SEXUAL ASSAULT IN A HIGHLY TRAUMATIZED INNER-CITY POPULATION: PREVALENCE, ASSOCIATED SEQUELAE, AND PSYCHOPHYSIOLOGICAL PHENOTYPES

by

ALEX O. ROTHBAUM

Submitted in partial fulfillment of the requirements for the degree of Master of Arts

Department of Psychological Sciences

CASE WESTERN RESERVE UNIVERSITY

January 2017
CASE WESTERN RESERVE UNIVERSITY
SCHOOL OF GRADUATE STUDIES

We hereby approve the thesis of

Alex O. Rothbaum

Candidate for the degree of Master of Arts.

Committee Chair
Norah C. Feeny, PhD

Committee Member
Lee A Thompson, PhD

Committee Member
Arin Connell, PhD

Date of Defense
October 26th, 2016

*We also certify that written approval has been obtained for any proprietary material contained therein.
# TABLE OF CONTENTS

List of Tables ........................................................................................................... 4
Acknowledgement ....................................................................................................... 5
Abstract ....................................................................................................................... 6
Introduction ................................................................................................................ 7
  Aims and Hypotheses .............................................................................................. 24
Method ...................................................................................................................... 25
  Participants .......................................................................................................... 25
  Measures .............................................................................................................. 26
  Procedure ............................................................................................................ 30
  Data Analytic Plan ............................................................................................... 32
Results ...................................................................................................................... 34
Discussion ............................................................................................................... 40
Appendix .................................................................................................................. 54
References ................................................................................................................. 64
List of Tables

Table 1. Demographics of Overall Sample and African American (AA) Subset of Sample................................................................. 54

Table 2. Characteristics of Sexual Assault Split Between Gender ....................... 56

Table 3. Chi Square Results Examining Differences in Sexual Assault Between African American Males and Females .............................................. 57

Table 4. Adjusted and Unadjusted Odds Ratios Associated with Sexual Assault Exposure.................................................................................................. 58

Table 5. Unadjusted and Adjusted Mean ± SEM for Continuous Health and Quality of Life Outcomes in both African Americans Exposed to Sexual Assault and African Americans Exposed to Trauma Without Sexual Assault ........... 59

Table 6. Demographics of Startle Subset of Sample.................................................. 61

Table 7. Unadjusted and Adjusted Startle Reactivity by Block .............................. 63
ACKNOWLEDGEMENTS

My sincerest appreciation of and thanks to my advisor, Norah C. Feeny, PhD for her mentorship, guidance, contributions, and time invested in this project and in my training in overall. I also am deeply grateful to Tanja Jovanovic, PhD for her continued mentorship as well as guidance and investments in this project specifically. This project was further facilitated by Vasiliki J. Michopoulos, MSc, PhD and Rebecca C. Roffman, MS. I am thankful to my committee members, Lee A. Thompson, PhD and Arin Connell, PhD, for their guidance and insights throughout this project.

This work was supported by NIMH (MH071537, MH098212), National Centers for Research Resources (M01RR00039), National Center for Advancing Translational Sciences (UL1TR00454), HHMI, ACTSI, NARSAD, EMCF, and the Burroughs Wellcome Fund awarded to PIs K. Ressler, T. Jovanovic, B. Bradley, and C.G. Gillespie.
Sexual Assault in a Highly Traumatized Inner-City Population: Prevalence, Associated Sequelae, and Psychophysiologic Phenotypes

Abstract

By
ALEX O. ROTHBAUM

Sexual assault is unfortunately a common form of interpersonal violence that confers considerable risk for negative psychological and physical outcomes. However, the prevalence and associated sequelae of sexual assault are understudied in key at risk groups like inner city and low-income populations. Using a subset of a large epidemiological sample comprised of 8,533 highly traumatized, low-income African American men and women, the current study examines the prevalence of sexual assault and a range of associated health outcomes among sexual assault survivors. Results indicate nearly 40% experienced sexual assault, primarily in childhood. Associated negative health outcomes include PTSD, Depression, self-harm, substance use, incarceration, and increased trauma exposure, among others. In a translational paradigm conducted on a subset (n=241), dark-enhanced startle yielded no differences between groups, however sexual assault was associated with habituation deficits.
**Introduction**

**Sexual Assault and its Prevalence**

Interpersonal violence is common in the United States (U.S; (Rosenberg & Fenley, 1991; Roth & Reiss Jr, 1993; Sumner et al., 2015) and has been identified by the Centers for Disease Control and Prevention (CDC) as a “serious public health problem” with major effects on quality of life (Centers for Disease Control and Prevention, 1985). This is especially true in inner-city populations, where exposure to trauma is particularly common (Gillespie et al., 2009). Sexual assault is a prevalent form of interpersonal violence (Breslau, 2009; Breslau et al., 1998; Burnam et al., 1988; Cloutier, Martin, & Poole, 2002; Elliott, Mok, & Briere, 2004; Isely & Gehrenbeck - Shim, 1997; Ullman & Brecklin, 2003) that is understudied in key at risk subpopulations. Much of the prevalence data for sexual assault is outdated and limited in scope, with estimates varying widely depending on the sample used. While population level estimates of victimization, as well as data from select subpopulations such as college students exist (Koss & Dinero, 1989; Krebs, Lindquist, Warner, Fisher, & Martin, 2007), many gaps remain in the understanding of its prevalence, especially in at-risk groups including inner city and low-income populations.

**Gaps in the Literature**

In the overall population, women are at higher risk for being sexually assaulted compared to men, with 3-27% of female respondents having reported sexual assault in their lifetime compared to 0.7-9.4% of men (Acierno, Resnick, & Kilpatrick, 1997; Burnam et al., 1988; Elliott et al., 2004; Kessler, Sonnega,
Bromet, Hughes, & Nelson, 1995; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). Reviews of the prevalence of violence against women estimate 1 in 5 women have been a victim of sexual assault (Goodman, Koss, & Russo, 1993), a statistic recently replicated by the CDC (Breiding et al., 2014). There is relatively little research examining prevalence of sexual assault in men, and lower prevalence is thought to be due in part to high incidence of underreporting, given high levels of societal stigma (Acierno et al., 1997; Breslau, Wilcox, Storr, Lucia, & Anthony, 2004; Burnam et al., 1988; Kessler et al., 1995). There have been additional breakdowns by ethnicity and other specific subpopulations, with research thus far finding that Caucasian women and female university students experience the highest occurrence of sexual assault (Acierno et al., 1997; Dohrenwend, 1998; Elliott et al., 2004; Koss, Gidycz, & Wisniewski, 1987). Similarly, among males, studies suggest Caucasian men are more likely to be victims of sexual assault than other subpopulations (Breiding et al., 2014; Isely & Gehrenbeck-Shim, 1997). However, there are gaps in the literature in terms of our understanding of the prevalence of sexual assault in key at risk subgroups, such as inner city, low socioeconomic populations. In this study, I will examine an at-risk African American population of highly traumatized, low socioeconomic status (SES) men and women living in an urban environment. Such populations may perceive high levels of stigma (McNair & Neville, 1996; Washington, 2001) and lack resources to report sexual assault (Logan, Evans, Stevenson, & Jordan, 2005). They may also be particularly vulnerable to the down-stream negative effects after trauma has occurred (Gillespie et al., 2009).
Throughout childhood and adolescence, negative or traumatic experiences during sensitive developmental phases have the potential to have broad impact into later stages of life (Felitti et al., 1998; Heim & Nemeroff, 2001; Sternberg et al., 1993). Unfortunately, sexual assaults tend to occur in this period with nearly a quarter of women reporting a first sexual assault before age 17, and nearly three quarters reporting a first assault before age 29 (Acierno et al., 1997). As an example, a study of over 4,000 American women reported that 29.3% of sexual assaults occurred before age 11 (Resnick et al., 1993), however this cannot be considered a representative sample as 85.2% were Caucasian and a majority had at least a high school education. While most studies examined rates of sexual assault among women, age trends are similar in men, with a majority of occurrences reported between ages 16 and 30 (Isely & Gehrenbeck - Shim, 1997). While many of the above reported studies have been replicated, sampling bias and under reporting may be excluding other groups who are heavily victimized, such as low SES groups, highly traumatized populations (i.e. those living in inner-city environments), and men. Thus, in the current study I will examine the prevalence of sexual assault in childhood and adulthood in an under-represented at-risk sample of African American women and men.

A Population at Risk for Trauma Exposure

In the U.S., low SES populations, especially African Americans living in urban environments are at risk for high levels of trauma exposure (Ford, 2008; Gillespie et al., 2009; Houry, Kemball, Rhodes, & Kaslow, 2006; Liebschutz et al., 2007; Schwartz, Bradley, Sexton, Sherry, & Ressler, 2005; Sumner et al.,
A recent study at an urban hospital serving primarily low-income, inner-city, African American patients, found that 87.8% of participants reported lifetime trauma exposure (Gillespie et al., 2009). Moreover, in these populations, much of the trauma is interpersonal in nature. Research shows that African Americans are at the highest risk for experiencing violence (Hanson, Kilpatrick, Falsetti, & Resnick, 1997; Kilpatrick, Seymour, & Boyle, 1991; Sumner et al., 2015). Much of this increased risk is concentrated in inner-city neighborhoods, where a majority of residents are of low SES and represent understudied vulnerable populations. In one study of inner-city individuals, 55% experienced a potentially lethal attack and 45% of females had experienced sexual assault (Schwartz et al., 2005). Similarly, among primarily inner-city patients surveyed in a hospital ED waiting room, 22% reported physical abuse in the last year and 9% sexual violence (Houry et al., 2006). Thus, this population is at-risk not only due to the rates of violence that they experience, but also due to the compound effects from a pattern of chronic and multiple trauma exposures. Historically, at-risk populations, namely highly traumatized, low SES African Americans living in an urban environment are largely under-represented in the research literature compared to Caucasians (Dancy, Wilbur, Talashek, Bonner, & Barnes-Boyd, 2004; Shavers - Hornaday, Lynch, Burmeister, & Torner, 1997), especially in terms of sexual assault. While some data on interpersonal violence in this population has emerged, a representative description of the prevalence of sexual assault across genders and the lifespan does not exist, nor does it begin to take into account the context of chronic traumatization and examine its effects.
compared to trauma exposure without sexual assault. The absence of representative prevalence data prevents a complete understanding of the sequelae of sexual assault, thus an epidemiological study examining the prevalence of sexual assault in this at-risk inner-city population will uncover much needed data in addressing this public health concern.

**Negative Outcomes Associated with Sexual Assault**

Trauma exposure often leads to, or is associated with, long-term negative psychological and physical health consequences (Cooper, Feeny, & Rothbaum, 2015; Friedman & Schnurr, 1995). From studies that examine multiple types of stress exposures, such as the Adverse Childhood Experiences study (ACES), the field is aware that adversity can have profound impacts on physical and mental health across demographic categories, regardless of associated risk and environment (Felitti et al., 1998; Golding, 1994). The impact of sexual assault is often more severe than when exposed to non-sexual traumas (Eisenman, Gelberg, Liu, & Shapiro, 2003; Golding, Cooper, & George, 1997; Martin, Rosen, Durand, Knudson, & Stretch, 2000; Zoellner, Goodwin, & Foa, 2000). However, the long and short-term correlates of sexual assault are largely understudied and have the potential to impact the individual’s overall wellbeing and quality of life in the aftermath of assault alone and in combination with other traumatic exposures. Much of the extant literature examining the aftermath of sexual assault is narrow in focus in that it primarily examines healthcare utilization, somatic symptoms, and posttraumatic stress disorder (PTSD), which results in a literature slanted to these specific samples, rather than a broader epidemiological approach. While
continued research is needed in these specific areas, new investigation is needed
to elucidate the full range of potential impacts of sexual assault using a more
complete definition of health, especially in populations experiencing chronic
traumatization. A wider view of the impact is vital, both overall, and in the
specific context of the inner-city population at hand. The current study aims to
examine a wide range of pathological and wellbeing categories in order to yield
associated outcomes that differentiate sexual assault from other forms of trauma
exposure.

**Global Effects on Health**

Sexual assault is both a physical and psychological trauma, thus studies
show that the effects impact multiple domains of health, broader than just specific
pathologies. Despite possible effects as a result of exposure to multiple traumas,
there appears to be a level of impact uniquely associated with sexual assault
and/or the unique conditions that are associated with it. The experiences
associated with sexual assault may also result in an increased awareness and thus
attention to more subtle symptoms that would otherwise go ignored (Golding,
1994; Goodman et al., 1993). Having excellent health is almost twice as likely for
women who have not been victims of sexual assault when compared to those who
have been, even when controlling for demographics (Golding, 1994). By
identifying health correlates of sexual assault, the distinctive manner by which
sexual assault affects the survivors can be better understood which will lead to
better treatment and prevention of both prolonged suffering of an individual and
burden to the health system.
Somatic Correlates of Sexual Assault

In addition to global effects on health and health perceptions mentioned above, there are somatic health consequences that may be acutely linked to sexual assault and become long-term concerns. In a study of women who had experienced sexual assault, one study found more than half were physically injured as a result of the assault (Resnick et al., 1993), with another study finding over half reported at least one specific somatic symptom (Golding, 1994). As such, research on physical systems has also focused on direct impacts of the physical actions of the assault itself, as exemplified by findings indicating that in addition to tissue damage from the assault (Beebe, 1991), major organ systems appear to be more susceptible to negative health outcomes (Golding, 1994). Like other types of traumatic events, sexual assault activates the immune system regardless of the presence of physical injury (Koss et al., 1994). In those with chronic trauma exposure, this results in chronic immune activation, which can lead to additional health concerns and conditions. The odds of developing chronic conditions such as diabetes, arthritis, and fibromyalgia and chronic gastrointestinal (GI), neurological, and reproductive symptoms are higher in women who have been sexually assaulted when compared to women who have not (Golding, 1994, 1999; Goodman et al., 1993; Sorenson, Stein, Siegel, Golding, & Burnam, 1987; Stein & Barrett-Connor, 2000). As demonstrated by these studies, there are many potential physical consequences of sexual assault, both immediate and long-term. What remains to be discerned is an overarching examination of a range of physical consequences/correlates within the same
epidemiological sample, and not just in samples that present for specific problems. Knowing the likely physical consequences of sexual assault that are replicated across cohorts, even if not immediately obvious, can assist in development of preventive care protocols. Additionally, the potential long-term physical consequences of sexual assault specifically in a population with chronic trauma exposure, such as those living in low income, inner-city neighborhoods, remain to be seen. Thus, in the current study I will investigate a range of health factors in those who have trauma histories that include sexual assault compared to those with trauma histories that do not include sexual assault. Given the high likelihoods of multiple traumatization, this should begin to highlight the unique contribution of sexual assault to physical health.

Psychological Correlates of Sexual Assault

Posttraumatic stress disorder (PTSD). PTSD is one of the most common psychological sequelae following sexual assault, and is even more so in the context of multiple traumatic experiences (Kessler, 2000). Further, PTSD is more commonly seen in traumas that are interpersonal nature (Breslau et al., 1998). PTSD is typically chronic and impairing (Kessler, 2000). Lifetime prevalence of PTSD was 6.8% (Kessler et al., 2005), however this rate is variable depending on the sample used, with those at higher risk of trauma exposure including military service and being in an inner-city environment reporting higher rates of PTSD (Gillespie et al., 2009; Hoge et al., 2004). In epidemiological samples, average lifetime prevalence of PTSD in sexual assault survivors specifically is 31% (Kilpatrick, Edmunds, & Seymour, 1992). In a prospective
study of females who had experienced sexual assault, 94% met symptomatic criteria for PTSD an average of 12 days post-trauma (Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). This number decreased to 47% at 3 month follow-up, however little improvement was seen after 3 months (Rothbaum et al., 1992). Importantly, past research suggests that income and education do not account for the type or severity of symptoms experienced in the aftermath of sexual assault (Becker, Skinner, Abel, & Treacy, 1982; Kilpatrick, Veronen, & Best, 1985; Ruch & Leon, 1983). It remains to be seen if this finding still holds three decades later.

There is research to suggest that a link exists between PTSD symptomatology and physical health symptoms (Zoellner et al., 2000), in which PTSD severity was one of the most robust predictors of self-reported physical symptoms (Zoellner et al., 2000). While this link has not been specifically investigated in sexual assault, it suggests that examining both within the same sample may yield results which impact clinical care as well as understanding of the interplay of bodily systems.

**Other psychological correlates/consequences of sexual assault.** Aside from PTSD and its associated symptomatology, survivors of sexual assault are prone to depression, anxiety, and substance abuse (Frazier, 1993; Goodman et al., 1993; Kilpatrick, Saunders, Veronen, Best, & Von, 1987; Myers, 1989; Ullman & Brecklin, 2003; Walker, Archer, & Davies, 2005). Depression, in particular, is highly comorbid with PTSD in addition to being a standalone outcome of sexual assault (Breslau, 2009; Felitti et al., 1998; Kilpatrick et al., 2003; Zoellner, Rothbaum, & Feeny, 2011). Depression has been found to be increased in a those with PTSD in a prospective study of female sexual assault survivors (Rothbaum et
Depression in the aftermath of sexual assault may also play a role in somatic symptoms, though research findings vary, with no evidence of poorer health related to depression in one study (Golding, 1999), and evidence to the contrary in another (Zoellner et al., 2000). Suicide attempts and suicidal ideation are very common among sexual assault survivors, with 33-50% of sexual assault survivors reporting suicidal ideation (Ellis, Atkeson, & Calhoun, 1981; Koss, 1990; Resick, Jordan, Girelli, Hutter, & Marhoefer-Dvorak, 1988). For those who have been sexually assaulted, rates of suicide attempt are 9 times higher after the assault occurs than those who were not assaulted (Kilpatrick, Best, et al., 1985).

Data and depth of investigation is lacking with other psychiatric diagnoses in comparison to PTSD, in addition to further downstream effects on mental health that may not be specific diagnoses (e.g. attitudes, outlook, emotion regulation).

While increased risk for psychopathology such as PTSD and depression is well documented among sexual assault survivors, there is little recent research on the wellbeing and quality of life of sexual assault survivors particularly in high-risk subpopulations. After sexual assault, there is often a loss of social support and economic resources (Golding, 1994). This is especially true in those who had fewer of these resources prior to being sexually assaulted (Goodman et al., 1993) such as those in an inner-city environment. When considering these effects, it should be noted that loss of resources in and of itself is a stressful event that compounds trauma exposure (Hobfoll, 2002). Further, in a review of related theories, Hobfoll concludes that one common element is that “people with resources are less likely to encounter stressful circumstances that negatively affect
psychological and physical well-being” in addition to “being more capable of solving problems inherent in stressful circumstances” (Hobfoll, 2002). This aligns with findings that those with high levels of social support throughout have better health outcomes and perceptions after experiencing a sexual assault (Kimerling & Calhoun, 1994; Martin et al., 2000). As such, the current study will include factors that encompass psychological and somatic well-being and quality of life, not simply the absence or presence of pathology.

It is important to understand the broad, down-stream negative health correlates of sexual assault in vulnerable populations. While health sequelae such as PTSD and STIs can result directly from the traumatic event, it may also lead to unhealthy behaviors that cause other negative health outcomes. This study will be unique in its broad approach to examining sexual assault in this population in a representative sample, covering multiple domains of health, not simply pathology.

**Translational Approaches to the Study of Sexual Assault**

As outlined above, exposure to sexual assault, more so than other types of trauma, confers high risk for negative psychological and physical health outcomes. Translational approaches have studied the mechanisms that may also help explain the heterogeneous nature of reactions in the face of trauma, which may elucidate pathways of risk, including following sexual assault. A current understanding in the literature is that one of the mechanisms underlying pathological responses to trauma is dysregulation of the fear response, especially in reactions such as PTSD. Despite the removal of the experience of intense fear, helplessness, or horror as part of Criterion A in the transition from DSM IV to
DSM 5, dysregulation of fear remains a central feature of the disorder (American Psychiatric Association, 2013; Amstadter, Nugent, & Koenen, 2009; Association, 2000; Briscione, Jovanovic, & Norrholm, 2014; Jovanovic & Ressler, 2010; Mahan & Ressler, 2012; Shin & Liberzon, 2010; Zoellner et al., 2011). The fear system is not unique to humans and is present across mammalian species (Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; VanElzakker, Dahlgren, Davis, Dubois, & Shin, 2014). As a result of having both a known precipitant as well as a common biological mechanism, robust translational models of fear have been developed and employed to assist in the study and treatment of trauma and related pathology. These same models can assist in explaining links between mental and physical symptomatology in the aftermath of sexual assault, especially in the context of chronic traumatization.

A robust physiological phenotype that has emerged from the translational study of fear, especially relevant to PTSD, is the acoustic startle response. Like fear, startle response to stimuli is well preserved translationally. Psychophysiological paradigms, such as acoustic response, can be beneficial when conducting clinical research, as they supplement other phenotypic data that can be subjective and unreliable if it relies entirely on self-report (Briscione et al., 2014). Additionally, startle paradigms allow for within subject data to be collected within a single session or across multiple sessions, which may give a more accurate picture of fear activation. Little startle research has been conducted specifically with sexual assault, especially outside of the realm of PTSD or with individuals from an environment of chronic traumatization. A previous study
examined the role of habituation in acoustic startle within a sample of sexual survivors with and without PTSD, as well as a control group (Rothbaum, Kozak, Foa, & Whitaker, 2001). Results indicated slower startle habituation among those with PTSD, suggesting an impaired ability to habituate to traumatic memories could result in a pathological fear response (Rothbaum et al., 2001). A limitation that necessitates further research, however, is that DSM-III-R criteria were used (Rothbaum et al., 2001). Additionally, while sexual assault was examined with and without the existence of PTSD, it was not examined in comparison to other trauma types or in a large sample (Rothbaum et al., 2001). This study does however provide evidence that the application of startle paradigms in examining the underlying physiological mechanisms following sexual assault is feasible and has clinical face validity.

The methodologies to examine startle responses have significantly evolved through recent translational work. One method that exemplifies this is dark-enhanced startle in humans, which is an experimental method of assessing fear response. This advance was achieved through its roots in light-enhanced startle in rodents, where the effects of light on startle show activation of fear responses (Walker & Davis, 2002). In such nocturnal species, bright light is an anxiogenic context, and startle response is increased. This can be translated to humans using dark-enhanced startle, in that dark increases anxiety and startle responses in humans. Studies conducted in an inner-city population show an overall higher startle rate in the dark than in light (Kamkwalala et al., 2012). Sexual assault was not specifically examined in this study, nor were the effects of dark-enhanced
startle in survivors of sexual assault compared to those with other trauma histories. In a sample of male Vietnam veterans, increased startle occurred in the dark for those with combat experience, so that both the PTSD group and trauma control group had dark-enhanced startle relative to a group without combat trauma (Grillon, Morgan, Davis, & Southwick, 1998). It is thought that this phenomenon occurred as a result of the fact that most operations in Vietnam were conducted in the dark (Briscione et al., 2014; Grillon et al., 1998). However, in the inner-city population, PTSD diagnosis was associated with greater dark-enhanced startle along gender lines, in that it was seen in women but not men (Kamkwalala et al., 2012). It was hypothesized that the sex differences may be associated with the bed nucleus of the stria terminalis (BNST), which mediates responses to light-enhanced startle (Walker & Davis, 2002) and is larger in men (Kamkwalala et al., 2012), thereby suggesting new neural pathways by which to examine reactions to trauma.

Startle paradigms have played a key role in studying one of the brain systems with the strongest association with fear and PTSD, the limbic system (Mahan & Ressler, 2012). This important system includes the amygdala, hippocampus, hypothalamus, and prefrontal cortex as well as the adrenal and pituitary glands. While this study will not examine specific brain regions, startle data can yield information about involved neural pathways, especially given the amount of data associated with startle investigations. These neural pathways have not been closely studied in sexual assault, especially outside of the realm of PTSD. The amygdala is a focus of many researchers in the realm of PTSD, as it is
thought to regulate fear (Mahan & Ressler, 2012; Phillips & LeDoux, 1992) and modulate memory storage of highly emotional memories (McGaugh, Cahill, & Roozendaal, 1996). The neural pathways in the amygdala have been associated with at least 14 different symptoms of PTSD (Weston, 2014) in humans, as well as pathways that connect the amygdala to the prefrontal cortex (Bishop, 2007). The amygdala has downstream connections to the hypothalamus, which regulates the hypothalamic-pituitary-adrenal (HPA) axis. The HPA axis regulates the release of various stress hormones including cortisol, and is controlled via negative feedback of cortisol on the hypothalamus and pituitary; these stress hormones are also related to fear learning and startle responses, which can be studied in startle paradigms (Jovanovic, Norrholm, Blanding, Phifer, et al., 2010; Jovanovic et al., 2011; McGaugh et al., 1996). Given these hormones circulate throughout the body, activation of these pathways can have a direct impact on physical health as well as mental health. Startle studies in humans have shown differential HPA axis functioning in those with and without PTSD (Yehuda, 1997), which may intertwine with a hypothesis that the amygdala is hyperactive in those with PTSD (Jovanovic, Norrholm, Blanding, Phifer, et al., 2010). In the study of trauma, specifically in PTSD, startle has played a key role in linking symptom presentation to underlying biological mechanisms not only in the brain, but also throughout the entire body, such as in the case of inflammation (Michopoulos et al., 2014). Startle can provide a robust measure that is not as susceptible to issues such as bias and self-report currently used as standard assessments in trauma. *Studying the startle response in those who have*
experienced sexual assault compared to those with traumatization without sexual assault may give insight into pathways that are associated with risk for the negative sequelae commonly seen in survivors of sexual assault.

Additionally, elucidation of these pathways may eventually inform how and when we intervene in the aftermath of such traumatic experiences. Thus, startle is useful in that it provides non-invasive methods for collecting physiological data, which can assist in assessing and characterizing reactions to traumatic events as well as provide clues as to the interplay of mental and physical health through well researched and validated neural pathways.

**Aims of the Study**

The epidemiology and impact of sexual assault is understudied in key at-risk subpopulations such as highly traumatized, low income, inner city men and women. The Grady Trauma Project population, comprised of over 10,000 primarily African American, highly traumatized, inner-city, low SES individuals, provides a unique opportunity to examine the specific contribution of sexual assault in the context of chronic and multiple trauma exposures. I aim to examine the prevalence of sexual assault in this population and to begin to examine the potential long-term effects/correlates of sexual assault on health and wellbeing. In addition, I aim to use data collected in a specific translational paradigm, dark enhanced startle, to investigate potential pathways to increased risk for the negative consequences of sexual assault.

**Aim 1:** To examine the prevalence and pattern of sexual assault in a large, at-risk sample. Despite documented rates of sexual assault in the literature, few studies
have examined the prevalence of sexual assault in high-risk populations such as highly traumatized, low income, inner-city African Americans. The data suggest that this population is at increased risk for overall trauma exposure (Gillespie et al., 2009; Kamkwalala et al., 2012; Schwartz et al., 2005). I use inventories of childhood and adult trauma exposure to gather prevalence data. I examine overall prevalence of sexual assault in the sample as well as within gender and mean age of first and most recent assault, which yield a breakdown of sexual assault that occurs in childhood and adulthood. It is my hope that the results of this examination yield the first clear epidemiological view of sexual assault in this population, inclusive of both genders.

**Hypothesis:** Consistent with the limited violence research in low-SES, inner-city, primarily African American populations, it is expected that there will be high prevalence of sexual assault in this sample, however, I do not propose directional hypotheses. Secondarily, I hypothesize consistent with research on interpersonal violence as well as sexual assault, it is expected that there will be a higher incidence of sexual assault reported in women when compared to men and that a majority will first be assaulted before age 30.

**Aim 2:** To examine physical and mental health correlates of sexual assault in an at-risk sample. Despite some evidence indicating the increased risk of trauma exposure and its related sequelae in highly traumatized, inner-city, primarily African American populations, sequelae beyond PTSD have rarely been examined. Using the portion of phenotype data collected relevant to these aims, I analyze variables that are associated as broader effects of sexual assault in the
context of chronic traumatization. I examine rates of trauma types, non-traumatic stressful events, mental health (e.g. PTSD, depression, suicidal and self-harm behavior), physical health (e.g. chronic illness, physical pain, BMI) health behaviors (e.g. substance use, eating, violence, arrests, employment, sleep), and quality of life (e.g. education, income).

**Hypothesis:** In line with research with other populations, I expect those who report sexual assault to have a higher occurrence of mental and physical illnesses than those who have experienced trauma but not sexual assault in this sample. Specifically, I expect a higher rate of PTSD and depression in those who have experienced sexual assault compared to those who are trauma exposed without sexual assault. I expect there to be higher reports of pain as well as suicidal and self-injurious behavior compared to those who are trauma exposed without sexual assault. In regards to substances, I expect there to be higher rates of lifetime and current use of alcohol and illicit substances as well as higher rates of emotional eating in those who have experienced sexual assault.

**Aim 3:** To examine potential pathways of increased vulnerability to trauma-related sequelae following sexual assault when compared to traumatization without sexual assault using dark-enhanced startle in a subset of the larger epidemiological sample. A previous study from this population shows a higher rate of dark-enhanced startle in females with PTSD compared to those who have been exposed to trauma but do not have PTSD (Kamkwalala et al., 2012). However, there is limited information about the specific effects of sexual assault on dark-enhanced startle and how it compares to traumas that are non-sexual in
nature. By exploring underlying physiology independent of PTSD diagnosis, I hope to begin to understand better the pathways by which sexual assault exerts its negative effects.

**Hypothesis:** Literature in this area is small and inconclusive, and thus this aim is exploratory in nature. Based on findings in light-enhanced startle in rodents and dark-enhanced startle in humans, I expect startle response to be elevated in dark blocks compared to light blocks.

**Method**

**Participants**

Since 2005, the Grady Trauma Project has collected 12,300 research interviews from individuals receiving outpatient services in various clinics, including primary care and OB/GYN, within Grady Memorial Hospital in Atlanta, Georgia, USA. Grady Memorial Hospital is a publicly funded urban hospital, serving primarily low-income residents who tend to be predominately African American and highly traumatized. Of those patients who provided consent, over 9,500 provided usable data with over 500 of those patients completed an additional battery of assessments by invitation, which included further interviews and psychophysiological assessment. Recruitment is ongoing, however. Currently, 76.2% are female; and 93.1% identify as African American, 3.1% identify as Caucasian, 1.8% identify as mixed race, 1.2% identify as other, 0.7% identify as Latino, and 0.1% identify as Asian. Of these, 3% identify as Hispanic. Participants range in age from 18-65, with the mean age of 40.09. The current study used only those with a self-reported race of African American.
Measures

Demographics Form: A form was developed at Emory to assess basic demographic characteristic such as age, self-identified, race, marital status, education, income, arrest, and employment status as well as basic health characteristics such as smoking and sleep status (Gillespie et al., 2009).

Measures of Trauma Exposure

Traumatic Events Inventory (TEI): The TEI (Schwartz et al., 2006; Schwartz et al., 2005) is a 14-item measure used to assess trauma exposure across the lifespan. The measure assesses abuse and non-abuse in childhood and adulthood across 13 separate categories of traumatic events. Along with these events, feelings of terror, horror, and helplessness during the event are assessed. In addition to assessing whether or not a trauma was experienced or witnessed, the TEI assesses the frequency of trauma exposure. This measure will provide a thorough accounting of trauma exposures, including type, how many times each type occurred, and for sexual assault, specifically, will provide a breakdown sexual assault through the life span, age at first event, and details regarding the offender(s).

Childhood Trauma Questionnaire Short Form (CTQ-SF): The CTQ-SF (Bernstein & Fink, 1998; Bernstein et al., 2003) is a 28-item which is validated against the original CTQ, which has high internal consistency ($\alpha = .79$ to .94) (Bernstein et al., 1994). The CTQ is a self-report inventory assessing childhood physical, sexual, and emotional abuse, and physical and emotional neglect. The CTQ results in a total score as well as subscale scores for each
category of childhood trauma. From this instrument I will be able to assess and compare trauma exposure before the age of 18, as well as categorize the subtype of childhood sexual assault.

**Measures of Physical Health and Wellbeing**

*Dutch Eating Behavior Questionnaire (DEBQ):* The (DEBQ) (Van Strien, Frijters, Van Staveren, Defares, & Deurenberg, 1986) is a 13-item self-report measure of eating behavior based on mood and emotions with good reliability ($\alpha = .80$ to $.95$) (Van Strien et al., 1986). Items are rated on a scale from 0 (no desire) to 4 (strong desire) for when eating behavior occurs. Items assess the desire to eat in various emotional states and yields a total score that measures emotional eating severity.

*Behavior Questionnaire (BQ):* The BQ is an internally developed measure consisting of 10 items to assess potentially violent behaviors. The measure inquires as to whether a participant has pushed or shoved someone, pulled a knife or gun on someone (without injury), stabbed or shot someone, punched or hit someone with something that could hurt, and/or beat up someone. In addition to assessing for the presence of these behaviors, the measure assesses approximated number of occurrences and if the violence occurred with an intimate partner.

*Pain Questionnaire (PQ):* The PQ is an internally developed measure consisting of 10 items to assess bodily pain. The measure assesses the patient’s self-report assessment of health as well as presence of pain. If pain is present,
follow-up questions assess the level of interference the pain has caused as well as
duration and medical intervention.

**Stressful Events Questionnaire II (SEQ-II):** The SEQ-II is a 17-item
measure developed internally. The SEQ-II is a shortened form of the internally
developed SEQ used in previously published work (Smith et al., 2011) to assess
recent and lifetime stress. The measure assesses occurrence of stressful life
events such as divorce and illness, and the time frame that they occurred (0=
never happened to me, 1= within the last month, 2= within the last 6 months, 3=
within the last year, 4= within the last 5 years, 5= more than 5 years ago). Data
from this measure will be used in part to assess aspects of wellbeing, as well as
general perceptions of health.

**Measures of Psychopathology**

**Modified PTSD Symptom Scale (MPSS):** The MPSS (Coffey, Dansky,
Falsetti, Saladin, & Brady, 1998; Falsetti, Resnick, Resick, & Kilpatrick, 1993) is
a validated 17-item measure derived from the PTSD Symptom Scale- Interview
(Foa & Tolin, 2000), designed for self-report with good internal consistency ($\alpha$ =
.94 to .97) (Coffey et al., 1998). The MPSS measures frequency of DSM-IV
PTSD symptoms in the two weeks prior to assessment, leading to a continuous
measure of severity, ranging from 0-51. The continuous output of symptom
severity can be used to create a dichotomous variable of PTSD diagnostic status
based on DSM-IV criteria. Although the criteria for PTSD have changed with the
new DSM-5 (APA, 2013), the study predates this change and all data were
collected based on DSM-IV.
**Beck Depression Inventory II (BDI-II):** The BDI-II (Beck, Steer, Ball, & Ranieri, 1996; Beck, Steer, & Carbin, 1988) is a 21 item, validated self-report measure that shows high internal consistency (α = .81 to .86) and correlates strongly with clinical ratings of depression (Beck et al., 1988). The BDI-II is summed for a single score assessing the quantity and severity of depression symptoms. Individuals are assessed regarding the past two weeks thus corresponding to DSM-IV timeframe criteria for major depression. The resulting symptom severity score can be used with a cutoff score (>=15) (Jovanovic, Norrholm, Blanding, Davis, et al., 2010) to dichotomize individuals based on diagnosis of depression. This will allow analyses to be conducted to examine both number of depressive symptoms as well as an analogue for a depression diagnosis.

**Suicidal and Self-Harm Behavior (SSH):** This is an internally developed form given to patients who endorse suicidal or self-harm behavior on other measures. This 8-item screener assesses the presence and frequency of suicide attempts, self-injury, and suicidal behavior.

**Alcohol Use Disorders Identification Test (AUDIT):** The AUDIT (Babor, Higgins-Biddle, Saunders, & Monteiro, 1994) is a 10-item validated self-report designed to screen for harmful and hazardous alcohol use with a high intra-scale reliability (α = .8 to .98) (Saunders, Aasland, Babor, De la Fuente, & Grant, 1993). Each item is rated on a scale from 0 to 4, with the highest possible total score being 40. The AUDIT uses ICD-10 definitions of alcohol use and dependence, and for the purposes of this study both the last year and the year
drinking was the heaviest were assessed. The AUDIT score will be used as a measure of current and lifetime alcohol use disorder.

**Drug Abuse Screening Test (DAST):** The DAST (Cocco & Carey, 1998a; Skinner, 1982; Yudko, Lozhkina, & Fouts, 2007) is a 10-item self-report questionnaire that has been validated in screening for use of both illegal drugs and prescription drug abuse with good reliability ($\alpha = .86$) (Cocco & Carey, 1998b). Each item is rated as yes or no, and for the purposes of this study both the last year and lifetime abuse were assessed as a proxy of substance use disorder diagnosis.

**Procedures**

Patients waiting for outpatient appointments and services were randomly approached in waiting rooms, primarily in Primary Care and OB/GYN, and invited to participate. If patients were interested in participating, research staff assessed eligibility criteria, ensuring patients were between the ages of 18-65, were English-speaking, were not actively psychotic, had not already participated, and were capable of providing informed consent. If patients consented, trained assessors conducted research interviews and all measures were administered through self-report that lasted approximately 45 minutes. Data were captured on iPads (Apple, Inc., Cupertino, CA) using REDCap (Vanderbilt University, Nashville, TN). At the completion of the interview, participants were paid $15 for their time.

Subsets of these patients with trauma exposure were asked to return for additional studies. One of these studies was a psychophysiological assessment.
which included dark-enhanced startle among other paradigms. Patients with trauma exposure completed the psychophysiological assessment if they had no major medical illnesses as assessed by medical personnel, loss of consciousness, or hearing impairment. Patients were screened for hearing impairment using an audiometer (Grason-Stadler, Model GS1710) and required to detect tones at 30 dB at frequencies ranging from 250-4000 Hz prior to the acoustic startle protocol. All study procedures have been reviewed and approved by the Institutional Review Board of Emory University as well as the Grady Research Oversight Committee.

**Dark-enhanced startle**

Dark-enhanced startle sessions lasted 8 minutes whereby participants were delivered startle probes during alternating light and dark blocks. Acclimation and habituation each lasted 2 minutes, while the dark-enhanced phase was 4 minutes long. The acclimation period involved no delivery of startle probes. Participants were exposed to 2 blocks with 4 startle probes each as a measurement of baseline startle responses during habituation. Following habituation, the participants were presented with 2 blocks of 8 startle probes, 4 of which were delivered in the light and 4 of which were delivered in darkness in a counterbalanced order across participants. Participants were in a sound-attenuating and lightproof booth. Startle probes were delivered 20 seconds after the condition changed to allow for adjustment. After the first startle probe, inter-trial intervals ranged from 9 to 22 seconds. Participants were compensated $50 for their participation.
The physiological data were acquired using BIOPAC MP150 for Windows (BIOPAC Systems, Inc, Goleta, CA) on Dell Latitude laptops running Windows Vista and Windows 7. The primary physiological data used were electromyographic (EMG) recordings of the eye blink muscle contraction, using Ag/AgCl electrodes placed on the orbicularis oculi muscle 1 cm below the pupil and the lateral canthus. A ground electrode was placed on the mastoid bone. Impedance levels were less than 6 kΩ for each individual. The startle probe was a 108-dB, 40-millisecond burst of broadband noise with zero rise time, delivered binaurally through headphones. The maximum amplitude of the eye blink muscle contraction 20 to 200 milliseconds after presentation of the startle probe was used as a measure of startle magnitude. The data acquired were filtered, rectified, and smoothed and exported for analyses using MindWare software (MindWare Technologies, Ltd, Gahanna, OH).

**Data Analytic Plan**

**Aim 1: Prevalence of Sexual Assault**

In order to determine the prevalence and pattern of sexual assault within the African American sub-sample, I report SPSS descriptives and frequencies of sexual assault overall. I report this data categorized as childhood sexual assault and adult sexual assault specifically, as well as the mean age of first and most recent assault. I created a binary variable from mean age of first assault to indicate whether or not the first assault occurred before age 30. Subsequently, frequencies are used to determine the percentage of those experiencing their first assault before age 30. In addition to the occurrence of sexual assault, I report descriptives
and frequencies split by gender. I report Chi-Square tests to assess the prevalence of sexual assault by gender.

**Aim 2: Sequelae**

In order to examine the physical, mental, and quality of life correlates of sexual assault in this sample, ANOVA tests and logistic regressions are used to compare those who have been traumatized without sexual assault to those who have been sexually assaulted. Using the results of Aim 1, a single dichotomous sexual assault variable was used to create the two comparison groups. For the purposes of this study, sexual assault is inclusive of any unwanted contact between the participant and another party’s sexual organs and/or any unwanted contact between another party and the participant’s sexual organs at any point in the lifespan. The characteristics of the individual outcome variables determined the test used, with continuous outcome variables (i.e. PTSD symptoms, number of depressive symptoms, rates of trauma exposure, number of suicide attempts, eating behavior, number of chronic illnesses, violent behaviors, physical pain, education, BMI, income, number of arrests, employment status, and sleep) tested in an ANOVA and dichotomous outcome variables (e.g. PTSD diagnosis, depression diagnosis, suicidal ideation, suicidal behavior, substance use, and chronic illness) tested using a logistic regression, which yield odds ratios. For tests yielding significant results, I examine the effect size of the finding. I hypothesized that those who have experienced sexual assault will have a higher occurrence of objectively negative outcomes when compared to trauma-exposed
individuals who have not experienced sexual assault. For the purposes of this aim, those without trauma exposure are not included in the analysis.

**Aim 3: Startle**

Examination of the underlying physiology of the sequelae of sexual assault is limited to a subset of the sample (241) that participated in an acoustic startle paradigm. Analyses mimic those described in previous research examining dark enhanced startle in a subset of this population focused on PTSD (Kamkwalala et al., 2012). Using the same dichotomous sexual assault variable as Aim 2, those who have experienced sexual assault are compared to those who have a trauma history but no sexual assault history. For the purposes of this aim, those without trauma exposure are not included in the analysis. The analyses of startle data employ a repeated-measures ANOVA to examine startle response continuously from baseline through the alternating light and dark blocks. The tested variables within subjects is block (of which there are two, each a cycle of lightness and darkness) and phase (lightness or darkness) with groupings between by sexual assault status. The outcome measured is startle magnitude. SPSS frequencies and descriptives of demographic variables as well as variables used in Aim 1 are included to examine whether or not this subset is representative of the larger sample.

**Results**

**Demographic Characteristics.** The overall sample (see Table 1) included 9,807 consenting participants where 93.1% of the sample with usable race data self-report as African American. Thus, for the purpose of the analyses conducted
for this study, only those who considered themselves African American were used (n=8533) given the very small proportions of other ethnicities, making it difficult to detect potentially meaningful differences. Within the sample of African American participants, the mean age reported was 40.06 years, 76.7% identified as female, and a majority (59.6%) reported being single/never married. Of this sample, 32.8% were unemployed, with a majority (57.2%) reporting an income of less than $1000.00 per month, and 20.4% reporting receipt of Social Security Disability. A subset of this sample (2.8%; n=241; see Table 6) participated in follow-up startle studies, which were used to investigate Aim 3 of this study. This subset did not significantly differ from the larger African American sample by age (t(8441)=.049, p=.961), relationship status (X^2(5, n = 8419) = 9.556, p =.089, \(V=.034\)), or household monthly income (X^2(4, n = 8127) = 3.826, p =.430, \(V=.022\)). However, compared to the overall sample, this subset includes a higher proportion of females (76.7% vs 87.1%; X^2(1, n = 8524) = 15.201, \(p <.001, \ V=.042\)) though the effect is minimal, college or technical school graduates (12.2% vs. 18.8%; X^2(6, n = 8420) = 17.294, \(p =.008, \ V=.045\)), and unemployed individuals (67.2% vs 74.5%; X^2(4, n = 8414) = 5.968, \(p =.015, \ V=.027\)), though to a minimal effect. Despite differences, both the larger sample and the subset represent the target demographic of this study in being low SES African Americans in an urban environment.

**Prevalence of sexual assault in a large, at-risk sample.** Table 1 describes the prevalence of sexual assault in these samples and the subsets used. As hypothesized, this was a highly traumatized sample, with 87.6% reporting
trauma exposure and 39.9% reporting some form of sexual assault. The mean age of first sexual assault was 10.68 years of age, with 97.3% (n=1782) of sexual assault occurring before age 30 (when age was reported). Categorically, 37.3% of sexual assault occurred in childhood (before age 18), and 10.7% in adulthood, indicating a majority of sexual assault in this sample is reported to have occurred in childhood.

When observing the prevalence of sexual assault by gender among African Americans in the sample (see Tables 2 and 3), there is no significant difference in age (male M= 9.81, SD= 7.03; female M =10.77, SD=6.72; t(1830)= -1.786, p = .074). In line with my hypothesis, females (45.4%) report significantly higher prevalence of sexual assault compared to men (22.1%) (X^2(1, n = 7920) = 327.125, p <.001, V=0.203). Both genders show a high prevalence of childhood sexual assault, with 21.5% of men and 42.3% of females reporting such (X^2(1, n = 7920) = 267.345, p <.001, V=0.184). In observing the prevalence of sexual assault, I find my hypotheses to be supported, in that a large portion of the sample has been sexually assaulted, a higher prevalence of sexual assault in women compared to men, and a majority of sexual assault occurring before age 30.

**Associated Health Outcomes of Sexual Assault.** In examining associated health outcomes, those who had experienced sexual assault at least one time were compared to those who had been exposed to trauma without sexual assault. Results of these analyses are reported in Tables 4 and 5. I first examined binary categorical outcomes, including PTSD diagnosis, depression diagnosis, presence of suicide attempt, presence of self-harm, presence of chronic disease, alcohol
use, and drug use (see Table 4). Compared to trauma-exposed individuals without sexual assault, individuals reporting sexual assault had increased odds of all outcomes, including PTSD (OR= 2.510, 95% CI= 2.249-2.801) and making a suicide attempt (OR 4.317, 95% CI= 3.697-5.042). These increased odds persist when adjusting for both gender and age, included in Table 4 (e.g. PTSD OR 2.625, 95% CI= 2.341-2.943; Suicide Attempt OR 4.266, 95% CI= 3.634-5.007).

For all of the above mentioned odds ratios, I considered experiencing sexual assault the exposure. As an example, those having a PTSD diagnosis were 2.51 times more likely to have been sexually assaulted. In all of the binary categorical outcomes, the odds of being exposed to sexual assault when having the negative outcome were increased, thus supporting my hypotheses.

When examining continuous scores (e.g. sum scores), I classified outcomes by effect sizes. As such, partial eta-squares above .14 were considered large, .06-.139 medium, and .01-.059 small. As seen in Table 5, childhood trauma as measured by the CTQ total has a robust association with sexual assault, in that those with sexual assault have a higher CTQ total than those who have experienced trauma without sexual assault. This finding indicates that those who have experienced sexual assault report larger and/or more frequent trauma exposure in childhood by an average of 18. Relative to individuals traumatized without sexual assault history, those who experienced sexual assault had elevated PTSD and depression symptoms, as well as increased frequency of trauma exposure, among other associated outcomes. These associations persisted and were of similar magnitude when analyses were adjusted for age and sex.
When comparing those who experienced sexual assault to those who report non-sexual trauma exposure, differences were seen in overarching measures of health with multiple categorical outcomes. When reporting perceived health, sexual assault survivors had greater proportions rating “poor” and “fair”, with a small effect size \( \chi^2(4, n = 1578) = 12.621, p = .013, V = 0.089 \). When examining perceived physical pain, those who had experienced sexual assault endorsed moderate, severe, and very severe pain in greater proportions with a medium effect \( \chi^2 (5, n = 1576) = 41.214, p < .001, V = 0.162 \). Finally, when examining perceived quality of sleep, those who had experienced sexual assault endorsed problems at greater proportions with a large effect \( \chi^2(4, n = 3709) = 159.793, p < .001, V = 0.208 \). Consistent with my hypothesis, those who had experienced sexual assault had more negative health perceptions in multiple domains compared to those who had experienced trauma without sexual assault.

In analyzing potential differences with quality of life related measures, each with multiple categories, results were mixed. Associated differences were observed in highest grade completed with a small effect \( \chi^2(6, n = 6485) = 58.748, p < .001, V = 0.095 \) such that those who had been sexually assaulted had a higher proportion of GED and tech school graduates and those without sexual assault had a higher proportion complete 12th grade or higher. A small effect emerged from significant differences in current relationship status \( \chi^2(5, n = 6482) = 24.343, p < .001, V = 0.061 \) such that those who had experienced sexual assault had a higher proportion of reporting their relationship status as separated or domestic partner. No associated differences were found with current
employment \(X^2(1, n = 6481) = 1.349, p = .245, \ V = 0.014\) or monthly income \(X^2(4, n = 6279) = 6.597, p = 0.159, \ V = 0.032\). Overall, in line with my hypotheses, sexual assault survivors reported considerably more associated negative outcomes in mental health, physical health, and well-being than non-sexual assault survivors. Of those negative outcomes, those which stand out are PTSD and Depression diagnoses and symptoms, presence of a suicide attempt, presence of self harm, childhood trauma, prevalence of trauma exposure, lifetime drug abuse, and perceptions regarding physical pain and sleep.

**Examining Translational Psychophysiological Paradigms in Sexual assault.** In an effort to elucidate possible psychophysiological mechanisms of exposure and outcomes for hypothesis 3, a dark-enhanced startle paradigm was employed and examined in a subset \(n=241\), see Table 6) of the larger study population, as previously described. Results were examined in repeated measures ANOVAs that included both blocks of light and dark phases. There were no significant differences in dark enhanced startle when comparing men and women who experienced sexual assault to those who experienced non-sexual trauma both unadjusted \((F(1,239)= 1.448, p = 0.230, \ \eta_p^2 = .006)\) and adjusted for sex \((F(2,238)= 1.169, p = 0.281, \ \eta_p^2 = .005)\) (see Table 7). Follow-up analyses only examining survivors of childhood sexual assault also did not yield significant differences unadjusted \((F(1,239)= 1.962, p = 0.163, \ \eta_p^2 = .008)\) or adjusted for sex \((F(2,238)= 1.692, p = 0.195, \ \eta_p^2 = .007)\). Significant differences between those who had experienced sexual assault and those who were traumatized without sexual assault were observed when examining habituation, a measure obtained through the dark-
enhanced startle paradigm. A robust effect is observed in both unadjusted $(F(1,240)= 4.854, p= 0.029, \eta^2_p=.020)$ and adjusted for PTSD diagnosis, age and sex $(F(4,232)= 4.478, p= 0.035, \eta^2_p=.019)$. These findings yield a result not originally included in my aims, but nonetheless demonstrate negative outcomes unique to sexual assault in the form of deficits in habituation. These deficits do show an unfavorable difference in acclimation in individuals who have experienced sexual assault compared to those who have experienced trauma without sexual assault.

For the analyses related to associated outcomes and psychophysiological paradigms, both age and sex were controlled for in adjusted analyses. By using these covariates, I can adjust for possible and likely gender differences, especially given the makeup of this sample as well as differences in incidence of both the exposure and outcomes in the general population. For dark enhanced startle specifically, it controls for the variance seen in a previous study showing differences along gender lines, likely due to sexually dimorphic brain structures (Kamkwalala et al., 2012). Adjusting for age allows consideration to an increased possibility of these outcomes occurring, given the nature of time.

Discussion

The current study examined the prevalence of sexual assault and associated sequelae, including health and quality of life outcomes, in a large epidemiological sample of highly traumatized, low SES African Americans living in an urban environment. While published estimates of sexual assault exist (Acierno et al., 1997; Burnam et al., 1988; Elliott et al., 2004; Kessler et al., 1995;
Resnick et al., 1993), epidemiological estimates in high-risk populations such as this one are lacking. Indeed, my data suggest a much higher frequency of sexual assault (39.9%) in this population than in previously published estimates, with nearly 2 in 5 experiencing sexual assault. The prevalence of childhood sexual assault was extremely high (37.3%), and consistent with literature on timing of sexual assault (Acierno et al., 1997; Isely & Gehrenbeck - Shim, 1997; Resnick et al., 1993), with my data showing that a majority (97.3%; mean age of first assault = 10.68) of sexual assaults occur before age 30. My results suggest sexual assault is associated with a host of negative outcomes including PTSD, depression, suicide attempts, self-harm, substance use, and poor health perceptions. To examine possible mechanisms linking sexual assault to these and other outcomes, a subset of participants engaged in a dark-enhanced startle paradigm, which aims to measure generalized fear in an experimental context. Importantly, these data lay the groundwork for further research in the realm of sexual assault mechanisms and policy in chronically traumatized, underserved populations, providing both necessary information and demonstrating feasibility. Specifically, without an accurate picture of prevalence it is difficult to conduct further research on sexual assault in underserved populations.

African Americans are underrepresented in medical research (Dancy et al., 2004; Shavers - Hornaday et al., 1997). Within this low income, urban sample, the majority had experienced trauma, were unemployed, and did not have more than a high school education (or its equivalent). As such, even without trauma exposure, this group is one that is disadvantaged and at risk for the development
of negative health outcomes. Indeed, factors such as low education, racial segregation, low social support, individual-level poverty, income inequality, and area level poverty are associated strongly with mortality and morbidity in and of themselves (Galea, Tracy, Hoggatt, DiMaggio, & Karpati, 2011). I found that close to 40% of the men and women in the present sample were sexually assaulted at least one time. When examined by gender, 22.1% of men and 45.4% of women reporting sexual assault, rates that are well beyond published ranges of sexual assault, with highest estimates of women being 27% and of men being 9.4% (Acierno et al., 1997; Burnam et al., 1988; Elliott et al., 2004; Kessler et al., 1995; Resnick et al., 1993). While there were significant differences in the occurrence of sexual assault between genders, this may be influenced by both a larger representation of females in this sample and under-reporting by men. In the case of both genders, I suspect that underreporting may be occurring, given literature showing health-related underreporting is common in cases of sexual assault (Pino & Meier, 1999; Rennison, 1999; Sable, Danis, Mauzy, & Gallagher, 2006) and general medical underreporting in underrepresented minorities (Briefel, Sempos, McDowell, Chien, & Alaimo, 1997; Newell, Girgis, Sanson-Fisher, & Savolainen, 1999). Thus I consider these findings conservative estimates of the prevalence of sexual assault in this population. Given the relatively high prevalence of sexual assault in this population, combined with little research examining sexual assault specifically in this population, this not only indicates a significant public health concern, but a possible failure of our public health
surveillance system to identify the magnitude of risk of sexual assault in this population.

With regard to when sexual assaults occur, my data are in line with previous reports suggesting that a majority of sexual assaults occurs in childhood (Acierno et al., 1997; Isely & Gehrenbeck-Shim, 1997; Resnick et al., 1993). Findings from this study indicate that in addition to high incidence of childhood sexual assault, individuals with a history of sexual assault have a higher score on the CTQ, measuring occurrence and frequency of a myriad of possible traumas in childhood, compared to those who are traumatized without sexual assault. As such, further investigation is warranted in determining the makeup of childhood trauma exposure, the risk factors for specific trauma types, as well as any factors that may be uniquely associated with childhood sexual assault in this population. My data suggest that particularly in at risk populations, additional sexual assault prevention and intervention efforts are needed early in children’s lives.

Numerous negative outcomes are associated with sexual assault (versus trauma without sexual assault) in this population. Among sexual assault survivors, multiple negative health and mental health outcomes were seen - health related perceptions were poorer, chronic disease was more likely, substance use was increased, and negative mental health outcomes, such as depression and PTSD, were increased when compared to non-sexual trauma exposure. Perhaps most alarming are the findings that a survivor of sexual assault has greater than four times the odds of a suicide attempt and over three times the odds of self harm compared to those who are trauma-exposed without sexual assault. With
awareness of these risks, sexual assault survivors can benefit from suicide and
self-harm screening and prevention that already take place in many health systems
(Horowitz et al., 2012; Lish et al., 1996). Consistent with extant studies of the
sequelae of sexual assault (Frazier, 1993; Goodman et al., 1993; Kilpatrick et al.,
1992; Rothbaum et al., 1992; Ullman & Brecklin, 2003), my data support that
those who have experienced sexual assault also have approximately 2.5 times the
odds of depression and PTSD diagnoses as well as a higher number of symptoms
for each of these diagnoses when compared to those traumatized without
experiencing sexual assault. The same is also true for both alcohol and drug use,
where those who are sexually assaulted have both increased odds of using as well
as higher scores on the alcohol and drug screening measures (over both lifetime
and past year) compared to those who are traumatized but not sexually assaulted,
indicating more problematic behavior related to substance use. Not only is there a
higher incidence of these negative outcomes in those who have experienced
sexual assault compared to those who are traumatized without sexual assault, but
there is also an increase in awareness of negative health aspects, in line with
previous research (Golding et al., 1997; Zoellner et al., 2000). Those who
experienced sexual assault reported significantly poorer perceived health, physical
pain, and sleep compared to those who were traumatized without sexual assault. It
is important to consider that all of these participants were enrolled in a waiting
room of a hospital, indicating they are already receiving some degree of medical
care, thus all were presumably aware to some degree of their own health status
and need for care. An important consideration in future study is the degree to
which this inherent health awareness and perceptions of health play a role in discussed outcomes associated with sexual assault. The fact that these participants are already receiving some degree of healthcare yet clearly experiencing negative health consequences, underscores importance of disseminating this data to incite changes in healthcare so that these effects can be identified and treated.

I also examined areas related to quality of life that might have an impact on health (e.g. incarceration and income). My data suggest that experiencing sexual assault is associated with small increases in being arrested, jailed and imprisoned, compared to those who experience non-sexual trauma. Incarceration is not only a generally negative event, but may also lead to further exposure to the possibility of sexual assault (Hensley, Koscheski, & Tewksbury, 2005). Similarly, I found small increases in self-reported violent behaviors in those who had experienced sexual assault, which may also relate to encounters with the judicial system and law enforcement, however this relationship was not examined in this study. This is notable, as it continues and encourages a cycle of violence, wherein those exposed to violence are more likely to engage in violent behaviors (Song, Singer, & Anglin, 1998). Incarceration presents a unique opportunity to break this cycle, using experimental intervention techniques (Gilligan & Lee, 2005), however, this has not been adopted by most correctional facilities, which are often violent places themselves (McCorkle, Miethe, & Drass, 1995). This cycle of violence and in some cases incarceration, may also negatively impact other areas of functioning, such as ability to attend school. Compared to those who had been trauma exposed without sexual assault, those who had been sexually assault
showed significant differences in education status, with those sexually assaulted having a lower proportion of high school graduates, but a higher proportion of GED attainment and technical school graduation. In terms of current relationship status, those who experienced sexual assault reported higher proportions of being separated or living with a domestic partner. These lack of resources, education, partnership, and potential social support may be stressful in and of themselves, which in turn may have an effect on health (Hobfoll, 2002). This stress may be magnified if a person is also a single parent (Cairney, Boyle, Offord, & Racine, 2003). Interestingly, there were not significant differences in current employment and monthly income, which is notable given the difference in educational attainment as well as previously mentioned adverse outcomes associated with sexual assault that could be impediments to maintaining gainful employment. The degree to which these associated quality of life outcomes are a result of sexual assault or health conditions cannot be determined by this study. However because they are associated with sexual assault as a specific type of trauma exposure (e.g. above and beyond simply experiencing a trauma) they represent a target for future research, with the possibility of intervention and prevention in those who are sexually assaulted.

In hopes of identifying a possible mechanism linking sexual assault to these and other negative outcomes, a subset of participants engaged in a dark-enhanced startle paradigm, which aims to measure generalized fear (Kamkwala et al., 2012). There were some small demographic differences between this subset and the larger sample including a higher proportion of sexual assault survivors,
females, college or technical school graduates, and unemployed individuals. The increase in sexual assault prevalence in this sub-sample allowed for an oversampling of the exposure of interest (sexual assault) therefore increasing my ability to examine an exposure that is rare on the population level.

Notably, dark enhanced startle results were not different between those who had experienced sexual assault and those who had been traumatized without sexual assault, indicating no substantial differences in generalized fear/anxiety. This is similar to the findings of Grillon et al. (1998), who showed that dark enhanced startle was associated with trauma exposure alone, regardless of PTSD diagnosis (Grillon et al., 1998). As such, I propose that all trauma exposure is likely to have a negative impact on anxiety in a non-specific manner. While these results do not implicate this pathway, it does provide useful information in suggesting that it does not play a role in the differential outcomes observed with exposure to sexual assault. Through the data collected in the dark-enhanced startle paradigm, I was also able to measure habituation, a measure indicating the time taken to become accustomed to the scenario. Within this paradigm, there emerged a significant difference in habituation such that those who had experienced sexual assault had deficits in habituation compared to those who had been trauma exposed without sexual assault. This result can be linked to the previously discussed habituation study by Rothbaum and colleagues (2001), wherein habituation deficits were found to be a marker of PTSD in a sample of sexual assault survivors with and without PTSD. Habituation is further implicated in findings showing a lack of habituation to contribute to negative treatment
outcomes compared to those who habituate well in clinical studies (Jaycox, Foa, & Morral, 1998). The current study showed habituation deficits with exposure to sexual assault compared to trauma without sexual assault, even when PTSD diagnosis was adjusted for. This suggests that further research is needed to examine the role PTSD in conjunction with sexual assault in habituation, as the field does not know its impact nor the role habituation plays in maintenance of these associated health impacts. As suggested by in a previous study, this deficit in habituation may be related to ability to cope and recover following a sexual assault, thus contributing to pathological responses such as PTSD (Rothbaum et al., 2001). Whether or not deficits in habituation contribute to the numerous negative outcomes observed in this study remains to be determined and should be investigated in future studies.

To the best of my knowledge this study is the first of its kind on numerous fronts, the first being the investigation of the prevalence of sexual assault and its associated outcomes in a highly traumatized, low SES, African American population living in an urban environment. I also believe this study to be unique in the use of a dark-enhanced startle paradigm to examine the potential mechanisms underlying the correlates/impact of sexual assault. My sample is unique in its focus, size, and breadth of data collected. Prior to this study, there are few large-scale estimates of the prevalence and sequelae of sexual assault in an urban, low SES, African American population in the literature. My findings provide background that can drive and justify the development of policy and practice to target screening for the occurrence of sexual assault as well as create
targeted programs to curb its incidence in a vulnerable population. This is especially needed as African Americans are less likely to seek treatment after trauma exposure and more likely to be exposed to trauma (Roberts, Gilman, Breslau, Breslau, & Koenen, 2011). Luckily, there is already a great deal of infrastructure and points of contact that can be built upon and subsequently integrated with sexual assault screening, prevention, and education such as schools, pediatrician visits, and government programs such as women-infants-children (WIC). In an increasing number of emergency department settings, there are specific nurses trained to deal with sexual assault, but currently these are focused primarily on the sexual assault exam (Campbell, Patterson, & Lichty, 2005). There are existing initiatives to have screening and prevention of general violence in dental practices (Von Burg & Hibbard, 1994) and correctional facilities (Gilligan & Lee, 2005) which could be adapted to include sexual assault screening and prevention. In addition to measures to prevent sexual assault, providers and organizations can become equipped to prevent and identify early associated negative outcomes by screening for findings such as pain, PTSD, depression, suicide, and self-harm. Given the high incidence of sexual assault in childhood, there is a need for increased focus in this age group as well. Screening for mental health problems, including suicide has been shown to be effective in schools (Horowitz, Ballard, & Pao, 2009; Husky, Sheridan, McGuire, & Olfson, 2011), though without a large established network it can be challenging. With this information, schools could focus on retaining those who have been sexually assaulted, as education alone can have a profound effect on health even outside of
the realm of sexual assault (Galea et al., 2011). Given the increase in arrests, etc. the justice system has underutilized potential to screen for trauma and mental health (Steadman, Pamela Clark Robbins, Islam, & Osher, 2007), especially in those who are in custody repeatedly. Schools, communities, and healthcare organizations can provide education and guidance in regards to responsible use of alcohol and other elicit substances, which is already a substantial research area (McBride, Farringdon, Midford, Meuleners, & Phillips, 2004; Tobler & Stratton, 1997). In cases where an individual is already misusing these substances, sexual assault history and outcomes associated with the behavior, such as PTSD and depression, should be examined as an underlying cause. While the outcomes examined in this study are certainly negative, suicide and self-harm allow little room for mistakes in prevention. Families, providers, communities, and organizations that come in contact and provide guidance for those who have been sexually assaulted need to be acutely aware of the possibility for and prevention of suicide and self-harm. There are many empirically supported suicide screeners which are short and easy to administer, which have been implemented with success in organizations that have elected to do so, such as schools and primary care offices (Horowitz et al., 2009). Additionally, this presents a use case apt for the use of mobile technology. Many mobile apps exist and present themselves as suicide screening and education apps, but many have content that is more harmful than helpful, with a recent review indicating a need for an app that is useful for multiple populations (Larsen, Nicholas, & Christensen, 2016). While these results and recommendations are not representative of all populations, they can certainly
be applied to other highly traumatized populations such as refugees. The current study finds a failure of our systems on multiple levels; in preventing sexual violence, in having proper surveillance of sexual violence across all communities, in identifying and preventing the long-term sequelae of sexual violence, and more. However, there is also hope in that there are infrastructures and feasible methods in existence able to rectify these failures without a need to completely reinvent how our systems work. These data provide a means to justify this work, as the suffering of this highly traumatized community, long underserved, is beginning to emerge.

Several limitations should be considered in interpreting these results. This is a cross-sectional study, thus my findings imply association, not causation. However, this is the first step in identifying causative mechanisms. In order to continue research in any capacity, some estimate of the magnitude of the exposure is necessary, which the current study provides. In addition, all measures other than the startle paradigm were self-report and therefore subject to potential bias. Though the measures are self-report, they are well-validated measures commonly used in research and easy to use in clinical and public health settings, as they require no specialized medical or psychological training. As mentioned previously, all participants were recruited from hospital waiting rooms, thus these data do not include those who do not seek medical care, either by choice or life circumstances, and thus may not capture the whole spectrum of the potential effects of sexual assault. Despite this, my data still indicate a large public health concern, despite the possibility of it being a conservative estimate of only those
already in the health system. The sample consisted only of low SES African Americans, and cannot represent other low SES or highly traumatized groups living in urban environments. However, African Americans are historically under-represented in medical research, thus this focused population contributes to closing a significant gap in the literature (Dancy et al., 2004; Shavers - Hornaday et al., 1997). The next logical step would be conducting a prospective study inclusive of these outcomes with naturally occurring comparison groups. Future studies should examine other possible mechanisms as to why sexual assault is associated with unique outcomes compared to trauma exposure without sexual assault, such as startle paradigms focusing on acquisition and extinction, trauma narratives, and inhibition tasks. Further, the role of genetics, epigenetics, and inflammation should be investigated to determine markers of risk, resilience, or as possible mediating factors of these outcomes that are associated specifically with sexual assault. These analyses should include re-analysis of the dark-enhanced startle data to determine if there is a mediating effect on outcome. Future research should also investigate the relationship between associated outcomes with frequency and severity of sexual assault as well as potential differences in outcome if sexual assault first occurs in childhood or adulthood.

The current study fills an important gap in the literature, clarifying the prevalence of sexual assault in an epidemiological sample of highly traumatized, low SES African Americans living in an urban environment. Overall, the prevalence of sexual assault in this population is nearly 40%, with the majority occurring in childhood. I found that prevalence in men was more than double
existing published data and similarly nearly double in women. These results are suggestive of a failure of the public health surveillance system for an already disadvantaged population, suggesting population level estimates are only useful to a degree, as they may be very different from sub-populations. I have begun to unpack the unique impact of sexual assault to other traumatization, showing increases in psychiatric diagnoses, chronic disease, self-harm, and suicide attempts, as examples. These negative events are likely to cause survivors years of pain and suffering, as well as have effects on other areas of functioning. More research is certainly warranted to fully identify the impact of sexual assault, especially in highly traumatized populations. Additionally health-related and non-health-related organizations share a responsibility in this public health concern. These results highlight an area ripe for intervention, both in terms of sexual assault itself and the negative impacts that persist throughout the lifespan in the aftermath of sexual assault.
Table 1
Demographics of Overall Sample and African American (AA) Subset of Sample

<table>
<thead>
<tr>
<th></th>
<th>Overall Valid % (n=9807)</th>
<th>AA Valid % (n=8533)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age</td>
<td>40.09</td>
<td>40.06</td>
</tr>
<tr>
<td>Female</td>
<td>76.2% (7055)</td>
<td>76.7% (6535)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>93.1% (8533)</td>
<td>100% (8533)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>3.1% (283)</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>0.1% (11)</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>0.7% (63)</td>
<td>0</td>
</tr>
<tr>
<td>Mixed</td>
<td>1.8% (167)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1.2% (113)</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic (Ethnicity)</td>
<td>3% (245)</td>
<td>2% (149)</td>
</tr>
<tr>
<td>Highest Grade Completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 12th Grade</td>
<td>21.5% (1945)</td>
<td>22% (1850)</td>
</tr>
<tr>
<td>12th or HS grad</td>
<td>35.9% (3250)</td>
<td>36.9% (3109)</td>
</tr>
<tr>
<td>GED</td>
<td>5.1% (463)</td>
<td>4.7% (397)</td>
</tr>
<tr>
<td>Some College/Tech School</td>
<td>22.9% (2076)</td>
<td>22.5% (1896)</td>
</tr>
<tr>
<td>Tech School Grad</td>
<td>4.6% (413)</td>
<td>4.4% (369)</td>
</tr>
<tr>
<td>College Grad</td>
<td>8.3% (748)</td>
<td>7.8% (654)</td>
</tr>
<tr>
<td>Grad School</td>
<td>1.8% (163)</td>
<td>1.7% (145)</td>
</tr>
<tr>
<td>Currently employed</td>
<td>32.9% (2978)</td>
<td>32.8% (2763)</td>
</tr>
<tr>
<td>Household Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-249</td>
<td>21% (1841)</td>
<td>20.8% (1691)</td>
</tr>
<tr>
<td>250-499</td>
<td>9.2% (809)</td>
<td>9.6% (779)</td>
</tr>
<tr>
<td>500-999</td>
<td>26.6% (2327)</td>
<td>26.8% (2178)</td>
</tr>
<tr>
<td>1000-1999</td>
<td>26.9% (2351)</td>
<td>26.9% (2188)</td>
</tr>
<tr>
<td>2000 or more</td>
<td>16.2% (1419)</td>
<td>15.9% (1291)</td>
</tr>
<tr>
<td>Current Relationship Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Never Married</td>
<td>58.3% (5274)</td>
<td>59.6% (5016)</td>
</tr>
<tr>
<td>Married</td>
<td>11.8% (1066)</td>
<td>11.2% (941)</td>
</tr>
<tr>
<td>Divorced</td>
<td>16.7% (1515)</td>
<td>16.2% (1362)</td>
</tr>
<tr>
<td>Separated</td>
<td>6.4% (581)</td>
<td>6.4% (537)</td>
</tr>
<tr>
<td>Widowed</td>
<td>4% (360)</td>
<td>4% (334)</td>
</tr>
<tr>
<td>Domestic Partner</td>
<td>2.8% (257)</td>
<td>2.7% (229)</td>
</tr>
<tr>
<td>Current SS Disability</td>
<td>20.1% (1812)</td>
<td>20.4% (1713)</td>
</tr>
<tr>
<td>Mean Weight (lbs)</td>
<td>193.65</td>
<td>194.03</td>
</tr>
<tr>
<td>Measure</td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Mean BMI</td>
<td>31.89</td>
<td>31.97</td>
</tr>
<tr>
<td>Measures of Sexual Assault</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Sexual Assault</td>
<td>40.8% (3491)</td>
<td>39.9% (3160)</td>
</tr>
<tr>
<td>Childhood Sexual Assault</td>
<td>38.1% (3259)</td>
<td>37.3% (2959)</td>
</tr>
<tr>
<td>Adulthood Sexual Assault</td>
<td>11.3% (860)</td>
<td>10.7% (754)</td>
</tr>
<tr>
<td>Trauma Exposure</td>
<td>88% (7046)</td>
<td>87.6% (6495)</td>
</tr>
<tr>
<td>Mean Age of First SA</td>
<td>10.72</td>
<td>10.68</td>
</tr>
<tr>
<td>SA Before Age 30</td>
<td>97.2% (1992)</td>
<td>97.3% (1782)</td>
</tr>
<tr>
<td>SA After Age 30</td>
<td>2.8% (58)</td>
<td>2.7% (50)</td>
</tr>
</tbody>
</table>

SA: Sexual assault
<table>
<thead>
<tr>
<th></th>
<th>Overall Sample Valid % (n)</th>
<th>AA Sample Valid % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Childhood SA</td>
<td>22% (456)</td>
<td>43.2%</td>
</tr>
<tr>
<td></td>
<td>(2798)</td>
<td>(405)</td>
</tr>
<tr>
<td>Adulthood SA</td>
<td>2.5% (46)</td>
<td>14.1%</td>
</tr>
<tr>
<td></td>
<td>(814)</td>
<td></td>
</tr>
<tr>
<td>Overall SA</td>
<td>22.8%</td>
<td>46.5%</td>
</tr>
<tr>
<td></td>
<td>(471)</td>
<td>(3015)</td>
</tr>
<tr>
<td>Mean Age of First SA</td>
<td>9.86</td>
<td>10.82</td>
</tr>
<tr>
<td>SA Before 30</td>
<td>96.6%</td>
<td>97.2%</td>
</tr>
<tr>
<td></td>
<td>(201)</td>
<td>(1790)</td>
</tr>
<tr>
<td>SA After 30</td>
<td>3.4% (7)</td>
<td>2.8% (51)</td>
</tr>
</tbody>
</table>

SA: Sexual Assault
Table 3
Chi Square Results Examining Differences in Sexual Assault Between African American Males and Females

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>$X^2$</th>
<th>DF</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Childhood SA</td>
<td>7920</td>
<td>267.345*</td>
<td>1</td>
<td>0.184</td>
</tr>
<tr>
<td>Adulthood SA</td>
<td>7021</td>
<td>159.098*</td>
<td>1</td>
<td>0.151</td>
</tr>
<tr>
<td>Overall SA</td>
<td>7920</td>
<td>327.125*</td>
<td>1</td>
<td>0.203</td>
</tr>
<tr>
<td>Age Cutoff of 30</td>
<td>1832</td>
<td>0.339</td>
<td>1</td>
<td>0.014</td>
</tr>
</tbody>
</table>

SA: Sexual Assault

*p < .001
<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th>Adjusted*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>CI</td>
</tr>
<tr>
<td>PTSD DX</td>
<td>2.51</td>
<td>2.249-2.801</td>
</tr>
<tr>
<td>Depression DX</td>
<td>2.579</td>
<td>2.302-2.890</td>
</tr>
<tr>
<td>Suicide Attempt</td>
<td>4.317</td>
<td>3.697-5.042</td>
</tr>
<tr>
<td>Self Harm</td>
<td>2.931</td>
<td>2.010-4.275</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>1.039</td>
<td>.755-1.431</td>
</tr>
<tr>
<td>Drug Use</td>
<td>1.298</td>
<td>.981-1.718</td>
</tr>
<tr>
<td>Chronic Disease</td>
<td>1.305</td>
<td>1.128-1.510</td>
</tr>
</tbody>
</table>

DX: Diagnosis; OR: Odds Ratio; CI: Confidence Interval

*Binary Logistic Regression with Sexual Assault exposure predicting outcome, covaried for 1) Age and 2) sex.
Table 5
Unadjusted and Adjusted Mean ± SEM for Continuous Health and Quality of Life Outcomes in both African Americans Exposed to Sexual Assault and African Americans Exposed to Trauma Without Sexual Assault

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>No SA</td>
<td>F</td>
<td>DF</td>
<td>P</td>
<td>ηp²</td>
</tr>
<tr>
<td>PTSD SX count</td>
<td>17.219 ± .224</td>
<td>10.276 ± .211</td>
<td>508.454</td>
<td>1,5893</td>
<td>&lt;.001</td>
<td>0.079</td>
</tr>
<tr>
<td>BDI SX Count</td>
<td>18.179 ± .224</td>
<td>11.892 ± .210</td>
<td>419.43</td>
<td>1,6726</td>
<td>&lt;.001</td>
<td>0.068</td>
</tr>
<tr>
<td>Mean Trauma Exposure</td>
<td>32.455 ± .305</td>
<td>25.229 ± .290</td>
<td>288.425</td>
<td>1,6299</td>
<td>&lt;.001</td>
<td>0.044</td>
</tr>
<tr>
<td>CTQ Total</td>
<td>51.344 ± .278</td>
<td>33.344 ± .270</td>
<td>2282.581</td>
<td>1,6415</td>
<td>&lt;.001</td>
<td>0.262</td>
</tr>
<tr>
<td>Times Arrested</td>
<td>4.209 ± .180</td>
<td>3.690 ± .179</td>
<td>4.161</td>
<td>1,3819</td>
<td>0.041</td>
<td>0.001</td>
</tr>
<tr>
<td>Times Jailed</td>
<td>3.966 ± .166</td>
<td>3.449 ± .164</td>
<td>1.903</td>
<td>1,3536</td>
<td>0.027</td>
<td>0.001</td>
</tr>
<tr>
<td>Age First Jailed</td>
<td>24.854 ± .302</td>
<td>24.281 ± .324</td>
<td>1.669</td>
<td>1,1712</td>
<td>0.197</td>
<td>0.001</td>
</tr>
<tr>
<td>Times in Prison</td>
<td>.893 ± .064</td>
<td>.912 ± .056</td>
<td>0.051</td>
<td>1,1458</td>
<td>0.821</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Age First Prison</td>
<td>27.599 ± .725</td>
<td>27.549 ± .661</td>
<td>0.002</td>
<td>1,325</td>
<td>0.96</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>AUDIT Lifetime</td>
<td>10.813 ± .270</td>
<td>9.523 ± .259</td>
<td>11.888</td>
<td>1,2718</td>
<td>0.001</td>
<td>0.004</td>
</tr>
<tr>
<td>AUDIT Last Year</td>
<td>4.324 ± .167</td>
<td>3.927 ± .157</td>
<td>3.003</td>
<td>1,3231</td>
<td>0.083</td>
<td>0.001</td>
</tr>
<tr>
<td>DAST Lifetime</td>
<td>4.024 ± .076</td>
<td>3.399 ± .076</td>
<td>33.658</td>
<td>1,2206</td>
<td>&lt;.001</td>
<td>0.015</td>
</tr>
<tr>
<td>DAST Last Year</td>
<td>1.166 ± .048</td>
<td>.911 ± .045</td>
<td>15.307</td>
<td>1,3190</td>
<td>&lt;.001</td>
<td>0.005</td>
</tr>
<tr>
<td>BMI</td>
<td>32.572 ± .208</td>
<td>31.621 ± .017</td>
<td>10.522</td>
<td>1,3206</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>BQ Total</td>
<td>4.910 ± .097</td>
<td>4.268 ± .088</td>
<td>24.086</td>
<td>1,3263</td>
<td>&lt;.001</td>
<td>0.007</td>
</tr>
<tr>
<td>DEBQ Total</td>
<td>17.228 ± .585</td>
<td>14.752 ± .564</td>
<td>9.277</td>
<td>1,1238</td>
<td>0.002</td>
<td>0.007</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Adjusted⁶</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>No SA</td>
<td>F</td>
<td>DF</td>
<td>P</td>
<td>ηp²</td>
</tr>
<tr>
<td>PTSD SX count</td>
<td>17.320 ± .228</td>
<td>10.182 ± .215</td>
<td>504.071</td>
<td>3,5882</td>
<td>&lt;.001</td>
<td>0.079</td>
</tr>
<tr>
<td>BDI SX Count</td>
<td>18.181 ± .228</td>
<td>11.886 ± .213</td>
<td>393.609</td>
<td>3,5716</td>
<td>&lt;.001</td>
<td>0.064</td>
</tr>
<tr>
<td>Mean Trauma Exposure</td>
<td>32.518 ± .312</td>
<td>25.239 ± .296</td>
<td>277.549</td>
<td>3,6286</td>
<td>&lt;.001</td>
<td>0.042</td>
</tr>
<tr>
<td>CTQ Total</td>
<td>51.939 ± .282</td>
<td>33.260 ± .274</td>
<td>2177.279</td>
<td>3,6402</td>
<td>&lt;.001</td>
<td>0.254</td>
</tr>
<tr>
<td>Times Arrested</td>
<td>4.820 ± .181</td>
<td>3.088 ± .180</td>
<td>2536.436</td>
<td>3,3811</td>
<td>&lt;.001</td>
<td>0.011</td>
</tr>
<tr>
<td>Times Jailed</td>
<td>4.551 ± .166</td>
<td>2.878 ± .164</td>
<td>48.533</td>
<td>3,3529</td>
<td>&lt;.001</td>
<td>0.014</td>
</tr>
<tr>
<td>Age First Jailed</td>
<td>24.476 ± .283</td>
<td>24.715 ± .305</td>
<td>0.311</td>
<td>3,1712</td>
<td>0.577</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Times in Prison</td>
<td>1.097 ± .062</td>
<td>.762 ± .054</td>
<td>15.917</td>
<td>3,1451</td>
<td>&lt;.001</td>
<td>0.011</td>
</tr>
<tr>
<td>Age First Prison</td>
<td>27.722 ± .766</td>
<td>27.454 ± .665</td>
<td>0.064</td>
<td>3,325</td>
<td>0.801</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>AUDIT Lifetime</td>
<td>11.729 ± .257</td>
<td>8.687 ± .245</td>
<td>70.384</td>
<td>3,2714</td>
<td>&lt;.001</td>
<td>0.025</td>
</tr>
<tr>
<td>AUDIT Last Year</td>
<td>4.839 ± .162</td>
<td>3.462 ± .152</td>
<td>37.183</td>
<td>3,3227</td>
<td>&lt;.001</td>
<td>0.011</td>
</tr>
<tr>
<td>DAST Lifetime</td>
<td>4.269 ± .073</td>
<td>3.158 ± .073</td>
<td>108.753</td>
<td>3,2204</td>
<td>&lt;.001</td>
<td>0.047</td>
</tr>
<tr>
<td>DAST Last Year</td>
<td>1.290 ± .047</td>
<td>.803 ± .044</td>
<td>55.5</td>
<td>3,3186</td>
<td>&lt;.001</td>
<td>0.017</td>
</tr>
<tr>
<td>BMI</td>
<td>32.341 ± .207</td>
<td>31.850 ± .207</td>
<td>2.758</td>
<td>3,3203</td>
<td>0.097</td>
<td>0.001</td>
</tr>
<tr>
<td>BQ Total</td>
<td>5.161 ± .096</td>
<td>4.064 ± .086</td>
<td>69.738</td>
<td>3,3258</td>
<td>&lt;.001</td>
<td>0.021</td>
</tr>
<tr>
<td>DEBQ Total</td>
<td>17.348 ± .590</td>
<td>14.674 ± .569</td>
<td>10.462</td>
<td>3,1236</td>
<td>0.001</td>
<td>0.008</td>
</tr>
</tbody>
</table>
SA: Sexual Assault; No SA: Traumatized without Sexual Assault; DF: Degrees of
Freedom; PTSD: Posttraumatic Stress Disorder; SX: Symptom; BDI: Beck
Depression Inventory; CTQ: Childhood Trauma Questionnaire; AUDIT: Alcohol
Use Disorder Identification Test; DAST: Drug Abuse Screening Test; BMI: Body
Mass Index; BQ: Behavior Questionnaire; DEBQ: Dutch Eating Behavior
Questionnaire

#ANOVA comparing Sexual Assault with Traumatized without Sexual Assault,
covaried for 1) Age and 2) sex.
Table 6
Demographics of Startle Subset of Sample

<table>
<thead>
<tr>
<th></th>
<th>Startle Subset Valid % (n=241)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age</td>
<td>40.02</td>
</tr>
<tr>
<td>Female</td>
<td>87.1% (210)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>100% (241)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>0</td>
</tr>
<tr>
<td>Mixed</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic (Ethnicity)</td>
<td>100% (239)</td>
</tr>
<tr>
<td><strong>Highest Grade Completed</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 12th Grade</td>
<td>22.9% (55)</td>
</tr>
<tr>
<td>12th or HS grad</td>
<td>30% (72)</td>
</tr>
<tr>
<td>GED</td>
<td>4.6% (11)</td>
</tr>
<tr>
<td>Some College/Tech School</td>
<td>22.1% (53)</td>
</tr>
<tr>
<td>Tech School Grad</td>
<td>9.2% (22)</td>
</tr>
<tr>
<td>College Grad</td>
<td>9.6% (23)</td>
</tr>
<tr>
<td>Grad School</td>
<td>1.7% (4)</td>
</tr>
<tr>
<td>Currently employed</td>
<td>25.5% (61)</td>
</tr>
<tr>
<td><strong>Household Income</strong></td>
<td></td>
</tr>
<tr>
<td>0-249</td>
<td>21.8% (52)</td>
</tr>
<tr>
<td>250-499</td>
<td>8.4% (20)</td>
</tr>
<tr>
<td>500-999</td>
<td>30.3% (72)</td>
</tr>
<tr>
<td>1000-1999</td>
<td>22.3% (53)</td>
</tr>
<tr>
<td>2000 or more</td>
<td>17.2% (41)</td>
</tr>
<tr>
<td><strong>Current Relationship Status</strong></td>
<td></td>
</tr>
<tr>
<td>Single/Never Married</td>
<td>57.5% (138)</td>
</tr>
<tr>
<td>Married</td>
<td>10.4% (25)</td>
</tr>
<tr>
<td>Divorced</td>
<td>20.4% (49)</td>
</tr>
<tr>
<td>Separated</td>
<td>6.3% (15)</td>
</tr>
<tr>
<td>Widowed</td>
<td>1.3% (3)</td>
</tr>
<tr>
<td>Domestic Partner</td>
<td>4.2% (10)</td>
</tr>
<tr>
<td>Current SS Disability</td>
<td>18.4% (44)</td>
</tr>
<tr>
<td>Mean Weight (lbs)</td>
<td>199.8</td>
</tr>
<tr>
<td>Mean BMI</td>
<td>33.05</td>
</tr>
</tbody>
</table>

Measures of Sexual
<table>
<thead>
<tr>
<th>Assault</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Sexual Assault</td>
<td>61.4% (148)</td>
<td></td>
</tr>
<tr>
<td>Childhood Sexual Assault</td>
<td>56.8% (137)</td>
<td></td>
</tr>
<tr>
<td>Adulthood Sexual Assault</td>
<td>19.9% (47)</td>
<td></td>
</tr>
<tr>
<td>Trauma Exposure</td>
<td>100% (241)</td>
<td></td>
</tr>
<tr>
<td>Mean Age of First SA</td>
<td>10.151</td>
<td></td>
</tr>
<tr>
<td>SA Before Age 30</td>
<td>99% (98)</td>
<td></td>
</tr>
<tr>
<td>SA After Age 30</td>
<td>1% (1)</td>
<td></td>
</tr>
</tbody>
</table>

SA: Sexual assault
Table 7
Unadjusted and Adjusted Startle Reactivity (Mean ± SEM) by Each Block in Microvolts

<table>
<thead>
<tr>
<th>Phase</th>
<th>Unadjusted</th>
<th>Adjusted*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>No SA</td>
</tr>
<tr>
<td>Light 1</td>
<td>75.443 ± 6.251</td>
<td>59.980 ± 7.886</td>
</tr>
<tr>
<td>Dark 1</td>
<td>86.813 ± 6.596</td>
<td>76.719 ± 8.321</td>
</tr>
<tr>
<td>Light 2</td>
<td>64.244 ± 5.724</td>
<td>52.125 ± 7.221</td>
</tr>
<tr>
<td>Dark 2</td>
<td>75.035 ± 6.440</td>
<td>67.957 ± 8.124</td>
</tr>
</tbody>
</table>

SA: Sexual Assault; No SA: Traumatized without Sexual Assault

*Repeated Measures ANOVA with Sex Covaried.
References


community population. *Journal of consulting and clinical psychology*, 56(6), 843.

Cairney, J., Boyle, M., Offord, D. R., & Racine, Y. (2003). Stress, social support and depression in single and married mothers. *Social psychiatry and psychiatric epidemiology, 38*(8), 442-449.


properties of a modified version of the PTSD Symptom Scale Self-Report.

*Journal of traumatic stress, 11*(2), 393-399.


*Nursing Outlook, 52*(5), 234-240. doi:

http://dx.doi.org/10.1016/j.outlook.2004.04.012


*Jama, 290*(5), 627-634.


Michopoulos, V., Rothbaum, A. O., Jovanovic, T., Almli, L. M., Bradley, B., Rothbaum, B. O., et al. (2014). Association of CRP Genetic Variation and
CRP Level With Elevated PTSD Symptoms and Physiological Responses in a Civilian Population With High Levels of Trauma. *American Journal of Psychiatry.*


(AUDIT). WHO collaborative project on early detection of persons with
Schwartz, A. C., Bradley, R., Penza, K. M., Sexton, M., Jay, D., Haggard, P. J., et
al. (2006). Pain medication use among patients with posttraumatic stress
disorder. Psychosomatics, 47(2), 136-142.
Posttraumatic Stress Disorder Among African Americans in an Inner City
Mental Health Clinic. Psychiatric Services, 56(2), 212-215. doi:
doi:10.1176/appi.ps.56.2.212
(1997). Why are African Americans under-represented in medical
research studies? Impediments to participation. Ethnicity & Health, 2(1-2),
363-371. doi: http://dx.doi.org/10.1016/0306-4603(82)90005-3
Smith, A. K., Conneely, K. N., Kilaru, V., Mercer, K. B., Weiss, T. E., Bradley,
B., et al. (2011). Differential immune system DNA methylation and
cytokine regulation in post-traumatic stress disorder. American Journal
of Medical Genetics Part B: Neuropsychiatric Genetics, 156(6), 700-708.


