NEIGHBORHOOD SAFETY AND ADOLESCENT HEALTH AND FUNCTIONING OUTCOMES: THE MEDIATING ROLE OF ACCESS TO OUTDOOR PLAY IN CHILDHOOD

by

SYDNEY G. KRONAIZL

(Under the Direction of Kalsea J. Koss)

ABSTRACT

Research demonstrates that play is promotive of children's holistic health and development. However, environmental threats at the neighborhood level impede children's right to safe and accessible outdoor play. The current study utilizes data from the Fragile Families and Child Wellbeing Study (N = 4,441) to evaluate the longitudinal relation between neighborhood safety in early childhood and health and functioning outcomes in adolescence. Mediation and moderation analyses were conducted. Results indicated that neighborhood risk in early childhood predicted poorer health and functioning outcomes in adolescence, though this finding varied by perceived versus observed report and developmental domain. Outdoor play was not found to be a mediator. Neighborhood collective efficacy significantly predicted play in middle childhood, as well as mental health and social functioning outcomes in adolescence. Outdoor play mediated the association between neighborhood collective efficacy and adolescent physical activity and anxiety. No moderation was found. Research and policy implications are discussed.

INDEX WORDS: Neighborhood safety, play, outdoor play, neighborhood collective efficacy, longitudinal, mental health, physical health, social functioning

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DEDICATION

I dedicate this thesis to my beloved grandparents, whose unconditional love and unwavering support have never ceased to inspire and empower me. I love you. I miss you.

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I have received a great deal of support and assistance throughout the process of completing this thesis, for which I am tremendously grateful. I would like to express my deepest appreciation to my major professor, whose mentorship was truly invaluable in the successful completion of this thesis. I would also like to extend my deepest gratitude to my committee, whose insightful feedback allowed me to expand my thinking and improve the quality of my work. Many thanks to my cohort for their kind and continuous encouragement and to my family for everything. Finally, I extend my sincere thanks to my dear partner for his steadfast support and comfort throughout the process of completing this thesis.

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CHAPTER 1

INTRODUCTION & LITERATURE REVIEW

Defining Play

Play is so central to development and so fundamental to the human experience that it has been declared by the United Nations (1989) a right of every child. Through play, children of all ages gain the opportunity to explore and understand the world around them. Play enables preschool- and school-aged children to achieve mastery, granting them control over objects and roles that would otherwise be too overwhelming. The developmental benefits of play are far-reaching, extending into the physical, cognitive, social, and emotional domains (Ginsburg et al., 2007; Milteer et al., 2012; Yogman et al., 2018).

Because play is so complex, it is difficult to define unanimously and entirely. Throughout the years, definitions of play have evolved, at each stage reflecting the beliefs of those who defined it. Advocates of play have defined it as "…practice for the body, exercise for the feelings, and training for the mind" (Eberle, 2014, p. 217). Some scholars argue that functional definitions of play are inherently insufficient (Eberle, 2014). Often, play is defined by those features that distinguish it from activities that are not play. Based upon this distinction, there is a growing consensus that play consists of activities that are child-led, intrinsically motivated, engaging, and somehow distinct from reality (Eberle, 2014; Lester & Russell, 2010).

Benefits of Play on Health & Functioning

Play promotes positive physical development by encouraging movement and building healthy bodies. Classical theories of play such as the pre-exercise theory (Groos & Baldwin, 1901) posit that play provides children with an opportunity to practice physical behaviors that will aid in later survival. Oftentimes, play involves physical activity utilizing both fine and gross motor skills. Such play has the ability to promote a healthy body weight and cardiovascular functioning (Pretty et al., 2009; Tremblay et al., 2015). Research has consistently demonstrated an inverse relationship between time spent playing outdoors and body mass index (Ansari et al., 2015; Kimbro et al., 2010). As such, play has been posited by healthcare professionals as a strategy to combat the obesity epidemic in the United States (Milteer et al., 2012; Yogman et al., 2018). However, less is known about how early outdoor play and recreation activities may act as a foundation upon which later physical activity and exercise habits are built—a necessary dimension to examine, as play in childhood is believed to be predictive of later physical activity (Pretty et al., 2009).

The benefits of play extend beyond just physical health, encompassing mental health as well. Play enables children to create positive relationships and ameliorates stress, both of which contribute to mental health and wellbeing (Lester & Russell, 2010). Additionally, play is inherently pleasurable (Lester & Russell, 2010). Such pleasurable experiences may improve children's ability to cope with stressful and negative experiences, thereby promoting mental wellbeing. (Cohn & Frederickson, 2009 as cited in Lester & Russell, 2010). Play involving physical activity has been found to be associated with decreases in depressive symptoms, indicating that there are both direct

and indirect effects of play on mental health (Korczak et al., 2017). Moreover, time spent engaged in play activities is inversely associated with time spent engaged in sedentary activities such as television viewing, which in turn is associated with mental health disorders such as anxiety and depression (Kimbro et al., 2011; Milteer et al., 2012).

Play also enables children to improve their social skills by providing opportunities for problem solving, negotiation, conflict resolution, self-advocacy, and communication (Milteer et al., 2012). Although it was previously thought that play reflected social skills, there now exists a growing consensus that play promotes the development of such skills as well. This is especially true for play involving peers because it requires perspective taking and cooperation. As children play with others, they develop an awareness of the actions and motivations of others and adjust their own actions accordingly (Lester & Russell, 2010). When children play with others, they must establish and abide by a set of agreed-upon rules and roles in order to participate. Children's engagement in interactive play is positively associated with social competence in preschool- and school-aged children (Newton & Jenvey, 2010; Whitebread, 2017).

Benefits of Outdoor Play

While play in general is associated with a variety of positive outcomes, there are additional benefits specific to play that takes place outdoors. Outdoor play is especially beneficial to physical health because there are typically fewer space constraints and more opportunities for gross motor play outdoors than indoors (Pretty et al., 2009; Tremblay et al., 2015). Indeed, evidence indicates that outdoor play and BMI in children are inversely related (Ansari et al., 2012; Molnar et al., 2004). Outdoor play involving physical activity, such as running, climbing, and jumping, has positive implications for bone

strength, muscle strength, flexibility, balance, and coordination (Ginsburg et al., 2007; Milteer et al., 2012; Tremblay et al., 2015; Yogman et al., 2018).

Outdoor play is also beneficial to social functioning and mental health. Evidence indicates that less conflict and more cooperation occur during outdoor play (McClain & Vandermaas-Peeler, 2016). In his theory of cognitive development, Jean Piaget (1962) describes play as being central to development—a mechanism by which children come to understand their environment by engaging with it. There are aspects of the environment unique to outdoor spaces that may be especially beneficial to children's healthy growth and development. As Bento & Dias (2017) explain, "The characteristics of the [outdoor] space (open and unpredictable) enable the development of joint goals between children, leading to experiences of companionship among peers" (p. 159). Additionally, outdoor play specifically occurs in minimally structured spaces that are conducive to peer socialization and healthy development (Tremblay et al., 2015). In other words, there are elements of the environment specific to outdoor play that may augment the social benefits of play. Outdoor play has also been found to be more child-led, flexible, and driven by the interests of the child than indoor play (Frost, 1992; Tremblay et al., 2015; Waters & Maynard, 2010). Finally, time spent outdoors is associated with increased relaxation and enjoyment as well as decreased stress (Pretty et al., 2009). Through playing freely outdoors, children can develop and demonstrate skills in addition to gaining information that would be otherwise unavailable indoors. In short, in the case of outdoor play, the benefits of play in general are compounded by the benefits of being outdoors.

Outdoor play has the theoretical impetus to improve mental health and social functioning, warranting further attention to be paid to these specific associations. Although outdoor play is conducive to healthy development, there is a lack of research examining the benefits of outdoor play in early and middle childhood on health and functioning in adolescence. Moreover, research that has examined this relationship longitudinally (e.g., Piccininni et al., 2018) lacks generalizability to children in the United States as it was conducted in a different country.

Unequal Access to Outdoor Play

Although play is recognized as a fundamental right of children, there are barriers that result in inequitable access to safe play environments. Residential and economic segregation, in addition to discriminatory housing policies, have contributed significantly to concentrated poverty that disproportionately affects children of color (Turner & Gourevitch, 2017). In such neighborhoods, children may not be able to play outdoors due to violence or other environmental threats, such as the presence of loitering adults, vandalism, drug dealing, or public intoxication (Burdette & Whitaker, 2005; Milteer et al., 2012). Moreover, adult caregivers may not have the time or ability to provide children with the supervision and protection necessary to ensure outdoor play is safe (Milteer et al., 2012). As a result, access to outdoor play for children in low SES neighborhoods is restricted due to a lack of safe outdoor play areas (Milteer et al., 2012). It is important to note that such restrictions are placed with the intention of maximizing protection, rather than minimizing play. In other words, survival and safety are higher priorities than physical activity and outdoor play (Dias & Whitaker, 2013).

Neighborhood Safety

Neighborhood safety can be conceptualized as existing along two dimensions: place and perception (Leverentz et al., 2018). Neighborhood safety as a function of place can be further distinguished as the presence of negative or unsafe conditions or the absence of positive structures or conditions, such as community spaces. In the case of the former, the presence of things such as loitering adults, drug dealing, and public intoxication have been found to be negatively associated with the amount of time children spend playing outdoors (Burdette & Whitaker, 2005; Burdette et al., 2006). Regarding physical disorder, the presence of items such as abandoned vehicles, buildings in disrepair, and litter or empty bottles have been found to be inversely associated with time children spent engaged in recreational physical activity such as outdoor play (Molnar et al., 2004). Moreover, the presence of such disorder is argued to bring about more serious forms of crime, thereby further reducing neighborhood safety (Skogan, 1990 as cited in Markowitz et al., 2001).

In the case of neighborhood safety as perception, the absence of green spaces, parks, and well-equipped and supervised playgrounds lead to a dearth of safe outdoor spaces for children to play (Milteer et al., 2012). For example, there are fewer parks and community centers in economically disadvantaged neighborhoods, and those that do exist may be deemed unsafe because of environmental threats such as the presence of violence (Milteer et al., 2012; Molnar et al., 2004). Qualitative research conducted with Black mothers of adolescent girls living in a low-income urban neighborhood identified a lack of safe recreational spaces as a key theme among participants (Dias & Whitaker, 2013).

As one participant explained:

> Where is the recreation? There are no swings. There are no slides. No nothing for the kids to do, but running around. And in the midst of running around, cars. So where are they going to play? Even if I did allow my daughter to come outside, where is she going to play?" (Dias & Whitaker, p. 213).

Evidence suggests that the physical environment of neighborhoods, such as a lack of access to parks, sidewalks, and recreation centers, is significantly associated with childhood obesity, presumably through a lack of physical activity play (Singh, et al., 2010).

The characteristics of neighborhoods, such as perceived social disorder and safety, can influence where and how residents spend their time. There exists a large body of evidence that suggests maternal perceptions of neighborhood safety influence children's access to outdoor play, in that mothers will not let their children play outdoors in neighborhoods they perceive as being unsafe—a finding that has persisted across age groups of children (Burdette & Whitaker, 2005; Dias & Whitaker, 2013; Kimbro & Schachter, 2011; Molnar et al., 2004; Wier et al., 2006).

Perceived neighborhood safety varies considerably by socioeconomic status. Weir et al. (2006) found that parents living in inner city neighborhoods expressed significantly higher levels of anxiety regarding neighborhood safety than did parents living in suburban neighborhoods. This anxiety, or lack thereof, influenced parents' behavior such that inner-city parents limited their children's outdoor play while suburban parents did not. Additionally, research has found that, in the neighborhoods perceived by parents to

be safest, a majority of inhabitants had at least a 3:1 household income to poverty ratio, and a majority of mothers had obtained a college degree (Burdette & Whitaker, 2005).

Perceived neighborhood safety also appears to be influenced by race, with Black and Hispanic mothers being over twice as likely to have fears regarding their child playing outside than their White counterparts (Kimbro & Schachter, 2011). Inequalities driven by structural racism are evident at the neighborhood level, with Black and Hispanic or Latino children and their families being significantly more likely to reside in neighborhoods with high rates of poverty and violence (Dias & Whitaker, 2013; Firebaugh & Acciai, 2016). Because play is believed to foster resilience, or the ability to persevere despite stress and adversity (Lester & Russell, 2010; Milteer et al., 2012), such trends indicate a troubling cycle. Here, the children for whom play's promotion of resilience would be especially beneficial are unable to access it due to the very stress and adversity such resilience would combat.

Neighborhood Collective Efficacy

Maternal perceptions of neighborhood safety are influenced not only by physical aspects of the neighborhood, but also by social connections with neighbors (Wier et al., 2006). Collective efficacy is defined as "…the ability to effectively intervene in neighborhood problems and to supervise residents to maintain public order" (Markowitz et al., 2001, p. 294). Collective efficacy can also be defined as a sense of closeness to or cohesion with one's neighbors (Burdette et al., 2006). A key assumption of social disorganization theory is that collective efficacy assists in the prevention of crime and delinquency in neighborhoods (Sampson et al., 1997). The inverse is also true, whereby a lack of collective efficacy results in higher rates of crime and delinquency, further

reducing opportunities for cohesion among neighborhood residents. Evidence suggests that mothers who perceive their neighborhood collective efficacy as moderate to high are significantly less likely to fear their children playing outside than are mothers who perceive their neighborhood collective efficacy as low (Weir et al., 2006). Higher maternal perception of collective efficacy has also been found to be associated with more time engaged in outdoor play among children (Kimbro et al., 2010).

Theoretical Framework: Social Organization Theory

In accordance with social organization theory, collective efficacy provides neighborhood residents with the opportunity to combat problems such as violence (Shaw & McKay, 1942; Sampson et al., 1997). However, such violence may affect the formation of collective efficacy as it renders public spaces unsafe, thereby preventing residents from socializing and creating social networks (Harding, 2009). In short, there exists a complex and mutually informative relationship between collective efficacy and neighborhood safety. The existence of this relationship is demonstrated in research indicating that neighborhoods perceived as demonstrating high collective efficacy are also perceived by residents as being safer (Kimbro & Schachter, 2011). This suggests that mothers in neighborhoods with high collective efficacy may allow their children to play outdoors as a sense of safety is fostered by strong social ties. The ability to rely on neighbors to assist in supervising and protecting children playing outdoors may provide "…an extra layer of protection for neighborhood children [playing] outside" (Milteer et al., 2012, p. e207).

Gaps in the Current Literature

A relation between collective efficacy and children's outdoor play has also been established, with research indicating that parents are more likely to allow their children to play outside in neighborhoods that they perceive as having moderate to high levels of collective efficacy (Wier et al., 2006). While research supports the belief that collective efficacy is related to both neighborhood safety and children's outdoor play as separate entities, less is known about how collective efficacy influences the relation between neighborhood safety and outdoor play. Moreover, much research on neighborhood safety relies on Census-tract data such as income and employment rates which fail to provide insight on social processes and pathways. Community surveys and observation are required to assess these dimensions of neighborhoods (Leventhal & Brooks-Gunn, 2000).

Cross-sectional research indicates that maternal perceptions of neighborhood safety influence children's access to outdoor play, especially among racial and ethnic minority children in economically disadvantaged and inner-city neighborhoods (Burdette & Whitaker, 2005; Dias & Whitaker, 2013; Kimbro & Schachter, 2011; Molnar et al., 2004; Wier et al., 2006). Although this relation has been found across age groups, there is a lack of research examining these relations longitudinally. That is, less is understood about how the impact of neighborhood safety on access to outdoor play persists across time. Finally, although there exists an emphasis on neighborhood influences on development, much research has focused predominantly on school readiness, academic achievement, delinquency, and childbearing as outcomes of interest (Leventhal & Brooks-Gunn, 2000; Harding, 2009). Although there is evidence to suggest that

neighborhood safety impacts the subsequent physical and mental health of child and adolescent residents, less is known about the mechanisms by which these impacts occur.

The Present Study

The goals of the present study were trifold. The first was to examine the longitudinal effect of neighborhood safety on holistic health and functioning in adolescence. It was hypothesized that neighborhood safety in early childhood would be significantly associated with mental health, physical health and activity, and social functioning in adolescence. This hypothesis is reflected in Figure 1 (Paths A1 – A3). The second was to examine outdoor play as a potential mediating mechanism between neighborhood safety and adolescent health and functioning. It was hypothesized that time spent engaged in outdoor play would mediate the relation between neighborhood safety in early childhood and health and functioning in adolescence, indicating that neighborhood safety in childhood improves health and functioning in adolescence via access to and utilization of outdoor play. This hypothesis is reflected in Figure 1 (Paths B & C). The third was to examine the role of maternal perceptions of collective efficacy as a potential moderator in the relation between neighborhood safety and children's engagement in outdoor play. It was hypothesized that collective efficacy would act as a moderator, such that mothers who perceive their neighborhoods as unsafe would be more likely to allow their children to play outside if they also perceive their neighborhoods as demonstrating collective efficacy. This hypothesis is reflected in Figure 1 (Path D). The posited relationships and research questions are presented below.

Research Questions

1. What is the relation between neighborhood safety in early childhood and health and functioning outcomes in adolescence?
2. To what extent is the relation between neighborhood safety and health and functioning outcomes mediated by outdoor play?
3. To what extent is the relation between neighborhood safety and outdoor play moderated by maternal perceptions of neighborhood collective efficacy?

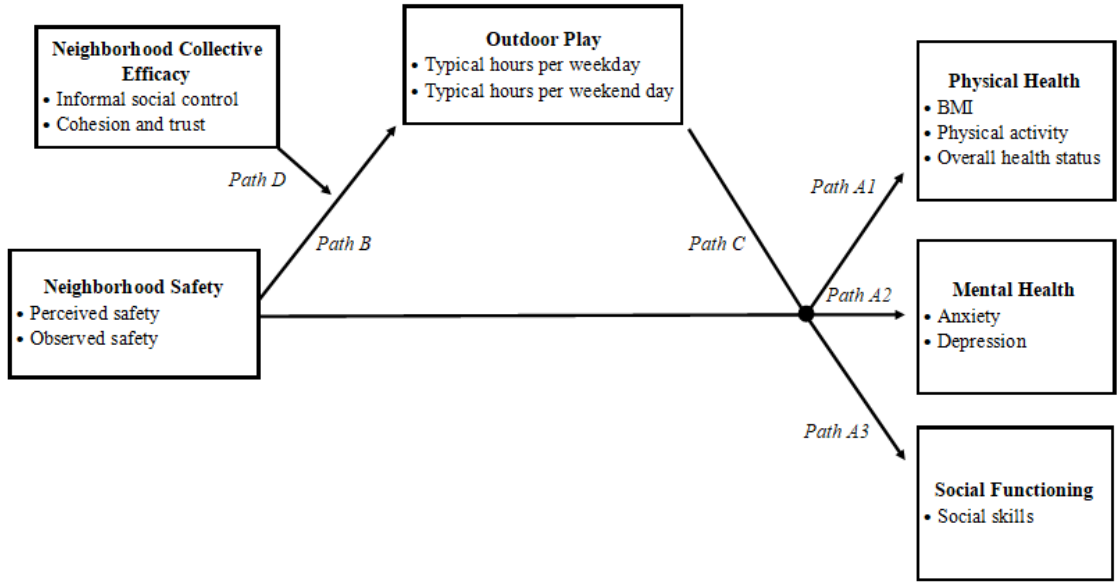

Figure 1. Proposed model

CHAPTER 2

METHOD

Participants

Data were obtained from the Fragile Families and Child Wellbeing Study (FFCWS), a nationally representative, longitudinal birth cohort study with baseline data collection occurring at children's birth, from 1998 – 2000. Additional waves of data collection occurred when children were approximately 1, 3, 5, 9, and 15 years old. The sample included 4,898 children and caregivers, with children born to unmarried parents being intentionally oversampled such that these participants constituted roughly three quarters of the sample (Reichman et al., 2001). Participants were included in the present analysis if they had completed the baseline interview (1998 – 2000) in addition to any of the follow-up interviews and home visits at years 5 (2003 – 2006), 9 (2007 – 2010), and 15 (2014 – 2017). This resulted in a sample of 4,441 children and their families. Of the 4,441 participants, 1,988 completed a home observation in addition to the survey, resulting in data on the condition of the home's surrounding block at age 5 for this subset of participants.

Neighborhood risk and collective efficacy were assessed via maternal report using data from the year 5 data collection wave. Outdoor play was measured via primary caregiver report using data from the year 9 data collection wave. Health and functioning outcomes were assessed via teen self-report using data from the year 15 data collection wave. Covariates of maternal marital status, education, and household income were

measured at baseline data collection. Additional covariates included maternal depression measured at year 5 and child Body Mass Index (BMI), time spent watching television in a typical week, and pubertal development measured at year 9. A flowchart illustrating the number of participants at each timepoint can be found below (Figure 2).

Demographics of the study sample (*N* = 4441) are presented in Table 1. At baseline, mothers were on average 25.18 years old (*SD* = 6.02) at the birth of their child. At year 5, children were on average 5.16 years old (*SD* = 0.24). At year 9, children were on average 9.29 years old (*SD* = 0.37). At year 15, teens were on average 15.60 years old (*SD* = 0.77). Of the children in the sample, 52.24% (n = 2320) were male. Racial/ethnic identity was measured via teen report at year 15. Responses indicate that 49.04% of participants (n = 1601) identified as non-Hispanic Black or African American, 24.90% (n = 813) identified as Hispanic or Latino, 18.07% (n = 590) identified as non-Hispanic White, 2.63% (n = 86) identified with an other racial/ethnic identity, and 5.36% (n = 175) identified as multiracial. Regarding maternal racial/ethnic identity, 48.33% of participants (n = 2142) identified as non-Hispanic Black or African American, 26.76% of participants (n = 1186) identified as Hispanic or Latino, 21.23% of participants (n = 941) identified as non-Hispanic White, and 3.68% (n = 163) identified with an other racial/ethnic identity.

Measures

Neighborhood Risk

Neighborhood risk was measured at year 5 using two distinct dimensions. First, maternal perception of neighborhood risk was measured on a yes/no scale based on response the question: “Have you ever been afraid to let [child] go outside because of violence in your neighborhood?” (0 = *no*, 1 = *yes*). Prior research investigating maternal

fears of children's outdoor play have also utilized this measurement (e.g., Kimbro & Schachter, 2011). Second, the Home Observation for Measurement of the Environment Inventory (Bradley & Caldwell, 1984) relying on interviewer observation was also used to measure observed wellbeing of the surrounding block. Four items assessing the condition of the block surrounding the home were summed to create the Condition of Surrounding Block subscale, consistent with Leventhal et al. (2004). The items comprising the subscale demonstrated very good internal reliability in the present study (Cronbach's $\alpha = 0.85$). The subscale included questions such as "Is there garbage/litter/broken glass in the street/sidewalks/yards?" to which interviewers responded on a 4-point Likert scale ranging from *almost none* to *yes, almost everywhere*. For analysis, responses were summed with higher scores indicating better conditions and lower scores indicating poorer conditions.

Collective Efficacy

Two sets of items were utilized together to measure neighborhood collective efficacy at year 5. An adapted version of the Informal Social Control Scale (Sampson et al., 1997) was used to assess the collective social control of residents' children. The scale consisted of five items and prompted mothers to report the likelihood that neighbors could be relied on to intervene in various situations using a 4-point Likert scale ranging from *very unlikely* to *very likely*. Here, the original instrument was modified such that the responses were consistent with a 4-point rather than a 5-point Likert scale. Items included situations such as "If children were spray painting buildings with graffiti." Internal consistency for the present study was good (Cronbach's $\alpha = 0.88$). The second set of items, drawn from the Social Cohesion and Trust Scale (Sampson et al., 1997), consisted

of five items regarding mother's perceptions of cohesion in their neighborhood. The adapted scale consisted of five items such as "This is a close-knit neighborhood" and responses were measured on a 4-point Likert scale from *strongly disagree* to *strongly agree*. Here, the original instrument was modified such that the responses were consistent with a 4-point rather than a 5-point Likert scale. The items comprising this scale demonstrated good internal consistency in the present study (Cronbach's $\alpha = 0.83$). Three negatively worded items in the Social Cohesion and Trust Scale were reverse coded and responses to the items from both scales were summed to create a measure of collective efficacy with higher scores indicating greater perceived collective efficacy. The current sample demonstrated adequate internal reliability (Cronbach's $\alpha = 0.76$). This method of measurement has been utilized in research investigating similar topics to those of the present study (e.g., Kimbro & Schachter, 2011).

Outdoor Play

Children's outdoor play was measured at year 9 via primary caregiver report, where caregivers were asked to report the number of hours their child typically spent playing outdoors separately for both a typical weekday and a typical weekend day. If mothers reported less than one hour of outdoor play per day, their response was coded by the interviewer as zero. Prior studies investigating children's outdoor play have relied on this method of measurement (e.g., Burdette & Whitaker, 2005; Burdette et al., 2006; Kimbro et al., 2011). Additionally, this caregiver report measure is correlated with physical activity levels in preschool-aged children measured via accelerometer (Burdette et al., 2004). For purposes of analysis in the present study, a total play variable, indicating the number of hours the child spent playing outdoors in a typical week, was computed by

summing the product of reported hours spent playing outdoors on a typical weekday by 5 with the product of reported hours spent playing outdoors on a typical weekend by 2. Child outdoor play on a typical weekday and weekend day were moderately and significantly associated with one another ($r = 0.54$, $p < 0.001$).

Physical Health: Body Mass Index (BMI)

Child physical health outcomes included calculated body mass index, teen report of physical activity, and teen report of overall health status. At the year 15 follow-up teens' height and weight were measured using standard procedures during the home visit if it was completed. Here, a randomly selected subsample of teens and families completed a home visit with the remainder of teens and families completing interviews conducted by phone. In participants for whom a home visit was not completed (n = 3351), BMI was measured via self-reported height and weight. Among children and teens ages 2 – 19 years, BMI percentile values below the 5th percentile are considered underweight, values from the 5th percentile to less than the 85th percentile are considered healthy weight, values above the 85th percentile and below the 95th percentile are considered overweight, and values above the 95th percentile are considered obese. (Centers for Disease Control and Prevention, 2018). In accordance with these CDC guidelines, 2.56% of teens (n = 76) were underweight, 59.12% (n = 1753) were healthy weight, 19.02% (n = 564) were overweight, and 19.29% (572) were obese. The results of a one-way ANOVA indicated that there were no significant differences in total play by BMI category ($F(3,2961 = 1.451$, $p = 0.226$).

Physical Health: Physical Activity

Teens completed three items assessing their levels of physical activity. First, teens reported how many days of the previous seven they had been physically active (i.e., engaged in activity that increased their heart rate) for at least 60 minutes. Second, they provided the number of days they engaged in physical activity for at least 30 minutes during a typical week. Lastly, they reported the number of days they engaged in vigorous physical activity (i.e., activity that made them sweat, made their heart beat fast, or made them out of breath) during a typical week. For each of the questions, responses ranged from *0* to *7* days a week. For analysis, a mean measure of total physical activity was calculated, with higher scores indicating greater levels of physical activity. These items demonstrated very good internal consistency (Cronbach's $\alpha = 0.88$).

Physical Health: Perceived Health Difficulties

Teens also rated their perceived general health on a 5-point Likert scale ranging from *excellent* to *poor*, with higher scores indicating greater perceived health difficulties. This measure of self-reported health was also used in the National Longitudinal Study of Adolescent Health and has been found to be moderately stable over time and correlated with measures of physical health such as weakness and headache (Boardman, 2006). Self-reported health is a crucial component in the assessment of one's overall health status (Idler & Benyamini, 1997).

Mental Health: Anxiety and Depression

Adolescent depressive symptoms were measured using an abbreviated version of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The original twenty-item scale assessing symptoms in the prior week was modified to include

five items assessing symptoms in the prior four weeks. The original scale demonstrates "high internal consistency, acceptable test-retest stability…and substantial evidence of construct validity" (Radloff, 1977, p. 400). The items comprising this modified scale were also utilized in the National Longitudinal Study of Adolescent to Adult Health (Add Health) and demonstrated adequate internal consistency (Cronbach's $\alpha = 0.76$) (Radloff, 1977). For this measurement, teens were asked to report the extent to which they agreed with statements such as "I feel I cannot shake off the blues, even with help from my family and friends," on a 4-point Likert scale ranging from *strongly disagree* to *strongly agree*. For analysis, responses were averaged to create a mean depressive symptoms score. The items comprising this composite measure demonstrated adequate internal consistency in the present study (Cronbach's $\alpha = 0.76$).

Adolescent anxiety symptoms were measured via the Brief Symptom Inventory 18 (BSI 18). The original scale consisted of 18 items assessing symptoms in the previous 7 days; the modified measure consisted of 6 items assessing symptoms in the previous 4 weeks and included items such as "I have spells of terror or panic" and "I feel nervous or shaky inside." Responses were measured on a 4-point Likert scale ranging from *strongly disagree* to *strongly agree*. The BSI 18 Anxiety Subscale has demonstrated high internal consistency ($\alpha = 0.85$) and test-retest reliability ($r = 0.80$) (Derogatis & Savitz, 2000). For analysis, mean scores of anxiety symptoms were created. The items comprising this composite measure demonstrated adequate internal consistency in the present study (Cronbach's $\alpha = 0.76$).

Social Functioning: Positive Social Functioning

To assess social functioning, teens completed items from the Adaptive Social Behavior Inventory (ASBI) (Hogan et al., 1992) and Social Skills Rating System (SSRS) (Gresham & Elliott, 1990). Both scales were modified to be appropriate for teen self-report by transformation into first-person statements. Teens rated how true they believed each statement was for them on a 3-point scale ranging from *not true* to *often true*. The Express Subscale of the ASBI assessed the teen's ability to understand the feelings of others, sympathize with others, and communicate openly and directly with others. It included three items, such as "I understand others' feelings like when they are happy, sad, or mad." This item has demonstrated adequate reliability in previous research (Hogan et al., 1992). The Assertion scale of the SSRS evaluated the teen's social behaviors and includes nine items such as "I make friends easily." This item has demonstrated good reliability in previous research (Cronbach's $\alpha = 0.90$) (Gresham & Elliott, 1990). For analysis, responses to the items in both scales were recoded from 1 – 3 to 0 – 2 and summed to calculate an overall score for positive social functioning. The included items demonstrated adequate reliability in the present study (Cronbach's $\alpha = 0.74$).

Covariates

Maternal age, maternal education, household income—measured via maternal report at baseline—and child's race/ethnicity—measured via self-report at age 15—were included as covariates in all analyses. Because the household income variable was highly skewed, a natural log transformation was performed prior to analyses. Pubertal development and time spent watching television at age 9 were also included as covariates

in all analyses. Pubertal development was measured using the Pubertal Development Scale (Petersen et al., 1988) consisting of several questions regarding physical development and change. Here, primary caregivers reported the degree to which general and sex-specific physical changes such as breast development and facial hair had occurred in their child, with responses options ranging from 1 (*No*) to 4 (*Development completed*). A yes/no question asking caregivers of girls if menstruation had started was recoded such that 4 = *Yes* and 1 = *No*. The mean of these responses was computed to create an overall pubertal development score. At age 9, mothers reported how many hours their child spent watching television on an average weekday and weekend day, either at home or elsewhere. Interviewers coded responses of less than one hour a day as zero. For the present analyses, a total television variable was created, reflecting the number of hours the child spent watching television in a typical week. Here, the product of reported hours spent watching television on a typical weekday and 5 was summed with the product of reported hours spent watching television on a typical weekend and 2. Maternal depression at age 5 was included as an additional covariate in those analyses involving mental health outcomes. Maternal depression was measured using Section A of the Composite International Diagnostic Interview Short Form (CIDI-SF) (Kessler et al., 1998), which used diagnostic guidelines set forth in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition (DSM-IV). Based on their responses, mothers were classified as either meeting or not meeting depression criteria. Child's Body Mass Index (BMI) at age 9, calculated using child's height and weight measurements, was included as an additional covariate in those analyses involving physical health outcomes.

Data Analysis

First, descriptive statistics for each of the study variables as well as correlations among variables were calculated. Next the association between perceived neighborhood risk and each individual health and functioning outcome was analyzed, as well as the association between observed wellbeing of the surrounding block and each individual outcome.

To determine the direct effect of perceived neighborhood risk on adolescent outcomes, as well as the indirect effect of perceived neighborhood risk through total outdoor play, mediation analyses were conducted using PROCESS (Hayes, 2018). Maternal marital status, maternal education, child's race/ethnicity, and household income at baseline as well as child's age, pubertal development, and time spent watching television at age 9 were included as covariates in all analyses. Child's body mass index (BMI) at age 9 and maternal depression ate age 5 were included as additional covariates for those analyses involving physical and mental health outcomes, respectively. To determine the direct effect of observed well-being of the surrounding block on adolescent outcomes, as well as the indirect effect of observed well-being of the surrounding block through total outdoor play, parallel analyses were conducted with observed well-being, rather than perceived risk, as a predictor.

To test whether effect of perceived neighborhood risk on total outdoor play was moderated by perceived collective efficacy, moderation analysis was conducted using PROCESS (Hayes, 2018). Maternal marital status, maternal education, child's race/ethnicity, and household income at baseline, as well as child's age, pubertal development, and time spent watching television at age 9 were included as covariates.

Parallel analyses were conducted using observed wellbeing of the surrounding block. Predictors and the moderator were mean-centered prior to analysis.

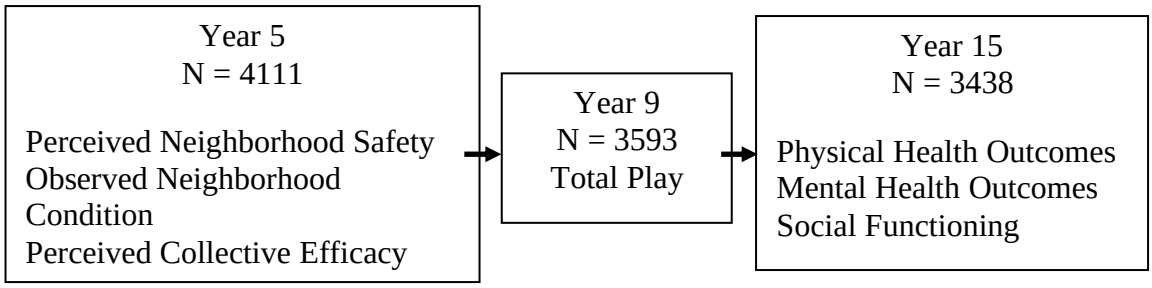

Figure 2. Participant flowchart

Table 1
Study Demographics (N = 4441)

Child Characteristics	**N (%)**	**M (SD)**
Sex		
Male	2320 (52.24)	.
Female	2121 (47.76)	
Race/Ethnicity		
White, non-Hispanic	590 (18.07)	
Black, non-Hispanic	1601 (49.04)	.
Hispanic/Latino	813 (24.90)	
Other	86 (2.63)	
Multiracial	175 (5.36)	
Age at year 5	.	5.16 (0.24)
Age at year 9	.	9.29 (0.37)
Age at year 15	.	15.60 (0.77)
Mother Characteristics		
Age	.	25.18 (6.02)
Household income	.	32128 (31536)
Marital status		
Married	1073 (24.16)	.
Unmarried	3368 (75.84)	
Race/Ethnicity		
White, non-Hispanic	941 (21.23)	
Black, non-Hispanic	2142 (48.33)	.
Hispanic/Latino	1186 (26.76)	
Other	163 (3.68)	
Education		
Less than high school	1505 (33.93)	
High school degree or equivalent	1374 (30.97)	.
Some college	1079 (24.32)	
College graduate or more	478 (10.78)	
Maternal depression		
Yes	702 (17.00)	.
No	3427 (83.00)	

Note. Aside from depression (year 5), all mother characteristics were measured at baseline data collection.

CHAPTER 3

RESULTS

Descriptive Statistics and Correlations

At year 9, children spent an average of 18.17 hours (*SD* = 10.75) engaged in outdoor play in a typical week. Additionally, children spent an average of 18.75 hours (*SD* = 11.36) engaged in television viewing in a typical week. Total play and total television were positively correlated ($r = 0.15$, $p < 0.01$). Maternal perceived neighborhood risk was found to be negatively correlated with observed wellbeing of the surrounding block, indicating that perceived neighborhood risk is associated with lower levels of wellbeing of the surrounding block. Maternal perceived neighborhood risk was also found to be negatively correlated with perceived collective efficacy, indicating that perceived neighborhood risk is associated with lower levels of perceived collective efficacy among mothers in the sample. Finally, both perceived neighborhood risk and observed wellbeing of the surrounding block were significantly correlated with each of the individual physical, mental, and social health and functioning outcomes such that greater neighborhood risk was associated with poorer functioning across all domains. The results of all descriptive and correlation calculations are reported in Table 2.

Neighborhood Functioning and Adolescent Outcomes

To test the relation between the neighborhood risk and observed wellbeing predictors and the adolescent health and functioning outcomes, regressions were utilized, the results of which are presented in Table 3. A significant effect of perceived

neighborhood risk was found on the outcomes of physical activity, indicating that higher neighborhood risk at age 5 was associated with lower physical activity levels at age 15 (β = -0.255, SE = 0.100, p = 0.011). Similarly, neighborhood risk at age 5 was associated with lower positive social functioning at age 15 (β = -0.694, SE = 0.198, p = 0.001). The association between perceived neighborhood risk at age 5 and perceived health difficulties at age 15 approached, but did not achieve, statistical significance (β = 0.094, SE = 0.048, p = 0.051). A significant effect of observed wellbeing of the surrounding block was found on the outcomes of physical activity (β = 0.059, SE = 0.021, p = 0.004), anxiety (β = -0.018, SE = 0.007, p = 0.013), depression (β = -0.020, SE = 0.006, p = 0.002), and positive social functioning (β = 0.181, 0.041, p < 0.001). These results indicate that higher observed wellbeing of the surrounding block at age 5 was associated with greater levels of physical activity and positive social functioning as well as lower levels of anxiety and depression at age 15.

Outdoor Play as a Mediator

To test the effect of total outdoor play as a mediator, separate multiple linear regressions were performed for each outcome, the results of which are presented in Table 4. Maternal depression was included as an additional covariate in those regressions involving mental health outcomes. Child's Body Mass Index (BMI) at age 9 was included as an additional covariate in those analyses involving physical health outcomes.

Perceived Neighborhood Risk

Perceived neighborhood risk was not significantly associated with total play in the case of any outcome. However, the association approached statistical significance in the case of BMI (β = -1.054, SE = 0.560, p = 0.060), anxiety and depression (β = -1.001, SE

= 0.536, p = 0.062), and positive social functioning (β = -1.011, SE = 0.534, p = 0.058). Total play was significantly associated with the outcomes of physical activity (β = 0.014, SE = 0.004, p < 0.001) and anxiety (β = -0.003, SE = 0.001, p = 0.027), indicating that more outdoor play at age 9 was associated with higher physical activity levels and lower anxiety levels at age 15. Total play was not significantly associated with the outcomes of BMI, perceived health difficulties, depression, or positive social functioning. No significant indirect effects were found, suggesting that outdoor play in middle childhood does not act as a mediator in the relationship between perceived neighborhood risk in early childhood and health and functioning outcomes in adolescence.

Observed Wellbeing of the Surrounding Block

Observed wellbeing of the surrounding block was not significantly associated with total play in the case of any outcome. Total play was significantly associated with the outcomes of physical activity (β = 0.013, SE = 0.004, p = 0.003), indicating that more outdoor play at age 9 was associated with higher physical activity levels at age 15. The association between total play and anxiety approached, but did not achieve, statistical significance (β = -0.003, SE = 0.002, p = 0.061). The direction of this association was in the expected direction, however, with higher levels of outdoor play at age 9 being associated with lower levels of anxiety. Total play was not significantly associated with the outcomes of BMI, perceived health difficulties, depression, or positive social functioning. No significant indirect effects were found, suggesting that outdoor play in middle childhood does not mediate the relationship between observed wellbeing of the surrounding block in early childhood and health and functioning outcomes in adolescence.

Collective Efficacy as a Moderator

To test the effect of perceived collective efficacy as a moderator of the relation between neighborhood risk and outdoor play, interaction terms for perceived risk and collective efficacy, as well as observed neighborhood condition and collective efficacy, were created. The results of these analyses are presented in Table 5. Perceived collective efficacy was significantly associated with total play such that higher levels of collective efficacy were associated with higher levels of outdoor play (β = 1.208, SE = 0.322, p < 0.001). However, neither perceived neighborhood risk nor the interaction term, were significantly associated with total play. Observed condition of the surrounding block and perceived collective efficacy at age 5 were both significantly associated with total play at age 9 (β = -0.238, SE = 0.115, p = 0.039 and β = 1.930, SE = 0.418, p < 0.001, respectively). These results indicate that higher levels of observed wellbeing were associated with lower levels of outdoor play, and higher levels of collective efficacy were associated with higher levels of outdoor play. However, the interaction term was not significantly associated with total play. Thus, there was no evidence of collective efficacy as a moderator of perceived or observed neighborhood risk.

Collective Efficacy as a Mediator

Because a significant main effect of collective efficacy on total play was found, additional mediation analyses were conducted with collective efficacy as the predictor. The results of these analyses are reported in Tables 6 & 7. The relation between collective efficacy and the outcomes of anxiety, depression, and positive social functioning were statistically significant (β = -0.042, SE = 0.020, p = 0.032 and β = -0.040, SE = 0.018, p = 0.027 and β = 0.547, SE = 0.116, p < 0.001, respectively). These

results indicate that higher levels of collective efficacy were associated with lower levels of anxiety and depression as well as higher levels of positive social functioning. Of note, every relation between the predictor of collective efficacy and the mediator of total play was statistically significant ($p < 0.001$), indicating that higher levels of perceived collective efficacy at age 5 were associated with higher levels of outdoor play at year 9 in the case of all outcomes. The relation between total play and physical activity was statistically significant ($\beta = 0.014$, SE = 0.004, $p < 0.001$), as was the relation between total play and anxiety ($\beta = -0.003$, SE = 0.001, $p = 0.026$). These findings indicate that more outdoor play at age 9 was associated with higher levels of physical activity and lower levels of anxiety at year 15. However, significant relations between the mediator of total play and the outcomes of perceived health difficulties, BMI, depression, and positive social functioning were not found. There was a significant indirect effect of total play in the association between perceived collective efficacy and physical activity (95% CI [0.057, 0.030]) as well as the association between perceived collective efficacy and anxiety (95% CI [-0.007, -0.001]), but not in the association between the predictor of perceived collective efficacy and the outcomes of BMI, perceived health difficulties, depression, and positive social functioning. Taken together, these results suggest that maternal perceptions of collective efficacy may act as a predictor of total play, rather than a moderator in relation to total play and adolescent health.

Table 2
Correlations & Descriptives

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Perceived Neighborhood Risk	1												
2 Observed Wellbeing of Surrounding Block	-.252**	1											
3 Perceived Collective Efficacy	-.367**	.193**	1										
4 Total Play (hours/week)	-.013	-.074**	.044*	1									
5 Youth's Body Mass Index (BMI) at Age 15	.061**	-.066**	-.050**	.030	1								
6 Mean Physical Activity Score	-.070**	.089**	.040*	.074**	-.091**	1							
7 Perceived Health Difficulties	.039*	-.047*	-.019	-.020	.234**	-.212**	1						
8 Mean Anxiety Score	.038*	-.054*	-.052**	-.033	.049**	-.120**	.213**	1					

Table 2 (cont.)
Correlations & Descriptives

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
9 Mean Depression Score	.050**	-.083**	-.061**	-.023	.067**	-.182**	.271**	.650**	1				
10 Positive Social Functioning	-.075**	.138**	.109**	-.008	-.043*	.256**	-.215**	-.240**	-.305**	1			
11 Youth's Body Mass Index (BMI) at Age 9	.030	-.064**	-.021	-.014	.714**	-.035	.222**	.024	.039*	-.003	1		
12 Mean Pubertal Development Score	.067**	-.096**	-.013	-.048**	.189**	-.120**	.102**	.041*	.060**	0	.258**	1	
13 Total Television	.056**	-.126**	-.077**	.149**	.080**	-.055**	.051**	.018	.025	-.037*	.086**	.078**	1
Mean	0.16	10.08	2.12	18.17	24.02	3.66	2.03	0.81	0.60	16.95	19.56	1.47	18.75
Standard Deviation	0.37	2.46	0.64	10.75	5.73	2.03	0.953	0.65	0.60	3.86	4.53	0.36	11.36
Range	0 - 1	0 - 12	0 - 3	0 - 57	9.49 - 62.76	0 - 7	1 - 5	0 - 3	0 - 3	0 - 24	9.84 - 47.17	1 - 4	0 - 75
N	4108	1988	4111	3593	3180	3420	3435	3437	3437	3438	3348	3630	3585

* $p < 0.05$ ** $p < 0.01$.

Table 3

Total Effects: Neighborhood Risk & Observed Wellbeing of Surrounding Block

Predictor	Outcome	N	R^2	B (SE)	p	95% CI
Perceived Neighborhood Risk	Physical Activity	2796	0.110	-0.255 (0.100)	0.011*	[-0.451, -0.060]
Perceived Neighborhood Risk	Body Mass Index (BMI)	2583	0.529	0.313 (0.210)	0.136	[-0.099, 0.725]
Perceived Neighborhood Risk	Perceived Health Difficulties	2805	0.065	0.094 (0.048)	0.051†	[-0.001, 0.189]
Perceived Neighborhood Risk	Anxiety	2837	0.016	0.046 (0.034)	0.171	[-0.020, 0.112]
Perceived Neighborhood Risk	Depression	2837	0.025	0.037 (0.031)	0.237	[-0.024, 0.097]
Perceived Neighborhood Risk	Positive Social Functioning	2838	0.026	-0.694 (0.198)	0.001***	[-1.082, -0.305]
Observed Wellbeing of the Surrounding Block	Physical Activity	1596	0.129	0.059 (0.021)	0.004**	[0.019, 0.099]
Observed Wellbeing of the Surrounding Block	Body Mass Index (BMI)	1476	0.528	-0.011 (0.045)	0.804	[-0.098, 0.076]
Observed Wellbeing of the Surrounding Block	Perceived Health Difficulties	1601	0.070	-0.018 (0.010)	0.081†	[-0.038, 0.002]
Observed Wellbeing of the Surrounding Block	Anxiety	1613	0.016	-0.018 (0.007)	0.013*	[-0.031, -0.004]
Observed Wellbeing of the Surrounding Block	Depression	1613	0.034	-0.020 (0.006)	0.002**	[-0.032, -0.007]
Observed Wellbeing of the Surrounding Block	Positive Social Functioning	1614	0.031	0.181 (0.041)	0.000***	[0.099, 0.262]

Note. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television.

Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.

*p < 0.05, **p < 0.01, ***p< 0.001.

Table 4
Mediation

Predictor	Outcome	N	Predictor → Mediator				Mediator → Outcome			
			R^2	B (SE)	p	95% CI	R^2	B (SE)	p	95% CI
Perceived Neighborhood Risk	Physical Activity	2796	0.081	-0.919 (0.539)	0.088†	[-1.975, 0.137]	0.115	0.014 (0.004)	0.000***	[0.007, 0.021]
Perceived Neighborhood Risk	Body Mass Index (BMI)	2583	0.088	-1.054 (0.560)	0.060†	[-2.152, 0.044]	0.529	0.011 (0.007)	0.129	[-0.003, 0.026]
Perceived Neighborhood Risk	Perceived Health Difficulties	2805	0.081	-0.899 (0.538)	0.095†	[-1.954, 0.156]	0.066	-0.001 (0.002)	0.748	[-0.004, 0.003]
Perceived Neighborhood Risk	Anxiety	2837	0.080	-1.001 (0.536)	0.062†	[-2.053, 0.051]	0.018	-0.003 (0.001)	0.027*	[-0.005, -0.000]
Perceived Neighborhood Risk	Depression	2837	0.080	-1.001 (0.536)	0.062†	[-2.053, 0.051]	0.026	-0.002 (0.001)	0.147	[-0.004, 0.001]
Perceived Neighborhood Risk	Positive Social Functioning	2838	0.080	-1.011 (0.534)	0.058†	[-2.058, 0.036]	0.026	0.005 (0.007)	0.452	[-0.008, 0.019]
Observed Wellbeing of Surrounding Block	Physical Activity	1596	0.072	-0.171 (0.117)	0.144	[-0.401, 0.058]	0.134	0.013 (0.004)	0.003**	[0.004, 0.022]
Observed Wellbeing of Surrounding Block	Body Mass Index (BMI)	1476	0.076	-0.158 (0.122)	0.196	[-0.398, 0.082]	0.528	0.003 (0.010)	0.735	[-0.016, 0.022]
Observed Wellbeing of Surrounding Block	Perceived Health Difficulties	1601	0.072	-0.173 (0. 117)	0.140	[-0.403, 0.057]	0.070	0.001 (0.002)	0.760	[-0.004, 0.005]
Observed Wellbeing of Surrounding Block	Anxiety	1613	0.072	-0.150 (0.116)	0.196	[-0.378, 0.078]	0.018	-0.003 (0.002)	0.061†	[-0.006, 0.000]
Observed Wellbeing of Surrounding Block	Depression	1613	0.072	-0.150 (0.116)	0.196	[-0.378, 0.078]	0.036	-0.002 (0.001)	0.133	[-0.005, 0.001]
Observed Wellbeing of Surrounding Block	Positive Social Functioning	1614	0.072	-0.150 (0.116)	0.197	[-0.377, 0.078]	0.031	0.007 (0.009)	0.435	[-0.011, 0.025]

Table 4 (cont.)
Mediation

Predictor	Outcome	Predictor → Outcome			Indirect Effect	
		B (SE)	p	95% CI	B (SE)	95% CI
Perceived Neighborhood Risk	Physical Activity	-0.243 (0.100)	0.015*	[-0.438, -0.048]	-0.013 (0.009)	[-0.032, 0.003]
Perceived Neighborhood Risk	Body Mass Index (BMI)	0.325 (0.210)	0.122	[-0.087, 0.737]	-0.012 (0.011)	[-0.036, 0.005]
Perceived Neighborhood Risk	Perceived Health Difficulties	0.094 (0.048)	0.053†	[-0.001, 0.188]	0.001 (0.002)	[-0.003, 0.005]
Perceived Neighborhood Risk	Anxiety	0.044 (0.034)	0.196	[-0.023, 0.110]	0.003 (0.002)	[-0.000, 0.007]
Perceived Neighborhood Risk	Depression	0.035 (0.031)	0.258	[-0.026, 0.095]	0.002 (0.002)	[-0.001, 0.005]
Perceived Neighborhood Risk	Positive Social Functioning	-0.689 (0.198)	0.001***	[-1.077, -0.300]	-0.005 (0.009)	[-0.026, 0.008]
Observed Wellbeing of Surrounding Block	Physical Activity	0.062 (0.020)	0.003**	[0.021, 0.102]	-0.002 (0.002)	[-0.006, 0.001]
Observed Wellbeing of Surrounding Block	Body Mass Index (BMI)	-0.011 (0.045)	0.813	[-0.098, 0.077]	-0.001 (0.002)	[-0.005, 0.003]
Observed Wellbeing of Surrounding Block	Perceived Health Difficulties	-0.018 (0.010)	0.083†	[-0.038, 0.002]	-0.000 (0.000)	[-0.001, 0.001]
Observed Wellbeing of Surrounding Block	Anxiety	-0.018 (0.007)	0.011*	[-0.032, -0.004]	0.000 (0.000)	[-0.000, 0.001]
Observed Wellbeing of Surrounding Block	Depression	-0.020 (0.006)	0.002**	[-0.033, -0.008]	0.000 (0.000)	[0.000, 0.001]
Observed Wellbeing of Surrounding Block	Positive Social Functioning	0.182 (0.042)	0.000***	[0.100, 0.263]	-0.001 (0.002)	[-0.006, 0.002]

Note. Total play is the mediator in all included pathways. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television. Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.
†p < 0.10, *p < 0.05, **p < 0.01, ***p< 0.001.

Table 5
Moderation

Variable	N	R^2	B (SE)	p	95% CI
Perceived Neighborhood Risk	3073	0.083	-0.630 (0.627)	0.316	[-1.860, 0.601]
Perceived Collective Efficacy	3073	0.083	1.208 (0.322)	0.000***	[0.577, 1.840]
Perceived Neighborhood Risk * Perceived Collective Efficacy	3073	0.083	-0.901 (0.774)	0.245	[-2.419, 0.617]
Observed Wellbeing of the Surrounding Block	1712	0.084	-0.238 (0.115)	0.039*	[-0.463, -0.012]
Perceived Collective Efficacy	1712	0.084	1.930 (0.418)	0.000***	[1.111, 2.750]
Observed Wellbeing of the Surrounding Block * Perceived Collective Efficacy	1712	0.084	0.008 (0.151)	0.956	[-0.288, 0.304]

Note. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television.
Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.
†p < 0.10, *p < 0.05, **p < 0.01, ***p< 0.001.

Table 6
Total Effects: *Collective Efficacy*

Predictor	Outcome	N	R^2	B (SE)	p	95% CI
Perceived Collective Efficacy	Physical Activity	2792	0.109	0.067 (0.059)	0.255	[-0.048, 0.181]
Perceived Collective Efficacy	Body Mass Index (BMI)	2581	0.529	-0.145 (0.123)	0.240	[-0.387, 0.097]
Perceived Collective Efficacy	Overall Health Status	2801	0.066	-0.024 (0.028)	0.389	[-0.080, 0.031]
Perceived Collective Efficacy	Anxiety	2833	0.017	-0.042 (0.020)	0.032*	[-0.081, -0.004]
Perceived Collective Efficacy	Depression	2833	0.027	-0.040 (0.018)	0.027*	[-0.750, -0.005]
Perceived Collective Efficacy	Social Functioning	2834	0.029	0.547 (0.116)	0.000***	[0.320, 0.774]

Note. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television.
Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.
†p < 0.10, *p < 0.05, **p < 0.01, ***p< 0.001.

Table 7
Collective Efficacy Predictor

Predictor	Outcome	N	Predictor → Mediator			
			R^2	B (SE)	p	95% CI
Perceived Collective Efficacy	Physical Activity	2792	0.086	1.167 (0.315)	0.000***	[0.548, 1.785]
Perceived Collective Efficacy	Body Mass Index (BMI)	2581	0.094	1.269 (0.327)	0.000***	[0.627, 1.911]
Perceived Collective Efficacy	Perceived Health Difficulties	2801	0.086	1.133 (0.315)	0.000***	[0.516, 1.750]
Perceived Collective Efficacy	Anxiety	2833	0.086	1.227 (0.313)	0.000***	[0.613, 1.842]
Perceived Collective Efficacy	Depression	2833	0.086	1.227 (0.313)	0.000***	[0.613, 1.842]
Perceived Collective Efficacy	Positive Social Functioning	2834	0.086	1.228 (0.312)	0.000***	[0.616, 1.841]

Note. Total play is the mediator in all included pathways. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television. Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.
†p < 0.10, *p < 0.05, **p < 0.01, ***p< 0.001.

Table 7 (cont.)
Collective Efficacy Predictor

Predictor	Outcome	Mediator → Outcome				Predictor → Outcome			Indirect Effect	
		R^2	B (SE)	p	95% CI	B (SE)	p	95% CI	B (SE)	95% CI
Perceived Collective Efficacy	Physical Activity	0.114	0.014 (0.004)	0.000***	[0.007, 0.021]	0.050 (0.585)	0.390	[-0.065, 0.165]	0.016 (0.006)	[0.057, 0.030]
Perceived Collective Efficacy	Body Mass Index (BMI)	0.529	0.012 (0.007)	0.117	[-0.003, 0.026]	-0.160 (0.124)	0.197	[-0.402, 0.083]	0.015 (0.010)	[-0.005, 0.037]
Perceived Collective Efficacy	Perceived Health Difficulties	0.660	-0.001 (0.002)	0.645	[-0.004, 0.003]	-0.024 (0.028)	0.408	[-0.079, 0.032]	-0.001 (0.002)	[-0.005, 0.003]
Perceived Collective Efficacy	Anxiety	0.019	-0.003 (0.001)	0.026*	[-0.005, -0.000]	-0.039 (0.020)	0.049*	[-0.078, -0.000]	-0.003 (0.002)	[-0.007, -0.001]
Perceived Collective Efficacy	Depression	0.028	-0.002 (0.001)	0.147	[-0.004, 0.001]	-0.038 (0.018)	0.036*	[-0.074, -0.003]	-0.002 (0.001)	[-0.005, 0.001]
Perceived Collective Efficacy	Positive Social Functioning	0.030	0.003 (0.007)	0.649	[-0.011, 0.017]	0.543 (0.116)	0.000***	[0.315, 0.771]	0.004 (0.009)	[-0.013, 0.023]

Note. Total play is the mediator in all included pathways. Models include controls for mother's marital status, and education, household income, child's age, race/ethnicity, pubertal development, and time spent watching television. Additional controls for physical and mental health outcomes include child's BMI and maternal depression, respectively.
†p < 0.10, *p < 0.05, **p < 0.01, ***p< 0.001.

CHAPTER 4

DISCUSSION

The results of the present study indicate that neighborhood risk in early childhood was associated with outcomes over a decade later in physical, mental, and social domains. Although this finding varied by perceived versus observer report, these findings suggest that higher levels of neighborhood risk in early childhood are strong predictors of poorer health and functioning outcomes in adolescence, while lower levels may predict better outcomes. The neighborhood in which an individual resides is indeed considered a social determinant of health, with both social and built aspects of the environment contributing to a variety of health and functioning outcomes (Centers for Disease Control and Prevention, 2018).

Additionally, the results illustrated a significant effect of time spent engaged in outdoor play in middle childhood on time spent engaged in physical activity in adolescence. These findings indicate that outdoor play is promotive of long-term health behaviors as it lays a foundation upon which these behaviors can be built. Consistent with previous research, these findings indicate that parental perceptions of neighborhood risk and disorder are associated with lower levels of physical activity in children and adolescents (Molnar et al., 2004; Weir et al., 2006). The findings of the present study expand upon prior research, indicating that the association between neighborhood risk and physical activity levels persists across time, with outdoor play in middle childhood being predictive of physical activity in adolescence. These findings have implications for

health and wellbeing in adulthood as well, as health in adolescence is considered critical in the transition to adulthood, carrying lifelong implications for later health and wellbeing (Wang et al., 2020). These findings are also consistent with the classical pre-exercise theory, in which Groos (1901) argues that play provides children with the opportunity to gain, practice, and refine skills necessary for later survival. The results of the present study indicate that this may be especially true in the case of physical activity, whereby active outdoor play in childhood allows children to gain physical activity skills necessary to healthy development. Additionally, outdoor play in middle childhood may act as a foundation upon which healthy habits around activity and exercise are built, resulting in long-term benefits to physical activity and health. In short, these findings indicate that the benefits of outdoor play to physical health and activity extend beyond those that are solely short-term.

Additionally, a significant effect of outdoor play on anxiety was found, indicating that increased time spent in outdoor play in middle childhood was significantly associated with lower levels of anxiety symptomology in adolescence. This finding is consistent with existing theory and evidence that outdoor play and exposure to nature are associated with positive mental health outcomes (Pretty et al., 2009; Tremblay et al., 2015; Piccininni et al., 2018). The relation between outdoor play and anxiety specifically has several proposed explanations. The first is that outdoor play may foster an appreciation of nature that has been found to be associated with reduced anxiety (Piccininni et al., 2018). Largo-Wright et al. (2018) suggest that time spent outdoors with nature may reduce stress by shifting attention away from stressors or by restoring fatigued coping resources in children. Indeed, research indicates that connectedness to nature is negatively associated

with perceived stress in adults (Wood & Smyth, 2020). Conversely, the play itself may be the most influential, as it is inherently pleasurable and evokes feelings of joy, curiosity, and excitement (Eberle, 2014; Tremblay et al., 2015; Yogman et al., 2018). Additionally, the psychoanalytic theory of play posits that play enables children to cope with anxiety as it acts as a neutral arena in which they can repeat, manipulate, and exercise mastery and control over stressful situations that would otherwise be too overwhelming to address (Wälder, 1933). Finally, it may be the case that increased physical activity that often accompanies outdoor play may itself serve to relieve stress and reduce anxiety. Indeed, physical activity and exercise have been found to promote mental health and reduce stress (Mikkelsen et al., 2017). Regardless, these findings suggest that outdoor play in middle childhood has long-term benefits for mental health in addition to physical health.

Although symptoms of anxiety and depression are often highly correlated and the disorders themselves comorbid, there are important distinctive features between the two such as temporal orientation and positive versus negative affect (Eyseneck & Fajkowska, 2018). While a significant effect of outdoor play on anxiety was found, the same effect was not found regarding the additional mental health outcome of depression. It may be the case that outdoor play is associated with decreased depressive symptoms concurrently, as has been found in prior research, but not longitudinally (Korczak et al., 2017). It may also be the case that the difference in the timing of the emergence of anxiety versus mood disorders such as depression plays a role. The emergence of anxiety has been found to peak in early to mid-adolescence, whereas the emergence of mood disorders such as depression have been found to peak in late adolescence to early adulthood (Lee et al., 2014). Thus, it may be the case that the effect of outdoor play on

depression may not be apparent until later on. Play is believed to improve mental health through its evocation of pleasure and joy as well as the coping it promotes (Milteer et al., 2012; Tremblay et al., 2015; Yogman et al., 2018). It could be the case that this joy and coping, as well as the connection to nature fostered by outdoor play, are uniquely effective in decreasing anxiety symptoms rather than depressive symptoms. Finally, it is possible that certain aspects of outdoor play not captured by the measure in the present study are uniquely impactful to depression, rather than anxiety, symptoms. For example, prior research demonstrates a relation between physical activity and decreased depression symptoms (Korczak et al., 2017). It is possible, then, that active outdoor play promotes a decrease in depression symptoms, while active or inactive outdoor play promotes a decrease in anxiety symptoms through the connection to nature it fosters.

While a significant effect of outdoor play on physical activity was found, the same effect was not found regarding the additional physical health outcomes of BMI and perceived health difficulties. It may be the case that changes in BMI may occur gradually and take longer than the six years between survey waves to emerge. Burdette & Whitaker (2005) explain that risk factors of overweight and obesity, measured via BMI, are often difficult to measure and likely interact with each other, resulting in an individual risk factor explaining only a small portion of variability in BMI outcomes. The findings regarding outdoor play on BMI are consistent with previous research in the same sample earlier in childhood (Burdette & Whitaker, 2005). Regarding overall health status and perceived health difficulties, the lack of a significant finding may be explained by the fact that numerous and complex factors influence one's perceived health status (Wang et al.,

2020). In other words, outdoor play may be one of many interrelated factors that contributes to one's overall perception of health status and health difficulties.

Regarding the relation between neighborhood risk and outdoor play, the findings remain inconsistent, with some past research finding a relation between neighborhood safety and outdoor play and others such as this study finding no such relation (Ansari et al., 2015; Burdette & Whitaker, 2005).

While perceived neighborhood risk and observed wellbeing of the surrounding block in early childhood were not found to be significant predictors of outdoor play in middle childhood, perceived collective efficacy in early childhood was associated with more outdoor play. These findings suggest that mothers' perceptions of social cohesion and control inform their decision to allow their children to play outdoors in their neighborhood. Collective efficacy refers to residents' sense of closeness to and connection with one another, as well as the perceived capacity of neighbors to intervene and act in each other's interests to reach common goals (Burdette et al., 2006). It may be the case that perceived collective efficacy exists as an additional safety net ensuring children are safe and supervised when they play outdoors that contributes to family decisions about time spent outdoors. These findings are consistent with previous research, demonstrated that higher levels of collective efficacy are associated with more hours of outdoor play (Kimbro et al., 2011.). Additionally, the findings of the present study demonstrate that this association persists across time, with perceived collective efficacy in early childhood predicting outdoor play in middle childhood.

In addition to a significant effect of perceived collective efficacy on outdoor play, a significant effect of collective efficacy was also found on all mental health and positive

social functioning outcomes, indicating that maternal perceptions of neighborhood collective efficacy in early childhood have long-term implications on anxiety, depression, and social functioning in adolescence. Collective efficacy is recognized as a form of social capital at the neighborhood level that is associated with positive health outcomes and may be effective in reducing health disparities and promoting health equity (Butel & Braun, 2019). The findings of the current study are consistent with this belief and indicate that maternal perceptions of social cohesion and control are promotive of children's long-term wellbeing and functioning, potentially through the action toward a shared goal of community health and wellbeing. Although a significant effect of maternal perceived collective efficacy on physical health outcomes in adolescence was not found, prior research demonstrates an association between teen-reported neighborhood collective efficacy and overall health status (Wang et al., 2020). This suggests that, regarding physical health outcomes, teen's perceptions of collective efficacy are more influential than maternal perceptions.

Finally, no significant effect of outdoor play on positive social functioning was found, a finding inconsistent with previous research (Newton & Jenvev, 2011; Whitebread, 2017). This may be due to the fact that the measure of outdoor play utilized in the present study did not distinguish between time spent playing outdoors alone versus playing outdoors with other children, which may be more promotive of social functioning skills.

Limitations

The present study possesses several limitations of note. The first is the measure of outdoor play, which prompted mothers to report how many hours their child spent

playing outdoors on a typical weekday and weekend day. This measure does not distinguish between time spent playing outdoors in the child's neighborhood and time spent playing outdoors in a friend's neighborhood, at school, or at childcare, for example. As such, the measures of perceived neighborhood risk and outdoor play are not in total alignment. Additionally, the measure of observed wellbeing of the surrounding block was an incomplete measure of neighborhood disorder. It may be the case that the presence of negative environmental stimuli or the absence of positive environmental stimuli within the neighborhood but outside of the block surrounding the child's home were predictive of outdoor play. Finally, it is important to note that outdoor play is not a direct measure of physical activity (Burdette & Whitaker, 2005). That is, outdoor play can easily be inactive, just as indoor play can be active. It will be important to address the various dimensions of play and their relation to physical, mental, and social outcomes in future research.

Implications

Regardless, the findings of the present study carry with them important implications. First, promoting both safety and social cohesion in neighborhoods may be especially promotive of children's outdoor play. This cohesion and collective efficacy can be fostered through the addition of community centers and resources that provide residents with spaces and opportunities to connect with one another. Additionally, it is necessary to recognize the factors that disadvantage families and deprive them of opportunities to build collective efficacy with neighbors, many of which are driven by structural inequality, oppression, and residential and economic segregation (Kimbro & Schachter, 2011). The findings of the present study highlight the importance of

advocating for policies and funding that provide and promote positive structures, as well as those that reduce and remove negative structures, in neighborhoods in the effort to encourage the creation of collective efficacy among residents. Such efforts to promote collective efficacy may have long-lasting impacts on the mental and physical health of children.

Additionally, these findings suggest that outdoor play is promotive of later physical health and functioning through the promotion of physical activity. However, the exact mechanisms by which this occurs remain unclear, warranting further attention. The findings of the present study also support the belief that outdoor play is promotive of wellbeing and the development of skills to cope with stress, as indicated by the effect of outdoor play in early childhood on anxiety in adolescence (Tremblay et al., 2015). While previous research has focused on perceived neighborhood safety as a predictor of outdoor play, the findings of the present study suggest that perceived collective efficacy may act as an especially influential predictor, warranting further attention. Regardless, these findings highlight the importance of outdoor play on long-term physical and mental health in children and adolescents.

Conclusion

Neighborhood contextual factors influence where and how children and caregivers spend their time. The findings of the present study suggest that efforts to improve access to outdoor play may have long-term benefits on adolescent physical and mental health, both of which are influential to wellbeing in adulthood (Wang et al., 2020). Additionally, access to outdoor play may be effectively achieved through the

promotion of collective efficacy among neighborhood residents through the provision of community resources as well as the removal of barriers driven by systemic inequality.

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