowicz, Lunsford, Harris, & Mulvagh, 2015). Fifty-two participants were eliminated for missing data. This left us 71 (2.8%) participants who reported having experienced IV within the past 12 months, and 2,502 (97.2%) participants who did not.

Table 3 shows the comparison of women reporting IV and women not reporting IV for all of the study variables. There were statistically significant differences for social support (IV M= 11.27, No IV M=12.45, p=<0.002) and social negativity scores (IV M=10.5, No IV M= 6.96, p= <0.000). There were also significant differences between depression (IV 38% depressed, No IV 20.5% depressed p=<0.000); income, ; race; and age (IV M=45.18, No IV M=45.78 p= 0.04). No significant differences were found between the two groups for mean CRP or BMI, or for smoking.

Analysis for Hypothesis 1

Hypothesis 1 examined whether IV, depression, smoking, and obesity were associated with elevated CRP in the SWAN participants as well as in the smaller subset data. Our univariate regression analysis (controlling for race, age, and income) demonstrated that IV and smoking were not significantly associated with CRP,. However, depression was significantly associated with CRP. On average, study participants with depression had CRP 0.97 units higher than those without depression (95% CI 0.390-1.551, p= 0.001). BMI was also significantly associated with CRP, with participants having an average 0.45 units higher than those with lower BMI (95% CI 0.281-0.614, p=0.000). In the full regression model, which included IV, depression, smoking, and BMI, while controlling for age, race, and income; only smoking and BMI were statistically significant. Smoking had a beta coefficient of 0.631 (95% CI 0.40-1.22, p= 0.037); and BMI a coefficient of 0.388 (95% CI 0.356-0.421, p=0.000. In our hierarchical regression, we first tested for multicollinearity, and our Tolerance and VIF values suggested that we did not have multicollinearity. Age, ethnicity, and income were entered initially, explaining 2.8% of the variance in CRP. When the entire model (including IV, BMI, smoking, and depression) was used, the total variance explained by the model was increased to 21%, and was statistically significant F (7,2481) = 94.99, p=<0.001. In the final model (IV, BMI, smoking, and depression), only BMI was statistically significant (beta= 0.438, p<0.001).

We also tested hypothesis 1 on the IV subsample. While controlling for age, race, and income, bi-variate regression showed a statistically significant relationship between BMI and CRP, with a BMI beta coefficient of 0.447 (95% CI 0.281-0.614, p=0.000). In the full regression model, only BMI was statistically significant, with a beta coefficient of 0.493 (95% CI 0.319-0.667, p=0.00). With hierarchical regression, the same results were generated, demonstrating no multicollinearity, with only BMI statistically significant (beta=0.558, p<0.001). Age, ethnicity,

and income were entered initially, explaining 6% of the variance in CRP. When the entire model was used, the total variance explained by the model was increased to 36%, and was statistically significant F (6, 59) = 5.64, p=<0.001.

Analysis for Hypothesis 2

Hypothesis 2 examined whether social support was related to lower CRP, and whether social negativity was related to higher CRP. Regression analysis of the variables in hypothesis 2 demonstrated that the association between CRP and social support was statistically significant, suggesting that higher levels of social support have a lowering effect of CRP (-0.098 beta coefficient) (95% CI -0.170—0.027, P=0.007). However, in the full regression model containing IV, depression, smoking, BMI, and our control variables, social support was no longer statistically significant. Social negativity was not significantly associated with CRP either in bivariate regression, or when included in the full model. Using hierarchical regression, neither social support nor social negativity reached a level of statistical significance, and the total model continued to explain 21% of the variance in CRP.

For the IV subsample, neither social support nor social negativity reached a level of statistical significance in relationship to CRP with either linear or hierarchical regression.

Exploratory analysis

Because of the structure of the IV question, we wondered whether the perception that IV was not "upsetting" might be related to CRP levels. Our exploration of perception of IV on CRP showed that there were not statistically significant differences between women who found IV "not at all upsetting" and women who found IV "very upsetting" (p=0.31) and CRP (see table 4). However, although our results did not reach a level of statistical significance, they demonstrated an interesting trend. Among the women who reported that their IV was "not upsetting", more

women had a high CRP level. Among the women who reported that they found their IV "somewhat upsetting" or "very upsetting" there were more women with low or normal CRP levels than with high. Though the results were not statistically significant, they are interesting, and could point to areas of future investigation.

CHAPTER 7

DISCUSSION

Although our review of the literature strongly suggests that there are associations between IV, depression, BMI, smoking, and CRP, our analysis of this data set did not find these relationships. This raises many questions about possible explanations; but perhaps one of the most interesting potential explanations is that our sample only had an IV prevalence rate of 2.8% of the SWAN population, whereas research suggests that the rates of IV are closer to 22.1% of women experience IV during their lifetime (CDC, 2012). This extremely low prevalence rate in this sample could be explained in a variety of ways. First, the measure that was used to assess IV specified that the IV occurred *within the past 12 months*. This would eliminate women who had experienced IV outside of this 12-month window, but still might physiologically be experiencing the effects. The National Intimate Partner and Sexual Violence Survey (NISVS) survey reported that 35.6% of women had experienced *lifetime* IV, but only 5.9% within the previous 12 months (Black et al., 2011). The literature demonstrates that childhood abuse is associated with disease and inflammation in adulthood, which suggests that abuse can have an impact that lasts many years, if not a lifetime (Felitti, Bremner, Walker, Whitfield, Perry, 2006); Tursich et al., 2014). Given that abuse suffered as a child can have lifelong implications, it is reasonable to think that abuse suffered in adulthood might have similar implications.

Secondly, it is possible that women narrowly interpreted the question being asked, especially since the time frame given was so constrained. The question asks if a woman was

"slapped, kicked, or otherwise hurt *in the past 12 months*". This does not necessarily take into account the other kinds of IV that can be equally damaging to the victim (sexual assault or abuse, psychological abuse, economic abuse, stalking, etc.), if the woman only answered yes if she were slapped or kicked. It is estimated that nearly half of all women (48.8%) experience psychological aggression, and approximately 10.8 % of women report to being stalked by an intimate partner (Black et al., 2011). Further, it has been demonstrated that women sexually assaulted by intimate partners are more likely to experience concurrent physical abuse than women who did not know their attacker (55%, 95% CI 49–61); known assailant compared with 31% (95% CI 26–36) unknown assailant; and 32% (95% CI 26–38; $P<.001$ acquaintance assailant) (Seyller, Denis, Dang, Boraud, Lepresle, Lefèvre, & Chariot, 2016). Perhaps a different question, or parameter, would have generated a sample closer to reported prevalence rates if the question were defined more broadly. Many other measures exist that address the other kinds of abuse that a woman might experience (stalking, sexual abuse, emotional abuse, etc), or might be experiencing, along with the question asked in the SWAN study (Rabin, Jennings, Campbell, & Bair-Merritt, 2009).

Thirdly, it is important to consider the issue of disclosure, or whether or not a person who experiences something—in this case, IV— accurately reports that they have experienced it. Research suggests that there are often very low rates of disclosure of information that many people consider highly personal including; sexual assault, HIV status, sexual orientation, intimate partner violence, and homelessness (Evans, Wertheim, 2002 see also Rhodes, Frankel, Levinthal, Prevnoveau, Bailey, & Levinson, 2007; Chen, 2006). For some, disclosure can result in an increased sense of vulnerability, alienation, loss of "normalcy", financial hardship, and relationship losses, making disclosure less likely to occur (Saiki, Lobo, 2011 see also Kahn,

Garrison 2009; McDonald, 2008; Montalvo-Liendo, Wardell, Engebretson, & Reininger 2009). Further, Saiki and Lobo (2011) state that disclosure exposes the person disclosing the information to risk of rejection or negative judgment, also potentially decreasing the rate of disclosure (Saiki, Lobo, 2011).

Additionally, fewer than half of IV incidents are reported to the police (Greenfeld et al., 1998). The most common reasons for *not* reporting IV to police are that the victim fears retaliation, they consider it a private matter, or, they do not believe that police will do anything or believe them (Greenfeld et al.,1998). Even in healthcare settings disclosure of IV is extremely low. Golding et al. (2000) report that fewer than 17.5% of women with IV history report sharing their abuse history with a health care provider. Data from the National Intimate Partner and Sexual Violence Survey estimated that, even though over 12 million people (both men and women) experienced some form of IV, only 480,000 injuries from these encounters are reported to law enforcement, and only 150,000 of these injuries received medical attention (Catalano, 2013). It is reasonable to speculate that if women experiencing IV are unwilling or unable to disclose IV to law enforcement, and to health care providers, they might also be unwilling or unable to disclose their IV experiences to research teams.

From a feminist research perspective, it makes sense that there is considerable crossover between IV, mental health, and risk behaviors because what is happening to a woman's body impacts her mind and emotions, and informs her actions. All four variables have been associated with CRP, as discussed above. The literature also discusses the associations between smoking and depression, and BMI and depression. Carpenter and colleagues (2000) demonstrated a significant association between obesity and smoking in women. Mykletun, Overland, Aarø, Liabø, & Stewart, (2008) however found the most significant association between anxiety

depression and smoking. It is likely that many complex relationships exist between these variables, and deciding how best to address them in the clinical setting as well as in the research environment will likely add to our knowledge about how they interact, how to treat them (simultaneously, one at a time, etc), and how they impact health will hopefully lead to improved health outcomes.

In looking at hypothesis 1, both the SWAN data set and the IV subset demonstrated statistically significant associations between BMI and CRP, which is consistent with the literature, but the lack of association between IV, smoking, depression in the hierarchical regression is not consistent with the literature. Though there is no simple explanation for these results, they do reinforce the importance of weight management as part of overall health.

The literature supports the hypothesis that there is an association between social support and social negativity and CRP, but this was also not found in our analyses. One possible explanation is that the scales that were used to measure social support and social negativity did not adequately reflect what was actually happening in participant's lives. Also, perhaps social support is more protective when it is directly related to the IV experience, for example having someone to talk to about the IV, which was not assessed in the SWAN data set. The perception that a woman had about the IV might also play a role, as our analysis did not show an association between being more bothered by IV and CRP or were less bothered. Though analysis did not reach a level of statistical significance, among women who reported that their IV was "very upsetting", more women had low or normal CRP than high. Also interesting, though not statistically significant, is that among women who reported that they were "not at all bothered" by their IV, more had high CRP than normal or low. This could speak to a weathering effect that

might occur in women who have experienced abuse for a long period of time, no longer reporting that they are bothered by it, but still experiencing an elevation in CRP.

Clinical Implications

Although we did not find statistically significant relationships between IV, depression, smoking, social support, or social negativity, this research, as a whole, adds to the literature by emphasizing to primary care providers (physicians, nurse practitioners, and physician assistants) the importance of including questions about IV history in patient assessments and family histories. For patients with multiple vague complaints, providers might benefit from exploring a possible IV history in their patients' pasts and using that information to better guide their care. For providers who know of a patient's IV history, examining the various body systems potentially affected might lead to better patient screening, education, and hopefully outcomes.

Results of our literature review related to CVD and CRP are also useful to consider for clinical practice. Research has shown that statin therapy affects LDL and CRP independently, and it has been proposed that CRP screening might provide an improved method of targeting statin therapy for those who might be at risk for CVD but who have normal LDL levels (Albert et al., 2002; Ridker et al. 1999). In Albert et al.'s (2002) primary prevention trial comparing pravastatin with placebo, they demonstrated a median CRP level reduction of 16.9% ($P<0.001$) at 24 weeks with no change in CRP levels in the placebo group, with the effect seen as early as 12 weeks after treatment initiation. Furthermore, they found no significant association between baseline CRP and baseline LDL-cholesterol levels, end of study CRP and end of study LDL, or

change in CRP and change in LDL, with the only significant predictor of change in CRP being randomization to pravastatin and baseline CRP levels (Albert et al., 2002).

Some evidence suggests that female-specific interventions might be more effective than those that target both men and women, possibly because they can address concerns and stresses that might be specific to women, such as greater household responsibilities, lower self-esteem, low self-efficacy regarding exercise or transportation, lack of spousal support, etc. (Bjarnason-Wehrens, Grande, Loewel, Völler, Mittag, 2007). Several psychosocial risk factors also effect women differently than men and are important to keep in mind when talking with patients. For example, hostility and work stress conferred less cardiac risk for women than did marital stress and anger suppression. The ability to identify psychosocial factors associated with elevated CVD risk in women can aid in the identification of women in the healthcare setting, as well as inform more effective intervention strategies.

In secondary analysis of the M-HART study of nursing interventions, Cossette, Frasure-Smith, and Lespérance (2002) found that approaches focused on education and encouragement predicted better outcomes for men, but worse outcomes for women. For women, better outcomes occurred when medical professionals listened to concerns about non-cardiac physical symptoms and discussed their treatment burden (Cossette et al., 2002). Depression has been consistently associated with increased CVD for both men and women, but psychological interventions to treat depression have not benefited women in terms of CVD outcomes (Cossette et al., 2002). While there is a need to explore the ways in which we can improve psychosocial interventions for women living with CVD, of utmost importance is the potential to use psychosocial interventions in women merely at risk for CVD in the clinical setting.

Limitations of the Study

One of the major limitations of this study is that it does not appear to be representative of the general population. In the SWAN data set, only 2.8% of women reported IV, in contrast to extimates in the general population of 22.1% (CDC, 2012), making this sample not representative.

We were also restricted by the very nature that we conducted a secondary analysis, and did not have the opportunity to shape the SWAN study. At the baseline interview, SWAN took a very limited approach to IV, asking only about abuse within the previous 12 months. Assessing only current or recent abuse dismisses earlier traumas that impact may current and future health outcomes, and it does not take into account the evidence showing that many women who are *currently* in abusive relationships may also have had a *history* of abuse of some kind (Campbell et al., 2008; Scott-Storey, 2011; Cavanaugh et al., 2012). With it's very narrow time range for IV (past 12 months) the SWAN dataset failed to take into account the potential effect of multiple or lifetime traumas in participants, severely limiting the study.

Directions for Future Research

Childhood abuse has been demonstrated to be associated with poorer health outcomes for many years, but abuse experienced as an adult has not been studied as extensively. Exploring the differences between abuse experienced during childhood vs. abuse experienced in adulthood (not just within the previous 12 months) would add to our knowledge of how abuse so negatively impacts health, and might how perception of abuse might be a factor. Children might perceive abuse very differently than adults, and this could impact not only treatment of abuse survivors, but health implications.

Another area of interest for future research includes establishing the prevalence of IV history screening in primary care settings as well as barriers to effective screening. Screening women for IV is recommended by many healthcare and health policy organizations including the USPSTF, American College of Nurse Midwives, American Academy of Family Physicians (Nelson, Bougatsos, & Blazina, 2012; Paterno & Draughon, 2016; American Academy of Family Physicians, 2013). In Golding et al.'s (2000) study of women with severe PMS, although IV history was nearly universal, only 17.5% of the participants reported ever having told a health care provider about the history. Plichta and Falik (2001) also discussed screening concerns based on their data that less than 29% of IV survivors reported having discussed the history with a health care provider and that of those few who did, 73% of them brought the history to their provider's attention without having ever been asked. These studies suggest that screening for a history of IV is not universally done in primary care settings, where providers are most likely to see women for many of the symptoms and conditions discussed here.

As discussed above, better screening tools for CVD in women is of critical importance. Traditional CVD risk algorithms like the Framingham risk score are less predictive in women and tend to *underestimate* CVD in women (Shaw, Bugiardini, & Merz, 2009). More novel risk factors, such as CRP, improve prediction in women and might be useful in the treatment of women.

Also, the best way to screen women for a history of IV is unclear. Is it preferable to discuss the issue in person with patients, or to ask on intake forms? Should screening be done only on intake into a practice, or more frequently? Would knowledge of IV history influence the plan of care and could it improve patient outcomes?

For clinicians, interventions cannot be utilized for conditions or experiences that they do

not know their patient is experiencing. An interesting next step would be to look at disclosure more closely, and look at factors in women that might influence her decision to disclose or not disclose IV history to a provider, as well as factors in providers or the health care experience. For example, developing a survey asking women if they have experienced IV, if they have told a health care provider, and then looking at what influenced that decision (being in a relationship, provider gender, time since IV experience, provider race/ethnicity, etc). Further, I propose that if women were aware that IV history could impact their cardiovascular health, they would be more likely to disclose abuse history to a healthcare provider, and this would be interesting to research.

Though much work remains to be done, bringing to light the relationship between IV history and a multitude of other health issues can hopefully improve health outcomes and satisfaction for both patients and those caring for them.

Appendix A
Tables

Table 1

Health Conditions Associated with IV

Cardiovascular	Urologic/ Gynecologic	Gastrointestinal	Risk Behavior	Health Perception
*Hypertension	*Premenstrual Syndrome	*Vague abdominal pain	*Drug/alcohol use	*Poor perception of health and wellbeing
*Hyperlipidemia	*Pelvic pain	*Constipation	*Risky sexual behavior	
*Obesity	*Frequent urinary tract infections	*Irritable bowel syndrome	* Misc.	*Greater use of sick days
*Diabetes	*Dyspareunia			*High rates of healthcare utilization
	*Anorgasmia			

Table 2

Variables and Measures

VARIABLE	**MEASURE**
Characteristics of woman • Age • Race • Income/Education Level	• Initial demographic questions
Risk Behaviors • Smoking • BMI	• Smoking was self reported, by answering "yes" to both "have you ever smoked regularly" and " do you currently smoke" • Kilograms/square meters
Mental Health: Depression	• CES-D score >16 = depressed
IV	• "In the last 12 months have you experienced the following: slapped, kicked, or otherwise hurt by husband/partner or someone else important to you?"
Social Support Social Negativity	• 4 item social support scale 0-20 • 10 item social negativity scale 0-30

Table 3

Sample characteristics

	IV *N* (%) 71 (2.8%)	No IV *N* (%) 2502 (97.2%)	Significance
Age, years (M, SD)	*N*=71 45.18yrs (2.24)	*N*=2573 45.78 yrs (2.68)	*P=0.027*
Race Caucasian African American Japanese Chinese Hispanic	 32 (45.1%) 29 (40.8%) 3 (4.2%) 3 (4.2%) 4 (5.6%)	 1215 (47.2%) 683 (26.5%) 249 (9.7%) 219 (8.5%) 207 (8%)	*P=0*.04
Income: Don't know Refused Less than $19,999 $20,000- $49,999 $50,000- $99,999 $100,000 or more	3 (4.2%) 0 19 (26.8%) 27 (38%) 16 (22.5%) 6 (8.5%)	21 (0.8%) 32 (1.2%) 327 (12.7%) 846 (32.9%) 944 (36.7%) 396 (15.4%)	*P=0*.000
CRP	*N*=71 M=3.31 (5.5)	*N*=2573 M= 3.5 (6.05)	*P=0*.789
Depression Depressed Not depressed	 27 (38%) 40 (56.3%)	 528 (20.5%) 1989 (77.3%)	*P=0*.000
BMI	*N*= 70 M=27.63 (6.6)	*N*=2545 M=27.63 (6.78)	*P=0*.998
Smoking Smoker Non-smoker	 15 (21.1%) 56 (78.9%)	 408 (15.9%) 2165 (84.1%)	*P=0*.286
Social Support Social Negativity	*N*= 71 M=11.27 (3.58) *N*= 71 M= 10.5 (5.95)	*N*=2572 M= 12.45 (3.24) *N*=2548 M= 6.96 (4.86)	*P=0.002* *P=0.000*

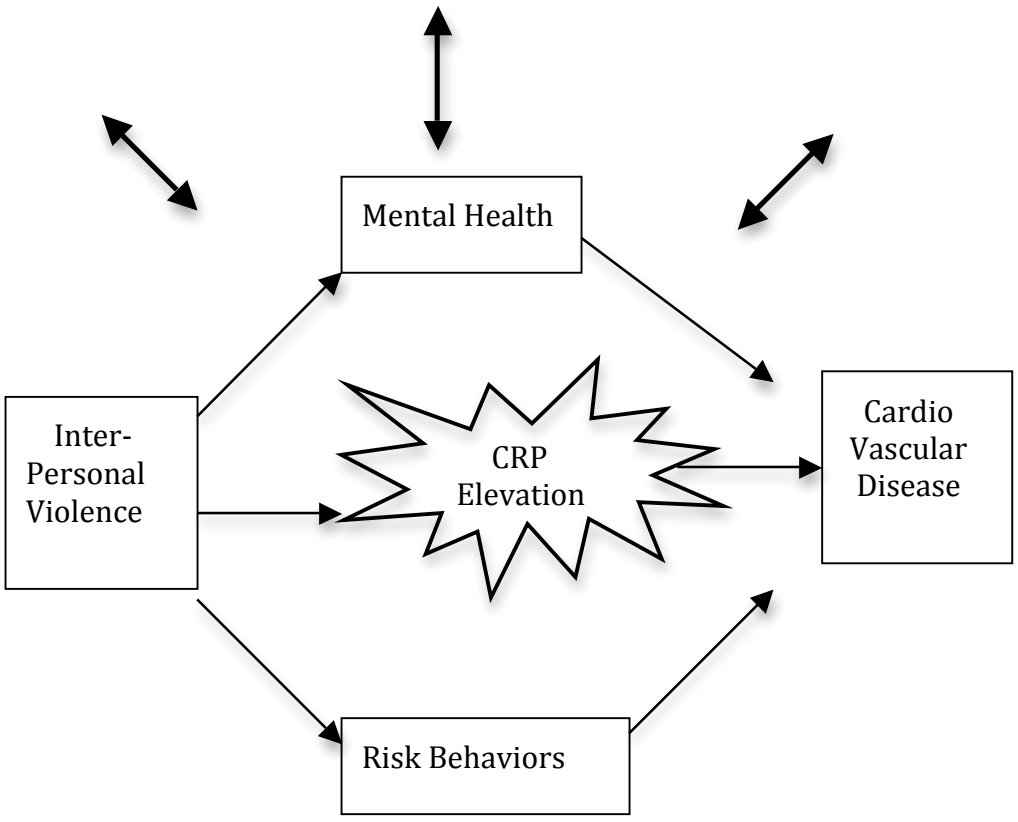
Table 4

Perception of IV

Hurt by someone close in past year	Low CRP	Normal CRP	High CRP	Total
Yes, Not at all Upsetting	0	2	3	5
Yes, Somewhat Upsetting	12	7	6	25
Yes, Very Upsetting	14	14	13	41
Total	26	23	22	71

Appendix B

Conceptual Model



Appendix C
Scales and Instruments Used

CES-D Depression Inventory

INSTRUCTIONS: For each statement, please place a mark in the column that best describes how you have been feeling *in the past week*.

		Rarely or none of the time (less than 1 day)	Some or a little of the time (1 – 2 days)	Occasionally or a moderate amount of the time (3 – 4 days)	Most or all of the time (5 – 7 days)
1.	I was bothered by things that usually don't bother me.				
2.	I did not feel like eating; my appetite was poor.				
3.	I felt that I could not shake off the blues, even with the help from family or friends.				
4.	I felt that I				

	was just as good as other people.				
5.	I had trouble keeping my mind on what I was doing.				
6.	I felt depressed.				
7.	I felt that everything I did was an effort.				
8.	I felt hopeful about the future.				
9.	I thought my life had been a failure.				
10.	I felt fearful.				
11.	My sleep was restless.				
12.	I was happy.				
13.	I talked less than usual.				
14.	I felt				

	lonely.				
15.	People were unfriendly.				
16.	I enjoyed life.				
17.	I had crying spells.				
18.	I felt sad.				
19.	I felt that people dislike me.				
20.	I could not get "going".				

Total:_____/60 (CESDT)

Social negativity Scale

The following section will ask you about personal feelings. These questions are important, as our feelings may directly affect our health or influence how we respond to health issues.

In your day-to-day life have you had the following experiences; Often, Sometimes, Rarely, or Never. (CIRCLE ONE ANSWER FOR EACH QUESTION)

		Often	Sometimes	Rarely	Never
a.	You are treated with less courtesy than other people				
b.	You are treated with less respect than other people				
c.	You receive poorer service than other people at restaurants or stores				
d.	People act as if they think you are not smart				
e.	People act as if they are afraid of you				
f.	People act as if they think you are dishonest				
g.	People act as if they're better than you are				
h.	You or your family members are called names or insulted				
i.	You are threatened or harassed				
j.	People ignore you or act as if you are not there				

Social Support Scale

The next few question focus on some other personal aspects of your life.

[HAND RESPONDENT CARD "A"] People sometimes look to others for companionship, assistance, or other types of support. How often is each of the following kinds of support available to you if you need it?

		None of the time	A little of the time	Some of the time	Most of the time	All of the time
a.	Someone you can count on to listen to you when you need to talk					
b.	Someone to take you to the doctor if you needed it					
c.	Someone to confide in or talk to about yourself of your problems					
d.	Someone to help with daily chores if you were sick					

IV Assessment

During the last 12 months, have you experienced any of the following: If you have not, circle 1 (NO). If you have and it was not at all upsetting, circle 2. If you have and it was somewhat upsetting circle 3. If you have and it was very upsetting circle 4. Please circle one answer for each question.

		NO	YES Not at all upsetting	YES Somewhat upsetting	YES Very upsetting
a.	Slapped, kicked, or otherwise hurt by husband/partner or someone else important to you	1	2	3	4

References

Albert, C.M., Ma, J., Rifai, N., Stampfer, M.J., & Ridker, P.M. (2002). Prospective study of C-reactive protein, homocysteine, and plasma lipid levels as predictors of sudden cardiac death. *Circulation*, 105(22), 2595-2599.

Albert, M.A., Danielson, E., Rifai, N., Ridker, P.M., & Prince Investigators. (2001). Effect of statin therapy on C-reactive protein levels: the pravastatin inflammation/CRP evaluation (PRINCE): A randomized trial and cohort study. *JAMA*, 286(1), 64-70.

Albert, M. A., Glynn, R. J., Buring, J., & Ridker, P. M. (2004). C-reactive protein levels among women of various ethnic groups living in the United States (from the Women's Health Study). The *American journal of cardiology*, 93(10), 1238-1242.

Alferi, S.M., Carver, C.S., Antoni, M.H., Weiss, S., & Duran, R.E. (2001). An exploratory study of social support, distress, and life disruption among low-income Hispanic women under treatment for early stage breast cancer. *Health Psychology*, 20, 41-46.

American Academy of Family Physicians. (2013). Intimate Partner Violence and Abuse of Elderly and Vulnerable Adults policy, http://www.aafp.org/patient-care/clinical-recommendations/all/domestic-violence.html.

American Heart Association. (n.d.) Risk factors and coronary artery disease. Retrieved February 2, 2011, from www.americanheart.org

American Heart Association. (n.d.). Women, heart disease, and stroke. Retrieved February 11, 2011 from www.americanheart.org/presenter.jthml?identifier+4786

Anda, R.F., Croft, J.B., Felitti, V.J., et al. (1999). Adverse childhood experiences and smoking during adolescence and adulthood. *JAMA*, 282 (17), 1652-1658.

Aronson, D., Bartha, P., Zinder, O., Kerner, A., Markiewicz, W., Avizohar, O., ... & Levy, Y. (2004). Obesity is the major determinant of elevated C-reactive protein in subjects with the metabolic syndrome. *International Journal of Obesity*, 28(5), 674-679.

Barrera, M. Jr. (2000). Social support research in community psychology. In J. Rappaport & E. Seidman (Eds.), Handbook of community psychology (pp. 215-245). New York, NY: Kluwer Academic/Plenum Publishers.

Basile, K. C., Arias, I., Desai, S., & Thompson, M. P. (2004). The differential association of intimate partner physical, sexual, psychological, and stalking violence and posttraumatic stress symptoms in a nationally representative sample of women. *Journal of Traumatic Stress,* 17 (5), 413–421.

Beck, J.E., Elzevier, Pelger, Putter, & Voorham-van der Zalm, (2009). Multiple pelvic floor complaints are correlated with sexual abuse history. *Journal of Sexual Medicine*, 6, 193-198.

Bermudez, E.A., Rifai, N., Buring, J.E., Manson, J.E., & Ridker, P.M. (2002). Relation between markers of systemic vascular inflammation and smoking in women. *American Journal of Cardiology*, 89(9), 1117-1119.

Bjarnason-Wehrens, B., Grande, G., Loewel, H., Völler, H., & Mittag, O. (2007). Gender-specific issues in cardiac rehabilitation: Do women with ischaemic heart disease need specially tailored programmes? *European Journal of Cardiovascular Prevention & Rehabilitation,* 14(2), 163-171.

Black, M.C., Basile, K.C., Breiding, M.J., Smith, S.G., Walters, M.L., Merrick, M.T., Chen, J., & Stevens, M.R. (2011). The national intimate partner and sexual violence survey (NISVS): 2010 *Summary Report*. Atlanta, GA: National Center

for Injury Prevention and Control, Centers for Disease Control and Prevention.

Black, M.C., & Breiding, M.J. (2008). Adverse health conditions and health risk behaviors associated with intimate partner violence-United States, 2005. *Morbidity & Mortality Weekly Report*, 57, 113-117.

Bonomi, A.E., Anderson, M.L., Reid, R.J., Rivara, F.P., Carrell, D., & Thompson, R.S. (2009). Medical and psychosocial diagnoses in women with a history of intimate partner violence. *Archives of Internal Medicine,*169, 1692-1697.

Bonomi, A., E., Thompson, R.S., Anderson, M., Reid, R.J., Carrell, D., Dimer, J.A., et al. (2006). Intimate partner violence and women's physical, mental, and social functioning. *American Journal of Preventive Medicine*, 30, 458-466.

Bosch, J., Weaver, T. L., Arnold, L. D., & Clark, E. M. (2015, August 12). The impact of intimate partner violence on women's physical health findings: From the Missouri behavioral risk factor surveillance system. *Journal of Interpersonal Violence*. doi 10.1177/0886260515599162.

Brenner, N.M., McMahon, & Warren. (1999). Forced sexual intercourse and associated health-risk behaviors among female college students in the United States. *Journal of Consulting Clinical Psychology,* 67, 252-259.

Breiding M.J., Black, M., Smith, S.G., Black, M.C., Mahendra, R.R. (2015). Intimate partner violence surveillance: Uniform definitions and recommended data elements, version 2.0. In. *Edited by National Center for Injury Prevention and Control CDC*. Atlanta, GA: Centers for Disease Control and Prevention.

Breiding, M. J., Black, M. C., & Ryan, G. W. (2008). Prevalence and risk factors of intimate partner violence in eighteen U.S. States/ Territories, 2005. *American Journal of Preventive Medicine,* 34, 112–118.

Breiding, M. J., Black, M. C., & Ryan, G. W. (2008). Chronic disease and health risk behaviors associated with intimate partner violence—18 U.S. states/territories, 2005. *Annals of Epidemiology*, 18, 538–544.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. Develop*mental Psychology*, 22(6), 723-742.

Brown, N.W., Wilson, & Kao. (2003). Correlates of sexual abuse and subsequent risk taking. *Hispanic Journal of Behavioral Medicine*, 23, 331-351.

Brown, D.S., Finkelstein, E.A., Mercy, J.A. (2008). Methods for estimating medical expenditures attributable to intimate partner violence. *Journal of Interpersonal Violence*, 23: 1747-66.

Burns, J. W., Quartana, P. J., Bruehl, S., Janssen, I., Dugan, S. A., Appelhans, B., ... & Kravitz, H. M. (2015). Chronic pain, body mass index and cardiovascular disease risk factors: tests of moderation, unique and shared relationships in the Study of Women's Health Across the Nation (SWAN). *Journal of behavioral medicine*, 38(2), 372-383.

Campbell, J.C. (2002). Health consequences of intimate partner violence. *Lancet;* 359:1331-6.

Campbell, R.L. (2006). Gynecological health impact of sexual assault. *Research in Nursing and Health*, 29, 399-413.

Campbell, J.C., Garza, M.A., Gielen, A.C., O'Campo, P., Kub, J., Dienemann, J., et al. (2003). Intimate partner violence and abuse among active duty military women. *Violence Against Women*, 9, 1072-1092.

Campbell R., Greeson M. R., Bybee D. (2008). The co-occurrence of childhood sexual abuse, adult sexual assault, intimate partner violence, and sexual harassment: A mediational model of posttraumatic stress disorder and physical health outcomes. *Journal of Consulting and Clinical Psychology, 76, 194-207.*

Campbell, J. C., & Soeken, K. L. (1999). Forced sex and intimate partner violence. *Violence Against Women*, 5,1017-1035.

Carbone-López, K., Kruttschnitt, C., & Macmillan, R. (2006). Patterns of intimate partner violence and their associations with physical health, psychological distress, and substance use. *Public Health Reports*, 121(4), 382–392.

Carpenter, K. M., Hasin, D. S., Allison, D. B., & Faith, M. S. (2000). Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study. *American journal of public health*, *90*(2), 251.

Catalano, S. (2013). Intimate partner violence: Attributes of victimization, 1993-2011. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics.

Cavanaugh C. E., Messing J. T., Petras H., Fowler B., La Flair L., Kub J., et al. (2012). Patterns of violence against women: A latent class analysis. *Psychological Trauma: Theory, Research, Practice, and Policy, 4, 169-176*.

Cerhan, J. R., Moore, S. C., Jacobs, E. J., Kitahara, C. M., Rosenberg, P. S., Adami, H. O., ... & Horn-Ross, P. L. (2014, March). A pooled analysis of waist circumference and mortality in 650,000 adults. In *Mayo Clinic Proceedings* (Vol. 89, No. 3, pp. 335-345). Elsevier.

Centers for Disease Control and Prevention (CDC). (2008). Adverse health conditions and health risk behaviors associated with intimate partner violence- United States, 2005. *Morbidity and Mortality Weekly Report,* 57, 113-117.

CDC. (2012). Understanding intimate partner violence. Retrieved February 11, 2016.

Champion, J. D., Piper, J., Holden, A., Korte, J., & Shain, R. N. (2004). Abused women and risk for pelvic inflammatory disease. *Western Journal of Nursing Research*, 26 (2), 176-191.

Champion, J. D., Piper, J., Shain, R. N., Perdue, S. T., & Newton, E. R. (2001). Minority women with sexually transmitted diseases: Sexual abuse and risk for pelvic inflammatory disease. *Research in Nursing and Health*, 24, 38-43.

Chapman, J. D. (1989). A longitudinal study of sexuality and gynecologic health in abused women. *Journal of the American Osteopathic Association*, 89 (5), 619-624.

Cloutier, S.M., Martin, & Poole. (2002). Sexual assault among North Carolina women: Prevalence and health risk factors. *Journal of Epidemiology and Community Health,* 56(4), 265-283.

Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology*, 7, 269-297.

Cohen, S., Underwood, L.G., & Gottlieb, B.H. (2000). Social support measurement and intervention: A guide for health and social scientists (pp. 53-85). New York, NY: Oxford University Press.

Coker, A. L. (2007). Does physical intimate partner violence affect sexual health? A systematic review. *Trauma, Violence, & Abuse*, *8* (2), 149-177.

Coker, A.L., Davis, K.E., Arias, I., Desai, S., Sanderson, M., Brandt, H.M., et al. (2002). Physical and mental health effect of intimate partner violence for men and women. *American Journal of Preventative Medicine*, 23:260-8.

Coker, A. L., Smith, P. H., Bethea, L., King, M. R., & McKeown, R. E. (2000). Physical health consequences of physical and psychological intimate partner violence. *Archives of Family Medicine*, 9 (5), 451-457.

Coker, A. L., Smith, P. H., McKeown, R. E., & King, M. L. (2000). Frequency and correlates of intimate partner violence by type: physical, sexual, and psychological battering. *American Journal of Public Health,* 90 (4), 553–559.

Coker, A. L., Watkins, K. W., Smith, P. H., & Brandt, H. M. (2003). Social support reduces the impact of partner violence on health: application of structural equation models. *Preventive medicine*, *37*(3), 259-267.

Cossette, S., Frasure-Smith, N., & Lespérance, F. (2002). Nursing approaches to reducing psychological distress in men and women recovering from myocardial infarction. *International Journal of Nursing Studies*, 39(5), 479-494.

Coutinho, T., Goel, K., de Sá, D. C., Carter, R. E., Hodge, D. O., Kragelund, C., ... & Torp-Pedersen, C. (2013). Combining body mass index with measures of central obesity in the assessment of mortality in subjects with coronary disease: role of "normal weight central obesity". *Journal of the American College of Cardiology*, *61*(5), 553-560.

D'Andrea, W., Sharma, R., Zelechoski, A.D., & Spinazola, J. (2011) Physical health problems after single trauma exposure: When stress takes root in the body. *Journal of the American Psychiatric Nurses Association,* 17, 378-392.

Daniels, K. (2005). Intimate partner violence & depression: a deadly comorbidity. *Journal of Psychosocial Nursing & Mental Health Services*, *43*(1), 44.

Davies, L., Ford-Gilboe, M., Willson, A., Varcoe, C., Wuest, J., Campbell, J., & Scott-Storey, K. (2015). Patterns of Cumulative Abuse Among Female Survivors of Intimate Partner Violence Links to Women's Health and Socioeconomic Status. *Violence against women*, *21*(1), 30-48.

Davila, G.B. (2003). Bladder dysfunction in sexual abuse survivors. *The Journal of Urology*, 170, 476-479.

de Maat, M.P., & Trion, A. (2004). C-reactive protein as a risk factor versus risk marker. *Current Opinion in Lipidology*, 15(6), 651-657.

Devaraj, S., Xu, D.Y., & Jialal, I. (2003). C-reactive protein increases plasminogen activator inhibitor-1 expression and activity in human aortic endothelial cells: Implications for the metabolic syndrome and atherothrombosis. *Circulation*, 107(3), 398-404.

De Vogli, R., Chandola, T., & Marmot, M.G. (2007). Negative aspects of close relationships and heart disease. *Archives of Internal Medicine,* 167(18), 1951-1957.

Dickinson, L.D., DeGruy, F.V., Dickinson, W.P., & Candib, L.M. (1999). Health-related quality of life and symptom profiles of female survivors of sexual abuse. *Archives of Family Medicine*, 8(1), 35-43.

Dillon, G., Hussain, R., Loxton, D., & Rahman, S. (2013). Mental and physical health and intimate partner violence against women: a review of the literature. *International journal of family medicine*, *2013*.

DiMatteo, M.R. (2004). Social support and patient adherence to medical treatment: A meta-analysis. *Health Psychology*, 23, 207-218.

Eby, K. K., Campbell, J. C., Sullivan, C. M., & Davidson, W. S. I. (1995). Health effects of experiences of sexual violence for women with abusive partners. *Health Care for Women International*, 16 (6), 563-576.

Elderon, L., & Whooley, M. A. (2013). Depression and cardiovascular disease. *Progress in cardiovascular diseases*, *55*(6), 511-523.

Emberson, J.R., Whincup, P.H., Morris, R.W., Walker, M., Lowe, G.D., & Rumley, A. (2004). Extent of regression dilution for established and novel coronary risk factors: Results from the British Regional Heart Study. *European Journal of Cardiovascular Prevention & Rehabilitation*, 11(2), 125-134.

Emerging Risk Factors Collaboration. (2012). C-reactive protein, fibrinogen, and cardiovascular disease prediction. *The New England Journal of Medicine*, 367(14), 1310.

Evans, L., & Wertheim, E. H. (2002). An examination of willingness to self-disclose in women with bulimic symptoms considering the context of disclosure and negative affect l evels. *International Journal of Eating Disorders*, 31, 344-348. doi: 10.1002/eat.10020.

Everson, S., Kaplan, G.A., Goldberg, D.E., Salonen, R., & Salonen, J. (1997). Hopelessness and 4-year progression of carotid atherosclerosis: The Kuopio Ischemic Heart Disease Risk Factor study. *Arteriosclerosis Thrombosis Vascular Biology*, 17(8), 1490-1495.

Everson-Rose, S.A., & Lewis, T.T. (2005). Psychosocial factors and cardiovascular diseases. *Annual Review of Public Health,* 26, 469–500.

Felitti, V.J., Anda, R.F., Nordenberg, D., … Marks, J.S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) *Study. American Journal of Preventative Medicine*, 14(4), 245-258.

Farley, M.G. (2002). Is a history of trauma associated with a reduced likelihood of cervical cancer screening? *Journal of Family Practice*, 51, 827-831.

Felitti, A., Bremner, J.D., Walker, J.D., Whitfield, C., Perry B.D. (2006). The enduring effects of abuse and relted adverse experiences in childhood. A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neuroscience*, 256. 174-186.

Friedman, E.M., Hayney, M.S., Love, G.D., Urry, H.L., Rosenkranz, M.A., Davidson, R.J., ... Ryff, C.D. (2005). Social relationships, sleep quality, and interleukin-6 in aging women. Proceedings of the National Academy of Sciences of the United States of America, 102(51), 18757-18762.

Frayne, S.S. (1999). Medical profile of women Veterans Administration outpatients who report a history of sexual assault occurring while in the military. *Journal of Women's Health and Gender Based Medicine,* 8(6), 117-127.

Frayne, S.S., Skinner, K.M., Sullivan, L.M., & Freund, K.M. (2003). Sexual assault while in the military: Violence as a predictor of cardiac risk. *Violence and Victims*, 18(2), 219-226.

Gallow, L.C., Troxel, W.M., Kuller, L.H., Sutton-Tyrrell, K. Edmundowicz, D. & Matthews, K.A. (2003). Marital status, marital quality, and atherosclerotic burden in postmenopausal women. *Psychosomatic Medicine*, 65(6), 952-962.

Gami, A.S., Witt, B.J., Howard, D.E., Erwin, P.J., Gami, L.A., Somers, V.K., & Montori, V.M. (2007). Metabolic syndrome and risk of incident cardiovascular events and death: a systematic review and meta-analysis of longitudinal studies. *Journal of the American College of Cardiology*, 49(4), 403-414.

Garcia-Moreno, C., Jansen, H. A. F. M., Ellsberg, M., Heise, L., & Watts, C. (2006). WHO Multi-Country Study on Women's Health and Domestic Violence against Women.

Glassman, A. (2008). Depression and cardiovascular disease. *Pharmacopsychiatry*.

Golding, J. M. (1996). Sexual assault history and limitations in physical functioning in two general population samples. Research in Nursing and Health, 19, 33-44.

Golding, J.T., et al. (2000). Prevalence of sexual abuse history in a sample of women seeking treatment for premenstrual syndrome. *Journal of Psychosomatic Obstetrics and Gynecology,* 21, 69-80.

Gore, S. (1981). Stress-buffering functions of social supports: An appraisal and clarification of research models. In B. Dohrenwend & B. Dohrenwend (Eds.) Stressful life events and their context (pp. 202-222).

Greenfeld, L., et al. (1998). Violence by intimates: analysis of data on crimes by current or former spouses, boyfriends, and girlfriends. *Bureau of Justice Statistics Factbook.* Washington DC: U.S. Department of Justice. NCJ #167237. Available from National Criminal Justice Reference Service.

Heinrich, P.C., Castell, J.V., & Andus, T. (1990). Interleukin-6 and the acute phase response. *Biochemical Journal,* 265(3), 621.

Hilden, M. (2004). A history of sexual abuse and health: A Nordic multicentre study. *International Journal of Obstetrics and Gynaecology*, 111(10), 1121-1127.

Horsten, M., Mittleman, M.A., Wamala, S.P., Schenck-Gustafsson, K., & Orth-Gomer, K. (2000). Depressive symptoms and lack of social integration in relation to prognosis of

CHD in middle-aged women. The Stockholm Female Coronary Risk Study. *European Heart Journal*, 21(13), 1072-1080.

House, J.S. (2001). Social isolation kills, but how and why? *Psychosomatic Medicine*, 63, 273-274.

Jewkes, R., Dunkle, K., Nduna, M., & Shai, N. (2010). Intimate partner violence, relationship power inequity, and incidence of HIV infection in young women in South Africa. *Lancet*, 376(9734), 41-48.

John, R., Johnson, J. K., Kukreja, S., Found, M., & Lindow, S. W. (2004). Domestic violence: Prevalence and association with gynaecological symptoms. *BJOG: An International Journal of Obstetrics & Gynaecology,* 111 (10),1128-1132.

Jundt, K., Scheer, I., Schiessl, B., Pohl, K., Haertl, K., & Peschers, U. M. (2007). Physical and sexual abuse in patients with overactive bladder: is there an association?. *International Urogynecology Journal*, *18*(4), 449-453.

Justice, B., (2007). National crime victimization survey. United States Department of Justice.

Kendall-Tackett, K. (2007). Inflammation, cardiovascular disease, and metabolic syndrome as sequelae of violence against women: The role of depression, hostility, and sleep disturbance. *Journal of Violence and Abuse*, 8(3), 93-102.

Kennedy, K. M. (2013). Heterogeneity of existing research relating to sexual violence, sexual assault and rape precludes meta-analysis of injury data. *Journal of forensic and legal medicine* 20, (5) 447-459.

Kahn, Jl, Garrison, A. (2009). Emotional self-disclosure and emotional avoidance; relations with symptoms of depression and anxiety. *Journal of Counseling Psychology*. 56 (4), 573-584.

Kiecolt-Glaser J.K., Preacher, K.J., MacCallum, R.C., Atkinson, C., Malarkey, W.B., & Glaser, R. (2003). Chronic stress and age-related increases in the proinflammatory cytokine IL-6. Proceedings of the National Academy of Sciences, 100, 9090–9095.

Kovac, S. H., Klapow, J. C., Kroenke, K., Spitzer, R. L., & Williams, J. B. (2003). Differing symptoms of abused versus nonabused women in obstetric-gynecology settings. *American Journal of Obstetrics & Gynecology*,188 (3), 707-713.

Krug, E., Dahlberg, L., Mercy, J., Zwi, A., & Lozano, R. (2002). World report on violence and health. Geneva, Switzerland: World Health Organization.

Krantz, D.S., & McCeney, M.K. (2002). Effects of psychological and social factors on organic disease: A critical assessment of research on coronary heart disease. *Annual Review of Psychology*, 53, 341–369.

Kushner, I., Rzewnicki, D., & Samols, D. (2006). What does minor elevation of C-reactive protein signify? *The American Journal of Medicine*, 119(2), 166-e17.

Lacey, K. K., McPherson, M. D., Samuel, P. S., Sears, K. P., & Head, D. (2013). The impact of different types of intimate partner violence on the mental and physical health of women in different ethnic groups. *Journal of Interpersonal Violence*, *28*(2), 359-385.

Lang, A.R. (2003). Sexual trauma, posttraumatic stress disorder, and health behavior. *Behavioral Medicine, 28*(4), 150-158.

Lacey, K. K., McPherson, M. D., Samuel, P. S., Sears, K. P., & Head, D. (2013). *Medicine*, 28, 150-158.

Lefkowitz, R.J., & Willerson, J.T. (2001). Prospects for cardiovascular research. *JAMA*, 285(5), 581-587.

Leserman, J.D., Li, Drossman, & Hu. (1996). Sexual and physical abuse history in gastroenterology practice: How types of abuse impact health status. *Psychosomatic Medicine*, 58, 4-15.

Leserman, J.L. (1998). Selected symptoms associated with sexual and physical abuse history among female patients with gastrointestinal disorders: The impact on subsequent health care visits. *Psychological Medicine*, 28, 417-425.

Leserman, J. (2005). Sexual abuse history: Prevalence, health effects, mediators, and psychological treatment. *Psychosomatic Medicine*, 67, 906-915.

Leserman, J., & Drossman, D. A. (2007). Relationship of abuse history to functional gastrointestinal disorders and symptoms some possible mediating mechanisms. *Trauma, Violence, & Abuse*, *8*(3), 331-343.

Letourneau, E. J., Holmes, M., & Chasedunn-Roark, J. (1999). Gynecologic health consequences to victims of interpersonal violence. *Women's Health Issues*, 9 (2), 115-120.

Lewis, M.A., & Rook, K.S. (1999). Social control in personal relationships: Impact on health behaviors and psychological distress. *Health Psychology*, 18, 63-71.

Libby, P., & Ridker, P.M. (1999). Novel inflammatory markers of coronary risk theory versus practice. *Circulation*, 100(11), 1148-1150.

Libby, P., & Simon, D.I. (2001). Inflammation and thrombosis: The clot thickens. *Circulation,* 103(13), 1718-1720.

Lin, N. (1986). Modeling the effects of social support. In N. Lin, A. Dean, & W. Ensel (Eds), Social support, life events, and depression (173-209). Orlando, FL: Academic Press.

Low, C.A., Thurston, R.C., & Matthews, K.A. (2010). Psychosocial factors in the development of heart disease in women: Current research and future directions. *Psychosomatic Medicine*, 72(9), 842.

Mason, S.M., Wright, R.J., Hibert, E.N., Spiegelman, D., Forman, J.P., Rich-Edwards, J.W. (2012). Intimate partner violence and incidence of hypertension in women. *Annals of Epidemiology*; 22, 8, 562-567.

Matthews, K.A., Raikkonen, K., Sutton-Tyrrell, K., & Kuller, L.H. (2004) Optimistic attitudes protect against progression of carotid atherosclerosis in healthy middle-aged women. *Psychosomatic Medicine*, 66(5), 640-644.

McDonald, C. (2008). Unpacking disclosure; interruption unquestioned practices. Issues in *Mental Health Nursing* 29, 639-649.

McNutt, L.A., Carlson, B.E., Persaud, M., & Postmus, J. (2002). Cumulative abuse experiences, physical health and health behaviors. *Annals of Epidemiology*, 12, 123-130.

Mehta, L.S., Beckie, T.M., DeVon, H.A., Grines, C.L., Krumholz, H.M., Johnson, M.N., ... Wenger, N.K. (2016). Acute myocardial infarction in women: A scientific statement from the American Heart Association. *Circulation*, 133(9), 916-947.

Meyer, J. P., Springer, S. A., & Altice, F. L. (2011). Substance abuse, violence, and HIV in women: a literature review of the syndemic. *Journal of Women's Health*, *20*(7), 991-1006.

Montalvo-Liendo, N., Wardell, D. W., Engebretson, J., & Reininger, B. M. (2009b). Factors Influencing Disclosure of Abuse by Women of Mexican Descent. *Journal of Nursing Scholarship*, 41, 359-367. doi: 10.1111/j.1547-5069.2009.01304.x.

Moreno, P.R., Falk, E., Palacios, I.F., Newell, J.B., Fuster, V., & Fallon, J.T. (1994). Macrophage infiltration in acute coronary syndromes: Implications for plaque rupture. *Circulation*, 90(2), 775-778.

Moser, A., Stuck, A. E., Silliman, R. A., Ganz, P. A., & Clough-Gorr, K. M. (2012). The eight-item modified Medical Outcomes Study Social Support Survey: psychometric evaluation showed excellent performance. *Journal of clinical epidemiology*, *65*(10), 1107-1116.

Mykletun, A., Overland, S., Aarø, L. E., Liabø, H. M., & Stewart, R. (2008). Smoking in relation to anxiety and depression: evidence from a large population survey: the HUNT study. *European Psychiatry*, *23*(2), 77-84.

National Heart, Lung, and Blood Institute (NHLBI). (2013). About the Heart Truth [Internet]. Accessed May 1, 2015, from www.nhlbi.nih.gov/health/educational/hearttruth/about/index.htm.

Nelson, H. D., Bougatsos, C., & Blazina, I. (2012). Screening women for intimate partner violence: a systematic review to update the US Preventive Services Task Force recommendation. *Annals of internal medicine*, *156*(11), 796-808.

Ng, D.M., & Jeffery, R.W (2003). Relationships between perceived stress and health behaviors in a sample of working adults. *Health Psychology*, 22, 638-642.

Nicolaidis, C. (2004). Intimate partner violence: A practical guide for primary care clinicians. *Women's Health in Primary Care*, 7, 349-362.

Nicolaidis, C., & Touhouliotis, V. (2006). Addressing intimate partner violence in primary care: Lessons from chronic illness management. *Violence and Victims*, 21, 101-115.

Nixon, R. D., Resick, P. A., & Nishith, P. (2004). An exploration of comorbid depression among female victims of intimate partner violence with posttraumatic stress disorder. *Journal of affective disorders*, *82*(2), 315-320.

O'Campo, P., Kub, J., Woods, A., Garza, M., Jones, A.S., Gielen, A.,C., et al. (2006) Depression, PTSD, and comorbidity related to intimate partner violence in civilian and military women. *Brief Treatment and Crisis Intervention*, 6, 99-110.

Ohsawa, M., Okayama, A., Nakamura, M., Onoda, T., Kato, K., Itai, K., ... Hiramori, K. (2005). CRP levels are elevated in smokers but unrelated to the number of cigarettes and are decreased by long-term smoking cessation in male smokers. *Preventive Medicine*, 41(2), 651-656.

Orth-Gomer, K., Wamala, S.P., Horsten, M., Schenck-Gustafsson, K., Schneiderman, N., & Mittleman, M.A. (2000). Marital stress worsens prognosis in women with coronary heart disease: The Stockholm Female Coronary Risk Study. *JAMA*, 284(23), 3008-3014.

Pannacciulli, N., Cantatore, F.P., Minenna, A., Bellacicco, M., Giorgino, R., & De Pergola, G. (2001). C-reactive protein is independently associated with total body fat, central fat, and insulin resistance in adult women. *International Journal of Obesity & Related Metabolic Disorders,* 25(10).

Papanicolaou, D.A., Wilder, R.L., Manolagas, S.C., & Chrousos, G.P. (1998). The pathophysiologic roles of interleukin-6 in human disease. *Annals of Internal Medicine*, 128, 127–137.

Pasceri, V., Willerson, J.T., & Yeh, E.T. (2000). Direct proinflammatory effect of C-reactive protein on human endothelial cells. *Circulation*, 102(18), 2165-2168.

Paterno, M. T., & Draughon, J. E. (2016). Screening for intimate partner violence. *Journal of Midwifery & Women's Health*.

Peters, K. M., Kalinowski, S. E., Carrico, D. J., Ibrahim, I. A., & Diokno, A. C. (2007). Fact or fiction—is abuse prevalent in patients with interstitial cystitis? Results from a community survey and clinic population. *The Journal of urology*, *178*(3), 891-895.

Plichta, S.F. & Falik. (2001). Prevalence of violence and its implications for women's health. *Women's Health*, 11(3), 244-258.

Rabin, R. F., Jennings, J. M., Campbell, J. C., & Bair-Merritt, M. H. (2009). Intimate partner violence screening tools: a systematic review. *American journal of preventive medicine*, *36*(5), 439-445.

Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied psychological measurement*, 1(3), 385-401.

Rape, Abuse, and Incest National Network. (n.d.). Statistics. Retrieved January 3, 2011, from http://www.rainn.org/statistics

Rejeski, W.J., Thompson, A., Brubaker, P.H., & Miller, H.S. (1992). Acute exercise: Buffering psychosocial stress responses in women. Health Psychology, 11, 355-362.

Resnick, H.A. (1997). Health impact of interpersonal violence 2: Medical and mental health outcomes. *Behavioral Medicine*, 23(2), 65-78.

Rhodes, K., Frankel, R., Levinthal, N., Prevnoveau, E., Bailey, J., & Levinson, W. (2007). "You're not a victim of domestic violence, are you?" Provider –patient communication about domestic violence. *Annals of Internal Medicine*, 147 (9), 620-628.

Ridker, P.M. (2001). Should statin therapy be considered for patients with elevated C-reactive protein? The need for a definitive clinical trial. *European Heart Journal*, 22(23), 2135-2137.

Ridker, P.M., Buring, J.E., Shih, J., Matias, M., & Hennekens, C.H. (1998). Prospective study of C-reactive protein and the risk of future cardiovascular events among apparently healthy women. *Circulation*, 98(8), 731-733.

Ridker, P.M., Hennekens, C.H., Buring, J.E., & Rifai, N. (2000). C-reactive protein and other markers of inflammation in the prediction of cardiovascular disease in women. *New England Journal of Medicine*, 342(12), 836-843.

Ridker, P.M., Rifai, N., Clearfield, M., Downs, J.R., Weis, S.E., Miles, J.S., & Gotto Jr, A.M. (2001). Measurement of C-reactive protein for the targeting of statin therapy in the primary prevention of acute coronary events. *New England Journal of Medicine*, 344(26), 1959-1965.

Ridker, P.M., Rifai, N., Pfeffer, M.A., Sacks, F., Braunwald, E., & Cholesterol and Recurrent Events (CARE) Investigators. (1999). Long-term effects of pravastatin on plasma concentration of C-reactive protein. *Circulation,* 100(3), 230-235.

Ross, R. (1999). Atherosclerosis—an inflammatory disease. *New England Journal of Medicine*, 340(2), 115-126.

Rozanski, A., Blumenthal, J.A., & Kaplan, J. (1999). Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation*, 99, 2192–2217.

Rutledge, T., Reis, S.E., Olson, M., Owens, J., Kelsey, S.F., Pepine, C.J., ... Cornell, C.E. (2004). Social networks are associated with lower mortality rates among women with suspected

coronary disease: The National Heart, Lung, and Blood Institute-Sponsored Women's Ischemia Syndrome Evaluation study. *Psychosomatic Medicine*, 66(6), 882-888.

Sadler, A.B. (2000). Health-related consequences of physical and sexual violence: Women in the military. *Obstetrics and Gynecology*, 96(3), 473-480.

Saiki, L. S. and Lobo, M. L. (2011), Disclosure: a concept analysis. *Journal of Advanced Nursing.* doi: 10.1111/j.1365-2648.2011.05741.x.

Schei, B., & Bakketeig, L. S. (1989). Gynaecological impact of sexual and physical abuse by spouse. A study of a random sample of Norwegian women. *British Journal of Obstetrics & Gynecology*,96 (12), 1379-1383.

Scott, K.M., Koenen, K.C., Aguilar-Gaxiola, S., Alonso, J., Angermeyer, M.C., Benjet, C., ... Iwata, N. (2013). Associations between lifetime traumatic events and subsequent chronic physical conditions: A cross-national, cross-sectional study. *PLOS ONE*, 8(11), e80573.

Scott-Storey, K. (2011). Cumulative abuse: Do things add up? An evaluation of the conceptualization, operationalization, and methodological approaches in the study of the phenomenon of cumulative abuse. *Trauma, Violence, & Abuse,* 12, 1-16.

Scott-Storey, K., Wuest, J., & Ford-Gilboe, M. (2009). Intimate partner violence and cardiovascular risk; Is there a link? *Journal of Advanced Nursing*, 65, 2186-2197.

Seyller, M., Denis, C., Dang, C., Boraud, C., Lepresle, A., Lefèvre, T., & Chariot, P. (2016). Intimate partner sexual assault: traumatic injuries, psychological symptoms, and perceived social reactions. *Obstetrics & Gynecology*, *127*(3), 516-526.

Shaw, L.J., Merz, C.N.B., Pepine, C.J., Reis, S.E., Bittner, V., Kelsey, S.F., ... Rogers, W.J. (2006). Insights from the NHLBI-Sponsored Women's Ischemia Syndrome Evaluation (WISE) Study: Part I: Gender differences in traditional and novel risk factors, symptom

evaluation, and gender-optimized diagnostic strategies. *Journal of the American College of Cardiology*, 47(3s1), S4-S20.

Sherbourne, C.D., Stewart, A.L. (1991). The MOS social support survey. *Social Science Medicine* 32 (6): 705-715.

Sowers MF, Crawford S, Sternfeld B, Morganstein D, Gold E, Greendale G, Evans D, Neer R, Matthews K, Sherman S, et al. Design, survey sampling and recruitment methods of SWAN: a multi-center, multi-ethnic, community-based cohort study of women and the menopausal transition. In: Wren J, Lobo RA, Kelsey J, Marcus R, eds. Menopause: Biology and Pathobiology. San Diego, CA: Academic Press, 2000:175–188.

Stein, M.L. (2004). Relationship of sexual assault history to somatic symptoms and health anxiety in women. *General Hospital Psychiatry*, 26, 178-183.

Stein, E. A., Kumbla, L., Miller, J., Srivastiva, L., & Kashyap, M. (1992). Development and evaluation of a competitive ELISA for Lp (a). *Clinical Chemistry*, 38(6), 1067.

Steiner, P. M., Friedel, J., Bremner, W. F., & Stein, E. A. (1981), January). Standardization of micro-methods for plasma-cholesterol, triglyceride and HDL-cholesterol with the lipid research clinics methodology. *Journal of Clinical Chemistry and Clinical Biochemistry* 19 (8), 850-850). Genthiner Strasse 13, D-10785 Berlin, Germany: Walter De Gruyter & Co.

Stewart, J.C., Janicki, D.L., Muldoon, M.F., Sutton-Tyrrell, K., & Kamarck, T.W. (2007). Negative emotions and 3-year progression of subclinical atherosclerosis. *Archives of General Psychiatry*, 64(2), 225-233.

Sullivan, T. P., Cavanaugh, C. E., Buckner, J. D., & Edmondson, D. (2009). Testing posttraumatic stress as a mediator of physical, sexual, and psychological intimate partner

violence and substance problems among women. *Journal of traumatic stress*, *22*(6), 575-584.

Sullivan, T. P., McPartland, T. S., Armeli, S., Jaquier, V., & Tennen, H. (2012). Is it the exception or the rule? Daily co-occurrence of physical, sexual, and psychological partner violence in a 90-day study of substance-using, community women. *Psychology of violence*, *2*(2), 154.

Suls, J., & Bunde, J. (2005). Anger, anxiety, and depression as risk factors for cardiovascular disease: The problems and implications of overlapping affective dispositions. *Psychological Bulletin*, 131, 260–300.

Sumner, J.A., Kubzansky, L.D., Elkind, M.S., Roberts, A.L., Agnew-Blais, J., Chen, Q., & Koenen, K.C. (2015). Trauma exposure and posttraumatic stress disorder symptoms predict onset of cardiovascular events in women. *Circulation*, 132(4), 251-259.

Swartout A. G., Swartout K. M., White J. W. (2011). What your data didn't tell you the first time around: Advanced analytic approaches to longitudinal analysis. *Violence Against Women, 17, 309-321*

Tolstrup, J.S., Hvidtfeldt, U.A., Flachs, E.M., Spiegelman, D., Heitmann, B.L., Bälter, K., ... Pereira, M. (2014). Smoking and risk of coronary heart disease in younger, middle-aged, and older adults. *American Journal of Public Health*, 104(1), 96-102.

Tomasuloand, G., & McNamara, J. (2007). The relationship of abuse to women's health status and health habits. *Journal of Family Violence*, 22(4), 231–235.

Torzewski, J., Torzewski, M., Bowyer, D.E., Fröhlich, M., Koenig, W., Waltenberger, J., ... Hombach, V. (1998). C-reactive protein frequently colocalizes with the terminal

complement complex in the intima of early atherosclerotic lesions of human coronary arteries. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 18(9), 1386-1392.

Tursich, M., Neufeld, R.W., Frewen, P.A., Harricharan, S., Kibler, J.L., Rhind, S.G., & Lanius, R.A. (2014). Association of trauma exposure with proinflammatory activity: a transdiagnostic meta-analysis. *Translational Psychiatry*, 4, 1-9.

Tracy, R.P. (1998). Inflammation in cardiovascular disease. *Circulation*, 97, 2000–2002.

Uchino, B.N., Cacioppo, J.T., & Kiecolt-Glaser, J.K. (1996). The relationship between social support and physiological processes: A review with emphasis on underlying mechanisms and implications for health. *Psychological Bulletin*, 119, 488–531.

Uchino, B.N. (2004). Social support and physical health: Understanding the health consequences of relationships. New Haven, CT: Yale University Press.

Umberson, D. (1987). Family status and health behaviors: Social control as a dimension of social integration. *Journal of Health and Social Behavior*, 28, 306-319.

Van Berlo, W.E., & Ensink, B. (2000). Problems with sexuality after sexual assault. Annual *Review of Sex Research*, 11, 235-257.

Van Gaal, L.F., Mertens, I.L., & Christophe, E. (2006). Mechanisms linking obesity with cardiovascular disease. *Nature*, 444(7121), 875-880.

Verma, S., Wang, C.H., Li, S.H., Dumont, A.S., Fedak, P.W., Badiwala, M.V., ... Stewart, D.J. (2002). A self-fulfilling prophecy: C-reactive protein attenuates nitric oxide production and inhibits angiogenesis. *Circulation*, 106(8), 913-919.

Visser, M., Bouter, L.M., McQuillan, G.M., Wener, M.H., & Harris, T.B. (1999). Elevated C-reactive protein levels in overweight and obese adults. JAMA, 282(22), 2131-2135.

Warnick, G. R., & Albers, J. J. (1978). A comprehensive evaluation of the heparin-manganese precipitation procedure for estimating high density lipoprotein cholesterol. *Journal of Lipid Research*, 19(1), 65-76.

Waters, H., Hyder, A., Rajkotia, Y., Basu, S., & Rehwinkel, J.A. (2004). The economic dimensions of interpersonal violence. Geneva, Switzerland: Department of Injuries and Violence Prevention, World Health Organization.

Wener, M. H., Daum, P. R., & McQuillan, G. M. (2000). The influence of age, sex, and race on the upper reference limit of serum C-reactive protein concentration. *The Journal of rheumatology,* 27(10), 2351-2359.

Whang, W., Kubzansky, L.D., Kawachi, I., Rexrode, K.M., Kroenke, C.H., Glynn, R.J., Garan, H., & Albert, C.M. (2009). Depression and risk of sudden cardiac death and coronary heart disease in women: Results from the Nurses' Health Study. *Journal of the American College of Cardiology,* 53(11), 950–958.

Whooley, M. A. (2006). Depression and cardiovascular disease: healing the broken-hearted. *Jama*, *295*(24), 2874-2881.

Wiederman, M.S. (1999). Obesity among sexually abused women: An adaptive function for some. *Women's Health*, 29, 89-100.

Willerson, J.T., & Ridker, P.M. (2004). Inflammation as a cardiovascular risk factor. *Circulation,* 109(21 suppl 1), II-2.

Williams, R. C., Harmon, M. E., Burlingame, R., & Du Clos, T. W. (2005). Studies of serum C-reactive protein in systemic lupus erythematosus. *The Journal of rheumatology*, *32*(3), 454-461.

Windgassen, E. B., Funtowicz, L., Lunsford, T. N., Harris, L. A., & Mulvagh, S. L. (2015). C-reactive protein and high-sensitivity C-reactive protein: an update for clinicians. *Postgraduate medicine*.

Wingood, G.M., & DiClemente, R.J. (1998). Rape among African American women: Sexual, psychological, and social correlates predisposing survivors to risk of STD/HIV. *Journal of Women's Health,* 7, 77-84.

Wittenberg, E., Joshi, M., Thomas, K.A., & McCloskey, L.A. (2007). Measuring the effects of intimate partner violence on health-related quality of life; A qualitative focus group study. *Health and Quality of Life Outcomes*, 5.

Wong, N.D., Pio, J., Valencia, R., & Thakal, G. (2001). Distribution of C-reactive protein and its relation to risk factors and coronary heart disease risk estimation in the NHANES III. *Preventive Cardiology*, 4, 109–114

Woods, A.P. (2005). The mediation effect of posttraumatic stress disorder symptoms on the relationship of intimate partner violence and IFN gamma levels. *American Journal of Community Psychology*, 36, 159-174.

Woods, S., Hall, R., Campbell, J., & Angott, D. (2008). Physical health and posttraumatic stress disorder symptoms in women experiencing intimate partner violence. *Journal of Midwifery and Women's Health*, 53(6), 538–546.

World Health Organization. (2003). International classification of diseases (10th ed.). Geneva, Switzerland: World Health Organization.

Yasojima, K., Schwab, C., McGeer, E.G., & McGeer, P.L. (2001). Generation of C-reactive protein and complement components in atherosclerotic plaques. *The American Journal of Pathology,* 158(3), 1039-1051.

Yudkin, J.S., Stehouwer, C., Emeis, J., & Coppack, S. (1999). C-reactive protein in healthy subjects: Associations with obesity, insulin resistance, and endothelial dysfunction a potential role for cytokines originating from adipose tissue? *Arteriosclerosis, Thrombosis, and Vascular Biology*, 19(4), 972-978.

Zhou, D., Kusnecov, A.W., Shurin, M.R., DePaoli, M., & Rabin, B.S. (1993). Exposure to physical and psychological stressors elevates plasma interleukin 6: Relationship to the activation of hypothalamic-pituitary-adrenal axis. *Endocrinology*, 133, 2523–2530.

Zwaka, T.P., Hombach, V., & Torzewski, J. (2001). C-reactive protein–mediated low density lipoprotein uptake by macrophages implications for atherosclerosis. *Circulation,* 103(9), 1194-1197.