PSYCHOLOGICAL FUNCTIONING AND TRAIT MINDFULNESS IN URBAN YOUTH

by
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Abstract

The goal of this dissertation was to examine comorbid psychological symptoms experienced by urban minority adolescents, an at-risk and understudied population, to inform screening and intervention efforts for youth at highest risk of developing comorbid disorders and prevent later emotional and behavioral problems.

The first study identified youth subgroups experiencing multiple psychological symptoms and compared them by psychosocial factors. Data were analyzed from a sample of 426 Baltimore City 8th grade students using latent profile analysis, which indicated four profiles characterized by concordance or discordance between student- and teacher-reported symptoms. Latent regressions found that the profile with high levels of student- and teacher-reported symptoms had the highest levels of trauma exposure, substance use, and maladaptive coping. The differentiation of the profiles indicates that future research and screening efforts should include information from both students and teachers to maximize the ability to detect students in need of supports.

The second manuscript aimed to validate the subgroups identified in the prior study and to examine differences between groups in sex and trait mindfulness. Confirmatory latent profile analysis with a sample of 201 Baltimore City 8th grade students reproduced the same profiles as the first study. Latent regressions found significant differences in sex and trait mindfulness between profiles, and showed more differences in trait mindfulness between profiles for females than for males. These findings indicate that further research is needed to understand sex differences in comorbid psychological symptoms and trait mindfulness in urban youth.

The third manuscript aimed to assess the associations between trauma exposures and comorbidity in urban youth, and to explore potential pathways through heart rate variability, using multilevel models with a sample of 112 Baltimore City 8th and 9th grade students. While findings did not reach statistical significance, results revealed potential patterns in the associations between trauma, comorbidity, and heart rate variability.

These studies contribute to the literature on comorbidity in at-risk youth by identifying subgroups of urban youth experiencing comorbid psychological symptoms based on the level of concordance and/or discordance between student and teacher reports. Moreover, we were able to further describe urban youth with comorbid symptoms.

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Chapter 1: Introduction

1.1 Problem Statement

Low-income urban youth are at increased risk for developing mental health issues, such as depression, anxiety, and post-traumatic stress disorder. This increased risk is likely due in large part to stress and trauma exposure, including neighborhood and interpersonal violence (Urban Institute, 2015). Understanding the mental health needs of urban youth is important for the promotion of their positive emotional and behavioral development.

Comorbidity of depression and anxiety in childhood is associated with worsened outcomes compared to either disorder alone, including increased suicide attempts and impairments in functioning later in life (Garber & Weersing, 2010). The current literature on comorbidity in urban youth has several key limitations. We do not yet understand whether subgroups of urban youth can be identified on the basis of their reported psychological symptoms. The extent to which different factors, such as trauma exposure, coping strategies, substance use, and other social and emotional characteristics, are associated with belonging to these distinct youth subgroups can further inform our understanding of youth needs. Distinguishing youth subgroups based on symptom comorbidity and identifying correlates of these subgroups has potential to inform treatment and prevention efforts. Thus, this dissertation will investigate comorbid mental health symptoms and their correlates in urban youth

Mindfulness has gained popularity as an intervention strategy to improve stress management and promote wellbeing (Zoogman et al., 2015). Traditionally, mindfulness has been defined as paying attention to the present moment without judgement (Kabat-Zinn, 1994). A growing empirical literature suggests that various school-based mindfulness programs

reduce psychological distress in youth (McChesney et al., 2015; Sibinga et al., 2013; Mendelson et al., 2010; Mendelson et al., 2013; Dariotis et al., 2016; Sibinga et al., 2016; Felver et al., 2016; McKeering & Hwang, 2018; Perry-Parrish et al., 2016). Research has also begun to evaluate the role of trait mindfulness (i.e., a person's baseline or average level of mindfulness; Siegling & Petrides, 2014) in mental health and how mindfulness-based programs can potentially enhance trait mindfulness as a means of improving mental health in adult populations (Mesmer-Magnus et al., 2017; Sahdra et al., 2017; Whitaker et al., 2014; Kiken et al., 2015; Laurent et al., 2015). This dissertation will assess trait mindfulness as a correlate of psychological comorbidity in urban youth.

This dissertation will utilize baseline data from two studies with Baltimore City public school students that assess effects of mindfulness-based interventions. The dissertation will contribute to current knowledge by modeling youth psychological functioning and its correlates in a non-institutionalized, urban minority youth sample, thus laying the groundwork for future larger-scale research to evaluate the impact of various prevention programming on youth mental health. Findings may have potential to improve the capacity to identify youth to target for interventions to prevent the development of mental health disorders, and risky behaviors, such as substance use and negative social behaviors.

1.2 Background

1.2.1   Aim 1

Urban, minority youth are a vulnerable population at risk for developing mental health symptoms and risky or maladaptive behaviors. Low-income, urban youth are exposed to stressors associated with poverty, such as neighborhood and interpersonal violence, lack of

resources, and instability in family and housing (Urban Institute, 2015; Farahmand et al., 2012). These types of traumas and stressors have been identified as risk factors for mental illness and poor physical health later in life (Farahmand et al., 2012; Grant et al., 2003; Toussaint et al., 2014). In large part due to these exposures, low-income, urban youth are at particular risk of developing mental and physical health problems (Grant et al., 2004).

We lack an understanding of comorbid psychological symptoms in minority youth, and how this comorbidity is related to internal and external factors, such as coping and trauma exposure. The broader body of literature on mental health shows that comorbidity of disorders is highly prevalent, both in representative samples in the U.S. and in high-risk youth samples (Liu et al., 2017; Salom et al., 2015; Wadsworth et al., 2001). With the advancement of latent variable modeling, there has been a significant increase in research exploring subgroups of individuals with comorbid psychological symptoms in various populations (Gomez & Vance, 2014; Mezulis et al., 2011; Hogue & Dauber, 2011; McChesney et al., 2015; Wadsworth et al., 2001; Ferdinand et al., 2005; Van Lang et al., 2006; Neuman et al., 2001). However, research in youth has been limited, and the small literature on the topic has some key gaps. First, many of the studies in this area focus on subgrouping youth based solely on depression and anxiety symptoms (Liu et al., 2017; Mezulis et al., 2011; Salom et al., 2015; Wadsworth et al., 2001; Ferdinand et al., 2005; van Lang et al., 2006; Peiper et al., 2015). While depression and anxiety are among the most prevalent mental health disorders in youth and are highly comorbid (Merikangas, He, Brody, et al., 2010; Merikangas, He, Burstein, et al. 2010; Avenevoli et al., 2015), post-traumatic stress disorder (PTSD) is also often experienced by urban youth (Horowitz et al., 2005). However, few studies of comorbidity in youth include trauma or PTSD symptoms

(Liu et al., 2017; Hogue & Dauber, 2011; McChesney et al., 2015). Finally, most of the research with urban or minority youth who experience comorbid mental health symptoms has focused on youth in clinical or juvenile justice settings (Liu et al., 2017; Gomez & Vance, 2014; Mezulis et al., 2011). There is a need to examine comorbidity in community samples to better understand the typical experiences of youth who live in an urban setting. This study (Aim 1a) addresses these key gaps by studying samples of Baltimore City public school students who are not institutionalized and by assessing and analyzing youth trauma symptoms in the context of identifying subgroups with comorbid psychological symptoms.

Examining factors that are associated with comorbid psychological symptoms is important for a more complete understanding of the mental health and behavior of at-risk youth populations (Liu et al., 2017). Prior research has explored latent variable modeling or associations of latent classes of psychological symptoms with internal and external factors, including coping (Aldridge & Roesch, 2008), trauma exposure (Liu et al., 2017; Copeland et al., 2009; Briere et al., 2010), and substance use (Salom et al., 2015; Behrendt et al., 2017; Fergusson et al., 1994; Morley et al., 2015; Reboussin et al., 2007). Separate studies have established that each of these correlates is associated with increased risk for, or protection from, psychological symptoms in youth. However, associations of latent classes of youth comorbid psychological symptoms have not yet been assessed in relation to all these factors in a single study. This study (Aim 1b) will be the first to explore these associations to better understand comorbid psychological symptoms in urban youth.

1.2.2 Aim 2

There is growing research on the role of trait mindfulness in relation to intervention impact among adults, but very little such work has been conducted with youth samples. Mindfulness (or state mindfulness) is defined as non-judgmental awareness of the present moment (Kabat-Zinn, 1994). In comparison, trait mindfulness (or dispositional mindfulness) is one's frequency of being mindful in daily life, or one's average level of mindfulness (Siegling & Petrides, 2014; Baer et al., 2006; Bravo et al., 2018; Frewen et al., 2011). A growing body of research indicates that changes in state mindfulness (through meditation) can create longer lasting changes in trait mindfulness, suggesting that trait mindfulness is malleable (Tang et al., 2015; Shapiro et al., 2011). While some studies have examined the links between trait mindfulness and mental health in adolescents (Calvete et al., 2017; Ciesla et al., 2012; Royuela-Colomer & Calvete, 2016), no research has examined the associations between trait mindfulness and comorbidity in urban youth. This study (Aim 2) aims to address this key gap. Clarifying how mindfulness is associated with psychological symptoms in this population can help to refine interventions to address youth mental health and give researchers further comprehension of the development of co-occurring psychological symptoms in at-risk youth (Breitborde et al., 2010).

1.2.3 Aim 3

Psychological functioning has been linked with the physiologic stress response in adult populations. Research on adults has indicated that stress and trauma exposure in childhood can impact the stress response (e.g., cortisol levels) and mental health later in life (Marin et al., 2011). One measure of the stress response is heart rate variability (HRV), a measure of beat-to-

beat variation in heart rate, which is measured using electrocardiogram or plethysmography

(Billman et al., 2015; Quintana et al., 2013; Eddie et al., 2015). In an individual with an adaptive

stress response, the sympathetic (SNS) and parasympathetic (PNS) nervous systems coordinate

to create variability in the length of time between heart beats (high HRV; Dennis et al., 2014). In

those with a maladaptive stress response, little to no variability is seen between heart beats

(Chalmers et al., 2014). Thus, lower HRV is an indicator of autonomic dysfunction and reduced

stress regulation (Quintana et al., 2013). Research in adults shows that low HRV also leads to

dysfunction in the immune system and the inflammation process, linking it to several physical

ailments, such as cardiovascular disease, type-II diabetes, and neurodegenerative diseases

(Chalmers et al., 2014; Kemp & Quintana, 2013).

Research on adults has indicated associations between HRV and mental health (Thayer

et al., 2009; Thayer et al., 2012). Specifically, the neurovisceral integration model proposes that

higher levels of stress are associated with lower HRV and more mental health problems (Thayer

et al., 2009). These associations occur due to interactions between the prefrontal cortex and

the autonomic nervous system (Thayer et al., 2009). Mental health disorders that have been

found to be associated with lower HRV in adults include anxiety (Chalmers et al., 2014; Kemp &

Quintana, 2013; Shinba et al., 2008; Kemp et al., 2014), depression (Kemp & Quintana, 2013;

Shinba et al., 2008; Kemp et al., 2014; Kemp et al., 2010; Meerwijk et al., 2014), post-traumatic

stress disorder (Dennis et al., 2014), and substance use disorders (Quintana et al., 2013; Kemp

& Quintana, 2013). Moreover, a growing literature indicates that HRV biofeedback, in

combination with counseling, can be an effective intervention in treating post-traumatic stress

disorder, depression, and substance use disorders in adults (Eddie et al., 2015; Moss & Shaffer, 2017).

Compared to adults, far fewer studies on HRV and mental health have been conducted in youth samples (Hamilton & Alloy, 2016; Blom et al., 2010; Koenig et al., 2016). Most of these studies have been conducted in international samples (Koenig et al., 2016), and very few studies have examined HRV and mental health in vulnerable youth populations exposed to adversity (Hamilton & Alloy, 2016). Findings from the proposed research (Aim 3) have potential to refine and expand the theory linking stress physiology and mental health in vulnerable youth populations.

1.3 Conceptual Framework and Approaches

Three theories inform the proposed dissertation aims: the transactional theory of stress and coping, resilience theory, and the neurovisceral integration model. The transactional theory and resilience theory informed the conceptualization of trauma exposure and comorbidity in all three studies, as well as the associations with correlates examined in the aims, such as coping strategies, trait mindfulness, and substance use. The neurovisceral integration model aided the conceptualization of the interactions among trauma, HRV and comorbidity as examined in aim 3.

The transactional theory of stress and coping posits that appraisals of threat in one's environment and the coping strategies used by the individual can create either positive emotions or distress (Lazarus & Folkman, 1984; Biggs et al., 2017). Coping strategies can either be targeted towards managing the stressor itself (i.e., problem-focused coping) or towards managing the feelings related to the stressor (i.e., emotion-focused coping; Biggs et al., 2017).

However, if the situation feels unresolved after using the coping strategy, this can lead to feelings of distress (Biggs et al., 2017). This theory is key to the conceptualization of the associations between trauma exposure (i.e., stress) and comorbid psychological symptoms in the study aims, as well as the role of factors related to coping, such as adaptive and maladaptive coping, rumination, and trait mindfulness.

Resilience theory was developed from positive psychology and seeks to understand the development of healthy behavior through the identification of both risk and protective factors (Fine & Sung, 2014). These factors can reside within an individual (i.e., trait mindfulness, coping mechanisms) or within the ecological context (i.e., trauma exposure). The focus of resilience-based interventions is to enhance and support the development of protective factors that can buffer against the negative effects of stress (Fine & Sung, 2014). This is key in the current study, as it is proposed that trait mindfulness is an important and malleable protective factor in promoting mental health and healthy behaviors. Moreover, resilience theory informs the conceptualization of the associations between trauma exposure and psychological functioning in the study aims. Exploring subgroups of comorbidity highlights the underlying heterogeneity in comorbid psychological symptoms in the population, and the fact that not all youth exposed to trauma go on to develop psychological symptoms.

The neurovisceral integration model, which informs the research questions in Aim 3, proposes that higher levels of stress are associated with impaired cognitive functioning, lower HRV, and mental health problems that occur through interactions between the prefrontal cortex and the autonomic nervous system (Thayer et al., 2009). A simplified version of the model proposed by Thayer and Sternberg can be seen in Figure 1.1 (Thayer & Sternberg, 2006;

Nikolin et al., 2017). The model links the functioning of the heart to various brain structures, one of which is the prefrontal cortex (PFC). The PFC is involved in executive functioning and self-regulation (Blakemore & Choudhury, 2006) and has been shown to modulate brain regions that are associated with the functioning of the autonomic nervous system, such as the amygdala and hypothalamus (Nikolin et al., 2017). In the model, inactivation of the PFC during stress increases sympathetic activation and parasympathetic suppression, which increases heart rate and lowers heart rate variability (Billman et al., 2015; Frewen et al., 2011). This model helped to inform a general understanding of HRV in this study and contributed to the development of Aim 3. The conceptual framework from the current study proposes that differing levels of exposure to trauma, causing various levels of stress, will impact the variation between heart beats as a potential marker of mental health symptoms.

Concepts from these three theories were combined to create the theory-based conceptual framework depicted in Figure 1.2. The model incorporates both internal (individual) and external (ecological) risk and protective factors that may impact mental health symptoms, behaviors, and HRV. Within this framework, varying levels of the risk and protective factors, including coping strategies, will impact the risk of an adolescent developing comorbid psychological symptoms. For example, youth who are exposed to more trauma may be at greater risk than youth with less trauma exposure of developing mental health symptoms. Moreover, youth with higher trauma exposure would be more likely to have lower HRV than youth with less trauma exposure. However, if an adolescent has more adaptive coping mechanisms, her risk for these outcomes would decrease, as adaptive coping is considered to be a protective factor, and may help in resolving the stress from the trauma exposure and

result in more positive feelings. While the adolescent would still experience a physiologic stress response, her ability to cope may prevent the development of mental health symptoms or low HRV. While the model incorporates arrows to show associations for simplicity, these relationships can be conceptualized as bidirectional.

1.4 Specific Aims

Aim 1: To explore psychological comorbidity and its correlates in urban youth

Aim 1a: To identify subgroups of youth with distinct patterns of self- and teacher-reported psychological symptoms (depressive, anxiety, trauma, internalizing, externalizing) in a low-income urban youth sample

Aim 1b: To explore the associations of the youth subgroups identified in Aim 1a with psychosocial factors, including coping mechanisms, substance use, and trauma exposure

Aim 2: To examine the associations of trait mindfulness and psychological comorbidity

Aim 2a: To validate the subgroups of psychological comorbidity identified in Aim 1 in a separate sample of urban youth

Aim 2b: To examine sex differences in subgroups of psychological comorbidity

Aim 2c: To examine the associations of the youth subgroups with trait mindfulness

Aim 2d: To explore sex differences in the associations between trait mindfulness and comorbidity subgroups

Aim 3: To assess the association of psychological comorbidity with the physiologic stress response and with trauma exposure

Aim 3a: To explore associations of psychological comorbidity (depression, anxiety, and trauma symptoms) with trauma exposures

Aim 3b: To explore partial pathways in the associations between trauma exposures and psychological comorbidity through heart rate variability (HRV)

1.5 Public Health Significance

Youth in low-income urban areas are exposed to various traumatic stressors at higher frequency and levels of severity than many other youth populations, leaving them vulnerable to developing mental health disorders and risky behavior. The current work can contribute to the theoretical understanding of the relations among trauma, coping, mental health, and substance use in a vulnerable youth population. Second, the current work adds to the new and growing literature on confirmatory latent variable modeling, as few studies have used this methodology with latent profile structures, and testing between models is still developing. Moreover, this is the first study to explore the relationship between trait mindfulness and psychological comorbidity with urban youth. Finally, there is a dearth of research on how the physiologic stress response is associated with mental health and its correlates in this population. By understanding these constructs and their relationships, the current work may improve the capacity to identify youth to target for programs to reduce the risk of developing comorbid mental health disorders and prevent future deficits in functioning.

1.6 Overview of Chapters

1.6.1   Chapter 2 Overview

The study presented in Chapter 2 identified subgroups of urban youth based on psychological symptoms that they and their teachers report through the use of a latent profile analysis. The associations of subgroup membership with self-reported experiences (i.e., adverse childhood experiences) and behaviors (i.e., coping strategies and substance use) were explored

using latent regression analyses. The latent profile analysis revealed a four-profile solution that showed differences in self- and teacher-reports: 1) overall low symptoms, 2) low student-reported, high teacher-reported symptoms, 3) high student-reported, low teacher-reported symptoms, and 4) overall high symptoms. The latent regressions revealed that the students in the overall high symptom profile had more trauma exposures, greater use of maladaptive coping mechanisms, and more substance use than students in the other profiles. The manuscript from this chapter is currently under review at the *Journal of Youth and Adolescence*.

1.6.2   Chapter 3 Overview

The study presented in Chapter 3 aimed to validate the latent profile structure found in Chapter 2 with a different sample of Baltimore City 8th grade students. Sex differences in the composition of the profiles were explored, as well as the associations between self-reported trait mindfulness and profile membership and a possible interaction effect of sex with self-reported trait mindfulness. The confirmatory latent profile analysis found that the 4-profile solution with fixed thresholds was the best fit for the data. These four profiles were the same as the profiles identified in Chapter 2. Latent regressions indicated that there were more significantly more females in the profile defined by high self-reported and low teacher-reported symptoms compared to the other profiles. Moreover, students in the profiles that had higher self-reported symptoms had lower trait mindfulness, while students in the profiles with lower self-reported symptoms had higher trait mindfulness. Finally, stratified latent regressions showed that trait mindfulness was a more significant characteristic of profile membership for females than males.

1.6.3   Chapter 4 Overview

The study presented in Chapter 4 explored the associations between trauma exposure

and comorbidity in urban youth. Further, the study explored potential partial pathways through

respiratory sinus arrhythmia, a measure of heart rate variability. Findings from the study

pointed to the potential of respiratory sinus arrhythmia, a measure of heart rate variability, in

partially explaining the associations between adverse childhood experiences and psychological

comorbidity. However, given the small sample size, the study highlights the need to further

study this phenomenon in larger samples of urban youth over a longer period of time.

1.6.4   Chapter 5 Overview

Chapter 5 highlights and summarizes results from each chapter. Strengths and

limitations of this research are discussed, as well as the public health implications of this work.

Chapter 2: Co-Occurring Mental Health Symptoms in Urban Youth: Comorbidity Profiles and Correlates

2.1 Abstract

Purpose: To identify subgroups of urban youth based on their self- and teacher-reported mental health symptoms, and to explore characteristics of these subgroups.

Methods: Cross-sectional data from 426 eighth grade students across 20 Baltimore City public schools were analyzed using latent profile analysis and latent regressions. Variables for latent profile analysis included self-reported symptoms (i.e., anxiety, depression, trauma, interpersonal issues and social problems) and teacher-reported symptoms (i.e., externalizing, internalizing, and social and emotional competence). Regressions used profile membership to predict trauma exposure, coping mechanisms, and substance use.

Results: A 4-profile solution was found from the latent profile analysis. The profile with high student- and teacher-reported symptoms had more trauma exposures, greater use of maladaptive coping mechanisms, and higher substance use.

Conclusions: The current study may help in the identification of urban youth who are at risk of developing multiple co-occurring psychological disorders to target for prevention efforts.

2.2 Introduction

While comorbidity of mental health disorders in adolescence is common and has been linked with negative outcomes in adulthood, more research is needed to adequately target prevention efforts toward youth who are at greatest risk for developing multiple mental health disorders. Low-income urban adolescents are at particular risk of developing multiple mental health disorders as they are more likely to experience various stressors from their environment, such as neighborhood violence, instability in family and housing, and interpersonal violence (Urban Institute, 2015; Farahmand et al., 2012). Thus, more research is needed on comorbid mental health disorders with vulnerable urban youth populations.

Comorbidity of Psychological Symptoms in Adolescents

Comorbidity of mental health disorders is a fairly common phenomenon, with prior research reporting that up to 60% of youth with a mental health disorder having a co-occurring second disorder (Essau & Torre-Luque, 2019; Abrams et al., 2003). Many of the studies exploring the co-occurrence of multiple mental health disorders in youth have placed particular focus on the overlap between depression and anxiety (Ferdinand et al., 2005; van Lang et al., 2006; Peiper et al., 2015; Wadsworth et al., 2001). However, a few studies with youth samples have included a broader scope of psychological symptoms when exploring comorbidity, such as internalizing, externalizing, aggressive behavior, and substance use (Gomez & Vance, 2014; Liu et al., 2017; Hogue & Dauber, 2011). In prior research on comorbidity in youth, very few studies included trauma or PTSD symptoms (Hogue & Dauber, 2011), which are often experienced by urban youth in communities with high rates of violence (Horowitz et al., 2005). To address this gap, the current study includes trauma symptoms, as well as symptoms of depression and

anxiety. Urban youth samples in studies of comorbidity have primarily been enrolled from clinical or juvenile justice settings. The current study examines comorbid psychological symptoms in a sample of urban youth recruited from public schools, providing clearer insight into symptoms experienced by a general urban youth population. Finally, few studies on comorbidity in youth have included data on mental health provided by multiple raters (Fergusson et al., 1994; Hogue & Dauber, 2011; Neuman et al., 2001). The current study uses both self-reported and teacher-reported data on youth symptoms to create subgroups of youth with distinct symptom profiles.

Correlates of Comorbid Psychological Symptoms in Adolescents

Exploring correlates and characteristics associated with comorbidity of mental health issues in youth can inform intervention approaches. Trauma exposure, coping styles, and substance use are factors that have been associated with comorbidity of mental health issues in youth, although few studies have examined these associations with psychological comorbidity in urban youth. Each of these factors merits further investigation among urban youth.

Exposure to adverse childhood events (ACEs) and other traumas has been linked with many psychological issues, such as anxiety, depression, and PTSD (Briere et al., 2010). One study examined the association of stressful life events, racial discrimination, and exposure to violence with comorbidity of externalizing and internalizing symptoms in youth (Liu et al., 2017). Comorbidity was associated with more stressful life events and violence exposure (Liu et al., 2017). In a study of youth in need of mental health services, latent classes of psychological symptoms were compared by psychosocial variables, such as having a member of the household who uses substances or participating in illegal activities (Hogue & Dauber, 2011). In

this study, students who were classified as experiencing comorbid externalizing symptoms were more likely to have a member of the household who ever used substances than youth in the other classes (Hogue & Dauber, 2011). The current study builds on this field of research by asking about lifetime exposure to adverse childhood experiences, rather than being limited to current or past-year exposure. Moreover, the current study looks at the impact of experiencing multiple traumas on psychological comorbidity.

Impaired capacity to cope effectively with stress, an aspect of self-regulation, has been identified as key to the development of psychological disorders in adolescents (Wigman et al., 2014; Gunnar & Vasquez, 2006; Kessler et al., 1985; Taylor & Stanton, 2007). Using positive or adaptive coping strategies, such as problem solving, is associated with fewer internalizing and externalizing problems, while the opposite has been found for maladaptive coping strategies, such as disengagement (Compas et al., 2001). While little research has focused on coping and comorbid psychological disorders in urban youth, one study of youth with comorbid mental health and substance use disorders found that coping ability was associated with fewer substance use days over six months (Anderson et al., 2006). In a study with urban youth, negative religious coping and avoidant coping were found to be associated with psychological distress, while positive religious coping and active coping were associated with healthy psychological adjustment (Terreri & Glenwick, 2013). The current study addresses the need for further research into coping strategies and co-occurring psychological symptoms in youth.

In addition to adverse childhood experiences and coping, some studies have explored the associations between comorbid disorders and substance use in youth. In the Hogue & Dauber (2011) study described above, youth who were identified as experiencing comorbid

externalizing symptoms were more likely to have a parent who reported suspicion that the adolescent used substances compared to the other subgroups. Peiper et al. (2015) explored subgroups of youth based on their reported anxiety and depressive symptoms, which resulted in four subgroups that differed by symptom severity and type. Past-month cigarette use was a significant predictor for membership in any of the four classes, while students who reported binge drinking in the past two weeks were more likely to be in the group that reported high levels of comorbid symptoms (Peiper et al., 2015). The current study addresses a key gap in the literature, which is blunt use by adolescents. Prior studies show that blunt use is more prevalent in youth who live in low-SES settings (Trapl & Koopman Gonzalez, 2017); however, few studies of comorbidity ask about this specific route of marijuana and tobacco use. The current study asks about lifetime use of alcohol, tobacco, marijuana, and blunts.

Current Study

The current study addresses several key gaps in the literature on comorbidity and its correlates, including the recruitment of a sample of urban youth from the general population, inclusion of multiple data sources and psychological symptoms, and the measurement of lifetime exposure to key adverse childhood events and illicit substances. The first goal of the current study was to explore whether distinct groups of youth could be identified based on their self-reported and teacher-reported mental health symptoms. Secondly, the current study aimed to examine the characteristics of these subgroups of urban youth, including their trauma exposure, coping strategies, and substance use. To that end, we used latent profile analysis (LPA) to assign a sample of urban middle school students into mutually exclusive profiles based on the pattern of responses from their self-reported and teacher-reported symptoms of

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depression, anxiety, trauma, internalizing, externalizing, and social functioning. We then used latent regressions to understand how profile membership was associated with trauma exposure, use of maladaptive and adaptive coping strategies, and use of various substances, including tobacco, alcohol, and marijuana. Based on prior research, we hypothesized that we would have approximately three to four groups, including one with low symptoms and one with high comorbidity symptoms. We also expected to have one group with high internalizing symptoms (i.e., depression, anxiety, and general internalizing symptoms) and one group with high externalizing symptoms (i.e., social issues and general externalizing symptoms).

2.3 Methods

Participants

This study used baseline data from 426 8th grade students across 20 Baltimore City public schools. Eighth graders were recruited in three different cohorts across three years to participate in a randomized controlled trial assessing a school-based mindfulness program (RAP Club) compared to an active control program focused on general health education. Parental consent and student assent were collected for each participating student. The randomized controlled trial received approval from the Baltimore City Public Schools Institutional Review Board; moreover, both the randomized controlled trial and the current study received approval from the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Measures

Prior to being randomized into either RAP Club or the active control program, students completed self-report surveys on their current psychological functioning and behavior.

Additionally, two 8th grade teachers from each school rated participating students' symptoms and behavior.

Self-Report Measures

Social and demographic factors in student surveys included sex (male, female) and race (African American, White, American Indian/Alaskan Native, Asian/South Asian, Native Hawaiian/Other Pacific Islander, Multicultural). Students also reported on their age and ethnicity.

The *Children's Depression Inventory – Short Form* (CDI-S; Kovacs, 1992) was used to measure depressive symptoms in youth. The CDI-S is a 10-item self-report measure of depressive symptoms over the past two weeks, with total scores that range from 0 – 20. The measure demonstrated adequate reliability within the current sample (see Table 2.1). Four self-report items were selected from the *PROMIS Pediatric Anxiety Item Bank v2.0* (Pilkonis et al., 2011) to measure anxiety symptoms over the past seven days. Raw sum scores were converted to standardized t-scores. In the current sample, the measure demonstrated adequate reliability. The *Child PTSD Symptom Scale* (CPSS; Foa et al., 2001) was used to measure trauma symptoms in participating students. The measure consists of 17 self-report symptom items, which are summed to create an overall symptom severity score. For the current sample, the measure demonstrated adequate reliability. The *Youth Outcome Questionnaire – Self Report* (YOQSR; Wells et al., 2003) was used to measure students' behavior. The measure is comprised of five subscales, including intrapersonal distress, somatic symptoms, interpersonal relations, social problems, and behavioral dysfunction. Due to their consistency with the teacher measures, the interpersonal relations and social problems subscales were used for the current study. The

interpersonal relations subscale has a score range of -6 to 34, with higher scores indicating

greater difficulty in interactions with family, peers, or other adults including verbal aggression

or defiance. The social problems subscale has a score range -2 to 26, with higher scores

indicating more behaviors that violate social norms, including truancy, physical aggression, or

vandalism. The interpersonal problems subscale demonstrated adequate reliability, but the

social problems subscale demonstrated reliability slightly below the common reliability cutoff of

.70 in the current sample. However, given that the reliability was close to the conventional

cutoff, we decided to include the social problems subscale in the current study.

Participants were also asked to respond to 8 items drawn from a measure of *Adverse*

Childhood Experiences (ACES; Data Resource Center for Child & Adolescent Health, 2016).

Students indicated if they had ever experienced any of the following events: the

divorce/separation of their parents, a parent/guardian death, parent/guardian in jail, witnessed

violence between parents/guardians, witnessed or was a victim of neighborhood violence, lived

with someone with mental illness, lived with someone who used drugs or alcohol, or were

judged unfairly for their race/ethnicity. An overall count of the number of ACEs experienced

was calculated for each participant (range 0-8).

Students completed two measures of coping strategies: the *Children's Response Style*

Questionnaire (CRSQ; Abela et al., 2000) and the *Brief COPE* (Carver, 1997). The full CRSQ

includes three subscales of coping styles, however students were only asked to complete the 14

items pertaining to rumination. Higher scores on this measure indicate greater rumination in

the face of distress. The measure demonstrated adequate reliability in the sample. The *Brief*

COPE is a 28-item measure of 14 coping strategies and the frequency of their use by

participants. Two overall scores were calculated from the *Brief COPE*: adaptive coping (16 items of strategies including positive reframing and seeking emotional support) and maladaptive coping (12 items of strategies including self-blame and denial). Both subscales demonstrated adequate reliability in the current sample.

Students also filled out four questions about lifetime substance use (CDC, 2013). Questions asked if students had ever smoked cigarettes, consumed alcohol, used marijuana, or used a blunt. Each item was rated as never used (zero days), one or two days, or more than three days.

Teacher Measures

Teachers completed the *Strengths and Difficulties Questionnaire* (SDQ; Goodman, 1997) and the *Social Competence Scale* (SCS; Kam & Greenberg, 1998). The SDQ is a 25-item measure of students' behavior and potential difficulties. Two scores were calculated from the SDQ: externalizing symptoms (based on 10 items, including losing one's temper and being easily distracted) and internalizing symptoms (based on 10 items, including worrying and feeling unhappy or depressed. Both subscales demonstrated adequate reliability in the study sample. The SCS is a 31-item measure of students' behavioral symptoms, from which we used only the 7-item social and emotional competence subscale. Higher scores indicated greater competence, and the subscale demonstrated adequate reliability in the study sample.

Statistical Analyses

A three-step latent modeling approach was used to identify latent profiles and test their associations with correlates (Masyn, 2017). In the first step, student self-reported psychological symptoms (anxiety, depressive, and trauma symptoms) and behavior (interpersonal relations

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and social problems), and teacher-rated behavior (internalizing and externalizing symptoms, and social and emotional competence) were z-scored and analyzed using latent profile analysis, accounting for the clustering of students within school, to determine the optimal number of symptom profiles in the participating students. The number of latent profiles was selected using standard fit indices (Bayesian and Sample-Size Adjusted Bayesian Information Criteria [BIC and A-BIC], Akaike Information Criteria [AIC], and Lo-Mendell-Rubin adjusted likelihood ratio test [LRT]) (Nylund et al., 2007). In step 2, individual students were assigned to their most likely profile, accounting for measurement error with BCH weights (Nylund et al., 2007). In step 3, the mostly likely membership variable was analyzed as a predictor of the outcome variables (i.e., student self-reported ACEs, coping strategies, and lifetime substance use) using the BCH weights (Nylund et al., 2007). Latent regressions also included sex, race, and study cohort year as covariates. Stata 14 was used to generate descriptive statistics, and MPlus Version 8 was used for latent profile analyses and latent regressions.

2.4 Results

The study sample consisted of 426 eighth grade students (M_{age} = 13.22 years, SD = 0.50 years; 58.7% female). Descriptive statistics for the sample are displayed in Table 2.1. The sample was primarily Black/African American (70.1%) or multicultural (12.7%). For psychological symptoms, the sample reported an elevated mean for trauma symptoms; however, mean anxiety and depressive symptoms were within the normal range.

Latent Profile Analysis

Table 2.2 reports the fit indices (AIC, BIC, LMRT, entropy) for the latent profile analysis (LPA) conducted using 2-, 3-, 4- and 5-profile solutions. The LPA revealed that the 4-profile

solution fit the data the best. This can be seen when comparing the LMR and BLRT tests for the 5- and 4-profile solutions. Moreover, the 4-profile solution had lower AIC and BIC values than the 3-profile solution. Finally, the 5-profile solution had a profile that included fewer than 10% of the sample. Thus, the 4-profile solution was deemed to be the best-fitting model. Profile 1 was composed of 188 adolescents (44.1%), profile 2 was composed of 57 adolescents (13.4%), profile 3 included 122 adolescents (28.6%), and profile 4 included 59 adolescents (13.9%).

Table 2.3 lists the conditional response means for all variables included in the LPA by profile membership. All conditional response means for self- and teacher-reported psychological symptoms for profile 1 were lower than the other profiles, while teacher-reported social and emotional competence was higher than other profiles. Thus, profile 1 was deemed the low-symptom group (LOW). Profile 2 showed that students self-reported generally low symptoms, while teachers reported higher symptoms and lower social and emotional competence; thus, profile 2 was deemed the low student-reported, high teacher-reported symptoms group (LSHT). Profile 3 had higher self-reported symptoms, but lower teacher-reported symptoms; thus, profile 3 was deemed the high student-reported, low teacher-reported symptoms group (HSLT). Finally, conditional response means indicated that adolescents in profile 4 had both high student- and teacher-reported symptoms; thus, they were deemed the high symptoms group (HIGH).

Latent Regressions

Regarding trauma exposure, adolescents in the HIGH symptom profile had significantly greater numbers of adverse childhood experiences than adolescents in any other profile. Moreover, students in the HSLT profile had significantly greater numbers of adverse childhood

experiences than students in the LOW profile. In examining specific trauma exposures, students in the HIGH profile, compared to the LOW profile, were significantly more likely to experience all of the measured traumas, except for parent/guardian divorce or separation, and parent/guardian death. Compared to the LSHT profile, students in the HIGH profile were significantly more likely to experience violence between parents/guardians and neighborhood violence. When compared to the HSLT group, the HIGH symptom profile students were more likely to have experienced a parent/guardian death and neighborhood violence. Compared to the LOW profile, students in the LSHT profile were more likely to have experienced living with someone with a mental illness or with a substance use disorder. Compared to the LOW group, students in the HSLT group were significantly more likely to have experienced violence between parents/guardians, neighborhood violence, or living with someone with a mental illness. Finally, compared to the LSHT profile, students in the HSLT profile were more likely to have witnessed violence between parents/guardians.

The use of maladaptive coping strategies differed significantly by profile, with those in the HIGH profile characterized by the greatest level of maladaptive coping, followed in descending order by the HSLT profile, the LSHT profile, and the LOW profile. No significant differences were seen in adaptive coping. Students in the LOW profile had significantly lower rumination scores than any other profile, and students in the LSHT profile had significantly lower rumination than students in the HSLT or HIGH profiles.

In models predicting substance use, students the HIGH profile had significantly higher use of all substances (cigarettes, alcohol, marijuana, and blunts) than students in the LOW and HSLT profiles. Compared to the LSHT profile, students in the HSLT group had significantly lower

use of marijuana and blunts. Additionally, students in the HIGH group had significantly higher use of alcohol and blunts than students in the LSHT profile. Finally, students in the HSLT group had significantly higher use of alcohol than students in the LOW group. No significant substance use differences were seen between the LOW and LSHT groups.

2.5 Discussion

The aim of the current study was to identify subgroups of urban youth based on their psychological symptoms as reported by both themselves and their teachers, and to explore group differences by important characteristics. The results of the LPA produced four profiles of comorbid symptoms based on student and teacher reports. Overall, the profile with high student- and teacher-reported symptoms (HIGH) had more trauma exposure, greater use of maladaptive coping mechanisms, and higher substance use. Moreover, the profile with high student-reported, but low teacher-reported symptoms (HSLT) had similar characteristics to the students in the HIGH group. The current study added to the literature on comorbidity in urban youth by including a range of symptoms (e.g., trauma symptoms), information from multiple reporters, and a community sample.

While we hypothesized that profiles may differ by groupings of symptoms, this was not the case. We found differences in prevalence of comorbid psychological symptoms as reported by youth themselves versus by teachers. This is consistent with prior research, which has found that youth are more reliable reporters of their internalizing symptoms, while adults in their lives (i.e., parents or teachers) are better reporters of externalizing symptoms (De Los Reyes et al., 2015; Neuman et al., 2001; Ialongo et al., 1993). Using a multiple informant approach is

important for assessing adolescent mental health, as youth may display symptoms in certain contexts, but not others (De Los Reyes et al., 2015).

When students rated themselves as experiencing one type of symptom (e.g., anxiety symptoms), they also tended to rate highly on other self-reported symptoms (e.g., trauma symptoms). This is true with the exception of the measures of interpersonal relations and social problems. For example, students in the HSLT group reported elevated depressive, anxiety, and trauma symptoms, but lower interpersonal issues and social problems. This may explain some of the disagreement between the self and teacher report in the HSLT group. If students in this subgroup are not displaying symptoms to the point of having issues with other peers or adults, then teachers may not be recognizing the presence of psychological symptoms.

Findings from this study are consistent with a growing body of research linking adverse childhood events and psychological disorders in youth (Schilling et al., 2007; McLaughlin, 2017). The group with high levels of self- and teacher-reported symptoms (HIGH) experienced more adverse childhood experiences than other urban youth, followed by youth with high self-reported symptoms and low teacher-reported symptoms (HSLT). Of note, compared to the LOW group, all other subgroups of youth were more likely to have ever lived with someone with a mental health disorder. Moreover, youth in the HSLT and HIGH groups were more likely to have experienced adverse events related to violence (i.e., witnessing or experiencing neighborhood violence, or witnessing violence between parents/guardians) than youth in the other subgroups. The association between adverse childhood events and comorbidity seen in this study of urban youth underscores the need for systems that promote positive emotional

development for youth who have experienced multiple traumas to prevent the development of psychological disorders (Bethell, Carle, et al., 2017; Bethell, Solloway, et al., 2017).

With respect to coping styles, maladaptive coping and rumination each differed across youth subgroups. There was a significant increase in these negative coping factors from the LOW to LSHT to HSLT to HIGH groups (with the exception that rumination did not increase between the HSLT and HIGH groups). By contrast, adaptive coping--the only protective factor or positive characteristic tested--did not differ significantly by subgroup. These findings are consistent with prior studies examining coping and adolescent mental health (Thompson et al., 2010; Groth et al., 2019). In a meta-analysis examining coping as a mediator in the relationship between locus of control and mental health, maladaptive coping was found to be a significant mediator between locus of control and mental health, while adaptive coping was not a significant mediator, nor was it significantly associated with mental health (Groth et al., 2019). Thus, maladaptive coping strategies, including rumination, may play a more significant role in the development or exacerbation of psychological symptoms.

In examining substance use, students in the HIGH symptom group reported greater use of all substances measured. However, there were no significant differences in substance use between the LOW and LSHT groups. Results showed that the largest differences in substance use across subgroups were in alcohol and blunt use. While alcohol use in the general U.S. adolescent population has significantly decreased over the past 20-30 years (Peiper et al., 2016), recent research shows that youth who live in low-income urban neighborhoods use alcohol at higher rates than youth in wealthier urban settings (Davis & Grier, 2015). Moreover, youth in low-SES settings are more likely to use blunts and less likely to use bongs/joints/pipes

as their route of marijuana consumption compared to their high-SES counterparts (Trapl & Koopman Gonzalez, 2017). While higher prevalence of alcohol and blunt use may have improved our ability to see differences between comorbidity subgroups, the low prevalence of cigarette and marijuana use may have limited our ability to see subgroup differences.

Limitations

The current study has several limitations. The relatively small size of the sample for the LPA and latent regressions, while exceeding the theoretical minimum, may have limited our ability to detect some possible differences between groups in characteristics low in prevalence, such as cigarette and marijuana use. Data used for the current study were cross-sectional so it was not possible to establish temporality with respect to development of symptom profiles versus correlates tested. For example, it is not clear whether maladaptive coping strategies led to the onset of symptoms or vice versa or whether causal pathways were bidirectional. Finally, all measures of the correlates were self-reported, which may have led to the observed higher associations between the correlates and self-reported mental health symptoms.

Future Directions

This study's identification and evaluation of distinct psychological subgroups may help inform assessments and interventions for urban youth. Future research seeking to understand the development of comorbid psychological symptoms in urban youth would benefit from prospective designs to track risk and protective factors and their effects on mental health. By establishing temporality with longitudinal study designs, risk and protective factors emerging earlier in the developmental pathway of comorbid symptoms could be clearly identified to target for prevention efforts. The current study may assist the progression of prevention

research in identifying urban youth who are most at-risk of developing comorbid mental health disorders. This research can inform culturally and developmentally appropriate programs to promote positive development in urban youth.

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Table 2.1. Student Demographics

Characteristics			(*n* = 426)
Age in years, mean (range)			13.22 (11-15)
Female sex, *n* (%)			250 (58.69)
Race, *n* (%)			
American Indian/Alaskan Native			13 (3.24)
Asian or South Asian			7 (1.75)
African American			281 (70.07)
Native Hawaiian/Pacific Islander			7 (1.75)
White			42 (10.47)
Multicultural			51 (12.72)
Hispanic/Latinx, *n*(%)			57 (13.48)
Psychological Symptoms	Reporter	Cronbach's α	M(SD)
Anxiety symptoms (PROMIS)	Student	.83	57.03 (10.13)
Depression symptoms (CDI)	Student	.86	3.39 (3.83)
Trauma symptoms (CPSS)	Student	.92	16.64 (12.38)
Interpersonal Relations (YOQSR)	Student	.73	4.47 (6.38)
Social Problems (YOQSR)	Student	.66	2.28 (3.50)
Externalizing (SDQ)	Teacher	.88	5.59 (4.36)
Internalizing (SDQ)	Teacher	.76	4.46 (3.32)
Social and Emotional Competence (SCS)	Teacher	.96	4.97 (0.99)
Correlates			*n* (%)
Parent/guardian divorce or separation	Student	N/A	223 (53.35)
Parent/guardian death	Student	N/A	49 (11.64)
Parent/guardian served jail time	Student	N/A	143 (34.54)
Witnessing violence between parents/guardians	Student	N/A	72 (17.31)
Witnessed or victim of neighborhood violence	Student	N/A	112 (26.86)
Lived with someone with mental illness	Student	N/A	73 (17.46)
Lived with someone with substance use disorder	Student	N/A	64 (15.27)
Treated/Judged unfairly because of race/ethnicity	Student	N/A	56 (13.37)
Cigarette use (YRBS)	Student	N/A	19 (4.49)
Alcohol use (YRBS)	Student	N/A	59 (14.01)
Marijuana use (YRBS)	Student	N/A	29 (6.84)
Blunt use (YRBS)	Student	N/A	33 (7.80)
			M(SD)
Total ACES Score	Student	N/A	1.86 (1.65)
Maladaptive coping (Brief COPE)	Student	.75	23.66 (5.92)
Adaptive coping (Brief COPE)	Student	.85	36.74 (9.50)
Rumination (CRSQ)	Student	.90	1.23 (0.75)

Table 2.2. Model fit indices for the 2-, 3-, 4-, and 5-profile solutions

Fit statistic	2-profile	3-profile	4-profile	5-profile
Log-likelihood	-4212.80	-4112.10	-4022.00	-3950.95
AIC	8475.60	8292.20	8130.00	8005.90
BIC	8576.96	8430.05	8304.34	8216.73
SSA-BIC	8497.62	8322.16	8167.88	8051.72
Entropy	.821	.834	.830	.864
LMR test	505.71	201.40	180.21	142.09
LMR, p-value	<0.0001	0.04	0.01	0.11
BLRT test	496.59	197.77	176.96	139.53
BLRT p-value	<0.0001	0.04	0.01	0.11
Error messages	NO	NO	NO	NO
Two-profile model	2			
1, n = 259, 60.8%	0.041			
2, n = 167, 39.2%	0.934			
Three-profile model	2	3		
1, n = 235, 55.2%	0.039	0.003		
2, n = 135, 31.7%	0.873	0.052		
3, n = 56, 13.1%	0.073	0.920		
Four-profile model	2	3	4	
1, n = 188, 44.1%	0.038	0.035	0.001	
2, n = 57, 13.4%	0.917	0.014	0.019	
3, n = 122, 28.6%	0.011	0.879	0.039	
4, n = 59, 13.9%	0.022	0.076	0.898	
Five-profile model	2	3	4	5
1, n = 57, 13.4%	0.036	0.066	0.012	0.000
2, n = 49, 11.5%	0.901	0.010	0.063	0.006
3, n = 190, 44.6%	0.004	0.930	0.032	0.000
4, n = 117, 27.5%	0.034	0.055	0.904	0.000
5, n = 13, 3.1%	0.040	0.000	0.018	0.935

Table 2.3. Comorbidity profile conditional response mean z-scores and standard deviations

Variable	Profile 1: LOW (*n* = 188)	Profile 2: LSHT (*n* = 57)	Profile 3: HSLT (*n* = 122)	Profile 4: HIGH (*n* = 59)
Anxiety symptoms	-.54 (.84)	-.33 (.86)	.67 (.77)	.70 (.79)
Depression symptoms	-.59 (.40)	-.32 (.77)	.56 (.81)	1.02 (1.38)
Trauma symptoms	-.72 (.53)	-.41 (.69)	.91 (.63)	.98 (.81)
Interpersonal Relations	-.65 (.66)	-.19 (.73)	.39 (.67)	1.53 (.71)
Social Problems	-.37 (.52)	-.21 (.63)	-.22 (.63)	1.93 (1.00)
Externalizing	-.44 (.69)	1.46 (.69)	-.30 (.75)	.54 (.93)
Internalizing	-.39 (.77)	.95 (1.06)	.06 (.93)	.16 (1.02)
Social and Emotional Competence	.37 (.71)	-1.32 (.84)	.36 (.75)	-.60 (1.01)

Table 2.4. Latent regression models of comorbidity profile membership with trauma exposure, coping, and substance use

Variables	Global Wald Test W (p)	LOW vs. LSHT β (p)	LOW vs. HSLT β (p)	LOW vs. HIGH β (p)	LSHT vs. HSLT β (p)	LSHT vs. HIGH β (p)	HSLT vs. HIGH β (p)
Parent/guardian divorce or separation (ACES)	4.27 (.23)	-0.09 (.34)	-0.11 (.13)	-0.14 (.09)	-0.02 (.83)	-0.06 (.61)	-0.04 (.73)
Parent/guardian death (ACES)	6.90 (.08)	-0.01 (.90)	0.06 (.14)	-0.12 (.07)	0.07 (.26)	-0.12 (.16)	**-0.18 (.01)**
Parent/guardian served jail time (ACES)	**8.05 (.045)**	-0.07 (.39)	-0.13 (.06)	**-0.21 (.02)**	-0.06 (.52)	-0.14 (.21)	-0.08 (.47)
Witnessing violence between parents/guardians (ACES)	**16.33 (.001)**	0.02 (.64)	**-0.14 (.01)**	**-0.22 (.004)**	**-0.16 (.01)**	**-0.24 (.004)**	-0.08 (.41)
Witnessed or victim of neighborhood violence (ACES)	**24.95 (.000)**	-0.05 (.55)	**-0.14 (.03)**	**-0.39 (.000)**	-0.10 (.25)	**-0.34 (.001)**	**-0.24 (.01)**
Lived with someone with mental illness (ACES)	**25.25 (.000)**	**-0.14 (.03)**	**-0.18 (.001)**	**-0.28 (.000)**	-0.04 (.62)	-0.14 (.15)	-0.10 (.31)
Lived with someone with substance use disorder (ACES)	**9.33 (.03)**	**-0.13 (.048)**	-0.10 (.07)	**-0.15 (.03)**	0.04 (.62)	-0.02 (.82)	-0.06 (.49)
Treated/Judged unfairly because of race/ethnicity (ACES)	6.33 (.10)	-0.09 (.16)	-0.01 (.76)	**-0.15 (.02)**	0.08 (.27)	-0.06 (.46)	-0.14 (.07)
Total ACES Score	**30.07 (.000)**	-0.48 (.11)	**-0.71 (.002)**	**-1.69 (.000)**	-0.24 (.47)	**-1.21 (.01)**	**-0.98 (.02)**
Maladaptive coping (Brief COPE)	**165.08 (.000)**	**-1.95 (.04)**	**-6.26 (.000)**	**-10.30 (.000)**	**-4.31 (.000)**	**-8.35 (.000)**	**-4.03 (.001)**
Adaptive coping (Brief COPE)	2.24 (.52)	1.01 (.57)	-1.32 (.36)	-1.52 (.46)	-2.33 (.23)	-2.53 (.30)	-0.20 (.93)
Rumination (CRSQ)	**136.32 (.000)**	**-0.26 (.02)**	**-0.94 (.000)**	**-0.89 (.000)**	**-0.68 (.000)**	**-0.63 (.000)**	0.05 (.74)
Cigarette use (YRBS)	**10.17 (.02)**	-0.07 (.24)	0.00 (.99)	**-0.24 (.003)**	0.07 (.23)	-0.17 (.09)	**-0.24 (.01)**
Alcohol use (YRBS)	**19.39 (.000)**	-0.11 (.16)	**-0.12 (.04)**	**-0.43 (.000)**	-0.01 (.92)	**-0.32 (.01)**	**-0.31 (.01)**
Marijuana use (YRBS)	**19.24 (.000)**	-0.15 (.07)	0.03 (.22)	**-0.40 (.000)**	**0.18 (.03)**	-0.25 (.05)	**-0.43 (.000)**
Blunt use (YRBS)	**24.64 (.000)**	-0.14 (.08)	0.04 (.12)	**-0.47 (.000)**	**0.18 (.02)**	**-0.33 (.01)**	**-0.51 (.000)**
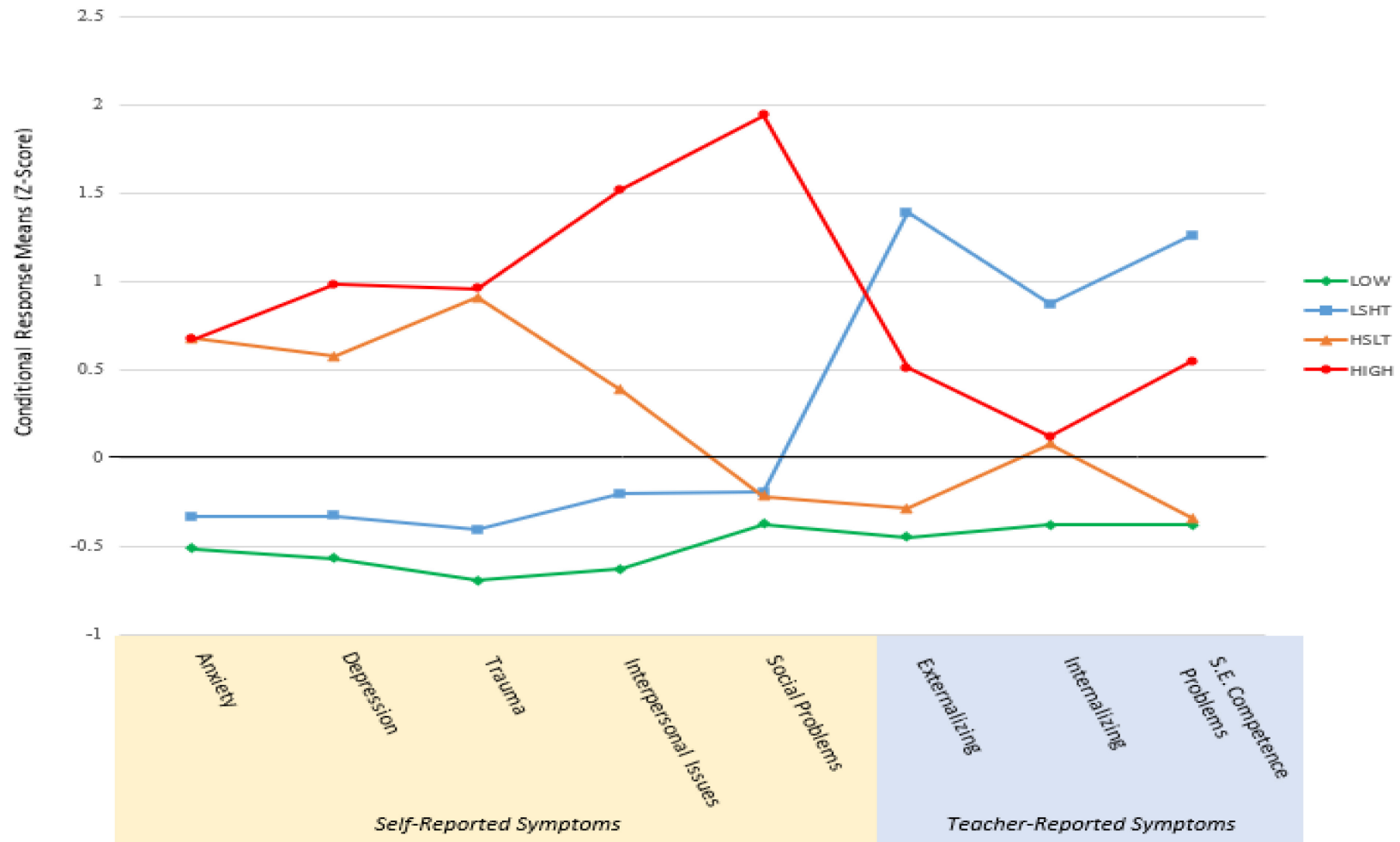
Figure 2.1. Z-score conditional response means by comorbidity profile membership

Note: LOW = overall low symptoms; LSHT = low self-reported, high teacher-reported symptoms; HSLT = high self-reported, low teacher-reported symptoms; HIGH = overall high symptoms; S.E. Competence Problems = problems with social and emotional competence – LPA conducted with social and emotional competence variable which was reversed for the figure

Chapter 3: Profiles of Comorbidity in Urban Youth: A Validation Study Exploring Sex Differences and Trait Mindfulness

3.1 Abstract

Purpose: To confirm latent profiles of psychological comorbidity in an urban adolescent sample, to examine differences in sex and trait mindfulness across these profiles, and to explore the potential interaction of sex and trait mindfulness.

Methods: Cross-sectional data from 201 eighth grade students from nine Baltimore City public elementary/middle schools were analyzed using confirmatory latent profile analysis and latent regressions. Variables for latent profile analysis included self-reported symptoms (i.e., anxiety, depression, and trauma symptoms, interpersonal issues and social problems) and teacher-reported symptoms (i.e., externalizing, internalizing, and social and emotional competence). Seven confirmatory latent profile analyses with varying levels of constraints were conducted. Regressions with profile membership as the independent variable were estimated to predict sex, trait mindfulness, and the interaction of sex and trait mindfulness.

Results: Confirmatory latent class analyses showed that the 4-profile solution with fixed thresholds was the best fit for the data. The profile characterized by high self-reported and low teacher-reported symptoms contained significantly more females than the other profiles. Moreover, the profiles characterized by low self-reported symptoms had higher trait mindfulness. Finally, trait mindfulness differed significantly more across profiles for female students than male students.

Conclusions: The current study may inform future research targeting prevention programming, including mindfulness-based interventions, to youth at risk of developing comorbid psychological symptoms.

3.2 Introduction

Psychological comorbidity, or the presence of symptoms of more than one mental health disorder, has gained attention in the field of psychiatric epidemiology due to its high prevalence and negative sequelae. Persons with multiple psychiatric disorders are more likely to have severe symptoms and lower social competence than those with one mental health disorder (Cerda et al., 2008; Renouf et al., 1997). Moreover, having comorbid diagnoses increases the risk of suicide (McManama O'Brien & Berzin, 2012; Renaud et al., 2008) and substance use (Roberts et al., 2007; Zilberman et al., 2003). In adults, the National Comorbidity Survey Replication (NCS-R) found that 27.7% of the sample reported at least two mental health disorders during their lifetime (Kessler et al., 2005). Among adolescents, results from the 2000 National Household Survey of Drug Abuse (NHSDA) showed that 37.7% of the sample reported two or more comorbid psychological symptom clusters (Chen et al., 2005). Moreover, two-thirds of the adolescents who reported one symptom cluster reported at least one additional symptom cluster (Chen et al., 2005).

Smaller studies of urban youth have begun to show that comorbidity is highly prevalent in this population. For example, one study of community-referred urban adolescents in need of treatment found that 80% of the sample had multiple mental health disorders (Hogue & Dauber, 2011). In the 2000 NHSDA, compared to all other ethnic groups, Black adolescents reported more comorbid symptoms (Chen et al., 2005). Minority urban youth are at risk of developing comorbid disorders due to their exposure to stressors related to structural and economic disenfranchisement (Pahl et al., 2020; Urban Institute, 2015; Farahmand et al., 2012). With the high prevalence of comorbidity in urban youth, and its negative consequences, more

information is needed about the characteristics of urban youth with comorbid psychological symptoms to better target interventions and mental health services.

Sex Differences in Comorbidity

A great deal of research has focused on sex differences in the prevalence of mental health disorders. Studies with adults have shown that women not only have a higher prevalence of depression and anxiety disorders than men, but they also suffer from greater illness burden from these disorders (McLean et al., 2011; Altemus et al., 2014; Gater et al., 1998; Zlotnick et al., 2007; Kessler et al., 1994). Among incarcerated adults, women were found to be more likely to have an internalizing disorder than men, while there were no sex differences in externalizing disorders (Zlotnick et al., 2007). Women were also found to be more likely than men to have comorbid mental health disorders than men (Zilberman et al., 2003). Similar patterns are seen in adolescents, where girls are more likely than boys to have anxiety and affective disorders, as well as comorbid psychiatric diagnoses (Chen et al., 2005; Hamblin, 2016). However, boys have a higher prevalence of externalizing disorders than girls (Hamblin, 2016).

Sex differences in mental health and comorbidity in adolescents may be explained by differences in experiencing symptoms, reporting of symptoms, and observations of behavior by adults. Research supports the impact that gender roles and norms have on the experience and reporting of psychological symptoms (WHO, 2002). For example, parents are more likely to restrict the behavior of adolescent girls as compared with boys and are more likely to have lower expectations for girls' achievement, which may lead girls to feel a lack of control or autonomy and contribute to development of depression (WHO, 2002; Nolen-Hoeksema, 2001).

However, socialization of boys teaches them not to express their emotions, which may lead to an underreporting of symptoms compared to girls (WHO, 2002; Hamblin, 2016). Compared to boys, girls are more likely to seek help for mental health disorders (Hamblin, 2016). Research has shown that adults, including teachers, are better able to identify behavioral problems, such as externalizing symptoms, in boys compared to girls (Hamblin, 2016). Moreover, prior studies show that teachers tend to have higher expectations of female students than male students (Gershenson et al., 2016), and teachers are more likely to report symptoms if a student is not doing well academically, which is a pattern more often seen with boys compared to girls (Green et al., 1996). These factors contribute to the sex differences in adolescent psychiatric diagnoses and comorbidity.

Trait Mindfulness and Mental Health

Trait mindfulness, defined as one's average level of mindfulness (Siegling & Petrides, 2014) or the frequency with which individuals are in a mindful state (Deng et al., 2020; Glomb et al., 2011), has been linked to improved mental health in studies of adults, including lower symptoms of depression and anxiety and lower substance use (Petrocchi & Ottaviani, 2016; Brown & Ryan, 2003; Fernandez et al., 2010). Trait mindfulness is a complex construct that encompasses several components, including the ability to describe inner experiences, observe experiences, act with awareness, and be non-judgmental of and non-reactive to experiences (Calvete et al., 2017; Baer et al., 2006). In a longitudinal study with young adults, the trait mindfulness quality of non-judging served as a protective factor against depression (Petrocchi & Ottaviani, 2016). In adolescents, studies have found that trait mindfulness, particularly acting with awareness, was associated with lower depressive symptoms (Calvete et al., 2017; Ciesla et

al., 2012; Royuela-Colomer & Calvete, 2016). Moreover, a longitudinal study in adolescents found that acting with awareness attenuated the association between stress and externalizing symptoms, as well as self-injurious behavior (Calvete et al., 2017). However, little to no research has been conducted specifically examining the associations between psychological symptoms and trait mindfulness in urban youth.

Comorbidity Profiles

A small body of literature has focused on identifying subgroups of youth experiencing comorbid psychological symptoms (Ferdinand et al., 2005; Fergusson et al., 1994; Gomez & Vance, 2014; Hogue & Dauber, 2011; Liu et al., 2017; Neuman et al., 2001; Peiper et al., 2015; Van Lang et al., 2006; Wadsworth et al., 2001). Subgroupings have differed across these studies due to the disorders being measured, the reporters of those symptoms, and the environments from which youth are sampled (i.e., youth from juvenile justice settings versus those in clinical care versus those in need of treatment from the community). The goal of this type of research is to group individuals based on their experienced symptoms to better understand the heterogeneity of symptom types and severity, as well as inform policy and better allocate resources for prevention and intervention programming (Peiper et al., 2015). A prior cross-sectional study of urban 8th grade students by our team identified four comorbidity groups using latent profile analysis of youth self-reported and youth teacher-reported symptoms: 1) overall low symptoms, 2) low student-reported, high teacher-reported symptoms, 3) high student-reported, low teacher-reported symptoms, and 4) overall high symptoms (Webb, Musci, & Mendelson, under review). Confirming whether these same groups also characterize a different sample of urban youth will contribute to evaluating the robustness of the groups in

urban youth, an important step toward refining theory on psychological comorbidity in youth (Schmiege et al., 2017).

Current Study

The current study addresses key gaps in the literature on comorbidity, sex differences, and trait mindfulness in urban youth, an understudied, at-risk population. The study used information from multiple informants and explored the role of trait mindfulness, which has been primarily studied in White samples. The first goal of the current study was to validate in a new sample the latent profile structure found in the prior study of Baltimore City middle school youth using the emerging methodology of confirmatory latent profile analysis (Webb et al., under review; Schmiege et al., 2017). The second goal was to explore sex differences in the comorbidity profiles. We hypothesized, based on the current literature on sex differences in adolescent mental health (Hamblin, 2016), that the profiles with low self-reported and high teacher-reported symptoms would include a greater proportion of boys than girls, as boys are less likely to report their own symptoms, but teachers may better able to identify externalizing symptoms in boys than girls. Moreover, we expected that the profiles with high self-reported symptoms would have a greater proportion of females than males, given the higher prevalence of internalizing symptoms in girls and evidence showing girls are more likely to report and seek help for mental health symptoms (Hamblin, 2016; WHO, 2002). We also explored the associations between trait mindfulness and profile membership, with the expectation that higher trait mindfulness would be seen in the profile with low self- and teacher-reported symptoms compared to the other three comorbidity groups. Finally, we explored the moderating effect of sex on the associations between profile membership and trait

mindfulness. As this is a novel study question, we did not have specific hypotheses or expectations for this study goal.

3.3 Methods

Participants

The current study used baseline data from 201 8th grade students across nine Baltimore City public schools. Students were recruited as part of a larger randomized controlled trial assessing a school-based mindfulness program (RAP Club) compared to an active control program focused on general health education. The trial recruited students from various Baltimore City public elementary/middle schools across four years. The sample for the current study is from the fourth-year cohort of the trial. Parental consent and student assent were collected for each participating student. Both the randomized controlled trial and the current study received approval from the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Measures

One week prior to the beginning of interventions, students were asked to complete self-report measures assessing their psychological well-being and their trait mindfulness. Additionally, two 8th grade teachers from each school rated participating students' symptoms and behavior.

Self-Report Measures

Social and demographic factors in student surveys included age, sex (0 = female, 1 = male), ethnicity, and race (African American, White, American Indian/Alaskan Native, Asian/South Asian, Native Hawaiian/Other Pacific Islander, Multicultural).

The *Children's Depression Inventory – Short Form* (CDI-S; Kovacs, 1992) was used to measure depressive symptoms in youth. The CDI-S is a 10-item self-report measure of depressive symptoms over the past two weeks, with total scores that range from 0 – 20. The measure demonstrated adequate reliability within the current sample (see Table 3.1). Four self-report items were selected from the *PROMIS Pediatric Anxiety Item Bank v2.0* (Pilkonis et al., 2011) to measure anxiety symptoms over the past seven days. Raw sum scores were converted to standardized t-scores. In the current sample, the measure demonstrated adequate reliability. The *Child PTSD Symptom Scale* (CPSS; Foa et al., 2001) was used to measure trauma symptoms in youth. The measure consists of 17 self-report symptom items, which are summed to create an overall symptom severity score. For the current sample, the measure demonstrated adequate reliability. The *Youth Outcome Questionnaire – Self Report* (YOQSR; Wells et al., 2003) was used to measure students' behavior. The measure is comprised of five subscales, including intrapersonal distress, somatic symptoms, interpersonal relations, social problems, and behavioral dysfunction. The interpersonal relations subscale demonstrated adequate reliability, but the social problems subscale demonstrated reliability slightly below the common reliability cutoff of .70 in the current sample. However, given that the reliability was close to the conventional cutoff and the subscale was used in the prior study, we decided to include the social problems subscale in the current study.

The *Child and Adolescent Mindfulness Measure* (CAMM; Greco et al., 2011) was used to measure trait mindfulness. The measure is comprised of 10 items, which are reverse scored and summed to create an overall trait mindfulness score, with higher scores indicating greater trait mindfulness. The measure had adequate reliability.

Teacher Measures

Teachers completed the *Strengths and Difficulties Questionnaire* (SDQ; Goodman, 1997) and the *Social Competence Scale* (SCS; Kam & Greenberg, 1998). The SDQ is a 25-item measure of students' behavior. Two scores were calculated from the SDQ: externalizing and internalizing symptoms. Both subscales demonstrated adequate reliability in the study sample. The SCS is a 31-item measure of students' behavioral symptoms, from which we used only the 7-item social and emotional competence subscale. Higher scores indicated greater competence, and the subscale demonstrated adequate reliability in the study sample.

Statistical Analyses

Student self-reported psychological symptoms (anxiety, depressive, and trauma symptoms) and behavior (interpersonal relations and social problems), and teacher-rated behavior (internalizing, externalizing, and social and emotional competence) were z-scored. A confirmatory latent profile analyses (CLPA) was first conducted using results from a prior study of Baltimore City middle school youth (Schmiege et al., 2017; Webb et al., under review). The previous study found a 4-profile solution (Webb et al., under review). Thus, we tested 3-, 4- and 5-profile solutions, using various constraints on thresholds and boundaries (Schmiege et al., 2017). The constraints were used to test for the presence of four specific latent profiles that were found in the prior study, including overall low symptoms (LOW), low student-reported and high teacher-reported symptoms (LSHT), high student-reported and low teacher-reported symptoms (HSLT), and overall high symptoms (HIGH; Webb et al., under review). The fit statistics for all unconstrained and constrained models were compared to find the model that best fit the data. Fit indices included -2 Log-Likelihood (-2LL), Akaike Information Criterion (AIC),

Bayesian Information Criterion (BIC), Sample-Size Adjusted Bayesian Information Criterion (a-BIC) and entropy (Nylund et al., 2007; Niileksela & Templin, 2018). The size of classes were also compared across models, and model interpretation was taken into account. All CLPA models accounted for clustering of students within schools.

After class enumeration using CLPA was completed, individual students were assigned to their most likely profile, accounting for measurement error with BCH weights (Nylund et al., 2007). The most likely membership variable was used in two latent regression models predicting to (1) sex and (2) trait mindfulness using the BCH weights (Nylund et al., 2007). Finally, to examine sex as a moderator, two latent regression models were conducted to examine the associations between trait mindfulness and profile membership in (3) females and (4) males separately. For models 1 and 2, age and ethnicity were included as covariates. Race was initially included, but due to the lack of variance in the sample, it was removed from the latent regression models. For models 3 and 4, ethnicity was further removed, as there was a lack of variance once the models were conducted by sex. All analyses were conducted using MPlus Version 8.

3.4 Results

The study sample consisted of 201 eighth grade students (M_{age} = 13.24 years, SD = 0.50 years; 63% female). Descriptive statistics for the sample are displayed in Table 3.1. The sample was primarily Black/African American (86%) or White (8%). A large portion of the sample was also Hispanic/Latinx (24%). For psychological symptoms, 49% of the sample reported elevated trauma symptoms at the cutoff score of 17 or higher, and approximately 69% reported elevated

symptoms of anxiety above the t-score cutoff of 55. However, only approximately 15% of the sample reported elevated depressive symptoms.

Enumeration of Latent Profile Model

CLCA (Schmiege et al., 2017) was conducted to replicate the profile structure found in a prior study of Baltimore City youth (Webb et al., under review). Fit indices and class sizes in seven models were compared (see Table 3.2). The lowest BIC value was seen in the 4-profile solution with fixed thresholds. The unconstrained 5-profile solution had the lowest AIC, a-BIC, -2LL, as well as the highest entropy. However, two of the profiles in the unconstrained 5-profile solution had small sample sizes. The 5-profile solution with constraints on 4 of the profiles and the unconstrained 4-profile solution also had classes with small sample sizes. Thus, the 4-profile solution with fixed thresholds was determined to be the best fit for the data. The solution revealed the same 4 profiles as the initial study: 1) overall low symptoms (LOW), 2) low self-reported and high teacher-reported symptoms (LSHT), 3) high self-reported and low teacher-reported symptoms (HSLT), and 4) overall high symptoms (HIGH; Webb et al., under review). The profile structure and z-score conditional means, which match those from the prior study, can be seen in Figure 2.1.

Sex Differences

The LOW and HSLT groups were majority female, while the HIGH symptom group was primarily male, and the LSHT group was evenly divided between males and females (see Table 3.3). Table 3.4 displays results of the latent regression analyses. The first model testing for sex differences showed that there was a significantly higher proportion of females in the HSLT

profile compared to the LOW, LSHT, and HIGH profiles. No other significant differences were seen in sex composition between comorbidity profiles.

Trait Mindfulness

The second latent regression model testing for differences in trait mindfulness found several differences across comorbidity profiles (see Table 3.4). The results showed that students in the HSLT and the HIGH profiles had significantly lower trait mindfulness than students in the LSHT and LOW symptom profiles. No significant differences were seen between the LOW and LSHT profiles, nor the HSLT and HIGH symptom profiles.

Stratified Analyses

Latent regressions stratified by sex (Table 3.4) revealed more significant differences in trait mindfulness across profiles for females than males. Among females, the two profiles with low self-reported symptoms (LOW and LSHT) had significantly higher trait mindfulness than the profile with high self-reported symptoms (HSLT and HIGH). However, among males, only the students in the HIGH symptom profile had significantly lower trait mindfulness than the profiles with low self-reported symptoms (LOW and LSHT). While the HSLT group had lower trait mindfulness than the LOW and LSHT groups for boys, these differences were not statistically significant. Finally, the difference in trait mindfulness between the HIGH symptom group and the LOW and LSHT symptom groups was more pronounced for females than for males (see Figure 3.1).

3.5 Discussion

The aim of the current study was to validate the profile structure of comorbid psychological symptoms as reported by urban middle school students and their teachers, and

to explore profile differences in sex and trait mindfulness. Our analyses replicated the same four profiles of comorbidity as reported in prior work (Webb et al., under review) using fixed thresholds. The profile with high student self-reported symptoms and low teacher-reported symptoms (HSLT) contained significantly more females than the other three profiles. Moreover, the students in the profiles with high self-reported symptoms (HSLT and HIGH) had significantly lower trait mindfulness than the students in the low self-reported symptom profiles (LOW and LSHT). Finally, more significant differences in trait mindfulness across comorbidity profiles were seen for female students than male students.

As we hypothesized, there were more females in the comorbidity profile with high self-reported symptoms and low teacher-reported symptoms (HSLT) than in the other profiles. This finding is consistent with previous research on sex differences in mental health: female youth are more likely to report symptoms of psychological disorders than males (Hamblin, 2016). Moreover, several of the self-report measures were focused on internalizing symptoms, which have a higher prevalence in females than males (Hamblin, 2016). We did not find a greater number of males in the profile with low self-reported and higher teacher-reported symptoms (LSHT) as expected. In fact, this profile was evenly divided between males and females. However, the profile with high self- and teacher-reported symptoms (HIGH) had more males than females. Prior research has found that there tends to be more conflict in teachers' relationships with male students than female students (Koepke & Harkins, 2008), which may explain the sex differences seen in teacher reports in the current study. Moreover, teachers are more likely to notice externalizing symptoms, which are more common in male students, than internalizing symptoms, which are more prevalent with female students (Hamblin, 2016).

However, the high self-reported symptoms in the majority male HIGH symptom profile is unexpected, given that prior research has found that boys are less likely than girls to report their mental health symptoms (Hamblin, 2016).

As hypothesized, trait mindfulness was higher in the comorbidity group with low self- and teacher-reported symptoms (LOW) than the profiles with high self-reported symptoms (HSLT and HIGH). This is consistent with prior literature demonstrating higher levels of trait mindfulness is associated with lower mental health symptoms, such as depression and anxiety (Brown & Ryan, 2003; Calvete et al., 2017). However, trait mindfulness was not lower in the profile with low self-reported and higher teacher-reported symptoms (LSHT) as we had expected. In fact, the LSHT group also had significantly higher trait mindfulness than the HSLT and HIGH symptom profiles. The majority of research on trait mindfulness and mental health has relied on self-reported mental health symptoms (Brown & Ryan, 2003; Calvete et al., 2017; Baer et al., 2006), while the current study included reports from teachers. Findings from the current study suggest that the symptoms that teachers are reporting may not have the same associations with trait mindfulness as self-reported symptoms. Additionally, trait mindfulness might have been more closely associated with the self-reported symptoms, as it is an internal state that relies upon self-report to be measured. This suggests potential issues with relying on teachers alone to refer students for targeted school-based mindfulness programming. As seen in the study, youth who had high-self reported symptoms, but whose teachers did not report symptoms, had lower trait mindfulness and could potentially benefit from mindfulness interventions. However, these students may be missed if relying upon teachers for referrals into mindfulness programming.

Overall, greater differences in trait mindfulness were seen across profiles for female students than male students. Key characteristics of internalizing disorders, such as depression, are the use of rumination as a coping strategy, and having a negative cognitive bias (i.e., a focus on negative content in memories, or interpretation of the environment; Paul et al., 2013). Prior research has shown that higher levels of trait mindfulness are protective against rumination and having a negative cognitive bias (Paul et al., 2013; Raes & Williams, 2010; Frewen et al., 2008). As internalizing disorders and the use of rumination as a coping strategy are more common in females than males (Hamblin, 2016; Johnson & Whisman, 2013), this might be a reason why trait mindfulness may play a larger role in psychological comorbidity for girls as compared with boys in this sample. Research on sex differences in the response to mindfulness programming is in an early stage; however, some preliminary studies in adults (Katz & Toner, 2013; Rojiani et al., 2017) and adolescents (Kang et al., 2018) have shown that females may benefit from mindfulness programming more than males. If trait mindfulness has a stronger link to psychological functioning for urban minority girls as compared with boys, then it is important for future studies to explore if mindfulness-based programs have differential impacts by sex on mental health in urban minority adolescents. .

Limitations

The current study has several limitations. The relatively small sample size may have limited our ability to see differences among the profiles. Data for the current study were cross-sectional, so it was not possible to determine temporality between trait mindfulness and comorbidity profile membership. Additionally, trait mindfulness was measured using the CAMM, which is a brief self-report measure that does not differentiate the five components of

trait mindfulness. Moreover, the self-report nature of the measure may contribute to the stronger associations with self-reported psychological symptoms seen in the current study. Future work is needed to improve the measurement of trait mindfulness (Coffey et al., 2010). Finally, the first item of the CPSS was excluded from the measure so that participating students would not be asked to disclose specific trauma exposures. This exclusion limits our ability to make conclusions about the presence of clinical disorder; however, rates of trauma symptoms measured in the sample are similar to those found in other samples of urban youth (Springer & Padget, 2000).

Future Directions

The current study contributes to the literature on comorbidity in urban youth by validating a prior latent variable model of symptoms with a sample of youth from the general population and by examining associations between trait mindfulness and comorbidity. The current study contributes to the growing literature utilizing the novel methodology of confirmatory latent variable modeling and supports the need for future research to continue using this methodology to replicate latent groupings of comorbid symptoms to improve theory and targeted interventions. Further research is also needed utilizing longitudinal data to better understand the temporal relationship between trait mindfulness and comorbid psychological symptoms. By establishing temporality, researchers may be able to determine whether trait mindfulness is a potential causal factor in developing comorbid symptoms, or if trait mindfulness might be acting as a mediator between trauma experiences and psychological functioning in urban youth. Finally, findings from the current study can inform future research examining the effects of mindfulness programming on the mental health of urban minority

youth, including a focus on potential sex differences in the impact of mindfulness programming

with adolescents, an area recently highlighted as important for exploration (Rojiani et al.,

2017).

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Table 3.1. Student Demographics

Characteristic			(*n* = 201)
Age in years, mean (range)			13.24 (12-15)
Female sex, *n* (%)			126 (62.69)
Race, *n* (%)			
American Indian/Alaskan Native			2 (1.20)
Asian or South Asian			1 (0.60)
African American			143 (85.63)
Native Hawaiian/Pacific Islander			1 (0.60)
White			13 (7.78)
Multicultural			7 (4.19)
Hispanic/Latinx, *n*(%)			47 (24.10)
Psychological Symptoms	Reporter	Cronbach's α	M(SD)
Anxiety symptoms (PROMIS)	Student	.84	57.64 (10.37)
Depression symptoms (CDI)	Student	.85	3.99 (4.05)
Trauma symptoms (CPSS)	Student	.91	17.88 (12.00)
Interpersonal Relations (YOQSR)	Student	.74	5.17 (6.64)
Social Problems (YOQSR)	Student	.67	2.67 (3.84)
Externalizing (SDQ)	Teacher	.90	5.87 (4.98)
Internalizing (SDQ)	Teacher	.85	2.91 (3.42)
Social and Emotional Competence (SCS)	Teacher	.93	3.19 (1.01)
Trait Mindfulness (CAMM)	Student	.88	25.95 (8.92)

Table 3.2. Model fit indices for CLPA models

Model	Log Likelihood	# of free parameters	Adjusted χ^2 LR	Entropy	AIC	BIC	a-BIC
4 profile, unconstrained	-1851.69	43	96.50	0.823	3789.38	3931.42	3795.19
4 profile, fixed thresholds	-1885.50	11	320.31	0.767	3793.01	3829.34	3794.49
4 profile, boundary constraints	-1856.63	43	--	0.797	3799.27	3941.31	3805.08
3 profile, unconstrained	-1899.95	34	93.47	0.776	3867.90	3980.21	3872.49
3 profile, smallest class removed	-1930.55	10	412.54	0.794	3881.09	3914.13	3882.44
5 profile, unconstrained	-1804.47	52	92.51	0.854	3712.94	3884.71	3719.96
5 profile, 4 profiles constrained	-1818.69	52	--	0.839	3741.37	3913.14	3748.40

Note. n=201. LR = Likelihood ratio. AIC = Akaike information criterion. BIC = Bayesian information criterion. a-BIC = sample-size adjusted Bayesian information criterion.

Table 3.3. Comorbidity profile conditional response mean z-scores, sex composition, and mean trait mindfulness

Variable	Profile 1: LOW (*n* = 93)	Profile 2: LSHT (*n* = 28)	Profile 3: HSLT (*n* = 56)	Profile 4: HIGH (*n* = 24)
Anxiety symptoms	-0.51	-0.34	0.67	0.67
Depression symptoms	-0.57	-0.33	0.58	0.98
Trauma symptoms	-0.69	-0.41	0.91	0.96
Interpersonal Relations	-0.63	-0.21	0.38	1.52
Social Problems	-0.38	-0.20	-0.22	1.93
Externalizing	-0.45	1.39	-0.29	0.51
Internalizing	-0.38	0.87	0.08	0.12
Social and Emotional Competence	0.37	-1.25	0.35	-0.55
% Female	61.29%	50.00%	82.14%	39.13%
Trait Mindfulness, *M(SD)*	29.39 (7.44)	29.18 (8.31)	21.19 (7.25)	19.70 (10.35)
Females	28.06 (7.72)	27.00 (8.30)	20.59 (6.84)	15.44 (6.15)
Males	31.46 (6.56)	31.36 (8.03)	24.11 (8.84)	22.43 (11.72)

Note: Standard deviations for mean z-scores are not listed as threshold constraints restrained all standard deviations to 0.000.

Table 3.4. Latent regression models of comorbidity profile membership with sex, trait mindfulness, and stratified analyses by sex

Variables	Global Wald Test W (p)	LOW vs. LSHT β (p)	LOW vs. HSLT β (p)	LOW vs. HIGH β (p)	LSHT vs. HSLT β (p)	LSHT vs. HIGH β (p)	HSLT vs. HIGH β (p)
Model 1:							
Sex (0 = female, 1 = male)	**18.86 (.0003)**	-0.12 (.42)	**0.28 (.002)**	-0.22 (.09)	**0.40 (.004)**	-0.10 (.54)	**-0.50 (.000)**
Model 2:							
Trait Mindfulness (CAMM)	**54.87 (.0000)**	0.53 (.83)	**9.52 (.000)**	**11.48 (.000)**	**9.00 (.000)**	**10.96 (.001)**	1.96 (.49)
Model 3 (females):							
Trait Mindfulness (CAMM)	**46.37 (.0000)**	1.04 (.77)	**9.13 (.000)**	**14.91 (.000)**	**8.09 (.01)**	**13.88 (.001)**	5.78 (.06)
Model 4 (males):							
Trait Mindfulness (CAMM)	**13.04 (.005)**	0.35 (.91)	10.38 (.07)	**9.93 (.01)**	10.03 (.11)	**9.57 (.02)**	-0.45 (.95)

Note: For males (model 4), there was an issue with the ethnicity variable, thus ethnicity was removed from both model 3 and model 4.
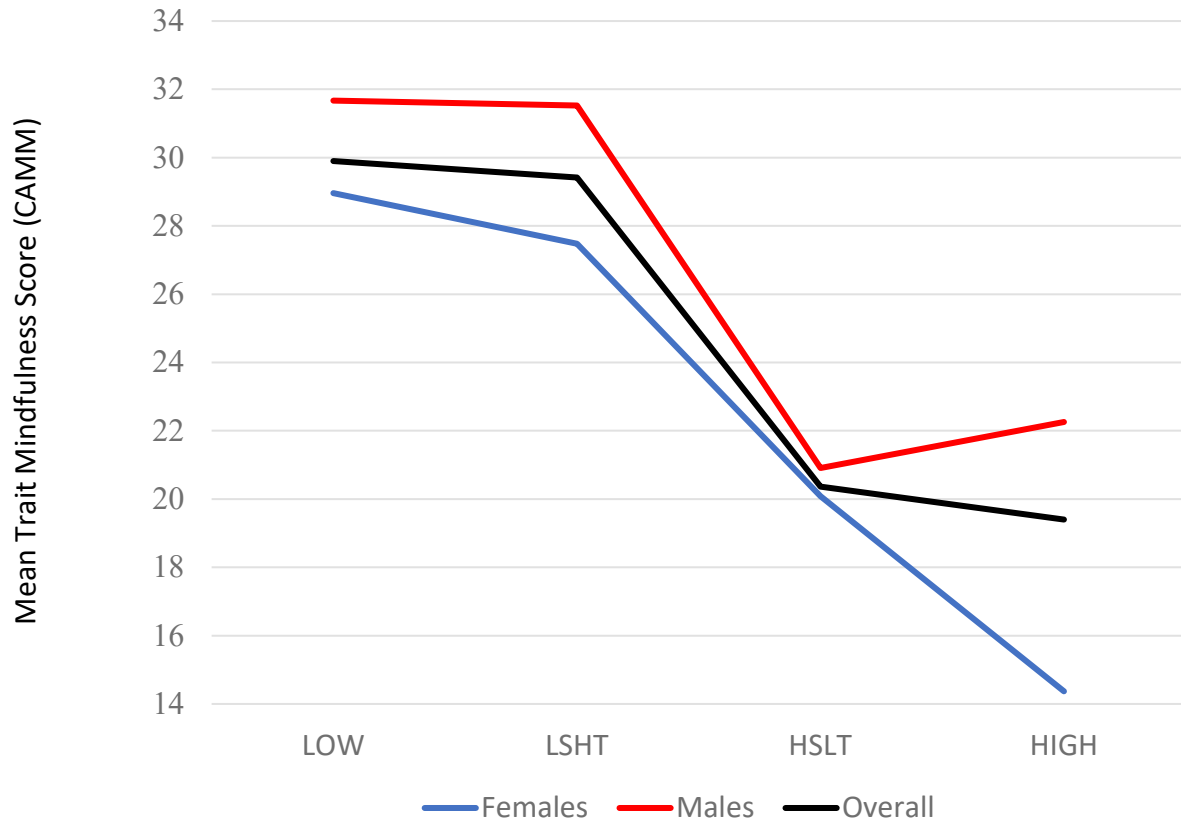
Figure 3.1. Mean trait mindfulness across comorbidity profiles for overall sample and stratified by sex.

Note: LOW = overall low symptoms; LSHT = low self-reported, high teacher-reported symptoms; HSLT = high self-reported, low teacher-reported symptoms; HIGH = overall high symptoms

Chapter 4: Trauma and Comorbidity in Urban Youth: Partial Pathways Through Respiratory Sinus Arrhythmia

4.1 Abstract

Purpose: To examine the association between trauma exposures and psychological comorbidity in urban youth, and to evaluate potential partial pathways in this association through heart rate variability.

Methods: Cross-sectional data from two studies with Baltimore City students were analyzed, which included 112 eighth and ninth grade students from 5 elementary/middle schools and 3 high schools. Students completed self-report measures of psychological symptoms, and had measurements of respiratory sinus arrhythmia (RSA) taken while completing the Trier Social Stress Task (TSST). Multilevel models were used to test the associations of specific trauma exposures, overall number of trauma exposures, and RSA with psychological comorbidity. Then partial pathways were tested with models that included the associations of both trauma exposures and RSA with comorbidity. A separate set of models were then conducted to test associations of trauma exposures, RSA, and partial pathways with comorbidity level (i.e., no symptoms, symptoms of one disorder, symptoms of two disorders, or symptoms of three disorders).

Results: No findings reached statistical significance; however, patterns in the data suggested possible associations among trauma, RSA, and comorbidity that the current study was likely underpowered to identify. Specific trauma exposures, including parent death and racial discrimination, as well as total number of trauma exposures, were associated with higher risk for comorbid mental health symptoms. Parent death and incarceration were also associated

with decreased RSA during the stress and recovery portions of the TSST. Moreover, several measures of decreased RSA were associated with greater comorbidity. Finally, the data suggested some potential partial pathways from trauma exposure to comorbidity through RSA that warrant further research.

Conclusions: The current study suggests several possible associations between psychological and physiological factors, which merit study with larger samples and longitudinal study designs. Further research is needed to understand the role of HRV in explaining the relationship between trauma and comorbid psychological symptoms in urban youth.

4.2 Introduction

Comorbidity of psychological disorders is highly prevalent, particularly in low-income urban minority youth (Chen et al., 2005; Kessler et al., 2005; Garber & Weersing, 2010; Hogue & Dauber, 2011). Psychological comorbidity in youth is associated with negative consequences both in adolescence and adulthood, including substance use (Roberts et al., 2007; Zilberman et al., 2003) and suicide (McManama O'Brien & Berzin, 2012; Renaud et al., 2008). Identification of youth at risk of developing multiple mental health disorders is key for development and implementation of prevention programming.

Trauma and Comorbidity

Research in adolescents and adults has consistently linked trauma exposure with the development of posttraumatic stress symptoms (Cisler et al., 2012; Dorrington et al., 2019; Kilpatrick et al., 2003; Lopez et al., 2017; Luthra et al., 2009; McLaughlin et al., 2013). In fact, post-traumatic stress disorder (PTSD) and depression are the most common psychological disorders that are associated with prior exposure to trauma (Cisler et al., 2012; Kilpatrick et al., 2003; Roussos et al., 2005; Lopez et al., 2017). In studies of youth, trauma exposure during childhood is associated with the development of symptoms of PTSD, depression, and anxiety in adolescence (Horowitz et al., 1995; McKay et al., 2005). Moreover, co-occurring symptoms of trauma and depression, a common comorbidity in minority populations (Myers et al., 2015), has been associated with trauma exposure (Delany-Brumsley et al., 2011; Myers et al., 2015). However, not everyone who experiences trauma goes on to develop those symptoms (Perkonigg et al., 2000).

Youth who live in low-income urban settings experience a high number of severe traumas (Stein et al., 2003; Urban Institute, 2015; Zona & Milan, 2011). Many of these trauma exposures are associated with poverty and discrimination (Pahl et al., 2020; Urban Institute, 2015; Farahmand et al., 2012). Specifically, urban youth have a high exposure to violence in their environments both at home and in the neighborhood, which has been linked to both internalizing and externalizing disorders (Lynch, 2003; Zona & Milan, 2011). Low-income minority urban youth have been found to have high rates of mental health disorders (Brooks-Gunn et al., 1997; Tolan & Henry, 1996; McKay et al., 2005).

Heart Rate Variability

Heart rate variability (HRV), which is defined as the variation in time between heart beats (Billman et al., 2015), has gained popularity in research focused on mental health. HRV is a result of the interplay of the sympathetic nervous system, which increases heart rate in response to a stressor, and the parasympathetic nervous system, which restores heart rate back to baseline levels via the vagus nerve (Dennis et al., 2014). Fluctuations in HRV can be seen in synchrony with breathing, also known as respiratory sinus arrhythmia (Billman et al., 2015; Yasuma & Hayano, 2004). During inhalation, the time between heart beats is shortened, while during exhalation that time is lengthened (Yasuma & Hayano, 2004). During times of stress, HRV tends to decrease as heart rate increases; HRV resumes its baseline level after recovery from the stressful event (Billman et al., 2015; Dennis et al., 2014).

Many studies have examined the association between trauma exposures and HRV (Haag et al., 2019; Liddell et al., 2016; van Ockenburg et al., 2015). Research has suggested that trauma exposures are associated with long-term impairment in the functioning of the vagal

nerve (Liddell et al., 2016; Porges, 2011; Thayer et al., 2012). This impairment reduces an individual's ability to adaptively react to stress; HRV becomes lower during times of stress and takes longer to come back to baseline (Liddell et al., 2016; Thayer et al., 2012).

Several studies have also linked low HRV with psychological symptoms, including depression (Hamilton & Alloy, 2016; Kemp et al., 2010; Koenig et al., 2016; Shinba, 2017; Shinba et al., 2008), anxiety (Chalmers et al., 2014; Shinba, 2017; Shinba et al., 2008), and trauma symptoms (Dennis et al., 2014; Shvil et al., 2013; Tan et al., 2011). Studies have begun to examine the association between HRV and psychological comorbidity in adults (Chang et al., 2013; Kemp et al., 2012; Kemp et al., 2014), but this association has rarely been studied in adolescents (Blom et al., 2010). Moreover, most studies conducted with adults have been with clinical samples and/or international samples that are not representative of U.S. urban populations, much less urban youth in the U.S. Given emerging evidence for links between trauma and HRV, as well as between HRV and mental health, studies have begun to examine the role that HRV plays in the associations between trauma exposures and mental health (Liddell et al., 2016). One study of adults in a post-conflict setting found that HRV mediated the association between trauma exposure and distress (Liddell et al., 2016). While urban youth also face high levels of trauma, no research has examined the role that HRV plays in explaining the association of trauma exposures with psychological comorbidity in this population.

The interactions among stress, HRV, and psychological symptoms are detailed in the neurovisceral integration model (Thayer et al., 2009). This model posits that through interactions between the prefrontal cortex and autonomic nervous system, increased exposure to stress (or trauma) can cause decreased vagal functioning and HRV, and increased allostatic

load (Thayer & Sternberg, 2006). Allostatic load is known as the "wear and tear" on the stress response and inflammatory systems, and is associated with worsened physical and psychological symptoms (Thayer & Sternberg, 2006, pp. 363). It is theorized that through these interactions, a pathway that links the mind and body exists that helps to explain the associations between trauma, HRV, and psychological symptoms.

Current Study

The current study explored cross-sectional associations between trauma exposures, HRV, and mental health in a sample of urban adolescents. The study addressed gaps in the relevant literature by assessing a sample of low-income minority urban youth from the general U.S. population and by examining comorbidity of psychological symptoms. The first goal of the study was to examine the associations of type and number of trauma exposures with comorbidity. We expected based on prior research (Horowitz et al., 1995; McKay et al., 2005) that youth who experienced trauma related to violence as well as higher numbers of trauma exposures would have more comorbid symptoms. Secondly, the current study assessed the associations between trauma exposures and respiratory sinus arrhythmia (RSA), with the expectation that traumas related to violence and higher numbers of trauma exposures would be associated with reduced RSA throughout a stress-inducing task. Third, we evaluated associations between RSA and comorbidity, expecting that lower RSA would be associated with increased comorbid psychological symptoms. Finally, we examined partial pathways between trauma exposures and comorbidity through RSA, expecting that RSA would account for some of the associations between trauma exposures and comorbid symptoms.

4.3 Methods

Participants

This study used baseline data from two randomized controlled trials of mindfulness programs conducted in Baltimore City Public Schools. Both studies assessed mindfulness-based programs in comparison to a general health active control program and collected data on heart rate variability. The first study, Project POWER (Promoting Options for Wellness and Emotion Regulation), recruited 54 eighth grade students from five elementary/middle schools as part of their fourth-year cohort. The second study, Project THAW (Teenage Health and Wellness), recruited 58 ninth grade students from three high schools. For both studies, signed parental consent and student assent were provided for each participating student. Approval was granted by Baltimore City Public Schools Institutional Review Board for both studies. Both parent studies and the current study received approval from the relevant Institutional Review Boards.

Measures

In each study, prior to randomization students completed self-reported surveys on their current psychological functioning and behavior. In a separate baseline data collection session, students were individually administered a stress-inducing task while their heart rate was measured using a photoplethysmography (PPG) ear clip.

Self-Report Measures

Social and demographic factors in student surveys included sex (male, female), age, and race (African American, Hispanic or Latinx, White Non-Hispanic, Asian or South Asian, Multicultural, Other).

Each study used a different validated measure of depression. Students in Project POWER completed the *Children's Depression Inventory – Short Form* (CDI-S; Kovacs, 1992), a 10-item self-report measure of depressive symptoms over the past two weeks, with total scores that range from 0-20. The measure demonstrated adequate reliability within the study sample (α = .89). Students in Project THAW completed the *Neuro-QOL Item Bank v1.1 Pediatric Depression Short Form* (Neuro-QOL; Cella et al., 2014), an 8-item self-report measure of depressive symptoms, with a total score range from 8-40. Raw sum scores were converted to standardized t-scores. The measure demonstrated adequate reliability in the sample (α = .86). For the CDI-S, participants were considered to have elevated depressive symptoms if they had a score of 15 or higher or if they scored at least 7 and endorsed both feelings of sadness and crying. For the Neuro-QOL, students were considered to have elevated depressive symptoms if their t-score was above the moderate cutoff of 55.

Both Project POWER and Project THAW used versions of the *PROMIS Pediatric Anxiety* measures that assessed anxiety symptoms over the past seven days. Students in Project POWER completed four items from the *PROMIS Pediatric Anxiety Item Bank v2.0* (Pilkonis et al., 2011), which has a total score range of 4-20. Students in Project THAW completed the *PROMIS Pediatric Anxiety Item Bank v2.0 Short Form 8a* (Irwin et al., 2010), which included 8 items and had a total score range of 8-40. Both PROMIS measures showed adequate reliability within their respective samples (POWER α = .85; THAW α = .85). Raw sum scores were converted to standardized t-scores and students were considered to have elevated anxiety symptoms if their t-score was above the moderate cutoff of 55.

To measure trauma symptoms, both studies utilized the *Child PTSD Symptom Scale* (CPSS; Foa et al., 2001). The measure consists of 17 items that are summed to create an overall trauma symptom severity score, which ranges from 0-51. The measure demonstrated adequate reliability in both Project POWER (α = .92) and Project THAW (α = .90), as well as in the overall sample (α = .91). Students were deemed to have elevated trauma symptoms if their symptom severity score was 16 or above (Nixon et al., 2013).

Finally, students in both studies completed 8 items drawn from a measure of *Adverse Childhood Experiences* (ACEs; Data Resource Center for Child & Adolescent Health, 2016). Students indicated if they had ever experienced the adverse childhood event listed, including parent/guardian death, parent/guardian divorce, parent/guardian in jail, witnessed violence between parents/guardians, witnessed or was victim to neighborhood violence, were judged unfairly for their race/ethnicity, ever lived with someone with a mental illness, or ever lived with someone who used drugs or alcohol. An overall count of the number of ACEs experienced was calculated for each student, which ranged from 0-8.

HRV and Stress Task

Participants in both studies had their heart rate measured using a PPT ear clip (Unyte, 2020), while completing a modified version of the Trier Social Stress Task (TSST; Kirschbaum et al., 1993) one-on-one with a blinded study staff member. At the beginning of the task, students were asked to relax for five minutes to gather a baseline measure of heart rate variability. Students were then told to imagine they were applying for an achievement award they really wanted. They were given five minutes to prepare a 5-minute speech on why they deserved the award; however, they could not use any notes that they took during the prep period. The study

staff member then told the student that they were going to video record their speech; however, no footage was taken of students during their speeches. After the 5-minute speech, students were asked to relax again for three minutes, after which they were thanked and debriefed on the task.

Physiological response data was collected throughout the five portions of the TSST in 30-second segments: 1) baseline, 2) explanation, 3) prep, 4) speech, and 5) recovery. Respiratory sinus arrythmia (RSA) was calculated using the Porges-Bohrer Method (Lewis et al., 2012), which is designed to remove variance in the data that is not due to spontaneous breathing and is able to calculate RSA when there is a high level of noise within the data. RSA was calculated for each of the five portions of the TSST.

Statistical Analyses

Preliminary analyses compared data from both Project POWER and Project THAW using t-tests. Students were then classified as either displaying comorbid symptoms (i.e., had scores above measure cutoffs for more than one disorder) or not having comorbid symptoms (i.e., displaying symptoms above a measure cutoff for one or fewer disorders). A second ordinal comorbidity variable, comorbidity level, was calculated based on the number of elevated psychological symptoms (0 = no symptoms, 1 = elevated symptoms of only one disorder, 2 = elevated symptoms of any two disorders, 3 = elevated symptoms of all three disorders).

Mixed effect logistic models were used to test the associations of trauma exposure and RSA with comorbidity, separately. Multilevel linear regression models were used to examine the associations between trauma exposure and RSA. Finally, mixed effect logistic regressions

were used to examine potential partial pathways between trauma exposures and comorbidity through RSA.

This set of analyses was conducted again assessing associations with comorbidity levels. Multilevel ordered logistic models were used to test the association of trauma exposure and RSA with comorbidity level, separately. Multilevel ordered logistic models were then conducted to test for partial pathways between trauma exposures and comorbidity levels through RSA. All mixed effect and multilevel ordered logistic models included age, sex, and study, and were multilevel in nature to account for clustering by school. Bonferroni corrections were used to account for multiple testing, where significance level was set at $p < .001$. All analyses were conducted using Stata version 14.

4.4 Results

The sample consisted of 112 eighth and ninth grade students (POWER $n = 54$, THAW $n = 58$). Descriptive statistics for the sample are displayed in Table 4.1. The sample was primarily Black/African American (85%) and the majority was female (61%). In the sample from Project POWER, elevated anxiety (59%) and trauma symptoms (50%) were highly prevalent. However, for Project THAW participants, only elevated trauma symptoms were highly prevalent (52%). Comparisons of RSA between the two samples showed no significant differences; thus, the samples were combined for all further analyses.

Trauma and Comorbidity

Models that examined the associations between trauma exposure and comorbidity showed that youth who experienced a parent death had five times higher odds of comorbid psychological symptoms (Table 4.2). Moreover, exposure to a higher number of ACEs was also

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associated with higher odds of comorbid psychological symptoms. In models that examined

trauma exposure and comorbidity levels, having lived with someone with a mental illness,

experiencing racial discrimination, and exposure to a higher number of ACEs were each

associated with greater odds of a higher comorbidity level (i.e., having more comorbid

psychological symptoms). After accounting for multiple comparisons (i.e., $p < .001$), these

findings did not reach statistical significance.

Trauma and RSA

Multilevel linear models of associations between trauma exposure and RSA during the

TSST demonstrated that youth who experience a parent/guardian death or incarceration had

lower RSA during the speech and recovery portions of the TSST (Table 4.3). However, these

findings did not reach statistical significance after accounting for multiple comparisons.

RSA and Comorbidity

Higher RSA during the explanation and preparation portions of the TSST was associated

with lower odds of psychological comorbidity (Table 4.4). Moreover, in the models of RSA and

comorbidity level, higher RSA in all five TSST portions was associated with lower odds of being

in a higher comorbidity class (i.e., lower odds of having more comorbid symptoms). These

findings were not statistically significant after accounting for multiple comparisons.

Partial Pathways

For models with comorbidity as the dependent variable (Table 4.5), interpretation of the

results focuses on parent death and total ACE score, as they were significantly associated with

comorbidity in prior models. In models that included parent death and RSA during the baseline,

explanation, preparation, and recovery periods of the stress task, experiencing a parent or

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guardian death maintained an association with increased comorbidity. However, in the model

that included parent death and RSA during the speech period of the TSST, parent or guardian

death was no longer associated with comorbidity (see Figure 4.1). In the models that included

ACE score and baseline RSA, higher ACE score was associated with increased comorbidity.

However, ACE score was no longer associated with comorbidity in models that included RSA

during the explanation, preparation, speech, and recovery periods of the TSST. After accounting

for multiple comparisons, these findings did not reach statistical significance.

For models with comorbidity level as the dependent variable (Table 4.6), description of

the results focuses on living with someone with a mental illness, racial discrimination, and total

ACE score, as they were each significantly associated with increased comorbidity level in prior

models. Models that included living with someone with a mental illness and RSA during speech

and recovery, living with someone with a mental illness maintained an association with higher

comorbidity level. However, in models that included RSA during the baseline, explanation, and

preparation periods, having lived with someone with a mental illness was no longer associated

with comorbidity level. In models of racial discrimination and RSA during the speech period,

experiencing racial discrimination was associated with greater odds of being in a higher

comorbidity level (i.e., having greater numbers of comorbid psychological symptoms).

However, in models that included RSA during the baseline, explanation, preparation, and

recovery periods, racial discrimination was no longer associated with comorbidity level. In

models that included total ACE score and RSA during the baseline, preparation, speech, and

recovery periods, higher ACE scores maintained their association with higher comorbidity

levels. However, in the model that included RSA during the explanation period, ACE score was

no longer associated with comorbidity level. Moreover, these findings did not reach statistical significance after accounting for multiple comparisons.

4.5 Discussion

The aim of the current study was to examine the associations between trauma exposures and comorbidity in urban youth, and partial pathways in that association through RSA. While no findings reached statistical significance, patterns emerged among trauma, RSA, and comorbidity that may help inform further research in this area. In particular, we found indications that RSA might be a partial pathway between the number of trauma exposures and comorbid psychological symptoms in urban youth, although effect sizes were small.

When examining the association between trauma and comorbidity, the strongest association was seen in youth who experienced a parent or guardian death; these youth were five times more likely to have comorbid psychological symptoms. This is consistent with prior research, as studies have found that death of a parent during childhood or adolescence is associated with mental health disorders, including depression and anxiety (Rheingold et al., 2003; Elizur & Kauffman, 1982; Harris, 1991; Silverman & Worden, 1992; Worden, 1996; Worden et al., 1999). In the current study, smaller associations with comorbidity were seen in youth who had lived with someone with a mental illness or who had experienced racial discrimination. Results from the current study also showed that the number of trauma exposures was potentially associated with comorbidity. Several studies have found that greater cumulative numbers of trauma exposures are associated with psychological disorders, both in adolescence and in adulthood (Myers et al., 2015; Green et al., 2010; McLaughlin et al., 2010; Lopez et al., 2017; Finkelhor et al., 2011; Huang et al., 2012). Thus, the current finding that

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higher numbers of adverse childhood events were potentially associated with higher odds of having comorbid psychological symptoms is consistent with prior literature.

Findings from the current study suggest a potential association between specific traumas (i.e., parent death and incarceration) to lower RSA during times of stress (i.e., speech) and immediately after stress (i.e., recovery), although effect sizes in these associations were small. This corresponds to some existing literature that shows that reduced HRV during times of stress is associated with trauma exposure (Liddell et al., 2016; Thayer et al., 2012). However, resting (or baseline) HRV has been found in prior literature to be associated with trauma exposure (Thurston et al., 2019; Shaikh al Arab et al., 2012), which we did not see in the current study. In addition to the associations seen with trauma exposures, several measures of RSA in the current study showed potential associations with comorbidity in urban youth. This is consistent with prior literature, which has shown that lower HRV is associated with psychological symptoms, including depression (Blom et al., 2010; Rechlin et al., 1994; Kemp et al., 2010), anxiety (Blom et al., 2010; Yeragani et al., 1993; Kawachi et al., 1995; Chalmers et al., 2014), and trauma symptoms (Chalmers et al., 2014; Dennis et al., 2014; Lakusic et al., 2007; Nagpal et al., 2013).

The current study showed the need for further research in understanding the role of RSA in the associations between trauma exposure and comorbidity. For example, in the association between parent death and comorbidity, RSA while under stress (i.e., during the speech) could potentially account for some the association. This supports the underlying theory of the neurovisceral integration model, showing a potential partial pathway between stress in the environment (i.e., parent/guardian death) and psychological symptoms through HRV (i.e.,

RSA while under stress). Prior longitudinal studies have found some evidence of the mediating effect of HRV in the associations between trauma and psychological disorders (Liddell et al., 2016). While the current study could not test mediation because of the cross-sectional design, it was the first to test associations between trauma exposures, HRV, and psychological comorbidity in urban youth.

The effects of many of the associations seen throughout the current study were relatively small, and highlights the need to examine other potential pathways. Prior research has explored a host of biological and physiological pathways between trauma and psychological symptoms. Some of these potential pathways include epigenetic changes, such as DNA methylation, (Nothling et al., 2019; van den Bosch & Meyer-Lindberg, 2019), hyperactivation of areas of the brain, including the hypothalamus-pituitary-adrenal (HPA) axis and amygdala (Tafet & Nemeroff, 2016), and neuroendocrine and immune system responses (Taylor, 2010). This aligns with prior research that calls for the development of standardized indexes of biomarker collection for studies of stress in youth to better examine multiple physiologic pathways (Condon, 2018). The findings of the current study can be used to guide further research examining various biological and physiological pathways, including HRV, in larger samples of urban youth over a longer period of time.

Limitations

The current study has several limitations. The sample size was small, which limited our power to detect statistically significant findings, particularly with the small effect sizes seen in the analyses. While the current study found similar rates of trauma symptoms as other samples of urban youth (Springer & Padget, 2000), we excluded the first item of the CPSS from data

collection, so that participating students would not be asked to disclose specific trauma

exposures. The exclusion of this item limits the measure's ability to make conclusions about the

presence of clinical disorder. Moreover, data from two studies were combined, which used

different measures of depression. While we were able to adequately address this issue by using

each measure's cutoff to determine elevated depressive symptoms, it is possible that each

measure may have been assessing differing aspects of depression or depressive symptoms, and

thus were not necessarily equivalent. Finally, some key covariates were not measured in both

studies, including physical activity and body mass index (Blom et al., 2010).

Future Directions

This study's efforts to detail the associations between trauma, HRV, and psychological

comorbidity may help to inform future studies with improvements in methodology. Future

research seeking to better understand these associations would benefit from enrolling larger

samples of at-risk youth and using prospective designs to be able to test HRV, and potentially

changes in HRV, as a mediator. By utilizing prospective study designs, researchers could

potentially identify if changes in HRV precede the development of comorbid psychological

disorders and better target when to implement prevention programming with youth who have

been exposed to trauma. The current study may also inform researchers on what types of

trauma exposures might be more salient for urban youth who have comorbid psychological

disorders that warrant further study, such as the death of a parent, parent incarceration, racial

discrimination, and polyvictimization.

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Table 4.1. Student Demographics

Characteristic	POWER (*n* = 54)	THAW (*n* = 58)	Overall (*n* = 112)
Age in years, mean (range)	13.20 (12-14)	14.60 (13-16)	13.93 (12-16)
Female sex, *n* (%)	35 (64.81)	33 (56.90)	68 (60.71)
Race, *n* (%)			
African American	48 (88.89)	47 (81.03)	95 (84.82)
Hispanic/Latinx	0 (0.00)	4 (6.90)	4 (3.57)
White Non-Hispanic	3 (5.56)	2 (3.45)	5 (4.46)
Asian or South Asian	0 (0.00)	2 (3.45)	2 (1.79)
Multicultural	3 (5.56)	0 (0.00)	3 (2.68)
Other	0 (0.00)	2 (3.45)	2 (1.79)
	n(%)	*n*(%)	*n*(%)
Anxiety symptoms	32 (59.26)	13 (22.41)	45 (40.18)
Depression symptoms	8 (14.81)	13 (22.41)	21 (18.75)
Trauma symptoms	23 (42.59)	28 (48.28)	51 (45.54)
No symptoms	16 (29.63)	23 (39.66)	39 (34.82)
Depression symptoms only	1 (1.85)	1 (1.72)	2 (1.79)
Anxiety symptoms only	12 (22.22)	4 (6.90)	16 (14.29)
Trauma symptoms only	4 (7.41)	16 (27.59)	20 (17.86)
Depression and Anxiety symptoms	1 (1.85)	1 (1.72)	2 (1.79)
Depression and Trauma symptoms	0 (0.00)	4 (6.90)	4 (3.57)
Anxiety and Trauma symptoms	12 (22.22)	1 (1.72)	13 (11.61)
Anxiety, Depression, Trauma symptoms	6 (11.11)	7 (12.07)	13 (11.61)
	M(SD)	M(SD)	M(SD)
Baseline RSA	6.88 (.75)	6.69 (.88)	6.78 (.82)
Explanation RSA	6.71 (.90)	6.55 (.97)	6.62 (.94)
Prep RSA	6.66 (.79)	6.44 (.95)	6.55 (.88)
Speech RSA	6.89 (.86)	6.68 (.90)	6.78 (.88)
Recovery RSA	6.91 (.85)	6.80 (.87)	6.85 (.86)

Table 4.2. Adjusted regression analyses of associations of trauma exposures with comorbidity and comorbidity levels

Comorbidity	OR	S.E.	95% CI	p	Wald χ^2
Parent/guardian divorce	1.46	0.63	0.62, 3.42	.38	4.38
Parent/guardian death	**5.11**	**3.72**	**1.23, 21.27**	**.03**	**7.88**
Parent/guardian incarcerated	1.21	0.53	0.52, 2.86	.66	3.81
Violence between parents/guardians	1.95	0.99	0.72, 5.28	.19	5.01
Neighborhood violence	1.36	0.64	0.54, 3.41	.52	3.82
Lived with someone with mental illness	1.26	0.64	0.47, 3.39	.64	3.83
Lived with someone using substances	1.72	0.97	0.57, 5.17	.34	4.09
Racial discrimination	2.42	1.46	0.74, 7.90	.14	5.20
Total ACEs score	**1.34**	**0.18**	**1.02, 1.75**	**.04**	**7.58**
Comorbidity Level	OR	S.E.	95% CI	p	Wald χ^2
Parent/guardian divorce	1.11	0.41	0.54, 2.28	.77	5.51
Parent/guardian death	2.92	1.87	0.83, 10.22	.09	8.14
Parent/guardian incarcerated	1.20	0.45	0.58, 2.49	.62	5.65
Violence between parents/guardians	2.16	1.00	0.87, 5.37	.10	8.38
Neighborhood violence	1.73	0.73	0.76, 3.94	.19	7.41
Lived with someone with mental illness	**2.48**	**1.05**	**1.08, 5.71**	**.03**	**10.01**
Lived with someone using substances	1.54	0.83	0.54, 4.45	.42	6.44
Racial discrimination	**2.89**	**1.50**	**1.05, 8.01**	**.04**	**9.97**
Total ACEs score	**1.37**	**0.17**	**1.07, 1.74**	**.01**	**11.89**

Table 4.3. Adjusted regression analyses of associations of trauma exposures with RSA during TSST

TSST – Baseline RSA	β	S.E.	95% CI	p	Wald χ²	Cohen's f²
Parent/guardian divorce	-0.20	0.16	-0.50, 0.11	.21	3.51	.013
Parent/guardian death	-0.07	0.28	-0.62, 0.48	.80	1.96	.001
Parent/guardian incarcerated	-0.30	0.16	-0.62, 0.01	.05	5.67	.035
Violence between parents/guardians	0.01	0.19	-0.37, 0.38	.96	3.06	.068
Neighborhood violence	0.05	0.17	-0.28, 0.38	.76	3.15	.069
Lived with someone with mental illness	0.03	0.18	-0.33, 0.39	.86	1.93	.0003
Lived with someone using substances	-0.10	0.18	-0.46, 0.26	.60	3.82	.134
Racial discrimination	-0.29	0.20	-0.68, 0.10	.14	5.25	.090
Total ACEs score	-0.06	0.05	-0.15, 0.03	.20	5.37	.149
TSST – Explanation RSA	**β**	**S.E.**	**95% CI**	**p**	**Wald χ²**	**Cohen's f²**
Parent/guardian divorce	-0.11	0.19	-0.47, 0.26	.57	0.94	.008
Parent/guardian death	-0.59	0.33	-1.23, 0.05	.07	3.97	.033
Parent/guardian incarcerated	-0.22	0.19	-0.59, 0.15	.25	2.03	.013
Violence between parents/guardians	-0.05	0.23	-0.50, 0.40	.82	0.96	.105
Neighborhood violence	0.04	0.20	-0.35, 0.43	.84	0.95	.105
Lived with someone with mental illness	-0.02	0.22	-0.44, 0.41	.94	0.70	.0001
Lived with someone using substances	-0.01	0.22	-0.44, 0.42	.96	0.92	.126
Racial discrimination	-0.37	0.24	-0.84, 0.09	.12	3.39	.132
Total ACEs score	-0.06	0.06	-0.18, 0.05	.27	2.17	.149
TSST – Prep RSA	**β**	**S.E.**	**95% CI**	**p**	**Wald χ²**	**Cohen's f²**
Parent/guardian divorce	-0.12	0.17	-0.45, 0.21	.47	2.79	.021
Parent/guardian death	-0.57	0.29	-1.14, 0.002	.05	5.88	.038
Parent/guardian incarcerated	-0.19	0.17	-0.52, 0.14	.26	3.23	.012
Violence between parents/guardians	-0.12	0.21	-0.52, 0.29	.58	2.94	.017
Neighborhood violence	0.19	0.18	-0.16, 0.55	.29	3.64	.022
Lived with someone with mental illness	-0.11	0.20	-0.49, 0.27	.57	2.27	.003
Lived with someone using substances	-0.09	0.20	-0.49, 0.31	.66	3.30	.058
Racial discrimination	-0.04	0.22	-0.48, 0.39	.84	2.62	.013
Total ACEs score	-0.06	0.05	-0.16, 0.04	.26	4.80	.088
TSST – Speech RSA	**β**	**S.E.**	**95% CI**	**p**	**Wald χ²**	**Cohen's f²**
Parent/guardian divorce	-0.11	0.17	-0.44, 0.22	.51	2.92	.023
Parent/guardian death	**-0.58**	**0.28**	**-1.13, -0.03**	**.04**	**6.53**	**.043**
Parent/guardian incarcerated	**-0.33**	**0.17**	**-0.66, -0.003**	**.048**	**6.09**	**.038**
Violence between parents/guardians	-0.30	0.21	-0.72, 0.11	.16	4.54	.018
Neighborhood violence	0.06	0.19	-0.31, 0.43	.75	2.54	-.002
Lived with someone with mental illness	0.003	0.20	-0.38, 0.39	.99	2.08	-.00001
Lived with someone using substances	-0.07	0.21	-0.48, 0.34	.73	3.02	.031
Racial discrimination	0.01	0.22	-0.43, 0.45	.97	2.45	-.002
Total ACEs score	-0.09	0.05	-0.19, 0.02	.10	6.15	.078
TSST – Recovery RSA	**β**	**S.E.**	**95% CI**	**p**	**Wald χ²**	**Cohen's f²**
Parent/guardian divorce	-0.07	0.16	-0.40, 0.25	.66	2.39	.002
Parent/guardian death	**-0.59**	**0.27**	**-1.13, -0.06**	**.03**	**6.96**	**.048**
Parent/guardian incarcerated	**-0.40**	**0.16**	**-0.72, -0.08**	**.02**	**8.27**	**.056**
Violence between parents/guardians	-0.08	0.21	-0.48, 0.33	.71	3.23	.024
Neighborhood violence	0.06	0.18	-0.29, 0.41	.74	3.21	.024
Lived with someone with mental illness	0.12	0.19	-0.26, 0.49	.53	2.65	.003
Lived with someone using substances	-0.19	0.20	-0.58, 0.19	.32	4.60	.091
Racial discrimination	-0.21	0.21	-0.63, 0.21	.33	4.13	.033
Total ACEs score	-0.08	0.05	-0.18, 0.02	.11	6.32	.105

Table 4.4. Adjusted regression analyses of associations of RSA with comorbidity and comorbidity levels

Comorbidity	OR	S.E.	95% CI	p	Wald χ²
Baseline RSA	0.84	0.23	0.49, 1.43	.51	3.38
Explanation RSA	**0.61**	**0.15**	**0.37, 0.99**	**.46**	**7.70**
Prep RSA	**0.58**	**0.15**	**0.34, 0.97**	**.04**	**6.99**
Speech RSA	0.61	0.16	0.37, 1.02	.06	7.51
Recovery RSA	0.80	0.21	0.48, 1.34	.40	5.01
Comorbidity Level	OR	S.E.	95% CI	p	Wald χ²
Baseline RSA	**0.60**	**0.14**	**0.38, 0.95**	**.03**	**8.66**
Explanation RSA	**0.54**	**0.11**	**0.36, 0.81**	**.003**	**12.86**
Prep RSA	**0.52**	**0.11**	**0.33, 0.80**	**.003**	**12.29**
Speech RSA	**0.51**	**0.11**	**0.34, 0.78**	**.002**	**14.15**
Recovery RSA	**0.64**	**0.14**	**0.42, 0.98**	**.04**	**9.41**

Table 4.5. Adjusted regression analyses of associations of trauma exposures and RSA with comorbidity

ACEs & Baseline RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.53	0.67	0.64, 3.61	.34	
Baseline RSA	0.87	0.24	0.51, 1.49	.62	4.17
Parent/guardian death	**6.22**	**4.86**	**1.34, 28.80**	**.02**	
Baseline RSA	0.85	0.24	0.49, 1.47	.56	**8.00**
Parent/guardian incarcerated	1.21	0.54	0.50, 2.90	.68	
Baseline RSA	0.85	0.24	0.50, 1.47	.57	3.54
Violence between parents/guardians	1.98	1.02	0.72, 5.42	.19	
Baseline RSA	0.79	0.23	0.45, 1.39	.42	5.00
Neighborhood violence	1.26	0.60	0.50, 3.19	.62	
Baseline RSA	0.79	0.22	0.46, 1.38	.41	3.62
Lived with someone with mental illness	1.21	0.61	0.45, 3.25	.71	
Baseline RSA	0.83	0.23	0.49, 1.43	.51	3.49
Lived with someone using substances	1.60	0.90	0.53, 4.81	.40	
Baseline RSA	0.83	0.24	0.47, 1.47	.52	3.72
Racial discrimination	2.13	1.31	0.63, 7.12	.22	
Baseline RSA	0.85	0.25	0.47, 1.51	.57	4.60
Total ACEs score	**1.32**	**0.18**	**1.01, 1.74**	**.04**	
Baseline RSA	0.90	0.27	0.50, 1.62	.73	**6.94**
ACEs & Explanation RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.21	0.56	0.48, 3.02	.69	
Explanation RSA	0.62	0.16	0.38, 1.02	.06	7.56
Parent/guardian death	**9.04**	**8.21**	**1.53, 53.57**	**.02**	
Explanation RSA	0.67	0.17	0.40, 1.10	.11	**11.46**
Parent/guardian incarcerated	1.01	0.48	0.40, 2.55	.98	
Explanation RSA	**0.61**	**0.15**	**0.37, 0.996**	**.048**	**7.69**
Violence between parents/guardians	1.64	0.93	0.54, 4.97	.38	
Explanation RSA	**0.55**	**0.15**	**0.33, 0.94**	**.03**	**9.04**
Neighborhood violence	1.10	0.56	0.40, 2.98	.86	
Explanation RSA	**0.55**	**0.15**	**0.33, 0.93**	**.03**	**8.39**
Lived with someone with mental illness	1.08	0.58	0.38, 3.10	.89	
Explanation RSA	**0.61**	**0.15**	**0.37, 0.99**	**.047**	**7.69**
Lived with someone using substances	1.56	0.88	0.52, 4.69	.43	
Explanation RSA	**0.56**	**0.15**	**0.33, 0.95**	**.03**	**8.54**
Racial discrimination	1.76	1.07	0.54, 5.77	.35	
Explanation RSA	**0.57**	**0.15**	**0.33, 0.97**	**.04**	**9.07**
Total ACEs score	1.26	0.19	0.94, 1.69	.13	
Explanation RSA	0.59	0.16	0.34, 1.01	.06	9.48
ACEs & Prep RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.41	0.63	0.58, 3.38	.45	
Prep RSA	0.59	0.16	0.35, 1.01	.05	7.18
Parent/guardian death	**5.25**	**4.28**	**1.06, 2.93**	**.04**	
Prep RSA	0.64	0.17	0.37, 1.09	.10	**9.83**
Parent/guardian incarcerated	1.08	0.49	0.45, 2.61	.87	
Prep RSA	**0.58**	**0.16**	**0.34, 0.98**	**.04**	**7.00**
Violence between parents/guardians	1.88	0.99	0.67, 5.27	.23	
Prep RSA	**0.56**	**0.16**	**0.33, 0.97**	**.04**	**8.29**

	OR	S.E.	95% CI	p	Wald χ²
Neighborhood violence	1.43	0.70	0.55, 3.72	.46	**7.52**
Prep RSA	**0.55**	**0.15**	**0.32, 0.94**	**.03**	
Lived with someone with mental illness	1.14	0.58	0.42, 3.11	.79	**7.03**
Prep RSA	**0.58**	**0.15**	**0.34, 0.98**	**.04**	
Lived with someone using substances	1.62	0.87	0.56, 4.66	.37	**7.28**
Prep RSA	**0.57**	**0.16**	**0.33, 0.98**	**.04**	
Racial discrimination	2.22	1.41	0.64, 7.73	.21	**8.00**
Prep RSA	**0.56**	**0.16**	**0.32, 0.97**	**.04**	
Total ACEs score	1.30	0.18	0.98, 1.71	.07	9.31
Prep RSA	0.61	0.17	0.35, 1.05	.08	
ACEs & Speech RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.32	0.59	0.54, 3.18	.54	7.57
Speech RSA	0.63	0.16	0.38, 1.05	.08	
Parent/guardian death	4.45	3.41	0.99, 20.01	.05	10.17
Speech RSA	0.69	0.18	0.41, 1.15	.15	
Parent/guardian incarcerated	0.96	0.44	0.39, 2.36	.92	7.52
Speech RSA	0.61	0.16	0.37, 1.02	.06	
Violence between parents/guardians	1.55	0.84	0.54, 4.47	.41	7.93
Speech RSA	0.63	0.16	0.38, 1.04	.07	
Neighborhood violence	1.25	0.61	0.48, 3.24	.65	7.51
Speech RSA	0.61	0.16	0.37, 1.01	.05	
Lived with someone with mental illness	1.32	0.68	0.48, 3.62	.59	7.67
Speech RSA	0.61	0.16	0.37, 1.02	.06	
Lived with someone using substances	1.79	0.96	0.62, 5.14	.28	7.94
Speech RSA	0.62	0.16	0.37, 1.03	.07	
Racial discrimination	2.30	1.31	0.76, 7.00	.14	9.06
Speech RSA	0.61	0.16	0.37, 1.02	.06	
Total ACEs score	1.27	0.18	0.97, 1.67	.09	9.25
Speech RSA	0.67	0.18	0.40, 1.13	.13	
ACEs & Recovery RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.33	0.59	0.56, 3.17	.53	5.30
Recovery RSA	0.82	0.22	0.49, 1.37	.45	
Parent/guardian death	**5.16**	**3.91**	**1.17, 22.77**	**.03**	**8.62**
Recovery RSA	0.91	0.25	0.53, 1.57	.75	
Parent/guardian incarcerated	1.03	0.47	0.42, 2.51	.96	5.01
Recovery RSA	0.80	0.22	0.47, 1.36	.41	
Violence between parents/guardians	1.74	0.92	0.62, 4.91	.30	5.82
Recovery RSA	0.78	0.21	0.46, 1.33	.37	
Neighborhood violence	1.21	0.58	0.47, 3.11	.70	5.01
Recovery RSA	0.78	0.21	0.46, 1.31	.34	
Lived with someone with mental illness	1.34	0.68	0.50, 3.63	.56	5.23
Recovery RSA	0.79	0.21	0.47, 1.32	.37	
Lived with someone using substances	1.70	0.90	0.60, 4.82	.32	5.52
Recovery RSA	0.82	0.23	0.48, 1.40	.47	
Racial discrimination	2.21	1.23	0.74, 6.60	.16	6.56
Recovery RSA	0.81	0.22	0.47, 1.37	.43	
Total ACEs score	1.29	0.18	0.98, 1.70	.07	7.62
Recovery RSA	0.88	0.25	0.50, 1.53	.64	

Table 4.6. Adjusted regression analyses of associations of trauma exposures and RSA with comorbidity levels

ACEs & Baseline RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.11	0.42	0.53, 2.32	.78	8.36
Baseline RSA	**0.62**	**0.14**	**0.39, 0.98**	**.04**	
Parent/guardian death	**4.00**	**2.67**	**1.08, 14.81**	**.04**	12.53
Baseline RSA	**0.60**	**0.14**	**0.38, 0.95**	**.03**	
Parent/guardian incarcerated	1.09	0.42	0.51, 2.32	.82	8.70
Baseline RSA	**0.60**	**0.14**	**0.38, 0.96**	**.03**	
Violence between parents/guardians	2.19	1.04	0.86, 5.58	.10	10.86
Baseline RSA	**0.60**	**0.15**	**0.37, 0.97**	**.04**	
Neighborhood violence	1.48	0.63	0.64, 3.39	.36	9.29
Baseline RSA	**0.60**	**0.15**	**0.37, 0.97**	**.04**	
Lived with someone with mental illness	2.32	1.01	1.00, 5.43	.05	12.21
Baseline RSA	**0.60**	**0.14**	**0.38, 0.94**	**.03**	
Lived with someone using substances	1.31	0.70	0.46, 3.73	.62	9.07
Baseline RSA	**0.57**	**0.15**	**0.34, 0.94**	**.03**	
Racial discrimination	2.24	1.20	0.78, 6.39	.13	10.62
Baseline RSA	0.63	0.16	0.39, 1.03	.07	
Total ACEs score	**1.32**	**0.17**	**1.03, 1.69**	**.03**	12.86
Baseline RSA	0.62	0.16	0.37, 1.04	.07	
ACEs & Explanation RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	0.87	0.33	0.41, 1.84	.71	12.27
Explanation RSA	**0.55**	**0.11**	**0.37, 0.82**	**.004**	
Parent/guardian death	**4.30**	**2.90**	**1.14, 16.14**	**.03**	17.03
Explanation RSA	**0.57**	**0.12**	**0.38, 0.86**	**.01**	
Parent/guardian incarcerated	0.93	0.37	0.43, 2.04	.87	12.89
Explanation RSA	**0.54**	**0.11**	**0.36, 0.81**	**.003**	
Violence between parents/guardians	1.82	0.91	0.68, 4.86	.24	14.32
Explanation RSA	**0.52**	**0.11**	**0.33, 0.80**	**.003**	
Neighborhood violence	1.39	0.61	0.59, 3.30	.45	13.63
Explanation RSA	**0.51**	**0.11**	**0.33, 0.78**	**.002**	
Lived with someone with mental illness	2.14	0.94	0.91, 5.06	.08	15.45
Explanation RSA	**0.53**	**0.11**	**0.36, 0.80**	**.002**	
Lived with someone using substances	1.02	0.57	0.34, 3.02	.98	13.38
Explanation RSA	**0.50**	**0.11**	**0.32, 0.78**	**.002**	
Racial discrimination	2.12	1.16	0.73, 6.18	.17	14.67
Explanation RSA	**0.53**	**0.12**	**0.34, 0.82**	**.004**	
Total ACEs score	1.25	0.17	0.96, 1.63	.09	15.03
Explanation RSA	**0.53**	**0.12**	**0.34, 0.83**	**.01**	
ACEs & Prep RSA	OR	S.E.	95% CI	p	Wald χ²
Parent/guardian divorce	1.04	0.39	0.50, 2.17	.91	11.70
Prep RSA	**0.53**	**0.12**	**0.34, 0.82**	**.004**	
Parent/guardian death	2.76	1.87	0.73, 10.42	.14	14.36
Prep RSA	**0.55**	**0.12**	**0.36, 0.86**	**.01**	
Parent/guardian incarcerated	1.05	0.40	0.50, 2.23	.89	12.32
Prep RSA	**0.52**	**0.12**	**0.34, 0.80**	**.003**	
Violence between parents/guardians	2.15	1.03	0.84, 5.50	.11	**14.26**
Prep RSA	**0.53**	**0.12**	**0.34, 0.82**	**.01**	

|	OR	S.E.	95% CI	p	Wald χ²
Neighborhood violence	1.73	0.74	0.75, 3.97	.20	**13.60**
Prep RSA	**0.51**	**0.12**	**0.33, 0.79**	**.003**	
Lived with someone with mental illness	2.16	0.93	0.93, 5.01	.07	**15.22**
Prep RSA	**0.53**	**0.12**	**0.34, 0.81**	**.004**	
Lived with someone using substances	1.24	0.69	0.42, 3.67	.70	**12.46**
Prep RSA	**0.50**	**0.12**	**0.32, 0.80**	**.004**	
Racial discrimination	2.73	1.49	0.93, 7.97	.07	**14.61**
Prep RSA	**0.52**	**0.12**	**0.33, 0.82**	**.01**	
Total ACEs score	**1.31**	**0.17**	**1.02, 1.67**	**.04**	**15.80**
Prep RSA	**0.55**	**0.13**	**0.34, 0.87**	**.01**	
ACEs & Speech RSA	OR	S.E.	95% CI	*p*	Wald χ²
Parent/guardian divorce	0.99	0.37	0.48, 2.05	.97	**13.49**
Speech RSA	**0.53**	**0.11**	**0.35, 0.80**	**.003**	
Parent/guardian death	2.20	1.41	0.63, 7.70	.22	**15.92**
Speech RSA	**0.54**	**0.12**	**0.35, 0.82**	**.004**	
Parent/guardian incarcerated	0.97	0.38	0.45, 2.07	.93	**14.16**
Speech RSA	**0.51**	**0.11**	**0.33, 0.78**	**.002**	
Violence between parents/guardians	1.86	0.90	0.72, 4.82	.20	**15.21**
Speech RSA	**0.53**	**0.12**	**0.35, 0.82**	**.004**	
Neighborhood violence	1.62	0.70	0.70, 3.77	.26	**14.94**
Speech RSA	**0.51**	**0.11**	**0.33, 0.79**	**.002**	
Lived with someone with mental illness	**2.67**	**1.14**	**1.16, 6.16**	**.02**	**18.98**
Speech RSA	**0.50**	**0.11**	**0.33, 0.76**	**.001**	
Lived with someone using substances	1.41	0.77	0.48, 4.11	.53	**14.33**
Speech RSA	**0.50**	**0.11**	**0.32, 0.78**	**.002**	
Racial discrimination	**3.07**	**1.64**	**1.08, 8.75**	**.04**	**17.65**
Speech RSA	**0.51**	**0.11**	**0.33, 0.79**	**.002**	
Total ACEs score	**1.30**	**0.17**	**1.01, 1.67**	**.04**	**17.16**
Speech RSA	**0.55**	**0.12**	**0.35, 0.86**	**.01**	
ACEs & Recovery RSA	OR	S.E.	95% CI	*p*	Wald χ²
Parent/guardian divorce	1.05	0.39	0.51, 2.18	.89	9.11
Recovery RSA	0.65	0.14	0.43, 1.00	.05	
Parent/guardian death	2.40	1.57	0.67, 8.67	.18	11.13
Recovery RSA	0.67	0.15	0.44, 1.04	.07	
Parent/guardian incarcerated	1.01	0.39	0.47, 2.14	.99	**9.41**
Recovery RSA	**0.64**	**0.14**	**0.41, 0.99**	**.04**	
Violence between parents/guardians	2.08	0.99	0.81, 5.31	.13	11.26
Recovery RSA	0.66	0.15	0.42, 1.02	.06	
Neighborhood violence	1.59	0.67	0.69, 3.63	.27	10.29
Recovery RSA	0.64	0.14	0.42, 1.00	.05	
Lived with someone with mental illness	**2.75**	**1.18**	**1.18, 6.37**	**.02**	**14.53**
Recovery RSA	**0.61**	**0.13**	**0.39, 0.94**	**.02**	
Lived with someone using substances	1.40	0.76	0.48, 4.07	.53	9.79
Recovery RSA	0.63	0.15	0.40, 1.00	.05	
Racial discrimination	2.70	1.43	0.96, 7.61	.06	12.39
Recovery RSA	0.67	0.15	0.43, 1.05	.08	
Total ACEs score	**1.32**	**0.17**	**1.03, 1.70**	**.03**	**13.50**
Recovery RSA	0.68	0.16	0.43, 1.09	.11	
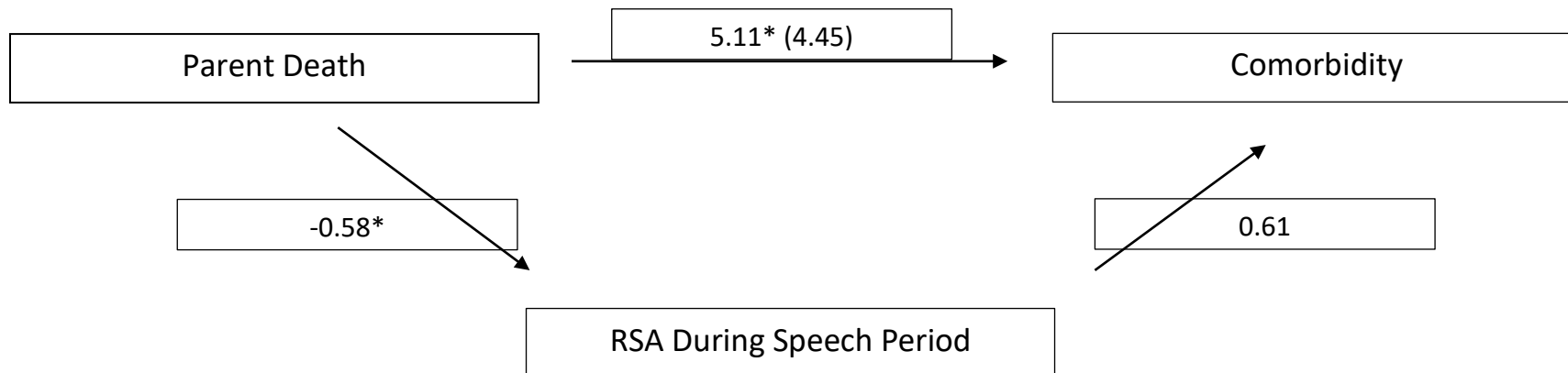
Figure 4.1. Partial pathway between parent death and comorbidity through RSA during the TSST speech period.

Note: Numbers listed in associations predicting to comorbidity are odds ratios. Number in association between parent death and RSA during speech period is a standardized regression coefficient. The odds ratio of parent death predicting comorbidity while controlling for RSA during speech period is listed in parentheses. *p < .05; RSA = respiratory sinus arrhythmia; TSST = Trier Social Stress Test.

Chapter 5: Discussion

This chapter presents an overview and key findings for each study, followed by a discussion of the limitations and strengths of the studies. The chapter also discusses the implications of this work for public health theory, research, and practice.

5.1 Study Overview and Key Findings

Co-Occurring Mental Health Symptoms in Urban Youth: Comorbidity Profiles and Correlates

The study described in Chapter 2 examined subgroups of Baltimore City youth based on their self-reported and teacher-reported psychological symptoms, as well as the characteristics of those subgroups, including trauma exposures, coping mechanisms, and substance use. This study addressed key gaps in the literature, one of which was the inclusion of urban youth recruited in schools to explore heterogeneity of comorbidity in the general urban youth population. Additionally, this study included salient psychological symptoms, such as trauma symptoms, and included data from multiple informants.

We identified four comorbidity subgroups within our sample of Baltimore City youth. These four groups were not differentiated by symptom type, but by concordance or discordance between the student- and teacher-reported symptoms. We found that the group characterized by high symptom levels as reported both by the students and teachers also had higher use of maladaptive coping mechanisms and substances (including cigarettes, alcohol, marijuana, and blunts), and had greater numbers of trauma exposures. However, the group with high self-reported but low teacher-reported symptoms also had high use of substances and maladaptive coping, as well as high numbers of trauma exposures.

Profiles of Comorbidity in Urban Youth: A Validation Study Exploring Sex Differences and Trait Mindfulness

The study presented in Chapter 3 sought to validate the profile structure that was established in Chapter 2 with a second sample of Baltimore City youth. Moreover, the study aimed to explore differences by sex and trait mindfulness across the subgroups of comorbidity. The study utilized the emerging method of confirmatory latent profile analysis to validate the subgroups found in the prior sample of urban youth. Moreover, the study addressed gaps in the literature on trait mindfulness, as it explored associations with comorbidity in an understudied population. Finally, the study addressed the question of how sex may impact the associations between trait mindfulness and mental health.

The same subgroups found in Chapter 2 were validated in a separate sample of Baltimore City youth. Moreover, the profile with high self-reported and low teacher-reported psychological symptoms contained more females than the other subgroups. Trait mindfulness was highest in the groups with high self-reported symptoms, and greater differences in trait mindfulness were seen across profiles for female students than male students.

Trauma and Comorbidity in Urban Youth: Partial Pathways Through Respiratory Sinus Arrythmia

The study described in Chapter 4 explored the associations between trauma exposures and comorbidity with an urban youth sample. Moreover, it explored the role of respiratory sinus arrythmia, a measure of heart rate variability, in this relationship. This study contributes to the literature by examining partial pathways between trauma and comorbidity through heart

rate variability in an adolescent sample in the U.S. Moreover, the sample was recruited from an at-risk, understudied population with high levels of comorbidity and trauma exposures.

The study did not yield significant findings; however, it revealed patterns that may inform future research. Moreover, small effect sizes seen in the associations between trauma, RSA, and comorbid psychological symptoms highlighted the need to further research on HRV in addition to other potential biological and physiological pathways. Higher numbers of adverse childhood experiences were associated with comorbidity, as were some specific adverse childhood experiences, such as parent/guardian death, living with someone with a mental illness, or racial discrimination. Moreover, parent/guardian death and incarceration was associated with lower respiratory sinus arrythmia during times of stress and recovery. Overall, lower respiratory sinus arrhythmia, a sign of dysregulated responses to stress, was associated with greater comorbidity.

5.2 Limitations and Strengths

One of the main limitations of the studies presented in Chapters 2, 3, and 4 is the relatively small sample sizes. While the overall Project POWER sample is sufficient for the needs of the parent randomized controlled trial, the samples used in Chapters 2 and 3 are relatively small to provide sufficient power for latent variable modeling. However, the samples did exceed theoretical thresholds that have been presented in prior research (Wurpts & Geiser, 2014). Additionally, two samples with HRV data needed to be combined to create the sample for the study presented in Chapter 4. Collection of HRV data is costly in time, training of personnel, and materials needed for measurement. Moreover, logistics of collecting HRV data on an individual basis in a school setting are often challenging and may limit the number of

students that can feasibly be assessed. Thus, the study in Chapter 4 may have been underpowered to detect small to moderate effects in the associations among trauma, HRV, and comorbidity.

A second key limitation in all three studies was the use of cross-sectional data. Regarding Chapters 2 and 3, when evaluating the role of risk factors (i.e., maladaptive coping and trauma exposure), protective factors (i.e., trait mindfulness and adaptive coping), and behavioral consequences (i.e., substance use) of comorbidity, longitudinal data is necessary to establish causal relationships. Moreover, the study presented in Chapter 4 was limited to discussing the partial pathways between trauma exposure, HRV, and comorbidity, rather than being able to formally test HRV as a mediator due to the lack of multiple measurements over time. Cross-sectional study designs were used, as data for the dissertation aims were pulled from ongoing school-based studies.

In addition to the limitations discussed, the studies presented in the above chapters have several strengths. Key study strengths include using data from multiple informants, inclusion of physiological data, and the methodologies used to analyze data. The use of data from multiple informants in Chapters 2 and 3 highlighted the value of using data from multiple sources when screening youth for participation in prevention programming or mental health services. The main strength in Chapter 3 was the use of a confirmatory methodology to aid in replication of findings in Chapter 2, which adds to the emerging literature on this method. Finally, the greatest strength of Chapter 4 is the use of physiological data to better understand the connections between the stress reaction and comorbidity in urban youth who are exposed to trauma.

5.3 Implications

The studies in this dissertation contribute to theories of risk and resilience in relation to comorbidity by assessing urban minority adolescents. Particularly in the areas of trait mindfulness and HRV, these studies shed light on potential associations with co-occurring mental health symptoms. Study findings align with the theories that informed the current work: the transactional theory of stress and coping, resilience theory, and the neurovisceral integration model. Specifically, findings from Chapter 2 highlight the associations among rumination and general maladaptive coping strategies with greater comorbid psychological symptoms, which is consistent with the transactional theory of stress and coping. While the study cannot establish causal relationships, it is hypothesized that students who utilize rumination or maladaptive strategies when faced with stress may not be fully resolving the situations that they are facing, resulting in feelings of distress, such as depressive, anxiety, or trauma symptoms. Moreover, increased number of trauma exposures were associated with comorbid psychological symptoms, consistent with the theory that stress in the environment may be overloading students' ability to cope, leading to distress; however, again, we cannot assume temporal associations in the analyses conducted in this study. Findings from Chapter 3 show the potential for trait mindfulness to be a protective factor for urban youth against the development of comorbid symptoms, which aligns with resilience theory and the translational theory. While the participants in the study had high levels of trauma exposures, those who had higher trait mindfulness had lower self-reported symptoms. Youth with higher trait mindfulness may have been more resilient and potentially able to implement more effective coping strategies, although further research establishing a temporal relationship between trait

mindfulness and psychological comorbidity is needed. Finally, findings from Chapter 4 show that there are potential pathways between increased numbers of trauma exposures and comorbid psychological symptoms through decreased RSA during times of stress, which is consistent with the underlying neurovisceral integration model. Increased exposure to trauma in the participating students could be leading to inactivation in the prefrontal cortex, impairment in vagal functioning, and increased allostatic load, resulting in lower RSA during times of stress seen in the study. This increase in allostatic load could be associated with increased comorbid psychological symptoms in this sample; however, further research is needed to see if the current findings are part of a causal pathway. Moreover, the study suffered from small effect sizes and a lack of statistically significant findings; thus, further research is needed to see if HRV is a significant pathway compared to pathways examined in other studies.

These findings also have implications for future research, particularly by highlighting the need for research that further examines heterogeneity in psychological comorbidity and establishes temporality between comorbidity and the correlates examined Chapters 2, 3, and 4. Much of prior research is youth focuses on measurement of single disorders, even though co-occurring symptoms are highly prevalent (Merikangas et al., 2010). The current study acknowledges that youth can experience varying constellations of psychological symptoms by using a methodology that is person-centered and was developed to understand this heterogeneity (Collins & Lanza, 2010). Further, the current work supports the need for future researchers to conceptualize psychological functioning in a more holistic way and include measures of multiple psychological symptoms (i.e., depression, anxiety, trauma, internalizing, externalizing) when studying youth mental health. While the current studies found associations

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between psychological comorbidity and the correlates studied, prospective longitudinal study designs are needed to examine the development of these factors in the context of emerging psychological symptoms. Understanding the timing of these developments may help target prevention and intervention efforts to key times of vulnerability to enhance protective factors and delay the onset of mental health disorders. Additionally, findings from the study in Chapter 3 point to the need for further research on sex differences in the impact of mindfulness interventions and the role of trait mindfulness on urban adolescent mental health. Given findings pointing to lower trait mindfulness in females and greater differences in trait mindfulness across profiles for females, more research is needed to assess whether mindfulness interventions may have a greater impact for girls' versus boys' mental health.

Study results also have implications for public health practice. A key implication is in the use of information from multiple informants when screening for urban adolescent psychological symptoms and when recruiting adolescents for prevention programs and/or mental health services. Findings from Chapter 2 and 3 indicate that there are youth who experience psychological symptoms who are not identified by their teachers, supporting prior research underscoring the importance of gathering information from multiple informants about youth psychological symptoms (De Los Reyes et al., 2013; De Los Reyes et al., 2015). Research using data from multiple informants commonly finds low-to-moderate agreement between raters (De Los Reyes et al., 2015). Discordance between raters has been attributed to several factors, including measurement error or biases of the raters (De Los Reyes et al., 2015). Regarding bias, prior research has indicated that teachers may be more likely to report externalizing symptoms that may contribute to classroom disruptions than internalizing

symptoms (Hamblin, 2016). However, increasingly there is an understanding of how youths'

symptoms may vary across contexts, and that gathering information from both students and

their teachers can ensure that youth who are in need of programming or services are not

overlooked (De Los Reyes, 2013). Moreover, it has been proposed that the information about

context gathered from multiple informant data can aid in the development of improved

assessments and interventions (De Los Reyes, 2013). The current study adds to this line of work

by extending it to urban youth and how they may be experiencing complex and co-occurring

symptoms that require data from multiple informants to adequately address.

Findings from these studies point to some factors that may be important in screening

for prevention efforts with urban youth. Prior studies of exposure to specific traumas and

cumulative traumas (Briere et al., 2010; Liu et al., 2017; Hogue & Dauber, 2011) and use of

maladaptive coping strategies (Wigman et al., 2014; Gunnar & Vasquez, 2006; Kessler et al.,

1985; Taylor & Stanton, 2007; Compas et al., 2001; Terreri & Glenwick, 2013) have shown

associations with increased psychological symptoms. Moreover, prior research has shown trait

mindfulness being associated with better psychological functioning in adolescents (Calvete et

al., 2017; Ciesla et al., 2012; Royuela-Colomer & Calvete, 2016). However, the current study

expands this research by highlighting associations with comorbid psychological symptoms in an

understudied, at-risk population. Additionally, differences between comorbidity groups in the

current studies show that screening for these correlates may help to identify youth whose

symptoms are not being reported by their teachers. Overall high symptom youth and youth

who had high self-reported symptoms and low teacher-reported symptoms had very similar

levels of the correlates examined in the studies. Lower trait mindfulness, higher numbers of

lifetime trauma exposures, and higher use of maladaptive coping mechanisms may be able to characterize this group and aid in screening efforts when identifying youth in need of programming or services that may otherwise not be referred to services by their teachers.

5.4 Conclusions

In summary, this dissertation examined heterogeneity in comorbid psychological symptoms in urban minority youth. We wanted to gain a better understanding of how psychological symptoms could be grouped in urban youth, as well as key characteristics of these groups, to enhance screening and intervention efforts. We found that comorbidity in urban youth tends to be differentiated by concordance or discordance between raters, and that youth with overall high symptoms had poorer coping mechanisms and greater levels of trauma exposure and substance use. We also found that youth who self-reported symptoms, but whose teachers did not report symptoms, had levels of these characteristics that were worrisome. Moreover, we found that youth with high comorbid symptoms had lower trait mindfulness, and that trait mindfulness may be a more defining characteristics of comorbid symptoms for female than male adolescents. Finally, we found patterns in the role of HRV in the associations between trauma and comorbid symptoms. This research extends our understanding of psychological comorbidity in urban youth and suggests directions for future efforts in mental health theory, research, and practice.
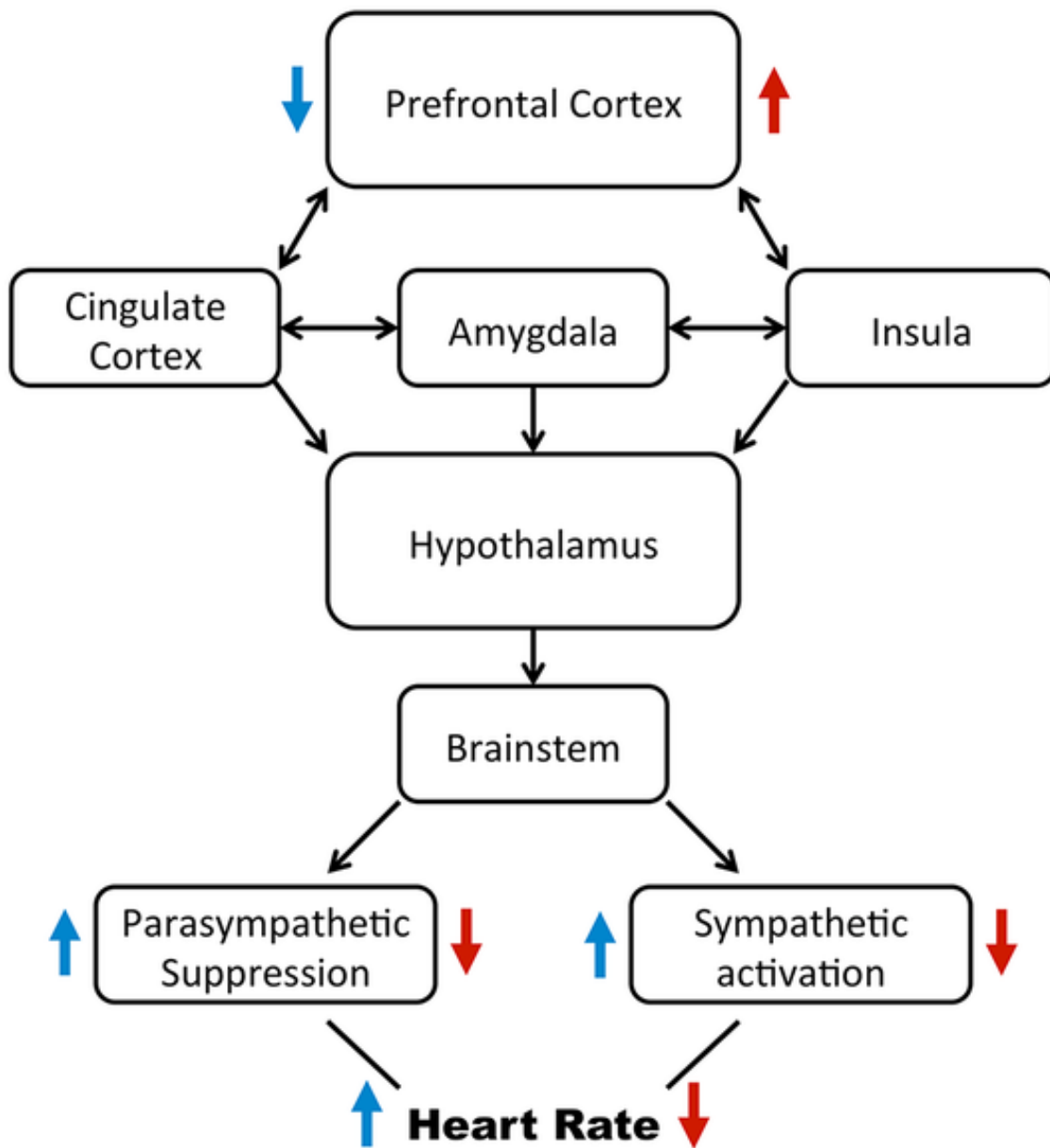
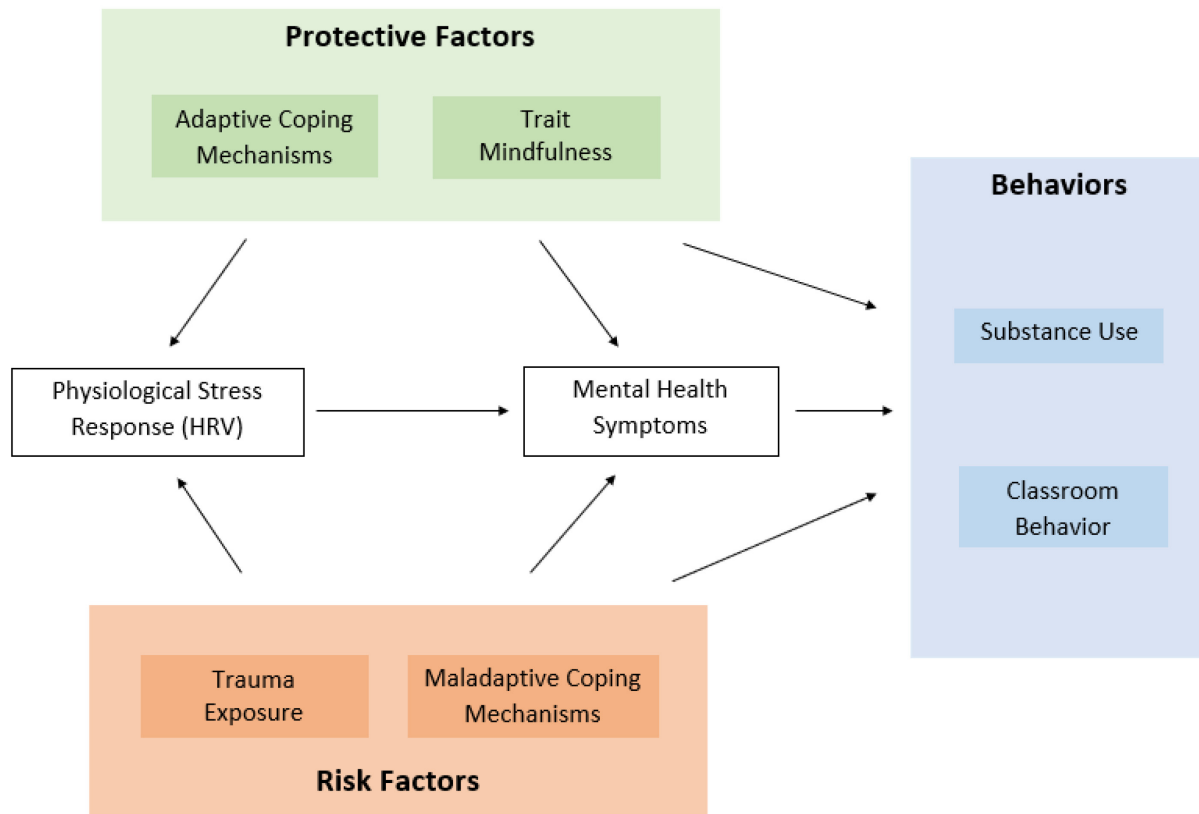Figure 1.1. Simplified neurovisceral integration model

Figure 1.2. Conceptual framework adapted from the translational theory of stress and coping, resilience theory, and the neurovisceral integration model

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the American Academy of Child & Adolescent Psychiatry*, *40*(1), 106-114. doi:

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youth: A meta-analysis. *Mindfulness*, *6*(2), 290-302. doi: 10.1007/s12671-013-0260-4

Curriculum Vitae

Lindsey Webb, PhD

Johns Hopkins Bloomberg School of Public Health   Phone: (443) 826-9885
Department of Mental Health   lwebb7@jhmi.edu
624 N Broadway, Room 895
Baltimore, MD

EDUCATION

Ph.D., Public Health, 2020
Department of Mental Health, Johns Hopkins Bloomberg School of Public Health,
Baltimore, Maryland
Dissertation: *Psychological Functioning and Trait Mindfulness in Urban Youth*
Dissertation Advisor: Tamar Mendelson, Ph.D.

M.H.S., Mental Health, 2016
Department of Mental Health, Johns Hopkins Bloomberg School of Public Health
Baltimore, Maryland

M.S., Counseling Psychology, 2012
Loyola University Maryland
Baltimore, Maryland

B.S., Psychology, 2009
University of Maryland, Baltimore County
Baltimore, MD

PROFESSIONAL EXPERIENCE

Position: **Graduate Research Assistant**, March 2017 – Present
Location: Johns Hopkins Bloomberg School of Public Health, Baltimore, MD
Supervisor: Tamar Mendelson, Ph.D.
Grants: 1. *Optimizing a Mindful Intervention for Urban Minority Youth Via Stress Physiology*, September 2019 – present, NCCIH
                    PI: Diana Fishbein, Ph.D., & Tamar Mendelson, Ph.D., R61 Grant
                    Responsibilities: Research Assistant - Assist with the adaptation of the control program (health education program) for the randomized controlled trial, organize and assist with selection of measures.

2. *RAP Club: Improving Mental Health and School Performance in Urban Eighth Graders*, March 2017 – present, IES-NCER

   PI: Tamar Mendelson, Ph.D., 84.305A Grant

   Responsibilities:
   - Graduate Research Assistant (year 1) - Conduct focus groups with students in intervention and control programs; conduct interviews with teachers and principals at participating schools.
   - Assessment Coordinator (year 2) – Organize supplies for intervention and control programs; assist in the coordination of survey data collection with students and teachers.
   - Control Group Instructor (year 2 and 4) - Conduct control groups (general health education program) at multiple school sites.

3. *Tailoring "DeStress Monday" for Teachers: A Pilot Development and Evaluation Project*, March 2017 – August 2017, Johns Hopkins Center for a Livable Future

   PI: Tamar Mendelson, Ph.D.

   Responsibilities: Research Assistant – Participant recruitment, website support, data collection, entry, and analysis, manuscript and presentation writing.

Position:	**Program Coordinator,** September 2012 – July 2016
Location:	Johns Hopkins School of Medicine, Baltimore, MD
Supervisor:	Erica Sibinga, M.D., M.H.S. & Jacky Jennings, Ph.D., M.P.H.
Grants:	1. *Improving Treatment Adherence in HIV-Positive Youth Through Mindfulness Training*, June 2013 – January 2019, NCCIH

   PI: Erica Sibinga, M.D., M.H.S., R01 Grant

   Responsibilities: Data Manager - Provided oversight to the planning and implementation of data collection for the project, including, but not limited to: coordination of data collection for both the parent study and sub-study; data management for the parent and sub-study; and administrating cognitive tasks to participants.

2. *Strengthening and Expanding Trauma-Informed Techniques to Foster Social and Emotional Development of Male Middle School Students in Baltimore*, May 2013-May 2015, Robert Wood Johnson Foundation

   PI: Nicole Johnson and Erica Sibinga, M.D., M.H.S.

   Responsibilities: Program Director – Provided oversight to the overall planning and implementation of the school-based program and evaluation, including, but not limited to supervising program coordinators at two school sites; managing program budget; scheduling and leading meetings with D-Stress instructors and staff; collaborating in the remodeling of curricula for second year; interviewing and hiring instructors; managing data collection and entry; performing some exploratory analyses; overseeing and coordinating analysis plans and

communication with biostatistician.

3. *D-Stress Baltimore: Preventing Mental Health Difficulties for Youth by Reducing Stress*, September 2012 – May 2013, Abell Foundation
   PI: Nicole Johnson and Erica Sibinga, M.D., M.H.S.
   Responsibilities: Program Director - Provided oversight to the overall planning and implementation of the school-based program and evaluation, including, but not limited to supervising program coordinators at two school sites; managing program budget; scheduling and leading meetings with D-Stress instructors and staff; and managing data collection and entry.

4. *An Evaluation of the New Jersey Personal Responsibility Education Program* (NJ PREP), November 2012 – April 2013, New Jersey Department of Health and Human Services
   PI: Jacky Jennings, Ph.D., M.P.H.
   Responsibilities: Research Assistant – Devised a comprehensive logic model overarching seven programs implemented by six sub-grantees in NJ PREP program aiming to lower unplanned pregnancy and HIV/STI transmission incidences in NJ youth; created common survey measures across approximately 40 – 50 sites to collect data on program outcomes. Created "report cards" and recommended changes to surveys that were sent to and implemented by sub-grantees.

Position: **Student Research Assistant (for credit)**, Jan 2015 – March 2015, Nov 2015 – Dec 2015
Location: Johns Hopkins Bloomberg School of Public Health, Baltimore, MD
Supervisor: Tamar Mendelson, PhD
Grants: 1. *School-Based Mindfulness Intervention to Prevent Substance Use Among Urban Youth*,
Jan 2015 – March 2015, Nov 2015 – Dec 2015, NIDA
PI: Tamar Mendelson, PhD, R34 Grant
Responsibilities: Assisted in the organization of data, creating codebook, and cleaning data for future analyses.

Position: **Counseling Intern**, January 2011 – May 2011
Location: Epoch Counseling Center, Catonsville, MD
Supervisor: Stephanie Marinelli, Ph.D., LCPC
Role: Provided individual substance abuse counseling to five adults and assisted in leading two outpatient groups.

Position: **Counseling Intern**, September 2010 – December 2010
Location: Man Alive Inc./Lane Treatment Center, Baltimore, MD
Supervisor: Melissa Wesner, LCPC
Role: Provided individual counseling to five adults with co-morbid substance use and mental health disorders using mindfulness techniques, CBT, and motivational interviewing; assisted in running an intensive outpatient group and an outpatient art therapy group.

Position: **Research Assistant**, February 2010 – July 2016
Location: Johns Hopkins School of Medicine, Baltimore, MD
Supervisor: Carisa Perry-Parrish, Ph.D.
Role: Conducted analyses and co-authored two manuscripts on emotion regulation for publication, as well as assisted in the planning and co-authored additional manuscripts in preparation. Assisted in composing IRB and grant applications, collected archival data, scored clinical assessments, wrote, and presented posters at well-known research conferences.

Position: **Research Assistant**, February 2010 – September 2012
Location: Johns Hopkins School of Medicine, Baltimore, MD
Supervisor: Erica Sibinga, MD, MHS
Grants: 1. *Reducing Stress in HIV-Infected Youth Through Mindfulness Training*, February 2010 – September 2012, NCCAM
            PI: Erica Sibinga, M.D., M.H.S., R21 Grant
            Responsibilities: Research Assistant – Participant recruitment; organizing groups (including food delivery and transportation for participants); data collection; data cleaning; conducted statistical analyses; abstract and paper writing.

      2. *Improving Wellness for Young Men*, February 2010 – August 2011, Johns Hopkins Center for Mind-Body Research
            PI: Erica Sibinga, M.D., M.H.S.
            Responsibilities: Research Assistant - Collected saliva samples for cortisol measurement; data entry; abstract writing.

Position: **Student Research Assistant (for credit)**, January 2008 – May 2009
Location: University of Maryland Baltimore County HABITS Lab, Baltimore, MD
Supervisor: Carlo DiClemente, Ph.D.
Role: Conducted literature searches and composed literature reviews. Organized collection of articles related to the Transtheoretical Model of Change. Assisted in the running of events for anti-smoking youth groups (T.R.A.S.H.)

PROFESSIONAL ACTIVITIES

Society Membership
2019   Society for Research in Adolescence
2019   Society for Research in Child Development (SRCD)
2018 - 2019   Society for Prevention Research (SPR)
2018   Academy Health

EDITORIAL ACTIVITIES

Peer Reviewer: *AIDS Care, Behavioral Medicine, British Journal of Developmental*
                       Psychology, Children, European Journal of Developmental Psychology,
                       Journal of Black Psychology, Mindfulness, Pediatrics

HONORS AND AWARDS

2020   Society for Research in Adolescence Emerging Scholar Student Travel
                       Award
2019   Alberta B. Szalita Award in Mental Health
2018   International Congress on Integrative Medicine & Health Young
                       Investigator Award
2010   Psi Chi Member Induction (Loyola)
2006 - 2009   Semester Academic Honors (UMBC)
2007   Dean's List (UMBC)

PUBLICATIONS

Peer-Reviewed Journal Articles
1. **Webb, L.**, Perry-Parrish, C., Ellen, J., & Sibinga, E. (2018). Mindfulness instruction for HIV-infected youth: A randomized controlled trial. *AIDS Care*, *30*(6), 688-695. doi: 10.1080/09540121.2017.1394434
2. Perry-Parrish, C., Copeland-Linder, N., **Webb, L.,** Shields, A., & Sibinga, E. (2016) Improving self-regulation in adolescents: Current evidence for the role of mindfulness-based cognitive therapy. *Adolescent Health, Medicine and Therapeutics*, *2016*(7), 101-108. doi: 10.2147/AHMT.S65820
3. **Webb, L.**, Stegall, S., Mirabile, S., Zeman, J., Shields, A., & Perry-Parrish, C. (2016) The management and expression of pride: Age and gender effects across adolescence. *Journal of Adolescence, 52*, 1-11. doi: 10.1016/j.adolescence.2016.06.009
4. Perry-Parrish, C., Copeland-Linder, N., **Webb, L.,** & Sibinga, E.M.S. (2016). Mindfulness-based approaches for children and youth. *Current Problems in Pediatric and Adolescent Health Care,46*, 172-178. doi: 10.1016/j.cppeds.2015.12.006
5. Sibinga, E., **Webb, L.**, Ghazarian, S., & Ellen, J. (2016). School-based mindfulness instruction: An RCT. *Pediatrics, 137*(1), 1-8. doi: 10.1542/peds.2015-2532

6. Weiss-Laxer, N., Platt, R., Osborne, L., Kimmel, M., Solomon, B., Mendelson, T., **Webb, L.**, & Riley, A. (2015). Beyond screening: A review of pediatric primary care models to address maternal depression. *Pediatric Research,* online printing, 1-8. doi: 10.1038/pr.2015.214

7. Perry-Parrish, C., **Webb, L.**, Zeman, J., Spencer, S., Malone, C., Reynolds, E., Hankinson, J., Specht, M., & Ostrander, R. (2015). Anger regulation and social acceptance in early adolescence: Associations with gender and ethnicity. *Journal of Early Adolescence,* online printing, 1-27. doi: 10.1177/0272431615611255

Manuscripts (Under Review)
1. **Webb, L.,** Clary, L., Johnson, R., & Mendelson, T. (under review). *Electronic and school bullying victimization by race/ethnicity and sexual minority status in a nationally representative sample of adolescents in the United States.* Under review at the Journal of Adolescent Health.

Manuscripts (In Preparation)
1. Sibinga, E., **Webb, L.,** Perin, J., Tepper, V., & Ellen, J. (in preparation). *MBSR in HIV-infected youth.*
2. **Webb, L.,** Clary, L., & Mendelson, T. (in preparation). *Electronic bullying victimization and suicide behavior by race/ethnicity and sexual minority status in a nationally representative sample of adolescents in the United States.*
3. **Webb, L.,** Clary, L., Johnson, R., & Mendelson, T. (in preparation). *Electronic bullying victimization and substance use by race/ethnicity and sexual minority status in a nationally representative sample of adolescents in the United States.*
4. Mendelson, T., **Webb, L.,** Artola, A., Molinaro, M. & Sibinga, E. (in preparation). *Online mindfulness programming for teachers: A pilot study of the DeStress Mondays campaign.*
5. **Webb, L.**, Mirabile, S., & Perry-Parrish, C. (in preparation). *Pride regulation and social acceptance: Gender and ethnicity differences in adolescents.*
6. **Webb, L.,** Mirabile, S., & Perry-Parrish. (in preparation). *Associations between pride regulation, social acceptance, and social functioning in African American youth: Age and gender differences*

Book Chapters
1. **Webb, L.,** & Sibinga, E. (in publication). Mindfulness-based stress reduction for youth and students. In T.L. Renshaw & S.R. Jimerson (Eds.), *Using Mindfulness to Promote Mental Health in Schools*. Oxford University Press.
2. Perry-Parrish, C., Copeland-Linder, N., **Webb, L.**, & Sibinga, E. (2016) Mindfulness-based therapies. In A. Breland-Noble, C.S. Al-Mateen, & N.N. Singh (Eds.), *Handbook of Mental Health in African American Youth.* Cham, Switzerland: Springer International Publishing.

TEACHING

Teaching Assistantships

Course:	The Epidemiology of Substance Use and Related Problems
Years/Terms:	2018-2019 2nd term
	2019-2020 1st term
Institution:	Johns Hopkins Bloomberg School of Public Health, Department of Mental Health
Principal Instructor:	Renee Johnson, Ph.D.

Course:	Prevention of Mental Disorders: Public Health Interventions
Years/Terms:	2017-2018 3rd & 4th term
	2018-2019 3rd term
	2019-2020 summer institute
Institution:	Johns Hopkins Bloomberg School of Public Health, Department of Mental Health
Principal Instructor:	Tamar Mendelson, Ph.D.

Course:	Fundamentals of Program Evaluation
Years/Terms:	2018-2019 3rd term
Institution:	Johns Hopkins Bloomberg School of Public Health, Department of Population, Family, and Reproductive Health
Principal Instructor:	Kristin Mmari, DrPH

Course:	The Intersection of Mental and Physical Health
Years/Terms:	2016-2017 4th term
Institution:	Johns Hopkins Bloomberg School of Public Health, Department of Mental Health
Principal Instructor:	Joseph Gallo, M.D., M.P.H. & Gail Daumit, M.D., M.H.S.

Mentorship

MHS Students:	Mentored students on how to navigate the 9-month MHS program, finding a research mentor, and next steps after completing the program (i.e., job applications and doctoral program applications).

2019-2020	Samantha Hutchison
2019-2020	Aditya Patibandia
2019-2020	Paula Zaremba
2019-2020	Nika Zharichenko
2019-2020	Yizhou Zhu

2018-2019	Angie Cruz
2018-2019	Dana Lee
2018-2019	Elise Planchet
2018-2019	Monica Rodriguez-Fernandez

Research Mentees:

| 2019 | Rachel Dows and Sushma Chapagain – Mentored on the process of writing and submitting poster abstracts for peer review at research conferences. |

GRANT PARTICIPATION

Training Grants

Grant:	*Drug Dependence Epidemiology Training Program (DDET)*, July 2017 – Present, NIDA, 5T32 DA007292
PI:	Renee Johnson, Ph.D.
Objective:	To produce the next generation of drug dependence epidemiologists who can address the need to reduce the burden of substance use disorders by conducting research, developing and implementing interventions, and examining substance use disorder services and systems of care.
Responsibilities:	Predoctoral Trainee – Complete coursework in substance use epidemiology and advanced statistical methods; attend regular meetings of DDET fellows; participate in substance use research.

Grant:	*Child Mental Health Services and Service System Research*, September 2016 – July 2017, NIMH, 4T32 MH019545
P.I.:	Philip Leaf, Ph.D.
Objective:	To train scientists to conduct research from a public health perspective concerning factors that affect the organization, implementation, and outcomes and mental health services and preventive interventions.
Responsibilities:	Predoctoral Trainee – Complete coursework in implementation and evaluation research; complete readings pertinent to training grant topics

CONFERENCE PRESENTATIONS
Presentations at Professional Conferences
1. **Webb, L.**, Clary, L., & Mendelson, T. (2020, March). *Urban adolescents' psychological functioning and trait mindfulness.* In Colaianne, B. (Chair), Mindfulness and Compassion Across Adolescence: Development, Associations with Psychological Well-Being, and Promotion in Schools. Accepted to the biennial meeting of the Society for Research on Adolescence, San Diego, CA (cancelled due to COVID-19).

2. **Webb, L.**, Clary, L., & Mendelson, T. (2020, March). *Electronic and school bullying: Increasing or decreasing for sexual minority and ethnic minority groups nationwide?* In Clary, L. (Chair), Exploring Contexts for Bullying Victimization in Middle and High School Students. Accepted to the biennial meeting of the Society for Research on Adolescence, San Diego, CA (cancelled due to COVID-19).

3. **Webb, L.**, Mirabile, S., & Parrish, C. (2019, March). *Gender and age differences in peer nominations and perceptions of pride regulation in black youth and links to social acceptance.* In Hawk, S. (Chair), Feeling, Flexibly: Flexibility in Child and Adolescent Emotion Regulation and its Links with Psychosocial Functioning. Presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.

4. **Webb, L.** (presider), Sibinga, E., & Mendelson, T. (2018, November). *The impact of mindfulness programming in urban public schools*. Presented at the International Symposium for Contemplative Research, Phoenix, AZ.

5. **Webb, L.,** & Sibinga, E. (2018, May). *Gender differences in effects of school-based mindfulness in urban minority youth*. Presented by Dr. Sibinga at the Pediatric Academic Societies' Annual Meeting, Toronto, ON.

6. Sibinga, E., **Webb, L.**, Kerrigan, D., & Ellen, J. (2018, May). *Mindfulness-based stress reduction improves coping in HIV-infected youth.* Presented by Dr. Sibinga at the Pediatric Academic Societies' Annual Meeting, Toronto, ON.

7. **Webb, L.**, Ghazarian, S., Ellen, J., & Sibinga, E. (2016, April). *Benefits of school-based mindfulness instruction for minority, urban males: A randomized controlled trial.* In Donovan, E. (Chair), Mindfulness-Based Interventions for Adolescents. Symposium presented by Dr. Sibinga at the biennial meeting of the Society for Research on Adolescence, Baltimore, MD.

8. **Webb, L.**, Johnson, N., & Sibinga, E. (2013, June). *D-Stress Baltimore: The efficacy of mindfulness-based stress reduction programs for middle grade students.* In Hurwitz, L. (Chair), Mental Health Workshop Track. Presented at the annual convention of the National Assembly on School-Based Health Care (NASBHC): Bringing Health Care to Schools for Student Success, Washington, D.C.

9. Sibinga, E., Perry-Parrish, C., Ghazarian, S., **Webb, L.,** & Ellen, J. (2013, May). *Mindfulness-based stress reduction for HIV-infected urban youth: A randomized, controlled trial.* Presented by Dr. Sibinga at the Pediatric Academic Societies' Annual Meeting, Washington, DC.

10. Sibinga, E., Perry-Parrish, C., Ghazarian, S., **Webb. L.**, & Ellen, J. (2013, April). *Mindfulness-based stress reduction for HIV-infected urban youth: A randomized, controlled trial.* Presented by Dr. Sibinga at the 11th Annual International Scientific Conference for Clinicians, Researchers, and Educators: Investigating and Integrating Mindfulness in Medicine, Health Care, and Society, Norwood, MA.

11. Sibinga, E., Perry-Parrish, C., Ghazarian, S., **Webb. L.**, & Ellen, J. (2013, February). *Mindfulness-based stress reduction for HIV-infected urban youth: A randomized, controlled trial.* In Semple, R. (Chair), *Clinical Applications of Mindfulness.* Symposium presented by Dr. Sibinga at the annual conference of Bridging the Hearts & Minds of Youth: Mindfulness in Clinical Practice, Education and Research, San Diego, CA.

Posters

1. **Webb, L.,** Musci, R., & Mendelson, T. (2020, May). *Profiles of comorbidity in urban youth and their correlates: A latent regression analysis.* Accepted to the 28th Annual Meeting of the Society for Prevention Research, Washington, D.C. (cancelled due to COVID-19).

2. Sibinga, E., **Webb, L.,** Perin, J., Kerrigan, D., & Tepper, V. (2020, May). *Mindfulness improves acceptance and medication adherence among HIV-infect youth: A mixed-methods, randomized controlled trial.* Accepted to be presented by Dr. Sibinga at the Pediatric Academic Societies Meeting, Philadelphia, PA (cancelled due to COVID-19).

3. **Webb, L.,** Clary, L., & Mendelson, T. (2020, March). *The associations of electronic bullying and substance use in racial/ethnic and sexual minority youth.* Presented at the annual meeting of the American Psychopathological Association, New York, NY.

4. Sibinga, E., **Webb, L.,** & Ellen, J.M. (2019, April). *Mechanisms of school-based mindfulness: Reductions in PTSD symptoms mediate improvements in important psychological outcomes.* Presented at the Pediatric Academic Societies Meeting, Baltimore, MD.

5. **Webb, L.,** Clary, L., & Mendelson, T. (2019, March). *Gender differences in trauma exposure and coping in low-income, urban youth.* Presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.

6. **Webb, L.,** & Mendelson, T. (2018, May). *A pilot study of a mindfulness website for teachers and classrooms: DeStress Mondays.* Presented at the International Congress on Integrative Medicine & Health, Baltimore, MD.

7. **Webb, L.**, & Sibinga, E. (2017, June). *Gender differences in the effect of mindfulness in urban minority youth.* Presented at the 25th Annual Meeting of the Society for Prevention Research, Washington, D.C.

8. Sibinga, E., **Webb, L.**, Moy, C., Ghazarian, S., Ellen, J.M., Stevenson, J., … Bezooayehu, Y. (2015, May). *Mindfulness, stress, and improved self-regulation among urban middle-school students.* Presented at the annual Johns Hopkins Community Health Forum, Baltimore, MD.

9. **Webb, L.,** Goldstein, L., & Perry-Parrish, C. (2012, November). *Pride management in youth: A multiple informant approach.* Presented at the 46th Annual Convention of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

10. **Webb, L.,** & Perry-Parrish, C. (2012, November). *Convergent validity between self-reports of emotion regulation in children and adolescents.* Presented at the 46th Annual Convention of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

11. **Webb, L.,** Perry-Parrish, C. (2012, November). *Peer nominations and self-reports of emotion regulation in children and adolescents: Convergent validity and age differences.* Presented at the 46th Annual Convention of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

12. **Webb, L.,** & Perry-Parrish, C. (2012, November). *Self- and peer reports of emotion regulation: Gender and ethnicity differences.* Presented at the 46th Annual Convention of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

13. **Webb, L.**, & Perry-Parrish, C. (2012, November). *Self-reports and peer reports of emotion regulation and social acceptance: Correlations between multiple informants.* Presented at the 46th Annual Convention of the Association for Behavioral and Cognitive Therapies,

National Harbor, MD

14. Sibinga, E., Perry-Parrish, C., Chung, S., Collado, S., **Webb, L.,** & Ellen, J. (2011, May). *School-based mindfulness instruction for urban middle-school male youth.* Presented at the joint meeting of the Pediatric Academic Societies and the Asian Society for Pediatric Research, Denver, CO.
15. Perry-Parrish, C., **Webb, L.**, & Ostrander, R. (2011, April). *Psychological, social, and behavioral correlates of childhood emotional dysregulation: A multiple informant approach.* Presented at the biennial meeting of the Society for Research in Child Development, Montreal, QC.
16. **Webb, L.**, & Perry-Parrish, C. (2011, March). *Convergent validity of self- and peer-reports of happiness regulation.* Presented at the biennial meeting of the Society for Research in Child Development, Montreal, QC.

ADDITIONAL INFORMATION

Psychological
Assessments:

Cognitive:	*Personality:*	*Surveys:*
WISC-IV	Rorschach	BASC-2
WAIS-IV	Thematic Apperception Test	ABAS-II
WIAT-III	Draw-A-Person	SCARED
KBIT	MMPI-2	BDI-II and BAI

Statistical Software: SPSS, STATA, SAS, R, MPlus