Exploring the association between early life stressors & childhood protective factors on early adolescent mental health disorders

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Abstract

Data from the National Longitudinal Survey of Children and Youth (NLSCY), and the Avon Longitudinal Study of Parents and Children (ALSPAC), both prospective cohorts, were used to explore the association between early life stressors, childhood protective factors, and early adolescent mental health outcomes (depression, anxiety, conduct disorder, and attention deficit hyperactivity disorder). Early life stressors were measured prenatally to the age of 3 within the ALSPAC analysis, while early life stressors were measured between the ages of 1-3 within the NLSCY analysis. Childhood protective factors, exclusively modifiable protective factors, (physical activity, extracurricular activities, positive parenting, and positive friendships) were measured between the ages of 6-11 within both ALSPAC and the NLSCY. Mental health outcomes were measured between the ages of 12-15 in both ALSPAC and the NLSCY. The associations between early life stressors and childhood protective factors on early adolescent mental health outcomes were computed using multivariate logistic regression modeling. It was found that the majority of early life stressors, including prenatal stressors and family dysfunction increased the odds of developing early adolescent mental health disorders although more statistically significant results were found within the NLSCY analysis. Contrarily, it was found that the majority of childhood protective factors reduced the likelihood of early adolescent mental health disorders with some exceptions found within the NLSCY analysis. No interaction terms between early life stressors and childhood protective factors were found to be statistically significant.

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CHAPTER 1: INTRODUCTION & LITERATURE REVIEW

Within this thesis, early life stressors and their impact on adolescent mental health will be investigated. Within this thesis, outcomes will be referred to 'adolescent' mental health disorders, although it is important to note that the outcomes are measured during 'early' adolescence, as they are measured between the ages of 12-15. Furthermore, the role of childhood protective factors will be investigated in two ways: 1) as a modifying variable, investigating the protective factors as interaction terms with early life stressors, and 2) as protective factors directly impacting adolescent mental health outcomes. These associations were investigated using two datasets, the National Longitudinal Study of Children and Youth (NLSCY) and the Avon Longitudinal Study of Parents and Children (ALSPAC).

1.1 EPIDEMIOLOGY OF DEPRESSION, ANXIETY DISORDER, CONDUCT DISORDER, AND ATTENTIONAL DEFICIT HYPERACTIVE DISORDER

Depression is a chronic and disabling disorder with an early onset often beginning in childhood or young adulthood[1]. Current estimates suggest that, world-wide, approximately 18-36% of the global population is affected by mental health disorders[2]. These mental health disorders do not just affect individuals but are believed to have considerable social and economic impacts[3,4]. Despite advances in the prevention and treatment of mental health disorders, recent studies indicate that these disorders are now among the top ten leading causes of disability globally with estimates that they are responsible for a global economic burden of up to $2.5 trillion, annually[5]. Suicide is now the second leading cause of death in adolescents aged 15 to 18 in Canada, while 91%

percent of individuals who die by suicide have a diagnosed mental health disorder[6] as noted in a systematic review of psychological autopsy studies by Cavanagh et al.

Similar to depressive disorders, anxiety disorders are highly prevalent and debilitating[7]. According to Baxter et al, 87 studies across 44 countries have provided global 1-year prevalence estimates of anxiety disorders ranging between 2.4%-29.8%[7]. This disorder is associated with fear, nervousness, apprehension and panic affecting not only ones' mental status but also physical symptoms including the cardiovascular, respiratory, gastrointestinal, and nervous system[8]. Anxiety disorders tend to start early in life and adversely affect school life, work life, as well as psychosocial functioning[9]. Recent prospective studies have suggested that anxiety disorders belong to the most chronic and recurrent mental health disorders having severe implications for everyday life[9-11].

Depression and anxiety are both considered to be internalizing disorders, as these disorders are often characterized by quiet, internal distress[12]. Contrarily, externalizing disorders are mental disorders characterized by maladaptive and externalizing behaviors that impair with daily life functioning[13]. One of the more prevalent externalizing disorders is conduct disorder[13]. According to the DSM-IV, conduct disorder is characterized by a pervasive and persistent pattern of aggressive, deceptive and destructive behaviors, usually beginning in childhood or adolescence[14]. Youth who are diagnosed with conduct disorder report higher levels of impairment and distress in virtually all domains of daily life, compared with other mental disorders[15]. Based on multiple studies, lifetime prevalence rates of conduct disorder range between

4.2-11% in Canada[16,17]. Recent studies have indicated that conduct disorder in childhood and adolescence is associated with increased risk of comorbid mental health disorders, legal problems and premature mortality[15].

Another common externalizing disorder in youth is known as attention deficit/hyperactivity disorder (ADHD). ADHD is a neurobiological disorder characterized by patterns of persistent and impairing symptoms of inattention, hyperactivity and impulsivity affecting individual's daily life activities[18]. Multiple cross sectional, clinical, and longitudinal studies have attempted to provide a global prevalence of ADHD. Polanczyk et al. conducted a comprehensive systematic review and meta-analysis, which documented a pooled global prevalence rate of 5.29% (CI95%=5.01-5.51)[19]. Although ADHD was first conceptualized as a disorder exclusive to childhood and adolescent, longitudinal studies have indicated that although there may be a decline in symptoms as one ages, ADHD tends to persist in a large proportion of individuals as they age into adulthood[20].

Although the direct etiology is unknown, there is a growing consensus that there are multiple factors that contribute to the onset, experience and prognosis of mental health disorders[21,22]. Developmental research has posited that there are distal factors that may increase or decrease the risk of mental illness in adolescents, including factors in utero and in early childhood[23,24,25,26]. Early life stressors in utero or early in a child's life may negatively alter the hypothalamic pituitary adrenal axis which serves as an important biological system used for coping[26]. It is believed that this negative alteration may, in fact, increase the risk of developing a mental health disorder later in life[24]. This

research is in keeping with the growing body of literature regarding the idea of fetal programing: this theory suggests that fetuses may be programmed to be more susceptible to poor health later in life (physical or mental)[27].

Along with this research, there as a growing amount of literature on the effects of childhood protective factors on adolescent health[28,29,30]. Within this literature, it is postulated that there are social, environmental, familial, educational, physical, cultural, and economic factors that can potentially be manipulated in order to reduce the risk of health disparities later in life[28,29,30]. In this study, early life stressors and childhood protective factors will be investigated to explore their potential as mitigating agents to mental health problems in two cohorts.

Given our growing knowledge of the impact that mental health has on the individual and society it becomes imperative that we investigate the factors that serve to improve mental health and decrease risk of mental illness. Research to date has tended to focus on proximal factors that may cause mental health disorders. This research aimed to investigate more distal factors that occur throughout the course of an individual's development. The overall objective of this research was to contribute to a better understanding of factors affecting mental illnesses experienced by children and youth. It is hoped that this research may contribute to the body of knowledge of preventative measures that can be taken to improve population health.

1.2 REVIEW OF THE LITERATURE - EARLY LIFE STRESSORS

A substantial amount of research has been conducted regarding the risks of early life stressors, that being acute, chronic, or toxic, on adolescent health, in utero or early in a child's life[23,24,25,26]. Early life stressors can alter the brain development of an individual,

consequently exerting long lasting effects on the development of mental health[26]. The "Fetal Programming Hypothesis" suggests that the conditions that the mother experiences during pregnancy may have long-term effects on the health of the fetus[27]. Epidemiological studies and extensive experimental studies have indicated that early life stressors or events may have a strong role in influencing the susceptibility of certain chronic diseases, later in life[31]. Pioneering research regarding this hypothesis has been conducted by Barker et al, who demonstrated that small size at birth is associated with an increased risk to adverse health outcomes in adulthood, including abnormal blood lipid values, hypertension, and heart disease[32]. This concept of "programming" posits the idea that during critical periods of early fetal development there is permanent change in the structure and function of the fetus that are caused by external environmental stimuli[27,33,34]. In more recent research, it has been postulated that individuals who have perceived to have experienced stress early in childhood or in utero may have diminished reward responses, which may reduce an individual's ability to experience positive emotions[35].

There has also been a growing amount of literature investigating the effects of early childhood stressors and adversities (not limited to in utero) and their association with adolescent mental health impairments[25,36,37,38,39,40]. Numerous studies have indicated that early life stressors can predict a wide array of adverse mental health outcomes, including depression and anxiety[,36,37,38,39,40,41,42]. These stressors range from financial hardship to parental divorce to a death in the family. The degree to which early life stressors effects mental health outcome has been noted to be associated with the

severity of the stressor[43]. Early life stressors are considered to be quite common within the general population; the National Comorbidity Survey Replication reported that over 50% of the American population has experienced some form of important stressor before the age of 18, examples including: parental divorce, parental death, or economic adversity[44]. It is also important to note that children who are exposed to early life stressors are often exposed to more than one stressor, as one stressor may create a chain reaction causing multiple stressors[40]. A notable landmark in developmental research is that of the Adverse Childhood Experiences Study (ACES), one of the largest investigations of childhood abuse and neglect and subsequent later-life health outcomes. Participants were recruited between 1995 and 1997 and were followed up to measure numerous health outcomes, with a high breadth or exposure and outcomes measures. Childhood exposure measures included the following categories: psychological abuse, physical abuse, sexual abuse, substance abuse within the family, mental illness within the family, domestic abuse, criminal behavior within the family, parental separation or divorce, and incarcerated family members. These adverse childhood experiences were then compared to measures of adult risk behavior, such as smoking and substance abuse, health status, and disease. This study indicated a high prevalence of adverse childhood experiences, notably 21% of participants reported sexual abuse. Additionally, it was found that adverse childhood experiences often occur together where approximately 40% of the original sample reported having experiences two or more adverse childhood event, and 12.5% experiencing four or more. Finally, a strong dose response relationship was found when comparing the number of categories

of adverse childhood events, in that those who experienced higher numbers of exposure categories were more likely to experience several of the leading causes of death in adults.[45].

Developmental research on early life stressors has indicated that offspring sex plays a role in the extent to how much the maternal stress is transmitted to the fetus[46,47]. Animal studies have indicated that male offspring are more sensitive to maternal stress, where female rodent offspring performed better on spatial memory tasks, and maze tasks[48]. Some human studies have indicated that males offspring of mothers who experienced stress during pregnancy are more susceptible to externalizing disorders (ADHD, conduct disorder), while female offspring are more susceptible to internalizing disorders (depression, anxiety)[49]. This relationship will be investigated throughout this research.

The data sets used in this thesis measure a plethora of early life stressors which generally fall into the following stressful event categories that have been investigated thoroughly within the literature: 1) separation from loved ones, 2) socioeconomic stress, and 3) experience or exposure to abuse. Please refer to Appendix A. to see the complete list of early life stressors measured in the datasets used for this research.

1.2.1 SEPERATION FROM A LOVED ONE

Within this thesis, early life stressors in utero and post utero were both investigated. The experience of a separation from a loved one and its association with poor mental health outcomes has been investigated in the literature, including both the childhood experience of separation as well as the pregnant mother's experience of separation from a loved one and consequently it's effect on the fetus[50,51,52,53,54,55,56,57.]

The social support and environment that a pregnant mother surrounds herself with has a strong impact on the amount of stress she will experience[58]. It is common knowledge that the loss or separation from a loved one for the mother is highly correlated with significant increases in perceived stress[47]. In addition to this increased perceived stress, research has indicated that maternal bereavement and grief due to the death of a partner during the prenatal phase, increases the risk of offspring psychosis later in life[49]. It is important to note that maternal bereavement is not limited to the death of a loved one, as the mother may experience grief from the separation from a loved one through divorce/separation from their partners. Parental divorce while the mother is pregnant is often associated with stress prior to the separation as there are often previous stressful factors that lead to parental divorce/separation including family conflict, anger, aggression, and deficient spousal nurturing[48]. In addition to the prior factors leading to the separation, this perceived stress often becomes chronic as the mother's responsibilities and family role often changes post separation, which may include more financial stress and further family conflict[54].

In addition to research surrounding the effects of a separation from a loved on the fetus, studies have indicated that childhood bereavement, childhood exposure to death and separation from family is also associated with numerous negative outcomes including a greater risk for depression, criminal behaviors, and school underachievement[50,51,52]. The notion that these stressors may lead to adverse adult outcomes has been widely supported by empirical research, as explained by both attachment theory and social learning theory[59]. There are many factors that may

mediate or moderate the child's experience of bereavement/separation including previous exposure to loss, coping mechanisms, relation to the person who has died, cultural norms and the circumstances surrounding death or separation[51].

In early literature is has been demonstrated that there are significantly higher rates of depressive disorders among children who have experienced parental death as compared to those who did not in clinical samples[60]. In more recent research this association has been demonstrated within non-clinical samples, making the results more generalizable to the population[51,61]. In a recent exploratory study conducted by Ellis et al. in the North West of England, findings indicated that individuals who have experienced parental death are not affected solely by the death of a parent, but they are exposed to disruptions in their continuity of daily living, social network changes and changes in communication strategies[62]. It was found that the longer the transitions continued following death, the more at risk the child was to adverse outcomes[59].

The circumstances surrounding and following the death of a parent have been noted to have an effect on the coping mechanisms exhibited by the survivors[63]. A retrospective study conducted by Harris et al. investigated the effect of environmental outcomes of a parent's death[64]. It was found that children who experienced parental death but remained in a stable loving and supportive environment fared better than children who experienced parental death and were transitioned into unfamiliar settings[61]. These findings postulate that it is not only bereavement that may affect a child's mental health outcome, it may be the combination of loss and significant transition that put a child at risk for developing mental health disorders.

Similarly, to maternal/prenatal separation from a loved one, childhood separation from a loved one is not limited to the death of a loved one, as it may be experienced through parental divorce/separation. Numerous large-scale surveys with nationally representative samples have found childhood divorce was modestly associated with long-term outcomes such as: lower satisfaction with various areas of life, higher levels of psychological distress or depression and higher rates of seeking counseling[65,66]. In a study conducted by Chase-Lansdale et al, it was found that childhood divorce increased the risk for a clinical cutoff point on the Malaise Inventory scale by 48% after controlling for economic status, social class background and gender[53]. The malaise inventory designed by Rutter et al. is a screening tool, measuring a wide range of emotional disorders including depression, anxiety, phobias and depression[67].

There are numerous factors that may lead to parental divorce including parental conflict, socioeconomic stress, mental illness[68] and domestic abuse[69]. These pre divorce factors are known as pre-disruption effects[70]. It is for this reason that it is imperative to control for these factors when investigating the association between parental divorce and adult mental health. In a study conducted by Chase-Lansdale et al, using the National Child Development Study, a longitudinal study of children born in England, Scotland or Wales provided evidence that childhood divorce can set in motion a chain of circumstances that affects an individual's mental health as they age, while controlling for measureable pre-disruption effects[71].

Parents have a formative influence on a child's personality, coping skills, and emotional control, as childhood is a malleable and a critical age[72]. A separation from

parents or family can lead to a disruption in the development of the skills necessary to promote mental health including resiliency, trust, coping and emotional management[73]. Within this thesis, separation from a loved one was investigated through measuring multiple items including, death or a parent, parental divorce, separation from family, among others.

Within this thesis, 'separation from a loved one' was measured using multiple items in both cohorts. Examples include: *Your partner died, A friend of relative died, You were divorced, Child had a separation from parents,* among others.

1.2.2 SOCIOECONOMIC STRESS

Children's experience of socioeconomic disadvantage has been shown to be associated with a wide range of disparities in adult life, including depression[74]. The notion that higher socioeconomic status leads to better health outcomes has been widely proven. It is posited that this causal pathway is due to factors such as living and working conditions, access to healthcare, and health literacy[75].

Parental socioeconomic stress, specifically while pregnant can cause due amount of stress on the mother[76]. Socioeconomic stress is often a chronic stressor and during the gestational period this chronic stressor can impact the development of the fetus, potentially leading to adverse mental health outcomes later in life[77]. In a longitudinal study, conducted by Johnson et al. The association between socioeconomic status and mental health disorders was investigated[78]. Logistic regression models indicated that low parental education, low parental occupation, and low parental outcome, beginning when the child is in utero, were associated with an increased risk for offspring anxiety

disorders as well as an increased risk for offspring depression, after controlling for single parent status, parental psychopathology, offspring gender and offspring IQ[74].

Childhood socioeconomic stress may contribute to adolescent development of psychopathology through numerous pathways that may be differentially related to aspects of childhood SES[79]. In a study conducted by Harper et al. life course socioeconomic position was measured using retrospective recall of parental education and occupation[80]. It was found that men who had parents with unskilled manual jobs and had less than a primary school level of education had higher rates of age-adjusted hopelessness and depressive symptoms in adulthood[76].

It has been noted that socioeconomic status is highly linked to educational attainment, often leading to a negative cycle of repeated generational low socioeconomic statuses[81]. Vallee et al. investigated the direct and indirect pathways linking early life socioeconomic position and adult depressive symptoms. Drawing from a 29-year cohort from the National Longitudinal Survey of Youth, using structural equation modelling of parental education and latent growth curves of household incomes, it was found that the respondent's socioeconomic attainments was highly rooted in their parent's socioeconomic position, while ultimately being associated with a higher risk of depressive symptoms[77]. These findings suggest that the intergenerational transmission of low socioeconomic positions and poor mental health can be altered by increasing the focus on childhood/adolescent education attainment[77].

In this study, 'socioeconomic stress' was measured using multiple items in both cohorts. Examples including: *Partner lost their job, Homeless status, Your income was reduced*, *You has major financial problems,* among others.

1.2.3 EXPERIENCE OF/EXPOSURE OF ADVERSE EVENTS

Extreme, repetitive, or abnormal patterns of abuse during critical periods of a child's brain development, can impair, often permanently the health development of neuroregulatory systems[82]. Drug abuse, spousal violence, and criminal activity within the household are often co-occurring with numerous forms of abuse involving the child. It is imperative that these conditions are measured as household factors as they are often interrelated with childhood abuse[83]. In the Adverse Childhood Experience (ACE) Study, conducted by Felitti et al, after adjusting for multiple covariates, it was found that the prevalence and risk of smoking, severe obesity, physical inactivity, depressed mood and suicide attempts was increased as the number of adverse childhood exposures increased with odds ratios as high as 12.2 for suicide attempts for children with 4 or more exposures to adverse events[45].

The experience of childhood maltreatment has been linked to a variety of alterations in the function and structure of the brain, specifically the stress response neurobiological systems[84]. Using data from the ACE study, Anda et al discovered that for persons with four or more adverse childhood events, the risk of panic reactions, depressed effect, anxiety and hallucinations were increased 2.5,3.6,2.4, and 2.7 fold, respectively[38]. Traumatic or repetitive childhood stressors including abuse, witnessing or being victim to domestic violence have a detrimental effect on the developmental of neural pathways and networks, especially on the neuroendocrine system[85]. This

cascade of events unveils a pathway to a variety of important long-term behavioral, health and social problems[85].

Childhood sexual abuse can have a wide range of effects in adulthood, as it is often a repeated act by someone known to the victim[86]. In a study conducted by Turner et al, childhood maltreatment along with childhood sexual abuse and its relationship with adult mental health outcomes was investigated[87]. Data from 2004-2005 National Epidemiological Survey on Alcohol and Related Conditions (NESARC) was used to measure childhood maltreatment, which included: physical abuse, sexual abuse, emotional abuse, emotional neglect, physical neglect and exposure to intimate partner violence[87]. The study provided evidence suggesting that a history of childhood sexual abuse co-occurring with other types of childhood maltreatment resulted in higher odds for many mental disorders including depression and anxiety as well as suicide attempts.

Childhood abuse is often poorly recalled as the victim may have repressed the memory, or they have surrounded the event with shame, guilt and embarrassment, and are therefore less likely to recall or report the event[88]. Due to this, longitudinal studies with reported and documented child abuse provide more valid measures of childhood abuse. Moylan et al. investigated the relationship between officially recorded child abuse and neglect and adult mental health, substance abuse and physical health outcomes in a sample of adults from the Lehigh Longitudinal study beginning in 1973 and 1974[89]. The results of this study convincingly demonstrated that there are longstanding adverse effects of childhood maltreatment on later adult mental

functioning; most significantly childhood welfare for outcomes of self-reported adult depression, anxiety, substance use risk, and general health[89].

It is well documented that childhood experience of abuse, be that physical, sexual, or emotional abuse, has long standing effects on the child. Literature has suggested this association may be to do physical and biological alterations in the child's brain development[82]. It has also been posited that this association exists due to familial and genetic factors[90]. Ultimately, this research brings to light the importance of preventing these early life traumas as well as mitigating their impact on adult mental health by introducing positive protective factors into the child's life.

Within this thesis, 'exposure or experience of abuse' was measured using multiple items in both cohorts. Examples include: *Your partner was emotionally cruel to your children, Your partner hurt you physically, Your partner hurt your children physically*, among others.

1.3 REVIEW OF THE LITERATURE - CHILDHOOD PROTECTIVE FACTORS

In developmental research, the roles of 'the positive' are often forgotten. Within this thesis, we will be investigating protective factors; modifiable characteristics that may alleviate the effects that stressors in the womb or early in life may have. Instead of focusing exclusively on the risk factors for mental illness, a new frontier of research is being developed on the prevention and potential of protective factors[91,92,93,94]. Although it remains important to manage risk factors, focusing attention to the implementation of protective factors and resilience is also a pivotal step in reducing adverse mental health outcomes. Childhood protective factors don't all work in the same regard as some may work by shielding a child from experiencing a risk factor, or reducing their

exposure to a risk factor; contrarily, protective factors may also work by reducing the impact of risk factors that have already been experienced[95,96]. It is the latter pathway that will be investigated throughout this thesis. Protective factors can interrupt the pathways in which risk factors develop into adverse outcomes, or can lead to a development of resiliency skills and coping mechanisms[93].

Practitioners, policy makers, researchers, and government bodies have considered the importance of focusing on developing resiliency in youth while also fostering positive coping skills and protective factors in the youth's environment and trying to understand how these factors can contribute to the influence of overcoming life adversities[97,98]. The Positive Youth Development theory suggests that it is not merely the absence of risk factors that leads to positive health outcomes, but rather the inclusion of fostering positive and protective factors, while being a part of a health-promoting environment that leads to long term positive health outcomes[99,100]. The constructs in which the developmental theory lies in seeks to focus on promoting bonding, fostering resilience, promoting social competence, emotional competence, cognitive competence, behavioral competence, moral competence, fostering self-determination, fostering spirituality, fostering self-efficacy, fostering clear and positive identity, fostering belief in the future, promoting recognition for positive behavior, promotes opportunities for prosocial involvement, and fostering prosocial norms[101].

Childhood protective factors are constructed in, but not limited to the individual, the caregiver/family and the environment/community[102]. Examples of factors at the individual level include: interpersonal skills, health literacy, nutrition, physical activity,

reading skills, and sleep levels[102]. Examples of factors at the caregiver/familial level include: Social and emotional support, positive parenting styles, attachment, nurturance, social activity, and development of friendships[102]. Examples at the environmental and community level include: Access to community support services, access to appropriate health services, opportunities to engage in community activities, and a feeling of belonging and participation[102].

Within this thesis, we investigated four modifiable protective factors, including: 1) physical activity, 2) participation in extracurricular activities, 3) positive parenting, and 4) positive friendships.

1.3.1 PHYSICAL ACTIVITY

Physical activity is a critical health behavior that plays a large role in the potential development of mental health disorders[103]. It is generally considered to be effective in reducing the incidence of depression, as well as promoting remission of depressive symptoms[103]. Current estimates have distinguished that less than 7% of children and youth in Canada are achieving the recommended 60 minutes of moderate to vigorous physical activity per day[104].

Evidence suggests that there are multiple ways in which physical activity is association with adolescent mental health. 1) Physical activity has been noted to reduce depressive symptoms; this evidence has been used to promote exercise as a part of a comprehensive treatment plan for major depressive disorder[105,106,107,108]. 2) Studies also suggest that physical activity can prevent the development of depression.[109,110,111,112] 3) Recent literature has also shown the reverse association, in that increased sedentary

behavior increases one's risk of developing depressive symptoms[113,114,115]. In the context of this thesis the physical activity as a preventative tool was investigated.

Exercise is often the first step in behaviour modification in order to treat or prevent chronic conditions[116]. There is strong evidence indicating that 2-2.5 hours of moderate to vigorous exercise per week sufficiently reduces the risk of developing a chronic disease[44]. Multiple studies have supported the notion that physical activity endorses a sense of self-esteem and self-worth, as well as promoting general well being[117,118,119].

There is no clear or direct mechanism for the association between physical activity and depression that has been established, however it has been proposed that there are biochemical, physiological and psychological mechanism leading towards the association between physical activity and numerous mental health disorders[120]. In the scope of this thesis the psychological mechanisms will be investigated.

It has been well established in the literature that physical activity is associated with a reduced depressive symptoms, however this association has been less established in adolescents, particularly in longitudinal studies[121]. In a recent study conducted by Rothon et al, using data from Research with East London Adolescents: Community Health Survey (RELACHS), it was found that after adjusting for multiple covariates, an association between physical activity and depressive symptoms for both boys and girls was found, indicating a decrease in the odds of depressive symptoms of about 8% for each additional hour of exercise undertaken per week[120].

Korczak et al conducted a study, synthesizing observational studies examining the association of physical activity in childhood and adolescence with depression[109]. The objective of this meta-analysis was to investigate the potential preventative effects of child and adolescent physical activity on major depressive disorder. With a total of 40 studies with 50 independent samples, found an overall effect size of -0.14, 95% CI (-.19 to -0.10), supporting the notion that child and adolescent physical activity is negatively associated with the risk of developing depressive symptoms[109].

In addition to Korczak's review, Mammen et al. investigated the effects of physical activity and the prevention of depression, reviewing prospective studies exclusively[112]. A comprehensive search was conducted and 30 studies were included for analysis. Studies were included if they were of longitudinal design, were prospectively based and if physical activity and depression were measured over at least two-time points. Among the 30 studies included in the analysis, 25 studies indicated a negative association between physical activity and the risk of developing depression[112]. Promoting the notion that physical activity serves as a highly valuable mental health promotion strategy.

With the high prevalence of depression and its impact on the individual and society as a whole, more attention is needed to identify effective mental health prevention strategies. It can be said that physical activity is arguably the most modifiable childhood protective factor which can have a profoundly positive effect on the development of mental health.

1.3.2 EXTRA CURRICULAR ACTIVITIES

Youth policy advocates promote that participation in extracurricular activities, including sports, the arts, and school clubs are a beneficial and productive use of leisure time, providing distinct opportunities for positive development[122]. Participation in extracurricular activities are related to positive youth development through fostering organizational skills while budgeting time and scheduling activities, engagement with adult leaders with emphasis on skill building, and involvement that requires sustained attention and clear feedback[123]. Furthermore, the more time adolescents are involved in structured activities, the less time they have to engage in problematic behaviors[123].

There is a growing body of research suggesting that adolescent's participation in extracurricular activities are associated with improved outcomes including academic adjustment, absence of behavioural problems, and mental well-being[124,125,126]. Extracurricular activities promote a sense of belongingness, allowing for positive future outlooks, serving as protective factors against mental stress, strain, and depression[93,127]. In a study conducted by Mason et al, the effects of an adolescent's social environmental were investigated; their social environment included social networks, extracurricular activities, and family relationship influences[128]. Participants were healthy adolescents between the ages of 12 and 21 years. Participation in extracurricular activities was measured by asking how many organized sports teams they were involved in, how many recreational clubs, and how many other activities they were involved in, adapted from the Centers for Disease control and Prevention, Youth risk Behaviour Surveillance Survey. Using forward linear regression models, it was found that participation in extracurricular activities was negatively associated with depressive symptoms,

specifically with females[128]. These findings highlight the role of the social environment on adolescent's mental wellbeing, promoting the insight into social based intervention targets for adolescent depression.

It has been proposed that there is a synergistic system connecting activity involvement with positive peer group composition and positive identity exploration[129]. It has been suggested that this synergistic system is facilitated by the association between extracurricular activities and the social environment, in that adolescents who participate in extracurricular activities have more academic friends, fewer friends who skip school and use drugs compared to adolescents who do not participate in extracurricular activities[130]. Peer group membership and activity involvement are also linked to exploration of ones sense of belonging and identity as a whole[129]. In a study conducted by Barber et al, data from the Michigan Study of Adolescent Life Transitions (MSALT), a longitudinal study beginning with 6th graders, was used to examine young adults sequalae of participation in high school activities and identity group. It was found that in young adulthood, those who participated in high school sports, or academic clubs, and identified as *jocks* or *brains* reported lower levels of depressed mood compared to other self-identities, which were linked to lower participation in school activities[130].

There is consistent evidence, positing that time spent in structured, supervised activities are related to positive academic and social outcomes for adolescents, ultimately leading to positive mental health outcomes[122,125,128]. It is imperative that adolescents, whether they are high risk or low risk be involved in structured activity

under the influence of positive peer networks and competent, positive adult role models.

1.3.2 POSITIVE PEER RELATIONSHIPS

Positive peer relationships have been shown to play a crucial role in a child/adolescent's development[131,132,133,134]. Peers contribute substantially to the development of social competence and self identity[135]. Contrarily, children who have negative peer relationships may be at risk to later life maladjustment, leading to negative mental health outcomes[136]. A child who is not socialized or is socialized in a poor environment is deprived of opportunities to learn normal, adaptive models of social conduct and cognition[137].

Research has shown that issues in early peer relationships, specifically in peer rejection may be associated with internalizing problems including anxiety and depression[138]. Research conducted by Shin et al, aimed to clarify the causal relationship between early peer relationships and adolescent psychological adjustment in an eight-year longitudinal study[131]. 3,808 first grade students participated and their peer relations were measured using the Korean Child behavior checklist; parents were also asked 'approximately how many friends does your child have?' and 'compared with other children of the same age, how well does your child get along with their peers?'. Results indicated that better peer relationships corresponded to lower Child Behaviour Checklist scores[131]. Their research demonstrated that childhood peer relationships are significantly associated with problems regarding emotion, behavior, and adjustment.

Positive peer relationships often include prosocial behaviours such as helping, sharing, showing concern for others, defending peers and including peers in activities[139].

Recently, research has shown the value of considering positive indicators of mental health, as opposed to attending strictly to negative indicators of psychopathology that focus on mental health problems or symptoms.

Peer relationships become increasingly significant sources of support from childhood to adolescence. These relationships foster companionship, advice, and comfort, while also having short and long term beneficial affects on social, cognitive and academic adjustment[132,139]. Current literature supports the notions that having supportive, positive peer relationships are associated with positive mental health outcomes, including more abstract measures including feeling good about yourself, feeling connected with other, being positive in outlook, and contributing to successes in subsequent romantic relationships[140]. Positive peer relations can provide a positive environment and context in which youth can develop[141].

1.3.3 POSITIVE PARENTING

The nature of a parent-child relationship has significant impacts on a child/adolescents developmental outcomes, especially mental health[142]. It is important that the long-term outcomes of parent child relationships on mental health outcomes are examined in order to refine and build policy and practice. Child abuse and neglect represent the most disturbed end of the spectrum and there are a number of studies demonstrating this relationship to be strong predictors of negative mental health outcomes[143,86]. The role of positive parenting on a child's positive mental health outcomes has been less studied.

Studies often capture parent-child relationships along two dimensions, reflecting a continuum from affectionate, warm, responsive parenting to cold and unresponsive

parenting[144,145]. Based on evidence in the literature on the development of psychological disorders, it is suggested that socio-relational, psychological and socio-economic pathways may connect parental care and control to the mental well-being of adolescents[146]. Attachment theory and positive psychological functioning may help to detail the pathway between parenting style and child mental well-being[147]. Children who experience responsive and caring relationships with their parents may be more securely attached to those parents, potentially leading them to be capable of being securely attached in later relationships in life[148].

Stafford et al investigated the role of parent-child relationships on offspring's positive mental wellbeing from adolescence to early older age[145]. The Parent-child relationship measure was based on parental care, behavioural control, and psychological control, measured using the Parental Bonding Instrument. Positive mental well-being was based on teacher ratings, when the child was 13 and 15 using the Rutter A Scale[145]. Life satisfaction was measured at the age of 36 using a single binary item: "Would you say that, on the whole, life has been good to you?" It was shown that recalled parental care and psychological control were both associated with positive mental wellbeing at multiple times points in the life course. It was hypothesized that well-being would be positively associated with parental care and negatively associated with psychological control, which was supported in this study.

Parenting styles have changed throughout time with positive, nurturing parenting styles becoming more prevalent[144]. According to the evidence in the literature, this growing trend of parenting style has the potential to reduce the

incidence of adverse mental health outcomes later in the child's life, ultimately reducing the burden of mental health disorders on the family and society as a whole[146,148].

1.4 AIM OF STUDY

This research's aim was to investigate role of early life stressors as well as their interactions with childhood protective factors in its pathways towards mental health outcomes. Building from developmental research, this research used logistic regression models to investigate the association between risk factors in utero and early in the child's life and later protective factors on the development of mental health disorders. Women and children who have perceived to have experienced early life stressors were investigated, being compared to those who have not experienced early life stressors. The potential modifying role of childhood protective factors was investigated, (i.e., reducing the participant's risk of developing a mental health disorder during adolescence).

1.5 OBJECTIVES

1) The first objective of this study is to investigate the roles of prenatal and postnatal stressors on adolescent mental health.

2) A second objective of this study to investigate the roles of childhood protective factors on adolescent mental health.

3) A third objective of this study to examine whether there are modifiable protective factors in a child's life that can mitigate the effects of prenatal stressors on adolescent mental health.

4) A final objective of this study is to examine whether there are modifiable protective factors early in a child's life that can mitigate the effects of early childhood stressors (age 0-3) on adolescent mental health.

Hypothesis: A number of studies have investigated the effects of early life stressors on the mental and physical outcomes on individuals from the fetal stage right through to the adult stage of development. Within this literature, there are research findings indicating that the stressors experienced by a child may have an effect on the development of their Hypothalamic Pituitary Adrenal Axis (HPA Axis) leading to poor coping skills and ultimately poor mental health outcomes. It is hypothesized that those women who experienced stress while pregnant, as well as children who experience early life stressors will be at higher risk for having adverse mental health outcomes. While there is a significant amount of research at the proximal level of risk factors for mental health outcomes, there is also research suggesting there are factors earlier in an individual's life that may affect their health outcomes. Recent literature has also demonstrated the important role of protective factors throughout a child's life that can reduce the risk of developing mental health disorders throughout the life course. It is hypothesized that there are modifiable protective factors that a child can experience that will reduce the risk of adolescent mental health disorder outcomes. Furthermore, it is hypothesized that there are protective factors that may mitigate the effects of early life stressors on a child, ultimately reducing their risk of having a mental health disorder later in life.

1.6 CONCEPTUAL FRAMEWORK

The conceptual framework proposed below is based off of three main theories of development: Fetal programming theory, Life Course Theory, and Positive Youth Development Theory. The fetal programming theory provides the underpinning of the model of how early life stressors in utero can affect the mental health outcomes of the fetus as they age[149]. Although an individual may be molded in utero, they also accumulate exposures across the life course that affects the risk of negative health outcomes[150,151]. It is here that the life course model becomes relevant. It is not solely during the gestational period that an individual can be exposed to factors that may affect their health. Biological, behavioral and psychosocial exposures early in life may also increase the risk of developing adverse mental health outcomes[151,152]. These distal risk factors may exaggerate the risk of developing a negative mental health outcome[153,154]. The Positive Youth Development Theory allows for the exploration of early life exposures that serve as protective factors, attenuating the affects of the early life stressors[155,156,157]. Investigating these chains of exposures through different developmental theories allows us to highlight how risk factors and protective factors interact with each other, ultimately leading to a mental health outcomes. Please refer to Appendix B. for a visual depiction of the conceptual framework.

CHAPTER 2:

This thesis used data from two prospective cohorts: the National Longitudinal Study of Children and Youth (NLSCY) and the Avon Longitudinal Study of Parents and Children (ALSPAC). ALSPAC data were used to study prenatal and postnatal stressors, while NLSCY data were used to study early childhood stressors. Methods and results are described separately for each study.

2.1 ALSPAC METHODOLGY

The Avon Longitudinal Study of Parents and Children is a trans-generational prospective birth cohort based in England created during 1991 and 1992[158]. All pregnant women were eligible to participate in the ALSPAC study and were recruited through media, community centres, and maternity clinics[159]. The final sample size of this cohort consisted of 14,541 pregnancies and 13,988 children still alive at 12 months[158]. In comparison to the UK census conducted in 1991, this sample represented a higher proportion of homeowners and a smaller proportion of Black and minority ethnic groups[160]. The aim of this study was to inform policy and practices about the environmental and genetic factors that affect a person's health and development[161]. Literature regarding the representativeness of the ALSPAC cohort to the population of Britain show that the study population is broadly representative of the British population[162].

There are many components of the study including: carer questions which are usually completed by the mother, but dependent upon the family circumstance, child based questionnaires which are completed by the main carer of the study child/young

person but are about the study child/young person, child completed questionnaires which are completed by the child/young person about themselves, partner questionnaires which are completed by the main partner of the carer themselves, father questionnaires which are completed by the father after enrolling into the study in his own right, puberty questionnaires which are completed by the main carer to start with, then carer and child together and finally the child alone and school questionnaires completed by staff at the schools attended by ALSPAC participants[161].

2.1.1 STRESSFUL LIFE EVENTS

Stressful life events in early pregnancy were assessed at eighteen-weeks gestation through a postal questionnaire[42]. Participants were asked if any of the 42 stressful events had occurred since pregnancy and to rate their impact impact *('0' – did not occur, '1'- yes but did not affect me to '4'-yes, and affected me greatly; those who did not experience the event received a score of 0*). Total stressful event score was calculated by the sum of an individual's answers (possible range 0-168), and then the score was coded into quartiles: minimal, mild, moderate and severe[42,163]. The questionnaires were administered at approximately 18 weeks gestation, which covered events from the beginning of the pregnancy, at 8 weeks postnatal which covers events from mid-pregnancy, at 8 months postnatal which covers events since birth, at 21 months postnatal which covers events since the child was 8 months old, at 33 months postnatal which covers event since the child was one and a half years old and at 3 years, 11 months postnatal which covers events since child was two and a half years old. Examples of the stressors include: Your partner died, your partner was ill, you lost your job, your income was reduced, you moved houses, you tried to have an abortion, you

had an accident, etc[164]. Prenatal and Postnatal stressors were measured separately, as well as combined. For the full list of early life stressors refer to Appendix A.

2.1.2 CHILDHOOD PROTECTIVE FACTORS

2.1.2.1 PHYSICAL ACTIVITY

At the age of 11, children who attended the clinic were asked to wear Actigraph AM7164 2.2 accelerometer around their waist for 7 days[165]. The accelerometers were to be worn during waking hours (expect for showering, bathing of participating in water sports). Physical Activity variables were derived from the raw accelerometer counts using customized software. Data from children who had worn the accelerometer for at least 10 hours a day for at least 3 days were considered valid[165]. According to the results from an ALSPAC calibration study, *Light Physical Activity* is based on the cut point of 200-3,599 cpm, *Moderate Physical Activity* is based on the cut point of 3,600-6,199cpm and *Vigorous Physical Activity* is based on the cut point of cpm equal to or above 6,200[166].

2.1.2.2 POSITIVE PARENTING

The positive parenting practices were assessed at ages 4 to 5 years by the mother of the child using 7 items measuring how often the mother engaged in the following activities:

- Read to the child
- Tell stories
- Draw pictures or other craft activities
- Play with toys or games indoors such as board or card games
- Play music
- Involve child in daily activities such as cooking or pet care

- Play outdoor games including walking or cycling

Items were rated from (0) *none* to (2) *sometimes* to (3) *everyday*. A total score ranging from 0-21 was calculated, a higher score indicating more positive parenting practices[167]. These seven items have been used an important indicators of early childhood development in UNICEF Multiple Cluster Index Surveys[168]. The parenting measure was coded into *High Positive Parenting* and *Low Positive Parenting* based on a 50th% cut point, as no other cut point has been indicated in the literature.

2.1.2.3 POSITIVE FRIENSDHIP

The positive friendships variable is based on two questions, asked to the mother of the child when the child was 10 years of age. There are two subscales regarding children's social relationships which are examined separately which include positive friendships and victimization. For this thesis, only the positive friendship variable was investigated. The mother was asked whether the child:

- Has at least one good friend
- Is liked by other children

Responses were rated as: (0) no, (1) somewhat, and (2) yes, a lot, which corresponded with *low*, *moderate*, and *high* level of positive friendship, respectively[169].

2.1.2.4 EXTRA-CURRICULAR ACTIVITES

Within the literature, there has been no documented distinct extracurricular participation measure with the ALSPAC dataset. After a thorough investigation of ALSPAC items related to youth extracurricular activities, the items listed below were used to create a measure of extracurricular activity participation. At the age of 9 the

mother of the child was asked about the frequency in which their child participated in the following activities:

- Frequency child plays musical instrument
- Frequency child goes to special groups
- Frequency child goes to Sunday School
- Frequency child goes to classes for foreign languages
- Frequency child goes to classes for singing groups

Parents were asked to rate the frequency in which their child participated in extracurricular activities noted above as: *nearly every day, 2-5 times a week, once a week, once a month, rarely, and not at all*. Each response frequency is given a score (1) for nearly every day, (2) for *2-5 times a week*, (3) for *once a week*, (4) for *once a month*, (5) for *rarely*, and (6) for *never*, allowing for a total of 36. The scores were coded in reverse so that a high score indicated high extra-curricular activity. To stay consistent with the NLSCY, extra-curricular activities was measured as *participators* and *non-participators* so that those who responded *never* to all items were considered *non-participators*.

2.1.3 OUTCOME MEASURES

2.1.3.1 DEPRESSION

Depressive and Anxious symptoms in late childhood and adolescence were assessed using the Short Mood and Feeling Questionnaire which is a short and simple child-reported or parent-reported questionnaire[42]. This outcome measure is a 13-item questionnaire based on the DSM-III-R criteria for depression, rated on a 3-point scale: *true* (score of 2), *sometimes true* (score of 1) *and not true* (score of 0)[170]. The ratings for

the total of all items produces a total score of 26[170]. Guidelines set out by Angold et al, determined that a score of 0-7 represent no/minimal depression, and a score of 8-26 represent clinically relevant depressive symptoms[170]. This questionnaire is designed to investigate depressive symptoms within the last two weeks. The Short Moods and Feelings Questionnaire was completed by participants at select research clinics at six time points (ages 10 to 11, 12 to 13, 13 to 14, 16 to 17, 17 to 18, and 18 to 19 years) either through a computer terminal during a clinic visit or through postal questionnaires. Within this thesis, this measure was investigated between the ages of 12 and 15, to be consistent with analyses from the NLSCY. This measure is designed to have low subject burden and maximal subject participation[170]. The items that were selected from the Short Moods and Feelings Questionnaire were heavily weighted towards the affective and cognitive items of depression, while including tiredness, restlessness and poor concentration[170]. A total score, ranging from 0-26 was calculated at each age (between 12 and 15 years of age) and an average score was created to represent depressive symptoms between the ages of 12-15. The questions asked include:

- I felt miserable or unhappy
- I didn't enjoy anything at all
- I was very restless
- I felt I was no good anymore
- I cried a lot
- I found it hard to think properly or concentrate

- I hated myself
- I was a bad person
- I felt lonely
- I though nobody really loved me
- I thought I could never bas as good as other kids
- I did everything wrong

2.1.3.2 ANXIETY

Anxiety was measured using a self-report at the age of 15 based of the Development and Well-being Assessment (DAWBA). The DAWBA is a package of interviews, questionnaires, and rating techniques designed to generate ICD-10 and DSM-IV psychiatric diagnosis on those ages 2-17.

2.1.4 SECONDARY OUTCOMES

Measures of Conduct disorder and attention deficit/hyperactive disorder are based on maternal reports of child conduct problems at the age of 15, using DSM-IV and ICD-10 criteria [162]. Measures of attention deficit/hyperactive disorder were collected at the age of 15 by a maternal report using DSM-IV criteria[162]. Both conduct disorder and attention deficit/hyperactive disorder were measured in a binary manner – yes or no. These measures are based off of Development and Well-being Assessment (DAWBA)[171].

2.1.5 COVARIATES

Covariates for the ALSPAC analysis were chosen *a priori* due to their association with either early life stressors or mental health disorders. ALSPAC covariates include: Teenage status of mother, sex, social class, maternal history of depression, maternal history of anxiety, maternal alcohol use, and maternal smoking.

2.1.5.1 SEX

Sex differences have been extensively noted to be associated with the risk of experiencing mental health disorders[172,173,174] as well as experiencing or perceiving early life stressors[175,176]. This may be due to biological reasoning as well as sex based conditioning throughout the lifecourse[175]. It has been posited that there is biological evidence highlighting how fetuses react to stressors differently based on their sex[177]. For this reason, sex was adjusted for in all models.

2.1.5.2 TEENAGE STATUS OF MOTHER

Literature has noted that teenage pregnancy and motherhood are associated with negative offspring mental health outcomes[178,179,] as well as offspring adverse mental health outcomes[180,181,182]. It has also been noted that teenage motherhood is associated with offspring stressful live events[183,184] as teenage pregnancy is often surrounded by stressful circumstances. For this reason, teenage status of mother was adjusted for in this analysis. Mothers who were 19 years of age or younger when giving birth to their first child were deemed 'teenage mothers'. Teenage mother status was dichotomized into 'yes' or 'no'.

2.1.5.3 HISTORY OF DEPRESSION

Research has consistently indicated that maternal depression has a strong association with offspring depression[185,186,187,188,189,190]. It has been suggested this may be due to genetic factors, familial, and environmental factors surrounding parental mental health disorders[187]. Studies have also indicated a relationship between maternal depression and early life stressors[191,192,193] as maternal depression can cause family disruption and a burden on the spouse and children. In the ALSPAC dataset maternal history of severe

depression prior to pregnancy was self-reported at 12 weeks' gestation using the prompt 'Have you ever had any of the following problems: severe depression?'[42].

2.1.5.4 MATERNAL DEPRESSION

Refer to ALSPAC 'history of depression' covariates for reasoning for covariate choice. Maternal depression was measured at 18 weeks and 32 weeks' gestation using the Edinburgh Postnatal Depression SCALE (EPDS). Mothers were categorized into '*high*' vs '*low*' prenatal depression based on the mean of their 18 and 32 weeks' gestation EPDS scores (>12 vs. ≤12)[194,42].

2.1.5.5 SOCIAL CLASS

Numerous studies have indicated that individuals from low socioeconomic status background are at increased risk for mental health disorders[195,196,197]. It has also been noted to be associated with the risk of experiencing early life stressors, as low socioeconomic status is often considered a stressor in itself[198,199]. Due to the potential confounding nature of socioeconomic status, it as was adjusted for within this analysis. Social class was measured using the higher of both of the parents score based on occupation ranging from (1) working class (2) intermediate class to (3) professional class.

2.1.5.6 MATERNAL ANXIETY

In the literature, it has been extensively noted that maternal anxiety is associated with negative offspring mental health outcomes[200,201]. Additionally, studies have demonstrated an association between maternal anxiety and offspring experience of early life stressors[202,203] as children may be more prone to perceiving stressful experiences if they are developing in a high anxiety environment. Maternal anxiety was

assessed using the Brown Crisp anxiety subscale. As there is no established cutoff for this measure, mothers were considered anxious if the mean score was in the top 15%, at 18 and 32 weeks' gestation[42].

2.1.5.7 PRENATAL MATERNAL SMOKING

Within the literature, maternal smoking has been shown to share a positive association with mental health disorders[204,205]. Furthermore, early life stressors have been noted to be associated with maternal smoking, as well as being associated with the risk of smoking later in life[206,207]. Maternal prenatal smoking was self-reported at 12 weeks' gestation as "any" vs "none".

2.1.5.8 PRENATAL MATERNAL ALCOHOL

It has been well recognized that maternal alcohol use is associated with poor offspring mental health, due to physiological, environmental, and social reasoning[208,209]. Maternal alcohol use also been noted to be associated with the risk of experiencing early life stressful events[210,211]. Maternal prenatal alcohol use was self-reported at 12 week's gestation as "at least once per week" vs "less than once per week".

2.2 NLSCY METHODOLOGY

This research used two longitudinal cohort studies based in Canada and Great Britain, known as the National Longitudinal Study of Children and Youth (NLSCY) and the Avon Longitudinal Study of Parents and Children (ALSPAC), respectively. This chapter describes the NLSCY analysis methodology.

The NLSCY is a prospective study of Canadian children, conducted by Statistics Canada and Human resources and Skills Development Canada, that investigated the health and development of children[212]. The study aimed to collect information regarding

factors that influence a child's social, emotional and behavioral development, while monitoring the impact of these factors on the development of the child[212]. The target population consisted of non-institutionalized civilian populations in Canada's 10 provinces, between the ages of 0-11 (at the time of selection). The study excluded those living on Indigenous reserves, Crown lands, members of the Canadian Armed forces and residents of some remote regions. The NLSCY began in 1994, collecting data every two years[212].

The NLSCY used a complex survey design, using the Labour Force Survey sampling frame[213]. In this study design, each province constituted an independent sample, which was allocated to ensure there was sufficient numbers in each province, providing reliable provincial estimates for all children[213]. In the first collection, 25,000 children between the ages of 0-11 were selected from the 10 provinces, as well as 2,300 children from the territories. Due to the multi-stage cluster design of the study, data were clustered in a hierarchical fashion. Each province was broken down into two parts: large cities and rural or small urban areas[214]. Within these sections, clusters of dwellings were identified. From here, households were selected from these clusters. The NLSCY first collection was divided into seven different age groups: 0-11 months, 1 year, 4-5 years, 6-7 years, 8-9 years, and 10-11 years[214].

The majority of questionnaires were administered by an interview using computer assisted interviewing[215]. The study was conducted in eight cycles, consisting of a number of different components: *child* component – for 0-11 year olds. In this category, the respondent was the 'person most knowledgeable' (PMK) which in 91.3%

of the cases is the mother of the child; *adult/general* component which was completed by the PMK or the spouse of the PMK of the child; *self-completed* questionnaire which was for participants 10-17; *cognitive tests* which measured various learning and developmental milestones at various ages; and finally, *youth* component which was completed by youth aged 16 years or older[214].

In this study, participants aged 4-5 years in cycle 1, 2, and 3 were included and followed through the remaining cycles. Please refer to Figure 2.1 which demonstrates the age of participants in each cycle and what variables are measured throughout the cycles.

Figure 2.1 NLSCY Age of Participants Throughout the Cycles

Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8
0/1	2/3	4/5	6/7	8/9	10/11	12/13	14/15
2/3	4/5	6/7	8/9	10/11	12/13	14/15	16/17
4/5	6/7	8/9	10/11	12/13	14/15	16/17	18/19
6/7	8/9	10/11	12/13	14/15	16/17	18/19	20/21
8/9	10/11	12/13	14/15	16/17	18/19	20/21	22/23
10/11	12/13	14/15	16/17	18/19	20/21	22/23	24/25

	EARLY CHILDHOOD STRESSORS
	CHILDHOOD PROTECTIVE FACTORS
	MENTAL HEALTH OUTCOMES

The study cohort was chosen based on the availability of predictive factors (early life stressors and childhood protective factors) as well as a response for each of the four

outcome measures, measured at least at one age point between years 12-15. 15,579 households in total were selected to participate in the NLSCY. Of these, there was an overall response rate of 86.3% (13,439). The total sample size for this study was 3,432.

2.2.1 EARLY CHILDHOOD STRESSORS

2.2.1.1 EARLY CHILDHOOD STRESSFUL LIFE EVENTS

Childhood stressors measured post-natal stressors, predominantly post-natal stressful experiences including topics such as death of a loved one, abuse, hospital stays, and moves. The PMK of each child which was most often the mother was asked: *In the past 24 months has the child ever experienced any event or situation that has caused him/her a great amount of worry or unhappiness*[214]. If the PMK answered yes to this question, they were then asked which of the following they have experienced:

- Death of parents
- Death in family (other than parents)
- Divorce/separation of parents
- Move
- Stay in hospital
- Stay in foster home
- Other separation from parents
- Illness/injury of child
- Illness/injury of a family member
- Abuse/fear of abuse
- Change in household members

- Alcoholism or mental health disorder in the family
- Conflict between parents
- Other

A new variable, early life stressors, was created using a sum of the number of stressful life events, which was then dichotomized into "high stress" (two or more early life stressors) and "low stress" (one or no experience of early life stressors)[25].

2.2.1.2 FAMILY DYSFUNCTION

The Family Dysfunction variable was used to measure early life stressors. At the age of 2-3, the PMK was asked to report on the overall level of dysfunction in their family[214]. The PMK was asked about 13 factors in their family functioning, and then were asked the level to which they agreed with each question by stating whether they: *strongly agreed, agreed, disagreed, strongly disagreed, not applicable, and don't know*. The total score varied between 0 and 36, with a high score indicating family dysfunction. As measured by Weeks et al, 2014 this variable was dichotomized, with the top 10th percentile being considered a 'high' level of dysfunction[25]. The items that were used to create the family dysfunction variable are as follows:

- Planning family activities is difficult because we misunderstand each other
- In times of crisis we can turn to each other for support
- We cannot talk to each other about sadness we feel
- We avoid discussing our fears or concerns
- Individuals in the family are accepted for what they are
- We express feelings to each other

- We feel accepted for what we are
- There are lots of bad feelings in our family
- We are able to make decision about how to solve problems
- Making decisions is a problem for our family
- We don't get along well together
- We confide in each other
- Drinking is a source of tension or disagreement in our family

2.2.2 CHILDHOOD PROTECTIVE FACTORS

2.2.2.1 PHYSICAL ACTIVITY

Physical activity was self-reported by the child; they were asked to reflect on their levels of physical activity in the past 12 months, between the ages of 10-11. Participants were asked the following questions:

- In the past 12 months, how often have you played sported with a coach or instructor (swimming lessons, baseball, hockey, etc.?)
- In the past 12 months, how often have you played sports or done physical activities without a coach or an instructor? (biking, skateboarding etc.)?

Participants were asked to rank each question as: n*ever, less than once a week, 1-3 times a week, and 4 or more times a week*. The Canadian Physical Activity Guides for Children and Youth[216] recommend engagement in physical activity daily, therefore we defined physical inactivity as engaging in organized/unorganized activities fewer than 4 times a week[217].

2.2.2.2 EXTRA CURRICULAR ACTIVITIES

Extracurricular activity participation was measured through a child self-report where the child was asked to reflect on their levels of extra-curricular activity in the past 12 months, between the ages of 10-11. Participants were asked the following questions:

- In the past 12 months, how often have you taken part in clubs or groups such as Guides or Scouts, 4-H club, community, church or other religious groups?
- In the past 12 months, how often have you taken part in art, drama or music groups, clubs or lessons outside of class

They were asked to rank each question as: *Never, less than once a week, 1-3 times a week, and 4 or more times a week*. In accordance with Geuvremont et al. extracurricular activity was dichotomized into *participation* and *non-participation* so that children who responded 'never' to both questions were considered to be *non-participants* and children who responded 'less than one a week' or above were considered participators[218].

2.2.2.3 POSITIVE PARENTING

Positive parenting was measured through a PMK report of their level of positive interactions with their children between the ages of 6-11[214]. The scale used for this measure was the Positive interaction scale (5 items, scale 0-20), based on the Parenting Practices Scale by Strayhorn and Weidman[219]. A positive interaction score was created using the following weighted items:

- How often do your praise your child by saying something like "Good for you!" or "What a nice thing you did!" or "That's good going!"

- How often do you and your child talk or play with each other, focusing attention on each other for five minutes or more, just for fun?
- How often do you and your child laugh together?
- How often do you do something special with your child that they enjoy?
- How often do you play sports, hobbies or games with your child?

Each PMK was asked to rank each item as: *never, about once a week or less, a few times a week, one of two times a day, many times each day, and not applicable*. The total score varied from 0-20 with higher scores indicating positive parenting. An average score was calculated between the ages of 6-11 for each child. As this particular subscale has not been categorized in previous literature, this variable was then dichotomized so that the top 50th percentile was considered *High Positive Parenting* and the bottom 50th percentile was considered *Low Positive Parenting.*

2.2.2.4 POSITIVE FRIENDSHIPS

Positive friendships was measured through a PMK report on their child's level of peer relationships based on the Marsh Peer Relations score[220]. This scale is intended to measure how well the youth feels that he/she gets along with his/her peers, identifying the extent and quality of the child's social support network[221]. PMKs were asked the following questions:

- I have many friends
- I get along easily with others my age
- Others my age want me to be their friend
- Most other my age like me

The PMK was then asked to respond with either: *false, mostly false, sometimes true/sometimes false, mostly true, or true*. A Peer Relations score (0-20) was derived from this and an average score was calculated for the child between the aged of 6-11, with higher scores indicating positive relationships with friends. As this particular subscale has not been categorized previously in the literature, this variable was then dichotomized so that the top 50Th percentile was considered *High Positive Friendships* and the bottom 50th percentile was considered *Low Positive Friendships.*

2.2.3 OUTCOME MEASURES

2.2.3.1 DEPRESSION/ANXIETY

Participants were asked a series of questions on symptoms relating to depression and anxiety, from here depression and anxiety scores were generated. When the study participants were between the age of 12-15, symptoms of depression and anxiety were assessed using 7 items from the Ontario Child Health Study, derived from the Child Behavior Checklist, which approximates the DSM(III)'s diagnostic criteria for emotional disorders[214]. The scores of participators at age 12-13 and then at 14-15 were averaged to create one score of adolescent mood disorder symptoms. The survey members were asked to state how well the following statements described them:

- I am unhappy or sad
- I am not as happy as other people my age
- I am too fearful or nervous
- I worry a lot
- I cry a lot
- I am nervous, high-strung, or tense

- I have trouble enjoying myself

Each item was then rated on a 3-point scale*: "never or not true," "sometimes or somewhat true,"* or *"often or very true."*

The total score was generated and then divided into 4 categories of severity[26,222,190]:

- participants who score below the 50th percentile will be scored as "no depressive anxiety symptoms,"
- participants between the 51st and 75th percentile will be classified as "low depressive anxiety symptoms,"
- participants between the 76th and 90th percentile will be considered "moderate"
- participants above the 90th percentile as "severe."

2.2.3.2 SECONDARY OUTCOMES

Measures of conduct disorder symptoms are based on the Child Behavior Checklist as well as the Antisocial Behavior Questionnaire, which the child responded to these self-reported questionnaires at the age of 12-15[223]. Measures of hyperactivity and inattention are based on the Children and Youth Hyperactivity/Inattention Subscale which was reported by the child between the ages of 12-15[224]. A total score was calculated for both conduct disorder symptoms and hyperactivity/inattention and an average score was created for each participant throughout the ages of 12-15. Consistent with precedence, conduct disorder symptoms and hyperactivity/inattention were scored using a dichotomous measure at the 10th percentile[225,226]. Those found in the top 10th percentile were considered to have high conduct disorder symptoms and high

hyperactivity/inattention. Participants were asked the following questions, to which they could respond: *never or not true, sometimes or somewhat true, often or very true.*

Conduct Disorder Symptoms

- I get into many fights
- When another young person accidentally hurts me I assume that he or she meant to do it, and I react with anger and fighting
- I physically attack people
- I threaten people
- I bully or am mean to others
- I kick or hit other people my age

Hyperactivity and Inattention

- I can't sit still, I am restless
- I am easily distracted. I have trouble sticking to any activity
- I can't concentrate. I can't pay attention
- I am impulsive. I act without thinking.
- I have difficulty waiting for my turn in games or group activities
- I cannot settle to anything for more than a few moments
- I am attentive. I have difficulty paying attention to someone.

2.2.4 COVARIATES

Covariates for both the NLSCY and the ALSPAC analysis were chosen *a priori* due to their association with either early life stressors or mental health disorders. NLSCY covariates include: PMK age, sex, socioeconomic status, and maternal depression (when the child

is an adolescent). Please refer to ALSPAC covariates for reasoning for adjustment unless a covariate was exclusively measure in the NLSCY analysis.

2.2.4.1 PMK AGE

Refer to ALSPAC covariates for reasoning for covariate choice. Teenage status of the mother was manually calculated. If the mother was 19 years of age or below when the child was born, they were deemed to be a teenage mother.

2.2.4.2 SEX

Refer to ASLPAC Covariates for reasoning for covariate choice. Sex of the child was measured as 'male' or 'female'.

2.2.4.3 SOCIOECONOMIC STATUS

Refer to ALSPAC Covariates for reasoning for covariate choice. Within the NLSCY, the socioeconomic variable was created using five variables:

- Level of education of the PMK
- Level of education of the spouse/partner
- Prestige of the PMK's occupation
- Prestige of the spouse/partner's occupation
- Household income

Although this variable was only measured at baseline (cycle 1), SES has been shown to remain stable across the lifespan[227,228], therefore this variable was deemed an appropriate measure of SES and was adjusted for within this thesis. This variable was dichotomized where those ≤10th percentile were classified as having low SES.

2.2.4.4 MATERNAL DEPRESSION

Maternal depression was adjusted for when the child was 12/13, as this measurement was closest to the outcome measurement of interest. Maternal depression is strongly associated with adolescent mental disorders[190]. The variable of maternal depression in the NLSCY is based on shortened scale based on a highly validated Center for Epidemiologic Studies Depression Scale (CES-D)[229]. The following questions were asked:

- "I felt that I could not shake off the blues even with help from my family or friends?"
- "I had trouble keeping my mind on what I was doing?"
- "I felt depressed?"
- "I felt that everything I did was an effort?"
- "I felt hopeful about the future; my sleep was restless?"
- "I was happy?"
- "I felt lonely?"
- "I enjoyed life?"
- "I had crying spells?"
- "I felt that people disliked me?"

Each item has four respondent options ranging from: *rarely or none of the time to most of all of the time*. In order to produce a cutoff in accordance with the 20-item DES-D (scores range from 0-60 and a score of 16 represents a classification of depression) the 12-item variable was cutoff were a score of 9 or above was classified as depression and those with scores below 9 were classified as non-depressed[230,190].

2.2.4.5 MATERNAL SMOKING

Please refer to ALSPAC covariates for reasoning of covariate choice. Maternal smoking was self-reported by the PMK when the child was 4/5 years of age. The PMK was asked

'At the present time, do you smoke cigarettes daily, occasionally or not at all?'. This measure was dichotomized into *yes* or *no* so that those who reported not at all were considered *no.*

2.3 STATISTICAL ANALYSIS – NLSCY & ALSPAC

2.3.1 MULTIVARIATE LOGISTIC REGRESSION

In order to investigate the association between early life stressful events and adolescent mental health outcomes, logistic regression modelling was conducted using the *PROC LOGISTIC* procedure in *SAS*[231] in order to calculate odds ratios (ORs) and 95% confidence intervals. Two models were computed for each of the outcomes of interest: (1) an unadjusted model, without covariates included, and (2) an adjusted model, with all covariates included. The *GLOGIT* option was used in *SAS* when outcomes had more than two categories – this function allows for the comparison of multiple categories of an outcome to a specified reference.

2.3.2 EFFECT MODIFICATION

It was hypothesized that childhood protective factors would have a modifying effect on the association between early life stressors and adolescent mental health outcomes. In order to investigate this, the modifying variables (childhood protective factors) were added to the multivariate logistic models in order to measure effect modification: whether the relationship between early life stressors and adolescent mental health outcomes is stronger or weaker in the presence of childhood protective factors. Effect modification of the primary associations and secondary associations by covariates was explored using interaction terms. Likelihood ratio tests were used to confirm if the

interaction terms significantly contributed to the model. Results were stratified and interpreted if a significant interaction was found.

2.3.3 MISSING DATA

Due to the longitudinal nature of both the NLSCY dataset and the ALSPAC dataset, missingness was an item needed to be addressed in the present study. For both the ALSPAC and NLSCY analysis, listwise deletion was used to address missing variables. Participants were removed from analysis if they were missing data on variables investigated within the analysis. No more than 5% of sample size was lost which each covariate. A missing data analysis was conducted, where participants removed from analysis were compared on sociodemographic and exposure variables to participants remaining in the analysis. Please refer to figure 2.2 and 2.3.

Figure 2.2 ALSPAC Drop Out Over Time Regarding Exposure, Protective Factors, Covariates, and Outcomes

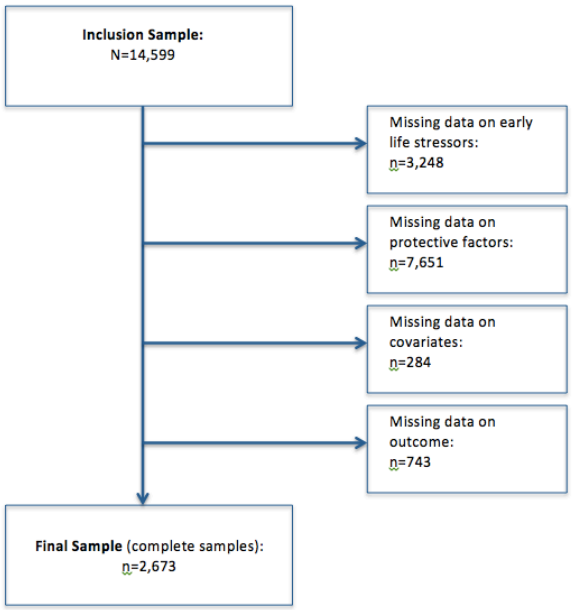
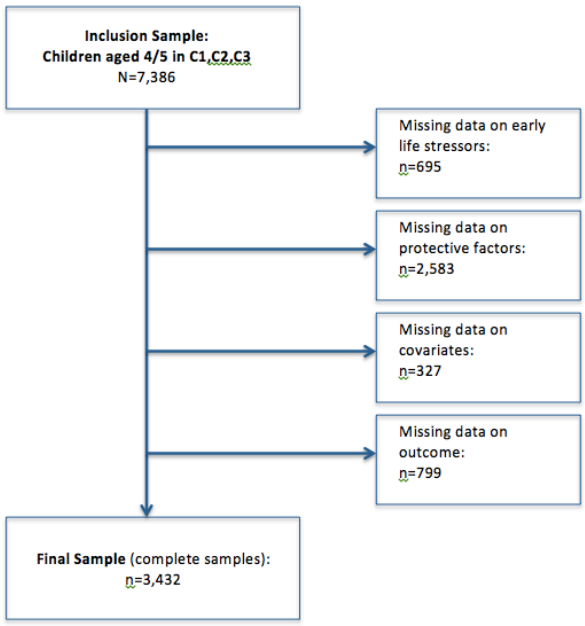


Fig 2.3 NLSCY Drop Out Over Time Regarding Exposure, Protective Factors, Covariates, and Outcomes



2.3.4 WEIGHTING

Within the NLSCY dataset, a longitudinal weight variable was taken from cycle 1 and was included in the analysis in order to take into account the complexity of the NLSCY, the Canadian sample, and design effects. Study survey weights were normalized by dividing the survey weight of each individual by the average weight value of the study sample. The ALSPAC dataset is not weighted, however, it represents the general population with a high breadth and frequency of data collection. Literature regarding the representativeness of the ALSPAC cohort to the population of Britain show that the study population is broadly representative of the British population[162].

CHAPTER 3: RESULTS

3.1 ALSPAC RESULTS

3.1.1 ALSPAC DESCRIPTIVE STATISTICS

ALSPAC respondents were evenly distributed between males (49.48%) and females (50.52%), were mostly born of non-teenage mothers (91.2%), predominantly came from intermediate social class families (50.05%), and the majority of respondents had mothers without reported depression (93.68%), history of depression (92.92), or history of anxiety (93.01%; see Table 3.1.1). Only 8.53% of respondents had mothers report prenatal smoking, while 14.49% of respondents had mothers report prenatal drinking. The majority of participants were found to participate in moderate physical activity (65.32%), and reported having high levels of positive friendships (91.58%).

Table 3.1.1 ALSPAC Proportion of Respondents by Mood Disorder at Age 12-15[1] (n=2673)

Variable	Total Sample (%)	MFQ depressive symptoms (%)	Non Depressed (%)	χ^2 p-value
Early Life Stressors (gestational-3yrs)				<.0001
1st quartile	23.50	16.02	25.94	
2nd quartile	26.90	22.98	25.34	
3rd quartile	25.22	25.34	23.86	
4th quartiles	24.38	35.65	24.85	
Sex				<.0001
Male	49.48	32.65	52.44	
Female	50.52	67.35	47.56	
Teenage Status of Mother				0.2908
No	91.12	12.11	82.90	
Yes	8.88	87.89	17.10	
Social Class				0.4642
Working	8.12	30.29	28.74	
Intermediate	50.08	59.37	59.14	
Professional	29.53	10.34	12.12	
Maternal History of Depression				0.1800
Yes	7.08	9.80	8.26	
No	92.92	90.20	91.74	
Maternal Depression				0.2231
Yes	6.32	10.60	6.74	
No	93.68	89.4	93.26	
Maternal Anxiety				0.2985
Yes	6.91	15.24	9.17	
No	93.01	84.76	90.83	
Physical Activity (age 10,11)				0.8126
Light	16.37	24.74	13.78	
Moderate	65.32	59.56	69.32	
Vigorous	18.31	15.70	16.90	
Extra-Curricular (age 9)				0.9522
Low	65.63	96.05	96.45	
High	34.37	3.95	3.55	
Positive Friendships (age 6-11)				<.0001
Low	1.14	86.73	1.04	
Moderate	7.28	11.00	6.97	
High	91.58	2.26	91.98	
Positive Parenting (age 6-11)				0.3269
Low	51.89	65.51	53.89	
High	48.11	34.49	46.11	
Maternal Smoking (any reported)				0.5234
Yes	8.53	12.00	7.07	
No	91.47	88.00	92.93	
Maternal drinking (at least once per week)				0.7593
Yes	14.49	13.76	13.51	
No	85.1	86.24	86.49	

χ^2 =Chi-Square

[1]Some percentages may not add up to exactly 100% due to rounding

Within the ALSPAC analysis, participants without outcome data were removed from analysis. In order to investigate potential bias, baseline social, demographic, and health characteristics of those lost to follow up between the ages of 12-15 by depression status were investigated. It was found that statistically significant higher proportion of males did not have outcome data. A noteworthy finding within the loss to follow up analysis is that stressful live events were not statistically significantly associated with any dropout.

Table 3.1.2. ALSPAC Baseline Social, Demographic, and Health Characteristics of Participants Lost to Follow Up at Age 12-15[1] Years by Depression Status

Variable	Without Outcome Data (%) (3,416)	With Outcome Data (%) (2,673)	χ^2 p-value
Early Life Stressors (gestational-3yrs)			0.078
1st quartile	27.78	23.5	
2nd quartile	23.80	26.90	
3rd quartile	22.47	25.22	
4th quartiles	25.95	24.38	
Sex			<.0001
Male	53.53	49.48	
Female	46.47	50.52	
Teenage Status of Mother			0.1072
No	77.21	91.12	
Yes	22.79	8.88	
Social Class			0.3174
Working	15.56	8.12	
Intermediate	60.36	50.08	
Professional	24.08	29.53	
Maternal History of Depression			0.0975
Yes	9.43	7.08	
No	90.57	92.92	
Maternal Depression			0.1996
Yes	10.30	6.32	
No	89.70	93.68	
Maternal Anxiety			0.2253
Yes	20.97	6.91	
No	79.03	93.01	
Physical Activity (age 10,11)			0.4765
Light	20.22	16.37	
Moderate	57.30	65.32	
Vigorous	22.48	18.31	
Extra-Curricular (age 9)			0.7352
Low	69.13	65.63	
High	30.87	34.37	
Positive Friendships (age 6-11)			0.0725
Low	12.33	1.14	
Moderate	22.16	7.28	
High	65.51	91.58	
Positive Parenting (age 6-11)			0.2185
Low	74.77	51.89	
High	25.23	48.11	
Maternal Smoking (any reported)			0.4210
Yes	15.21	8.53	
No	84.79	91.47	
Maternal drinking (at least once per week)			0.4327
Yes	13.04	14.49	
No	86.96	85.1	

[1]Some percentages may not add up to exactly 100% due to rounding.

3.1.2 ASSOCIATIONS BETWEEN STRESSFUL LIFE EVENTS AND ADOLESCENT MENTAL HEALTH OUTCOMES

Eleven logistic regression models were built, investigating prenatal, postnatal, and prenatal and postnatal combined as risk factors for adolescent depressive symptoms, anxiety, Attention Deficit/Hyperactivity Disorder (ADHD), and conduct disorder (between the ages of 12-15). Odds ratios and corresponding 95% confidence intervals can be found in Tables 3.1.3-3.1.14. The adjusted logistic regression models controlled for all covariates, including: Sex, teenage status of mother, social class, maternal history of depression, maternal depression, maternal anxiety, prenatal maternal smoking, and prenatal maternal drinking.

Stressful live events were measured in quartiles, indicating minimal, mild, moderate, and severe levels of early life stressors, and it was found that respondents who experienced mild, moderate, and severe levels of stressful live events exclusively during the postnatal period had an increased odds of depressive symptoms, between the ages of 12-15, compared to respondents who indicated minimal levels of early life stressors (Severe OR 2.50 95%CI: 1.92-3.25), (Moderate OR 1.65 95%CI:1.27-2.13), and (Mild OR 1.45 95%CI 1.12-1.87). Additionally, moderate stressful live events that were measured at the prenatal period exclusively were found to be non-significant risk factors, comparing to those who indicated minimal levels of early life stressors. However, respondents who experienced moderate and severe levels of early life stressors were found to have an increase in odds of experiencing depressive symptoms in adolescence, compared to those who indicated minimal levels of early life stressors (Severe OR 2.03 95%CI: 1.38-2.99), (Moderate OR 1.52 95%CI:1.03-2.24). Not

surprisingly, this association was also found when measuring early life stressors at the prenatal and postnatal stage in combination. Respondents who indicated severe levels of early life stressors had a 129% increase in odds of experiencing depressive disorders later in life (OR 2.29 95%CI: 1.78-2.95). Respondents who indicated moderate levels of early life stressors had a 57% increase in odds (OR 1.57 95%CI: 1.21-2.03), while those who indicated mild levels of early life stressors were at 36% increase in odds of adolescent depressive symptoms (OR 1.36 95% CI: 1.05-1.76).

Similarly, to the previously mentioned models, stressful live events, were investigated at the prenatal level, postnatal level, and in combination, as risk factors for anxiety during adolescence. All models, investigating this association were statistically non-significant in adjusted models. However, in unadjusted models, statistically significant associations were found for respondents who reported minimal and mild levels of prenatal and postnatal life stressors, where those who reported moderate levels of early life stressors were at 94% increased odd of experiencing anxiety in adolescence (OR 1.94 95% CI: 1.52-2.35) and those who indicated severe levels of early life stressors were at 2.39 times the odds of experiencing anxiety adolescence (OR 2.39 95%CI: 1.68-3.11).

Respondents who reported moderate and severe levels of prenatal and postnatal (in combination) stressful live events were at increased odds of having a diagnosis of conduct disorder at the age of 15. (Moderate OR 5.27 95%CI 1.04-9.49) (Severe OR 9.43 95%CI: 1.98-16.85). The remaining models (measuring prenatal early

life stressors and postnatal early life stressors exclusively) were non-significant in adjusted and unadjusted models.

Finally, no adjusted or unadjusted models were found to be statistically significant when investigating stressful live events as a risk factor for adolescent diagnosis of ADHD.

Table 3.1.3. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal and Postnatal Early Life Stressors and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	**1.36**	1.05-1.76	**1.79**	1.35-2.23
Moderate ELS	**1.57**	1.21-2.03	**1.90**	1.34-2.45
Severe ELS	**2.29**	1.78-2.95	**2.94**	2.22-3.65

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[2]Reference Category=No/Minimal Depressive Symptoms
Bolded ORs indicate p-values <0.05

Table 3.1.4. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal Early Life Stressors and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	1.02	0.69-1.52	1.49	1.03-1.94
Moderate ELS	**1.52**	1.03-2.24	1.76	1.25-2.26
Severe ELS	**2.03**	1.38-2.99	**2.26**	1.89-2.63

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[2]Reference Category=No/Minimal Depressive Symptoms
Bolded ORs indicate p-values <0.05

Table 3.1.5. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Postnatal Early Life Stressors and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	**1.45**	1.12-1.87	**1.64**	1.36-1.92
Moderate ELS	**1.65**	1.27-2.13	**1.73**	1.44-2.01
Severe ELS	**2.50**	1.92-3.25	**2.78**	2.11-3.45

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[2]Reference Category=No/Minimal Depressive Symptoms
Bolded ORs indicate p-values <0.05

Table 3.1.6. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal and Postnatal Early Life Stressors and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	0.70	0.31-1.56	0.91	0.59-1.22
Moderate ELS	**1.77**	0.91-3.47	1.94	1.52-2.35
Severe ELS	**1.74**	0.86-3.47	**2.39**	1.68-3.11

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[3]Reference Category=No Anxiety
Bolded ORs indicate p-values <0.05

Table 3.1.7. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal Early Life Stressors and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	0.67	0.21-2.20	0.71	0.39-1.79
Moderate ELS	1.71	0.57-5.10	1.92	0.89-2.46
Severe ELS	1.62	0.54-4.91	1.87	0.93-3.22

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[3]Reference Category=No Anxiety
Bolded ORs indicate p-values <0.05

Table 3.1.8. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Postnatal Early Life Stressors and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	1.01	0.48-2.10	1.38	0.77-1.98
Moderate ELS	1.56	0.79-3.12	1.55	0.85-2.26
Severe ELS	**1.97**	0.97-4.02	2.68	0.91-4.46

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[3]Reference Category=No Anxiety
Bolded ORs indicate p-values <0.05

Table 3.1.9. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal and Postnatal Early Life Stressors and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	3.47	0.62-6.32	2.21	0.94-7.78
Moderate ELS	**5.27**	1.04-9.49	4.36	1.52-9.84
Severe ELS	**9.43**	1.98-16.874	8.54	2.25-14.84

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
Bolded ORs indicate p-values <0.05

Table 3.1.10. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal Early Life Stressors and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	9.63	0.30-18.95	13.53	0.84-26.22
Moderate ELS	11.83	0.37-23.28	14.53	0.72-24.35
Severe ELS	26.99	0.93-53.04	31.72	0.87-62.57

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
[4]Reference Category=No Conduct Disorder
Bolded ORs indicate p-values <0.05

Table 3.1.11. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Postnatal Early Life Stressors and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	4.68	0.84-8.52	4.89	0.95-8.83
Moderate ELS	**5.62**	1.02-10.21	**6.17**	2.23-10.11
Severe ELS	**10.67**	2.91-18.42	9.65	2.98-16.32

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
Bolded ORs indicate p-values <0.05

Table 3.1.12. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Postnatal and Prenatal Early Life Stressors and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	3.90	0.48-7.32	4.58	0.57-8.59
Moderate ELS	4.82	0.63-9.01	5.17	0.68-9.65
Severe ELS	6.36	0.86-11.86	7.78	0.93-14.63

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
Bolded ORs indicate p-values <0.05

Table 3.1.13. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Prenatal Early Life Stressors and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	xxxx	xxxx	xxxx	xxxx
Moderate ELS	xxxx	xxxx	xxxx	xxxx
Severe ELS	xxxx	xxxx	xxxx	xxxx

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
XXXX – Sample size too small for statistical output
Bolded ORs indicate p-values <0.05

Table 3.1.14. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Postnatal Early Life Stressors and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Mild ELS	3.41	0.39-6.42	4.31	0.68-7.94
Moderate ELS	5.32	0.72-9.91	5.68	0.79-10.58
Severe ELS	7.60	0.82-14.38	8.76	0.94-16.57

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ELS: Early Life Stressors. Mild, Moderate, Severe vs Minimal
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
Bolded ORs indicate p-values <0.05

3.1.3 ASSOCIATIONS BETWEEN CHILDHOOD PROTECTIVE FACTORS AND ADOLESCENT MENTAL HEALTH OUTCOMES

To investigate the roles of the childhood protective factors, each childhood protective factor was investigated in sixteen adjusted and unadjusted logistic regression models, investigating their effects on adolescent mental health outcomes. Odds ratios and corresponding 95% confidence intervals can be found in Tables 3.1.15.-3.1.30. The adjusted logistic regression models controlled for all covariates, including: Sex, teenage status of mother, social class, maternal history of depression, maternal depression, maternal anxiety, prenatal maternal smoking, and prenatal maternal drinking.

Respondents who reported high levels of positive friendships early in life were at a 53% decrease in odds of depressive symptoms during adolescence with an OR of 0.47 (95%CI 0.24-0.92) compared to those who reported low levels of positive friendships early in life. This association was not found to be statistically significant within the moderate positive friendship category. Additionally, children who grew up with high levels of positive parenting were significantly less likely to have depressive symptoms in adolescence, in adjusted models (OR 0.75 95%CI 0.64-0.88). It was found that participation in extracurricular activity was not found to be statistically significant when

investigating depressive symptoms as an outcome in adjusted and unadjusted models. Finally, children who participated in moderate to vigorous physical activity, daily, were less likely to experience depressive symptoms later in life, compared to children who only participated in light physical activity (Moderate OR 0.72 95% CI 0.52-0.91) (Vigorous OR 0.58 95%CI 0.41-0.83).

Furthermore, moderate and high levels of early life positive friendship had a protective effect on adolescent anxiety, with reduced odds of 57% and 76%, respectively. Additionally, youth who participated in extracurricular activities growing up had a 36% decrease in odds of experiencing adolescent anxiety (OR 0.64 95% CI 0.46-0.83). Finally, when investigating the role of positive parenting on adolescent outcomes of anxiety, no adjusted or unadjusted models were found to be statistically significant.

Moreover, the association between positive friendships and conduct disorder outcomes were found to be statistically non-significant in adjusted and unadjusted models. Additionally, when investigating the role of positive parenting on adolescent outcomes of conduct disorder, no adjusted or unadjusted models were found to be statistically significant. Furthermore, adjusted and unadjusted models investigating the association between physical activity and conduct disorder were also found to be statistically non-significant. Finally, no adjusted or unadjusted models were found to be statistically significant when investigating childhood protective factors for adolescent diagnosis of ADHD.

Table 3.1.15. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[6]	0.77	0.37-1.61	0.59	0.24-0.95
High[6]	**0.47**	0.24-0.92	0.60	0.22-0.96

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[2]Reference Category=No/Minimal Depressive Symptoms
[6]Reference Category=Low Positive Friendship
Bolded ORs indicate p-values <0.05

Table 3.1.16. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[6]	**0.43**	0.07-0.82	0.47	0.05-0.89
High[6]	**0.24**	0.05-0.41	0.32	0.03-0.69

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[3]Reference Category=No Anxiety
[6]Reference Category=Low Positive Friendship
Bolded ORs indicate p-values <0.05

Table 3.1.17. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[6]	**1.13**	0.14-9.41	0.96	0.86-12.11
High[6]	**0.45**	0.06-3.38	0.73	0.56-5.64

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[4]Reference Category=No Conduct
[6]Reference Category=Low Positive Friendship
Bolded ORs indicate p-values <0.05

Table 3.1.18. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[6]	xxxx	xxxx	xxxx	xxxx
High[6]	xxxx	xxxx	xxxx	xxxx

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
[6]Reference Category=Low Positive Friendship
XXXX – Sample size too small for statistical output
Bolded ORs indicate p-values <0.05

Table 3.1.19. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[7]	0.75	0.64-0.88	0.47	0.54-0.89

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[2]Reference Category=No/Minimal Depressive Symptoms
[7]Reference Category=Low Positive Parenting Score
Bolded ORs indicate p-values <0.05

Table 3.1.20. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[7]	0.76	0.49-1.20	0.99	0.62-1.36

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[3]Reference Category=No Anxiety
[7]Reference Category=Low Positive Parenting Score
Bolded ORs indicate p-values <0.05

Table 3.1.21. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[7]	0.93	0.56-1.55	1.27	0.65-1.89

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[4]Reference Category=No Conduct Disorder
[7]Reference Category=Low Positive Parenting Score
Bolded ORs indicate p-values <0.05

Table 3.1.22. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[7]	1.48	0.72-3.04	2.135	0.73-3.54

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
[7]Reference Category=Low Positive Parenting Score
Bolded ORs indicate p-values <0.05

Table 3.1.23. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra Curricular and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participation[8]	0.90	0.58-1.39	1.23	0.51-2.00

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[2]Reference Category=No/Minimal Depressive Symptoms
[8]Reference Category=Non-Participator
Bolded ORs indicate p-values <0.05

Table 3.1.24. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association between Extra-Curricular and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participation[8]	**0.64**	0.46-0.83	0.53	0.32-0.75

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[3]Reference Category=No Anxiety
[8]Reference Category=Non-Participator
Bolded ORs indicate p-values <0.05

Table 3.1.25. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra-Curricular and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participation[8]	0.52	0.12-2.16	1.60	0.10-3.10

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[4]Reference Category=No Conduct
[8]Reference Category=Non-Participator
Bolded ORs indicate p-values <0.05

Table 3.1.26. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra-Curricular and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participation[8]	xxxx	xxxx	xxxx	xxxx

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
[8]Reference Category=Non-Participator
XXXX – Sample size too small for statistical output
Bolded ORs indicate p-values <0.05

Table 3.1.27. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activity and Adolescent Depressive Symptoms[2]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[9]	0.72	0.52-0.91	0.76	0.63-0.88
Vigorous[9]	0.58	0.41-0.83	0.59	0.52-0.65

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[2]Reference Category=No/Minimal Depressive Symptoms
[9]Reference Category=Light Physical Activity
Bolded ORs indicate p-values <0.05

Table 3.1.28. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activity and Adolescent Anxiety[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[9]	1.66	0.53-2.80	1.86	0.62-3.10
Vigorous[9]	0.93	0.40-2.18	1.75	0.60-2.91

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[3]Reference Category=No Anxiety
[9]Reference Category=Light Physical Activity
Bolded ORs indicate p-values <0.05

Table 3.1.29. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activity and Adolescent Conduct Disorder[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[9]	0.88	0.31-1.45	0.83	0.28-1.38
Vigorous[9]	0.54	0.23-1.21	0.75	0.16-1.34

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
[4]Reference Category=No Conduct Disorder
[9]Reference Category=Light Physical Activity
Bolded ORs indicate p-values <0.05

Table 3.1.30. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activity and Adolescent ADHD[5]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Moderate[9]	0.86	0.27-1.44	0.87	0.21-1.53
High[9]	0.50	0.18-1.36	0.27	0.12-1.42

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.
ADHD – Attention Deficit/Hyperactivity Disorder
[5]Reference Category=No ADHD
[9]Reference Category=Light Physical Activity
Bolded ORs indicate p-values <0.05

3.1.4 INTERACTIONS BETWEEN STRESSFUL LIFE EVENTS AND CHILDHOOD PROTECTIVE FACTORS ON ADOLESCENT MENTAL HEALTH OUTCOMES

The modifying effect of childhood protective factors on the association between stressful live events and adolescent depressive symptoms was investigated within the ALSPAC dataset. Childhood protective factors included: Physical activity, participation in extracurricular activity, experiencing high levels of positive friendships, and experiencing high levels of positive parenting. Adjusted and unadjusted beta coefficients and corresponding p-values of each interaction term can be found in Table 3.1.31, 3.1.32, and 3.2.33. All interaction terms with each childhood protective factor and prenatal stressful live events, postnatal stressful live events, and prenatal and postnatal stressful live events combined were found to be statistically non-significant in adjusted and unadjusted models.

Table 3.1.31. Adjusted[a] and Unadjusted Regression Models Summarizing the Interactions Terms of Childhood Protective Factors and Prenatal & Postnatal Early Life Stressors on Adolescent Depressive Symptoms[5].

Interaction terms	Adjusted[a] (Beta Coefficients)	p-value	Unadjusted (Beta Coefficients)	p-value
High Positive Friendship *ELS[1]	Severe: (10.99)	0.9568	Severe: (9.33)	0.8465
	Moderate:(-0.16)	0.8170	Moderate: (-0.25)	0.7558
	Mild: (-0.38)	0.5369	Mild: (-0.15)	0.4551
Moderate Positive Friendship *ELS[1]	Severe: (10.96)	0.9569	Severe: (7.52)	0.8992
	Moderate:(-1.08)	0.0911	Moderate: (1.26)	0.0845
	Mild: (-0.73)	0.2013	Mild: (-0.79)	0.3152
High Physical Activity*ELS3[2]	Severe: (-0.16)	0.7744	Severe: (-0.52)	0.7533
	Moderate: (0.18)	0.7427	Moderate: (0.25)	0.5668
	Mild: (0.06)	0.8771	Mild: (-0.07)	0.7854
Moderate Physical Activity*ELS[2]	Severe: (-0.04)	0.9391	Severe: (-0.08)	0.8214
	Moderate: (-0.30)	0.5948	Moderate: (-0.68)	0.4587
	Mild: (0.36)	0.3734	Mild: (0.78)	0.2487
Extra-Curricular Participation *ELS[3]	Severe: (-0.47)	0.3628	Severe: (-0.57)	0.2584
	Moderate: (-0.35)	0.5013	Moderate: (-0.21)	0.4458
	Mild: (0.21)	0.5188	Mild: (0.34)	0.4187
High Positive Parenting Score*ELS[4]	Severe: (-0.49)	0.5224	Severe: (0.06)	0.9481
	Moderate: (-0.28)	0.7384	Moderate: (-0.15)	0.7587
	Mild: (0.10)	0.8451	Mild: (0.41)	0.8411

ELS=Early Life Stressor

[5]Severe, Moderate, Mild Depressive symptoms – Compared to No Depressive Symptoms

[1]Reference Category=Low Positive Friendship

[2]Reference Category=Light Physical Activity

[3]Reference Category=Extra-curricular Non-Participation

[4]Reference Category=Low Positive Parenting Score

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.

Table 3.1.32. Adjusted[a] and Unadjusted Regression Models Summarizing the Interactions Terms of Childhood Protective Factors and Prenatal Early Life Stressors on Adolescent Depressive Symptoms[5].

Interaction terms	Adjusted[a] (Beta Coefficient)	p-value	Unadjusted (Beta Coefficient)	p-value
High Positive Friendships *ELS[1]	Severe: (9.84)	0.7845	Severe: (10.84)	0.2536
	Moderate:(-1.47)	0.6653	Moderate: (-2.28)	0.3284
	Mild: (-0.89)	0.5112	Mild: (-0.24)	0.3397
Moderate Positive Friends *ELS[1]	Severe: (8.48)	0.4251	Severe: (8.47)	0.2874
	Moderate:(-2.27)	0.3514	Moderate: (2.54)	0.2663
	Mild: (-0.99)	0.6521	Mild: (-1.22)	0.1254
High Physical Activity*ELS[2]	Severe: (-0.34)	0.4511	Severe: (-0.95)	0.2684
	Moderate: (1.19)	0.5784	Moderate: (0.34)	0.2219
	Mild: (0.18)	0.6681	Mild: (-0.64)	0.3621
Moderate Physical Activity*ELS[2]	Severe: (-0.24)	0.7415	Severe: (-0.81)	0.5164
	Moderate: (0.58)	0.6932	Moderate: (-1.64)	0.3614
	Mild: (1.37)	0.4886	Mild: (1.74)	0.2117
Extra-Curricular Participation *ELS[3]	Severe: (-1.68)	0.3485	Severe: (-2.41)	0.1689
	Moderate: (-0.79)	0.4184	Moderate: (-0.41)	0.3001
	Mild: (1.24)	0.5487	Mild: (1.38)	0.3651
High Positive Parenting Score*ELS[4]	Severe: (-0.78)	0.5118	Severe: (0.92)	0.0845
	Moderate: (-1.68)	0.6845	Moderate: (-1.67)	0.1345
	Mild: (0.79)	0.3588	Mild: (0.88)	0.1174

ELS=Early Life Stressor

[5]Severe, Moderate, Mild Depressive symptoms – Compared to No Depressive Symptoms

[1]Reference Category=Low Positive Friendship

[2]Reference Category=Light Physical Activity

[3]Reference Category=Extra-curricular Non-Participation

[4]Reference Category=Low Positive Parenting Score

[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.

Table 3.1.33. Adjusted[a] and Unadjusted Regression Models Summarizing the Interactions Terms of Childhood Protective Factors and Postnatal Early Life Stressors on Adolescent Depressive Symptoms[5].

Interaction terms	Adjusted[a] (Beta Coefficient)	p-value	Unadjusted (Beta Coefficient)	p-value
High Positive Friendship *ELS[1]	Severe: (12.22)	0.9841	Severe: (10.33)	0.4581
	Moderate:(-0.27)	0.9512	Moderate: (-3.58)	0.9481
	Mild: (-0.48)	0.6528	Mild: (-0.84)	0.8455
Moderate Positive Friendship *ELS[1]	Severe: (13.25)	0.9127	Severe: (12.84)	0.8451
	Moderate:(-1.94)	0.4587	Moderate: (1.98)	0.5412
	Mild: (-1.78)	0.5324	Mild: (-1.68)	0.6512
High Physical Activity*ELS[2]	Severe: (-0.68)	0.8854	Severe: (-1.58)	0.7845
	Moderate: (0.68)	0.7668	Moderate: (0.57)	0.5847
	Mild: (0.14)	0.9541	Mild: (-0.24)	0.6158
Moderate Physical Activity*ELS[2]	Severe: (-0.84)	0.9638	Severe: (-0.66)	0.8845
	Moderate: (-0.65)	0.6854	Moderate: (-2.68)	0.5846
	Mild: (1.25)	0.4955	Mild: (0.27)	0.9824
High Extra Curricular*ELS[3]	Severe: (-0.95)	0.4589	Severe: (-1.64)	0.7512
	Moderate: (-1.36)	0.7845	Moderate: (-2.22)	0.6325
	Mild: (1.25)	0.6214	Mild: (0.49)	0.6819
Positive Parenting*ELS[4]	Severe: (-0.86)	0.7481	Severe: (0.47)	0.9522
	Moderate: (-4.24)	0.8411	Moderate: (-4.58)	0.8451
	Mild: (0.70)	0.9876	Mild: (0.89)	0.8982

ELS=Early Life Stressor
[5]Clinically Relevant Depressive Symptoms– Compared to No Depressive Symptoms
[1]Reference Category=Low Positive Friendship
[2]Reference Category=Light Physical Activity
[3]Reference Category=Extra-curricular Non-Participation
[4]Reference Category=Low Positive Parenting Score
[a]Adjusted for sex, teenage status of mother, maternal history of depression, maternal depression, maternal anxiety, maternal smoking, and maternal drinking.

3.2 NLSCY RESULTS

3.2.1 NLSCY DESCRIPTIVE STATISTICS

NLSCY respondents were distributed among males (49.30%) and females (50.69%), predominantly from higher socioeconomic status families (81.40%), and predominantly born from non-teenage mothers (81.77%). Only 2.97% of the study sample had experienced high levels of early life stressors (2 of more stressful life events), while 6.37% of the study sample experienced high levels of family dysfunction early in life. It was found that 2.35% of the respondent's mothers had depression when the

respondent was between the ages of 12-15. In regards to childhood protective factors, positive friendship and positive parenting was generally evenly distributed; 52.39% experienced low positive friendships between the ages of 6-11, and 45.01% of respondents experienced low levels of positive parenting between the ages of 6-11. Within the study sample, physical activity (13.96%) was less common than physical inactivity (86.04%). It was also noted that participation in extra-curricular activity (65.24%) was more prevalent in respondents, compared to non-participation (34.76%), between the ages of 6-11.

Table 3.2.1. NLSCY Weighted Proportion of Respondents by Mood Disorder at Age 12-15[1] (n=3432)

Variable	Total Sample (%)	No Symptoms (%)	Mild Symptoms (%)	Moderate Symptoms (%)	Severe Symptoms (%)	χ^2 p-value
Early Life Stressors (age 4,5)						0.9174
Low Stress	97.03	97.41	89.11	84.54	79.12	
High Stress	2.97	2.89	10.89	14.46	20.88	
Family Dysfunction						0.3042
Low Dysfunction	93.63	95.20	92.84	91.00	87.96	
High Dysfunction	6.37	4.80	7.16	9.00	12.04	
Sex						<.0001
Male	49.30	60.60	48.63	32.67	33.46	
Female	50.69	39.40	51.37	67.33	66.54	
Teenage Status of Mother						0.2097
Yes	8.23	6.72	7.90	11.33	11.95	
No	81.77	87.84	89.21	83.19	86.78	
Socioeconomic Status						0.6524
Low	18.60	19.26	18.13	20.11	22.32	
High	81.40	80.74	81.87	79.89	76.68	
Maternal Depression (age 12-15)						0.2650
Yes	2.35	1.82	2.19	2.84	4.70	
No	97.65	98.18	97.81	97.16	95.3	
Maternal Smoking (any reported)						0.5147
Yes	7.51	5.23	4.92	8.47	10.02	
No	92.49	94.77	95.08	91.53	89.98	
Physical Activity (age 10,11)						0.4486
Physical Inactivity	86.04	82.32	86.11	87.02	89.65	
Physical Activity	13.96	17.68	13.89	12.98	10.35	
Extra-Curricular (age 10,11)						0.0005
Non-participation	34.76	31.76	35.51	36.89	38.13	
Participation	65.24	68.24	64.49	63.11	61.87	
Positive Friendships (age 6-11)						0.0934
Low	52.39	47.38	55.35	58.64	55.90	
High	47.61	52.62	44.65	41.36	44.10	
Positive Parenting (age 6-11)						0.6636
Low	45.01	55.42	52.32	58.74	57.22	
High	54.99	44.58	47.68	41.26	42.78	

χ^2 =Chi-Square

[1]Some percentages may not add up to exactly 100% due to rounding

Participants without outcome data were removed from analysis. In order to investigate potential bias, baseline social, demographic, and health characteristics of those lost to follow up between the ages of 12-15 was investigated. Statistically significant higher proportions of men and non-participants in extracurricular activities were found in participants who were lost to follow up between the ages of 12-15. A

noteworthy finding within the loss to follow up analysis is that early life stressors were not statistically significantly associated with any dropout.

Table 3.2.2. NLSCY Baseline Social, Demographic, and Health Characteristics of Participants Lost to Follow Up at Age 12-15[1] Years by Depression Status

Variable	Without Outcome Data (%) (4,231)	With Outcome Data (%) (3,432)	χ^2 p-value
Early Life Stressors (age 4,5)			0.9883
Low Stress	97.34	97.03	
High Stress	2.65	2.97	
Family Dysfunction			0.2156
Low Dysfunction	91.24	93.63	
High Dysfunction	8.77	6.37	
Sex			<0.0001
Male	51.83	49.30	
Female	48.17	50.69	
Teenage Status of Mother			0.2765
Yes	11.32	8.23	
No	88.67	81.77	
Socioeconomic Status			0.1184
Low	33.95	18.60	
High	66.05	81.40	
Maternal Depression (age 12-15)			0.2214
Yes	0.29	2.35	
No	99.71	97.65	
Maternal Smoking			0.3744
Yes	11.12	7.51	
No	88.88	92.49	
Physical Activity (age 10,11)			0.4783
Physical Inactivity	88.20	86.04	
Physical Activity	11.80	13.96	
Extra-Curricular (age 10,11)			<0.0001
Non-participation	37.23	34.76	
Participation	62.77	65.24	
Positive Friendships (age 6-11)			0.0653
Low	59.27	52.39	
High	40.73	47.61	
Positive Parenting (age 6-11)			0.2311
Low	69.30	45.01	
High	30.70	54.99	

[1]Some percentages may not add up to exactly 100% due to rounding.

3.2.2 ASSOCIATIONS BETWEEN EARLY CHILDHOOD STRESSORS AND ADOLESCENT MENTAL HEALTH OUTCOMES

To investigate the roles of early childhood stressors on adolescent mental health outcomes, six multinomial regression models were built, investigating childhood stressors and family dysfunction as risk factors for adolescent mood disorder symptoms,

hyperactivity and inattention symptoms, and conduct disorder symptoms. Odds ratios and corresponding 95% confidence intervals can be found in Tables 3.2.3-3.2.8. The adjusted logistic regression models controlled for all covariates, including: Sex, PMK age, maternal depression, socioeconomic status, and maternal smoking.

In the adjusted model, respondents who experienced two or more childhood stressors during childhood had 1.73 times the odds (95% CI: 1.72-1.84) of experiencing severe mood disorder symptoms during their adolescence. Adjusted models also indicated that respondents experiencing two or more childhood stressors during their childhood had 1.07 (95% CI: 1.03-1.08) times the odds of experiencing mild mood disorder symptoms in their adolescent years. Additionally, the association between childhood stressors and moderate mood disorder symptoms were found to be statistically insignificant (OR 1.00 95%CI:0.97-1.08) in adjusted and unadjusted models.

Another measure of childhood stressors utilized within this analysis was the measure of family dysfunction when the child was 2-3 years of age. In the adjusted regression models, it was found that experiencing high levels of family dysfunction early in life increased the odds of experiencing mood disorder symptoms across mild, moderate, and severe levels with increased odds of 1.09 (95%CI 1.05-1.13), 2.23 (95% CI2.17-2.29), and 1.11 (95% CI 1.08-1.13), respectively.

Adjusted logistic regression models were built to investigate the association between early life stressors and family dysfunction early in life and adolescent symptoms of hyperactivity and inattention. It was found that children who experienced two or more childhood stressors had an increase in the odds of experiencing symptoms

of hyperactivity and inattention during adolescence (OR 1.13 95%CI:1.06-1.20). This association was consistently found when measuring family dysfunction as a risk factor, where respondents who experienced high levels of family dysfunction in childhood had an increase in the odds of experiencing adolescent symptoms of inattention and hyperactivity (OR 1.22 (95%CI: 1.25-1.47).

Respondents found in the high childhood stressor category demonstrated a 27% increased risk in experiencing conduct disorder symptoms during adolescence (OR 1.27 95% CI: 1.23-1.32). This relationship was consistent when measuring family dysfunction as a risk factor in that respondents belonging to the high family dysfunction category were 1.36 times more likely to experience conduct disorder symptoms between the ages of 12-15 (OR 1.36 95% CI: 1.33-1.40).

Table 3.2.3. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Early Life Stressors and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
Two or more ELS[1]	**1.07**	1.03-1.08	**0.843**	0.82-08.6
	Moderate		*Moderate*	
Two or more ELS[1]	1.00	0.97-1.08	**1.12**	1.09-1.15
	Severe		*Severe*	
Two or more ELS[1]	**1.78**	1.72-1.84	**1.51**	1.47-1.56

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
ELS=Early Life Stressors
[1]Reference Category=One or No Early Life Stressors
[2]Reference Category=No Mood Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.4. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Early Life Stressors and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Two or more ELS[1]	**1.27**	1.23-1.32	**1.37**	1.33-1.42

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
ELS=Early Life Stressors
[1]Reference Category=One or No Early Life Stressors
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.5. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Early Life Stressors and Adolescent Hyperactivity and Inattention Symptoms[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Two or more ELS[1]	**1.13**	1.06-1.20	1.26	**1.23-1.30**

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
ELS=Early Life Stressors
[1]Reference Category=One or No Early Life Stressors
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

Table 3.2.6. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Family Dysfunction and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
High Dysfunction[5]	**1.11**	1.08-1.13	**1.36**	1.34-1.38
	Moderate		*Moderate*	
High Dysfunction[5]	**2.23**	2.17-2.29	**2.03**	2.00-2.08
	Severe		*Severe*	
High Dysfunction[5]	**1.09**	1.05-1.13	**1.08**	1.04-1.11

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[2]Reference Category=No Mood Disorder Symptoms
[5]Reference Category=Low Level of Family Dysfunction
Bolded ORs indicate p-values <0.05

Table 3.2.7. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Family Dysfunction and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Dysfunction[5]	**1.36**	1.33-1.40	**1.55**	1.52-1.58

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[5]Reference Category=Low Level of Family Dysfunction
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.8 Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Family Dysfunction and Adolescent Hyperactivity and Inattention Symptoms[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Dysfunction[5]	**1.22**	1.16-1.30	**1.11**	1.08-1.14

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[5]Reference Category=Low Level of Family Dysfunction
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

3.2.3 ASSOCIATIONS BETWEEN CHILDHOOD PROTECTIVE FACTORS AND ADOLESCENT MENTAL HEALTH OUTCOMES

To investigate the roles of the childhood protective factors, each childhood protective factor was investigated in twelve adjusted and unadjusted logistic regression models, investigating their direct effects on adolescent mental health outcomes. Odds ratios and

corresponding 95% confidence intervals can be found in Tables 3.2.9-3.2.20. The adjusted logistic regression models controlled for all covariates, including: Sex, PMK age, maternal depression, socioeconomic status, and maternal smoking.

The association between early life extracurricular participation and adolescent mood disorders was investigated and it was found that respondents in the *participation* category were found to have a statistically significant decrease in odds of experiencing mood disorder symptoms in adolescence across all levels of symptoms severity (Mild: OR 0.95 95% CI: 0.93-0.97, Moderate: OR 0.86 95% CI: 0.84-0.88, Severe: OR 0.29 95% CI: 0.28-0.29).

In unadjusted models, high levels of childhood physical activity was found to have a protective effect on experiencing mood disorders as adolescents across all levels of mood disorder symptom severity, although no adjusted measures were found to be statistically significant. (Mild: OR 0.84 95% CI: 0.60-1.17, Moderate: OR 0.88 95% CI: 0.54-1.14, Severe: OR 0.64 95% CI: 0.38-1.08).

Additionally, it was found that participants who reported having high levels of positive friendships early in life were at significant decreased odds of experiencing adolescent mood disorders across all mood disorder symptoms severity. (Mild: OR 0.70 95% CI: 0.62-0.78, Moderate: OR 0.85 95% CI: 0.77-0.92, Severe: OR 0.66 95% CI: 0.60.-0.72).

Finally, positive parenting was investigated as a protective factor for adolescent mental health outcomes in adjusted regression models. Those who were in the high positive parenting category between the ages of 6-11 had a decrease in odds of

experiencing mood disorders across all mood disorder symptoms severity levels. (Mild: OR 0.85 95% CI: 0.80-0.88, Moderate: OR 0.8095% CI: 0.76-0.84, Severe: OR 0.90 95% CI: 0.87.-0.93).

Moreover, childhood participation in extracurricular activities was found to have a protective effect on experiencing hyperactive and inattention symptoms during adolescence (OR 0.89 95% CI: 0.87-0.92). This protective trend was also found when investigating childhood measures of positive friendships (OR 0.82 95%CI: 0.72-0.92). Surprisingly, this protective trend was not found when investigating early life physical activity and positive parenting and adolescent hyperactivity and inattention symptoms, where participants who were physically active were 1.12 times more likely to experience adolescent inattention and hyperactive symptoms (OR 1.12 95%CI: 1.09-.16) in adjusted models, while respondents who had parents scoring high on the positive parenting scale were 1.36x more likely to experience symptoms of hyperactivity and inattention in adolescence.

Children who participated in extra-curricular activities as they grew up were at a 33% decrease in odds of experiencing adolescent conduct disorder symptoms compared to non-participants (OR 0.77 95% CI: 0.75-0.90). Following the trend seen with extra-curricular activities, childhood physical activity was also found to have a protective effect on experiencing conduct disorder symptoms during adolescence with a 16% decrease in odds (OR 0.84 95% CI: 0.81-0.86). This protective trend was also found when investigating early life positive friends and adolescent conduct disorder symptoms (OR 0.74 95% CI: 0.72-0.75). Finally, respondents who experienced high levels of positive

parenting between the ages of 6-11 were also at a 25% decrease in odds of experiencing conduct disorder symptoms in adolescents (OR 0.75 95%CI: 0.70-0.70).

Table 3.2.9. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra-Curricular Activities and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
Participants[6]	**0.95**	0.93-0.97	**0.97**	0.96-0.99
	Moderate		*Moderate*	
Participants[6]	**0.86**	0.84-0.88	**0.88**	0.86-0.89
	Severe		*Severe*	
Participants[6]	**0.29**	0.27-0.31	**0.35**	0.34-0.36

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[2]Reference Category=No Mood Disorder Symptoms
[6]Reference Category=Non-Participants
Bolded ORs indicate p-values <0.05

Table 3.2.10. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra-Curricular Activities and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participants[6]	0.77	0.75-0.80	0.71	0.58-0.83

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[6]Reference Category=Non-Participants
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.11. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Extra Curricular Activities and Adolescent Hyperactivity and Inattention Symptoms[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Participants[6]	**0.89**	0.87-0.92	**0.65**	0.64-0.67

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[6]Reference Category=Non-Participants
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

Table 3.2.12. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activities and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
Physically Active[7]	**0.84**	0.60-1.17	**0.73**	0.71-0.74
	Moderate		*Moderate*	
Physically Active[7]	**0.88**	0.54-1.14	**0.74**	0.72-0.76
	Severe		*Severe*	
Physically Active[7]	**0.64**	0.38-1.08	**0.49**	0.48-0.50

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[2]Reference Category=No Mood Disorder Symptoms
[7]Reference Category=Not Physically Active
Bolded ORs indicate p-values <0.05

Table 3.2.13. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activities and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Physically Active[7]	**0.84**	0.81-0.86	**0.80**	0.77-0.81

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[7]Reference Category=Not Physically Active
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.14. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Physical Activities and Adolescent Hyperactivity and Inattention Symptoms[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
Physically Active[7]	**1.12**	1.09-1.16	**1.76**	1.74-1.78

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[7]Reference Category=Not Physically Active
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

Table 3.2.15. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
High Score[8]	**0.70**	0.62-0.78	**0.71**	0.70-0.72
	Moderate		*Moderate*	
High Score[8]	**0.85**	0.77-0.92	**0.62**	0.61-0.63
	Severe		*Severe*	
High Score[8]	**0.66**	0.60-0.71	**0.71**	0.70-0.72

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[2]Reference Category=No Mood Disorder Symptoms
[8]Reference Category=Low Positive Friendship Score
Bolded ORs indicate p-values <0.05

Table 3.2.16. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[8]	**0.74**	0.72-0.75	**0.53**	0.52-0.54

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[8]Reference Category=Low Positive Friendship Score
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.17. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Friendships and Adolescent Hyperactivity and Inattention[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[8]	**0.82**	0.72-0.92	**0.64**	0.52-0.76

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[8]Reference Category=Low Positive Friendship Score
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

Table 3.2.18. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting and Adolescent Mood Disorder Symptoms

	Adjusted[2] OR	95% CI	Unadjusted[2] OR	95% CI
	Mild		*Mild*	
High Score[9]	**0.85**	0.80-0.88	**0.85**	0.84-0.86
	Moderate		*Moderate*	
High Score[9]	**0.80**	0.76-0.41	**0.80**	0.79-0.81
	Severe		*Severe*	
High Score[9]	**0.90**	0.87-0.93	**0.76**	0.75-0.77

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[2]Reference Category=No Mood Disorder Symptoms
[9]Reference Category=Low Positive Parenting Score
Bolded ORs indicate p-values <0.05

Table 3.2.19. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting Activities and Adolescent Conduct Disorder Symptoms[3]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[9]	**1.35**	1.29-1.41	2.77	2.73-2.80

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[7]Reference Category=Low Positive Parenting Score
[3]Reference Category=Low Conduct Disorder Symptoms
Bolded ORs indicate p-values <0.05

Table 3.2.20. Adjusted[a] and Unadjusted Odds Ratios Summarizing the Association Between Positive Parenting Activities and Adolescent Hyperactivity and Inattention Symptoms[4]

	Adjusted OR	95% CI	Unadjusted OR	95% CI
High Score[9]	**0.88**	0.86-0.89	**0.64**	0.52-0.76

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.
[9]Reference Category=Low Positive Parenting Score
[4]Reference Category=Low Hyperactivity and Inattention Scores
Bolded ORs indicate p-values <0.05

3.2.4 INTERACTIONS BETWEEN EARLY CHILDHOOD STRESSORS AND CHILDHOOD PROTECTIVE FACTORS ON ADOLESCENT MENTAL HEALTH OUTCOMES

As noted in the objectives of this thesis, the modifying effect of childhood protective factors on the association between childhood stressors/family dysfunction and adolescent mood disorder outcomes was investigated. Physical activity, participation in extracurricular activity, experiencing high levels of positive friendships, and experiencing high levels of positive parenting, were all investigated as interaction terms with childhood stressors and family dysfunction in adjusted and unadjusted models. Adjusted and unadjusted beta coefficients and corresponding p-values of each interaction term can be found in Tables 3.2.21 and 3.2.22. All interaction terms, adjusted and adjusted,

with each childhood protective factor and childhood stressors and family dysfunction were found to be statistically non-significant.

Table 3.2.21. Adjusted[a] and Unadjusted Regression Models Summarizing the Interactions Terms of Childhood Protective Factors and Childhood Stressors on Adolescent Depressive Symptoms[5].

Interaction terms	Adjusted[a] (Beta Coefficient)	p-value	Unadjusted (Beta Coefficient)	p-value
Positive Friends *ELS[1]	Severe: (-0.057)	0.1060	Severe: (-0.33)	0.2791
	Moderate:(0.41)	0.1627	Moderate: (0.55)	0.0313
	Mild: (0.38)	0.0708	Mild: (0.38)	0.0402
Positive Parenting*ELS[2]	Severe: (0.24)	0.3864	Severe: (0.05)	0.8333
	Moderate: (-0.25)	0.2947	Moderate: (-0.34)	0.0981
	Mild: (0.18)	0.2812	Mild: (0.11)	0.4730
High Physical Activity*ELS[3]	Severe: (-0.16)	0.7744	Severe: (-0.15)	0.7533
	Moderate: (0.18)	0.7427	Moderate: (0.07)	0.8799
	Mild: (0.06)	0.8771	Mild: (-0.03)	0.9142
High Extra-Curricular*ELS[4]	Severe: (-0.08)	0.7587	Severe: (0.05)	0.8950
	Moderate: (-0.54)	0.2313	Moderate: (-0.13)	0.7541
	Mild: (-0.11)	0.7299	Mild: (0.05)	0.8383

ELS=Early Life Stressor

[5]Severe, Moderate, Mild Depressive symptoms – Compared to No Depressive Symptoms

[1]Reference Category=Low Positive Friendship

[2]Reference Category=Not Physically Active

[3]Reference Category=Extra-curricular Non-Participation

[4]Reference Category=Low Positive Parenting Score

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.

Table 3.2.22. Adjusted[a] and Unadjusted Regression Models Summarizing the Interactions Terms of Childhood Protective Factors and Family Dysfunction on Adolescent Depressive Symptoms[6].

Interaction terms	Adjusted[a] (Beta Coefficient)	p-value	Unadjusted (Beta Coefficient)	p-value
Positive Friends *ELS[1]	Severe: (-0.27)	0.7335	Severe: (-0.14)	0.4332
	Moderate:(0.70)	0.2498	Moderate: (0.79)	0.0841
	Mild: (-0.58)	0.2594	Mild: (2.68)	0.0962
Positive Parenting*ELS[2]	Severe: (-0.31)	0.5819	Severe: (0.044)	0.9207
	Moderate: (-0.16)	0.7225	Moderate: (0.11)	0.7638
	Mild: (0.11)	0.7732	Mild: (0.01)	0.9949
Physical Activity*ELS[3]	Severe: (-0.16)	0.6844	Severe: (-1.44)	0.1265
	Moderate: (0.18)	0.7338	Moderate: (-0.73)	0.3767
	Mild: (0.06)	0.7411	Mild: (-1.24)	0.0839
Extra-Curricular*ELS[4]	Severe: (11.37)	0.9748	Severe: (1.72)	0.0396
	Moderate: (-1.42)	0.2760	Moderate: (1.033)	0.2571
	Mild: (0.80)	0.3677	Mild: (1.07)	0.1425

ELS=Early Life Stressor

[6]High Family Dysfunction vs Low Family Dysfunction

[1]Reference Category=Low Positive Friendship

[2]Reference Category=Not Physically Active

[3]Reference Category=Extra-curricular Non-Participation

[4]Reference Category=Low Positive Parenting Score

[a]Adjusted for sex, teenage status of mother, socioeconomic status, and maternal depression, maternal smoking.

CHAPTER 4: DISCUSSION

4.1 SUMMARY OF MAIN RESULTS

There has been an abundance of research regarding the risk of early life stressors on adolescent health including both physical and mental health[27-42]. In like manner, there is a new trend emerging, investigating the impact of childhood protective factors as well[103-146]. Despite this, there is limited research investigating the separate roles of prenatal risk factors and post-natal risk factors and their interaction with childhood protective factors on adolescent mental health. As a result of this gap in the literature, the present study sought to accomplish four primary objectives: 1) to investigate the roles of prenatal and postnatal stressors on adolescent mental health, 2) to investigate the roles of childhood protective factors on adolescent mental health, 3) to examine whether there are modifiable protective factors in a child's life that can mitigate the effects of prenatal stressors on adolescent mental health, 4) and finally to examine whether there are modifiable protective factors early in a child's life that can mitigate the effects of early childhood stressors (age 0-3) on adolescent mental health. This section will outline the major findings found within this study while specific findings highlighted in this section will be discussed in more detail in the subsequent sections

It was hypothesized that the offspring of pregnant women who experienced stress during the gestational period would be at higher risk for having adverse mental health outcomes during adolescence. This hypothesis was supported in the present findings, in that prenatal maternal stressors were found to have an association with a higher likelihood of offspring mental health disorders during adolescence although not all models were found to be statistically significant. Prenatal maternal stressors were

measured exclusively in the ALSPAC dataset, and it was noted that more models were found to be statistically significant when investigating postnatal (maternal and child) stressors, compared to prenatal stressors exclusively, as risk factors. The secondary hypothesis regarding postnatal stressors was also supported in this research's findings. In multiple models in both datasets, it was found that children between the ages of 0-3 who experienced early life stressors were more likely to experience mood disorders, as well as ADHD and conduct disorder, in adolescence. There were no dramatic deviations from this hypothesis although some models were statistically non-significant. That said, within the ALSPAC analysis, when investigating adolescent anxiety, prenatal and postnatal stressors investigated together were found to be statistically significant in unadjusted models, where adjusted models were found to be statistically non-significant. Attenuating for potential confounders eliminated the association between prenatal and postnatal stressors and adolescent anxiety; implying that this association was likely confounded by socio-demographic variables, or by maternal history of mental health disorders. It is important to note that the use of objective stressors within both datasets, allows for the disentanglement between the effect of stressful life events and coping strategies of the mother and child. A dose-response relationship was demonstrated when investigating prenatal stressors and adolescent depressive symptoms in that mothers found in the fourth quartile of early life stressors had higher odds of offspring depressive symptoms compared to mothers found in the third quartiles, although confidence intervals between quartiles overlapped. Quartiles were based on how many stressors the mothers experienced and how much these stressors

affected them. This dose response relationship has also been shown in Robinson et al's study which indicated that the more stressors the mother experienced during pregnancy, the more likely the chid would exhibit internalizing symptoms[232]. Similarly, this dose-response relationship was found in the research of Mackinnon et al[41].

Moreover, it was hypothesized that childhood protective factors between the ages of 6 and 11 would have a protective effect on the odds of experiencing mental health disorders during adolescence. This hypothesis was supported in this research, although with a few exceptions that will be discussed further in this section. For the majority of models, the findings from this analysis suggested that childhood protective factors reduced the likelihood of adolescent mental health disorders. Conversely, childhood protective factors that deviated from the hypothesis were positive parenting and physical activity. Within the NLSCY dataset it was found that children who experienced positive parenting throughout their childhood were more likely to exhibit symptoms of hyperactivity and inattention during adolescence. Additionally, positive parenting was also found to be a risk factor for adolescent symptoms of conduct disorder. This was also seen when investigating physical activity in childhood, in that it was a risk factor rather than a protective factor for the development of hyperactivity and inattention symptoms in adolescence. This finding is discussed in more detail further in this chapter.

Finally, it was hypothesized that there are modifiable protective factors that may mitigate the effects of prenatal and postnatal stressors on a child, ultimately reducing their risk of developing a mental health disorder later in life. Although our results did

not contradict this hypothesis, there was no evidence of a statistically significant modifying effect of childhood protective factors on early life stressors.

4.2 PRENATAL STRESSORS

As mentioned previously, the ALSPAC dataset was the only dataset that measured prenatal in addition to postnatal stressors. Questionnaires were administered at 18 weeks gestation, 8 weeks postnatal, 8 months postnatal, 21 months postnatal, and at 33 months postnatal. Within this study, the 18 weeks gestation and 8 weeks postnatal questionnaires were used to measure prenatal stressors while the remaining questionnaires were used to measure postnatal questionnaires. The effects of prenatal stressors, postnatal stressors, and the combination of both were investigated. The findings from this research are in accordance with the fetal programming hypothesis in that prenatal stressors were found to be a statistically significant risk factor for offspring adolescent depressive symptoms for mothers who experienced stressors in the third and fourth quartiles. Our results are in line with numerous longitudinal studies, notably, evidence demonstrated by Kingsbury et al, who completed a prospective study of 10, 596 parents and offspring which suggested that the offspring of mothers exposed to stressful life events during pregnancy may be at risk for depression and elevated depressive symptoms at the age of 17 and 18, after adjusting for stressors in the late prenatal and early postnatal period[42]. Although gestational stress hormones were not measured within the present study, the results support the fetal programming hypothesis, indicating that maternal exposure to stress in utero may lead to the abnormal development of the HPA axis in the fetus, potentially having long term consequences for the offspring, as the HPA axis is used to modulate stress and coping

behaviours[233]. It is important to note that the current study is not providing evidence towards a causal association, as there is an absence of measures regarding any biological markers; rather it lends evidence to what the fetal programming hypothesis proposes. Furthermore, in previous literature, prenatal stress has been linked to elevated levels of inflammation, which ultimately affect the development of the fetal brain[234]. In light of this postulation, positive parenting was investigated as a potential modifying factor and will be discussed further. Additionally, the findings presented in this thesis support numerous studies reporting on the association between prenatal anxiety and stress and offspring emotional and behavioural disorders[33, 26,235,236] as well as multiple animal studies investigating the fetal programming hypothesis[237,238]. Somewhat surprisingly, the findings from this study were unable to support the evidence demonstrated by Mackinnon et al, in their prospective study investigating the association between prenatal stress and externalizing symptoms in childhood, as the results when investigating prenatal stressors and adolescent externalizing disorders were found to be statistically non-significant[41]. Mackinnon et al found that mothers exposed to the highest quartile of prenatal stressors were more likely to have offspring belong to the high symptom trajectory for hyperactivity and conduct disorder. Their results demonstrated a positive, dose-response relationship with symptoms of externalizing disorders. A potential reason for this discordance in findings is the difference in the timing and the measure of adolescent externalizing symptoms used within the present study. Symptoms of ADHD and conduct disorder in Mackinnon's study were measured using the Strengths and Difficulties Questionnaire at the age of 6,

9, 11, 13, and 16 years[42], while symptoms of ADHD and conduct disorder within the present study were measured using the DAWBA at the age of 15. The DAWBA is a diagnostic tool, which uses ICD-10 and DSM-IV criteria. Although this measure is highly valid and reliable, the prevalence of participants diagnosed with conduct disorder or ADHD who experienced high levels of prenatal stressors was too small to generate any statistical findings. Finally, a compelling explanation of the discrepancy in findings is the initial age of the outcome measurement. As noted previously, Mackinnon's outcome was measured beginning at age 6, whereas in this present study, the outcome was measured at the age of 15. It has been noted that lengthier amounts of time between an exposure and an outcome can reduce the strength of association, and can be diluted or missed if the wrong time frame is measured[239].

4.3 POSTNATAL STRESSORS

Postnatal maternal and child stressors were measured in both the ALSPAC and NLSCY datasets between the ages of 0-3 by the PMK or the primary caregiver (within the NLSCY, 89.9% of the PMKs were the biological mothers, and 93% of primary caregivers were the biological mothers) measuring items such as separation from loved ones, socioeconomic stress, and exposure to abuse. The present findings suggest that children between the ages of 0-3 who experienced early life stressors were more likely to experience adolescent mental health disorders. Within the ALSPAC dataset, the magnitude of the odds ratios were larger when investigating postnatal stressors exclusively compared to prenatal stressors exclusively, or the combination of prenatal stressors and postnatal stressors. Additionally, postnatal exposures exclusively at the second, third, and fourth quartile of postnatal stressors were statistically significant,

while prenatal stressors were only statistically significant in the third and fourth quartile. These findings remain in accordance with numerous studies that investigated the role of early life stressors on the development of adolescent mental health disorders[25,26,36,37,38], including Lansford et al's 12 year prospective study on the long-term effects of early childhood physical maltreatment. Within Lansford's study of 585 children, found that adolescents who experienced maltreatment in childhood early in life had higher levels of anxiety, depression, dissociation, posttraumatic stress disorder symptoms, social problems, thought problems, and social withdrawal compared to their non maltreated counterparts[240]. Similarly, Fergusson et al conducted a study investigating the effects of childhood sexual abuse on 18 year olds in New Zealand, finding that those who reported having experienced childhood sexual abuse has higher rates of major depression, anxiety disorder, conduct disorder, substance use disorder and suicidal thoughts, compared to those who did not report any childhood sexual abuse[241]. The trajectories of poverty and children and adolescent's mental health, investigated by McLeod and Shanahan, indicated that children and adolescents who were considered poor throughout their childhood, and who indicated prior histories of poverty had higher levels of depression and antisocial behaviours[242]. The findings regarding postnatal stressors and adolescent mood disorders were found to be consistent with the majority of the literature on early life stressors ranging experience or exposure to abuse and financial hardships. As mentioned previously, a dose response relationship was found within the ALSPAC dataset in that participants who experienced higher levels of early life stressors had higher odds of experiencing mental health

outcomes. This finding is in accordance with the Adverse Childhood Experience Study in that a clear does-response curve was indicated: as the number of adverse childhood experiences increased, so did the level of risk for numerous mental health outcomes, in a strong, graded fashion.

Within the NLSCY, early life stressors and family dysfunction were both found to be significantly associated with a higher likelihood of adolescent inattention and hyperactivity and conduct disorder symptoms. Similarly, in the ALSPAC dataset, women found in the third and fourth quartile of postnatal stressors were at an increased risk of being diagnosed with conduct disorder during adolescence, although these measures should be interpreted with caution as the confidence intervals were quite wide, indicating a higher margin of error. Although less research has focused on conduct disorders and ADHD as adolescent outcomes of postnatal early life stressors, research has indicated that the child's early life family experience is a highly influential environmental factor contributing to adolescent conduct disorder[243]. These familial risk factors include harsh punishment style parenting, institutional living early in life, parental rejection, inconsistent parents, alcoholic parents, parental conflict and physical violence, single parenthood, maternal depression, and socioeconomic status. Moreover, Biederman et al, investigated the role of the family environment early in a child's life on ADHD. Biederman's work demonstrated a positive association between childhood family adversity indicators and the risk of ADHD later in life[244], stressing the complexity of the interactions between adversity factors and cognitive, academic, and social functioning in children. Many of the familial risk factors listed above were measured as early life

stressors within in both datasets, providing evidence of accordance with previous literature.

Although certain stressful live events be that in utero or post utero are unavoidable, understanding the impact of these stressors on the child is the first step to mitigating this risk. These findings highlight the impact of prenatal and postnatal stressors on offspring adolescent mental health, indicating the need to reduce the amount of stressors that pregnant women and young children experience.

4.4 PROTECTIVE FACTORS

The roles of modifiable protective factors on the development of positive mental health in adolescents has been less established than the roles of early life stressors in the literature. This thesis extends the limited amount of research regarding the impact of modifiable childhood protective factors. Within this thesis it was deemed important to exclusively investigate modifiable protective factors, as it allows the findings to become more generalizable and relatable to our target audience while offering strong implications for targeted interventions. A noteworthy comment regarding the analysis of protective factors is the potential of reverse causality. It is possible that children who had early internalizing symptoms were less likely to join extra-curricular activities or sports teams. Ultimately this may have created a bias, indicating a protective effect that is in fact, not real. The true association we may have uncovered is that the participants with earlier onset internalizing disorders are less likely to engage in activities that require physical effort, social engagement, time management, and commitment, as these components of physical activity and extracurricular activities may be more difficult for those who have internalizing disorders[245]. With this said, there is research indicating

successful effects of the protective factors investigated in this study as interventions for those suffering from mental health disorders[246,247,248,249] implying that although a bias may be present within this study, it is not creating a completely spurious association.

4.4.1 PHYSICAL ACTIVITY

The role of physical activity on mental health in children and adolescents has been less addressed in research compared to adult populations, although researchers, educators, and policy makers are becoming increasingly interested in the positive effects of physical activity on the mental health of our youth[250,251]. Within the NLSCY dataset, the measure of physical activity was based on questionnaires completed by the child regarding their participation in multiple sports including gymnastics, karate, and soccer, among others. In contrast, in the ALSPAC dataset, an objective measure of physical activity was used, using an accelerometer, where participants were measured for seven consecutive days during waking hours. The accelerometer has high reliability and high criterion validity, which provided greater power to detect associations, compared to non-objective measures.

The findings of the present study lend support to the trend found in the literature regarding the benefits of youth physical activity, indicating that childhood physical activity is a protective agent, reducing the risk of adolescent mental health disorders[103,111,112]. Within the ALSPAC dataset, statistically significant models indicated that moderate and vigorous levels of physical activity compared to low levels of physical activity reduced the likelihood of depressive symptoms while the NLSCY dataset indicated a protective effect on the development of conduct disorder in adolescence.

Strawbridge et al conducted a large-scale study investigating the role of physical activity on mental health[110]. A wide range of physical activities were measured including long walks, exercise, sports, and swimming, which demonstrated a strong protective effect on subsequent adolescent depression. The findings from this analysis lend support to several longitudinal studies that have reported a protective effect of physical activity on incident depression, as indicated by Mammen's systematic review of physical activity and the prevention of depression, where 25 of the 30 included prospective studies found a significant, inverse relationship between physical activity and follow-up depression[112]. The present study extends the current body of evidence regarding the association between youth physical activity as subjective and objective measures were investigated, indicating a protective trend, regardless of the type of physical activity measurement.

A deviation from the literature and from our hypothesis was found when investigating the role of physical activity on adolescent hyperactivity and inattention symptoms. It was hypothesized that physical activity would have a protective role, however the current findings suggest that physical activity was a risk factor for adolescent ADHD. A compelling explanation for this finding is that parents of children who are exhibiting symptoms of ADHD at a young age may be more compelled to place their children in activities requiring physical activity in order to expend their higher amounts of energy, which is a common symptom of ADHD[252]. Manifestations and symptoms of ADHD are often more noticeable earlier in a child's life compared to more internalizing disorders[253]. It is possible that a parent who notices their child to be

hyperactive, would be more inclined to encourage their child to participate in physical activity so as to mitigate any negative behaviours that may result from hyperactivity and inattention.

It is likely that it is not one single mechanism that contributes the protective nature of physical activity, rather a combination of physiological, biochemical, and psychosocial mechanisms operating in concert. The preventative aspect of physical activity may be explained by its role in the prevention of multiple physical ailments such as heart disease as literature has noted significant associations between physical and mental health[254,255,256]. Moreover, it has been noted that physical activity may foster an increased sense of self-esteem, as well as a sense of inclusion in a community, ultimately leading towards positive mental health development[121]. A recent systematic review, conducted by Lubans et al, investigated the mechanisms of physical activity for cognitive and mental health in youth, mapping a range of potential mechanisms including psychosocial mechanisms, behavioural mechanisms, and neuroendocrine mechanisms[257]. The strongest evidence was found for the improvement of physical self-perceptions, consequently increasing self-esteem.

4.4.2 EXTRA CURRICULAR ACTIVITIES

Within the NLSCY dataset, it was found that participants who participated in extra-curricular activities were less likely to develop mood disorder symptoms, hyperactivity and inattention symptoms, and conduct disorder symptoms compared to youth who do not participate in extra curricular activities. Similarly, within the ALSPAC analysis, the

findings suggest that youth participation in extra curricular activities reduces the likelihood of anxiety later in life.

This research lends support to the previous understanding of the association between youth participation in extra curricular activities and the development of mental health[123,125,126,127]. Although there are discrepancies within the literature, with some research suggesting moderate to no association[124] and other research suggesting a clear association, specifically within longitudinal studies[258,122], this may be due to the large variance in the measurements of extracurricular activities.

The findings of the present study are in line with the positive youth development theory as it suggests that youth participation in organized activities provides ample opportunities for positive growth and development[259]. There are multiple components of the positive youth development theory including: competence, confidence, connection, character, caring and compassion[259]. Each one of these components can be fostered through the participation of structured, inclusive extra curricular activities lead by positive role models and leaders[260]. Youth who participate in these activities are able to view their actions within a social, academic, cognitive, and vocational context, while developing a positive sense of self-worth, creating bonds with people and institutions within their community, while developing respect for societal and cultural values.

4.4.3 POSITIVE PEERS

Within this study, findings indicated that participants who engage in positive peer relationships were less likely to experience mood disorders, symptoms of inattention and hyperactivity, and symptoms of conduct disorder in the NLSCY analysis. Additionally

within the ALSPAC analysis, positive peer relationships reduced the likelihood of experiencing depressive symptoms and anxiety. As mentioned previously the prevalence of ADHD and conduct disorder in ALSPAC were too low to yield any significant results.

As children gain independence from their families, their interactions with their peers become increasingly more important[261]. These positive peer relationships foster prosocial behaviours, including acts of kindness, empathy, sharing, and inclusion[262]. Youth who perceive prosocial acts from their peers and who engage in prosocial acts themselves have been found to have fewer symptoms of internalizing forms of psychopathology, as noted by Crick et al[263]. The roles of positive friendships in youth have been previously examined within two psychological perspectives: the social bonding perspective and the social interaction perspective[264]. The social bonding perspective focuses highly on the positive nature of friendships, highlighting its ability to positively contribute to a child's emotional, cognitive, academic, and behavioural functioning, whereas the social interaction perspective often highlights the punitive effects of poor friendships in regards to risk taking, antisocial behaviours and internalizing problems[264]. Within this study, it is only the positive effect, conceptualized within the social bonding perspective, of friendship that was investigated. In future research, measuring both the effects of positive peer relationships as well as negative peer relationships may produce interesting and valuable findings.

The findings presented in this study are in line with evidence supported in the literature regarding the role of positive peer engagement including the work of Suldo et al[265], Shin et al[131] and the longitudinal findings of Sakyi and colleagues[266], which indicate

a link between peer relationships and psychological health at adolescence and adulthood.

4.4.4 POSITIVE PARENTING

When investigating the role of positive parenting within this study, results indicated a protective effect on mood disorder symptoms and depressive symptoms within the NLSCY and ALSPAC, respectively. These findings lend support the body of knowledge surrounding the role of the parent and their parenting style and the health and development of the child, physically and mentally. One specific study, conducted by Tabek et al, investigated the importance of positive parenting in predicting adolescent mental health[267]. It was found that maternal and paternal positive parenting was associated with the development of positive mental health practices and habits in adolescence. Within the present study the positive parenting measure only encompassed maternal parenting practices. A future direction of this work would be to investigate the roles of both paternal and maternal parenting practices. Furthermore, a study of 515 students conducted by Dallaire et al, sought to investigate the impact of supportive-positive parenting as well as the role or harsh-negative parenting[268]. Results indicated harsh-negative parenting styles were strongly, positively related to adolescent depressive symptoms while supportive-positive parenting styles were negatively associated with adolescent depressive symptoms.

Interestingly, within this study, it was found that positive parenting was a risk factor for symptoms of hyperactivity and inattention and conduct disorder in adolescence. These findings deviated from our original hypothesis, similarly to the role

of physical activity and symptoms of hyperactivity and inattention. Externalizing disorders such as ADHD and conduct disorder often present symptoms earlier in life in comparison to internalizing disorders such as depression of anxiety[253]. It is plausible that parents of children who exhibit symptoms of ADHD and conduct disorder between the ages of 6-11 may be more inclined to engage in positive parenting practices, as they may have sought professional help for their child or engaged in research of parenting practices on their own, ultimately promoting a change in parenting behaviours[269]. Although literature has noted the positive impact of parenting programs and initiatives on children with externalizing disorders[270,271], within this study it is possible that participants who exhibited externalizing behavioural issues at a young age, prompt their parents to engage in more positive parenting techniques, but when the outcomes of ADHD and conduct disorder were measured in adolescence the association between early childhood externalizing behaviours and adolescent externalizing disorders was stronger than the effects of the positive parenting initiatives on the childhood externalizing behaviours.

Recent research has highlighted the importance of the childhood experience for future mental health development[272,273]. The impact of different parenting approaches and the quality of these approaches is now known to extend throughout the life course[274]. Parenting is being recognized as one of the most important modifiable determinants of future mental health[275]. The way in which parents engage with their children ultimately affects the child's autonomy, attachment, identity, and social relational skills[275]. These structured yet warm relationships provide a standard for the

child to develop similar relationships with future peers[276]. From a biological standpoint, in a study conducted by Whittle et al, it was indicated that positive parenting predicts the development of the adolescent amygdala and prefrontal cortex, ultimately affecting reward processes and emotional reactivity and regulation[277]. These findings were consistent with their previous hypothesis, which was based on previous findings that low levels of psychopathology were associated with attenuated amygdala development.

4.5 MODIFYING EFFECT OF CHILDHOOD PROTECTIVE FACTORS

The modifying role of physical activity, participation in extra-curricular activities, positive peer relationships, and positive parenting on early life stressors and its association with adolescent mental health was investigated through the analysis of multiplicative interaction terms. Our findings did not provide any evidence of the hypothesized modifying effect as none of the investigated interaction terms were found to be statistically significant. As suggested by the life course theory, what distinguishes a child as high-risk or low risk is not necessarily exposure to a specific risk/protective factor but rather is it a life history characterized by multiple familial, environmental, psychosocial, and biological factors[278]. Despite the strong association between experiencing stressful life events and adverse developmental outcomes, this association is by no mean deterministic. Cases of individuals who have experienced high levels of adversity while avoiding adverse mental health outcomes has been widely noted[279]. The identification of these individuals has lead to the important investigation of the processes that lead to this resilience. One convincing approach to explaining this resilience is the presence of protective factors that act to mitigate the effects of the early life stressors; this concept was first introduced by Rutter and colleagues[73]. Rutter proposed a conceptualization of

protective factors, suggesting an interaction between the protective factor, the risk exposure, and the outcome. It is because of Rutter's work that researchers have investigated the effects of various protective factors[280,281,282]. Research conducted by Banyard and colleagues sought to identify promising protective factors for individuals who have experienced adverse childhood events[28]. As hypothesized individual protective factors surround personal strengths including interpersonal skills and meaning making were positively associated with health related quality of life after accounting for participant's exposure to childhood stressful life events. Additionally, Morely-Fletcher et al experimentally investigated the degree to which prenatal stress can be reversed through the enrichment of a rat's physical environment[283]. Their findings indicated that rats that are exposed to stress during the prenatal period could benefit from the modulatory effects of an enriched environment during the preadolescent stage. Although it was hypothesized that a modifying effect would be found between childhood protective factors and early life stressors, this effect was not found to be statistically significant within our analysis. One explanation for this null finding may have been due to the measurement of the protective factors. Within both ALSPAC and the NLSCY, the measures of the protective factors were somewhat crude, using a combination of multiple items that were deemed appropriate to represent the protective factor being investigated. This was notably true when measuring extra-curricular activities as it had not previously been measured in the literature within ALSPAC. Furthermore, the protective factors investigated may operationalize at optimal times throughout the life course, which was not investigated within this research[284].

Specifically, categorical measures were measured at one age point, which was chosen so as to be closest to the age of the outcome response. It could be that these protective factors actually operationalize optimally at a different age point then the age at which it was measured within this study. Furthermore, the smaller sample size within this analysis may have affected the power of the study, ultimately reducing the likelihood of detecting a modifying effect. That said, although the findings of this research were unable to provide evidence towards the modifying effect of protective effects, the main effects of protective factors found in this study still provide valuable evidence, contributing and extending the literature surrounding positive youth development. It is possible that statistically significant interaction terms were not found within this study because the protective factors investigated are beneficial for all peoples, including those who experienced early life stressors and those who did not. In summary, the results indicate that although an individual may have experienced early life stressors, there are modifiable protective factors that reduce the likelihood of developing multiple mental health disorders later in life.

4.6 IMPLICATIONS

The effects of early life stressors on the child's mental health development have both research and public health implications for the field of child and adolescent mental health as well as prenatal and maternal health. In addition to this, the role of modifiable protective factors also provides important research and public health implications. This research highlights risks and protective factors that may lead to the development of adverse mental health outcomes later in life.

Firstly, a noteworthy implication of this research is the need for increased prenatal support for the mother during the gestational period as well as the postnatal period. The findings of this research clearly indicate that the child is at risk during both the prenatal and postnatal period. Targeted interventions including increased support for struggling mothers, increasing health literacy within this population, and providing means to help pregnant women and new moms learn how to constructively cope with stressors may lessen the extent to which these stressors may impact their child[275]. An example of a successful intervention was investigated by Woolhouse et al, where the MindBabyBody program was evaluated on its effectiveness to reduce depression, anxiety, and stress. This program is a 6-session mindfulness-based group therapy program, developed specifically for pregnant women. Mothers are introduced to mindfulness approaches and strategies including formal and informal mindfulness training, mindful movements, and cognitive exercises. Results from Woolhouse's small pilot study demonstrated some indication of within group effects over time for women who took part in the MindBabyBody intervention as significant improvements were noted for depression, anxiety, and mindfulness scores. The results of the present study demonstrate the need to undertake trials designed to reduce stress in pregnant women and new mothers, specifically those who are at a higher risk of experiencing psychosocial stressors. Dr. David Olds and colleagues have completed significant work regarding the effectiveness of parenting interventions at the prenatal and postnatal level[285,286,287,288]. Notably his research on preventing child maltreatment and crime with prenatal and infancy support of parents indicated the importance of the nurse family

partnership (home visits from a designated nurse) from the prenatal to the infancy stage in order to mitigate the risk of a host of adverse parent and child outcomes including the development of criminal behaviour[289]. The program's mainly focuses on improving neurodevelopmental, cognitive, and behavioural functioning of the infant by improving prenatal health, reducing neglect and child abuse, reducing behavioural dysregulation, and enhancing family functioning and economic self-sufficiency.

A unique component of the present study was the investigation of exclusively modifiable protective factors. It was discussed *a priori* that it was imperative that the protective factors investigated were to be modifiable by nature so that the findings could be easily integrated towards intervention approaches as well as be more relatable to our target audience. In terms of public health policy, such results suggest that efforts to engage our children in physical activity, participate in extra-curricular activities, promote positive peer relationships and practice positive parenting behaviours may serve as a useful strategy to promote resilience in children and reduce the risk of developing poor mental health outcomes in adolescence.

As noted in this research and previous literature, the quality of the parent-child relationship is a strong determining factor towards the development of positive mental health, consequently, parenting is being recognized as one of the most important modifiable determinants of mental health. This research promotes the need for the development or continuous funding of interventions and programs that support parenting. Existing programs range from prenatal and postnatal maternal mental health programs, parenting support programs in infancy and early years, formal parenting

programs, focusing on children's behaviours, and parenting support to high-risk groups including parents with severe mental health problems[290]. Parenting programs have considerable potential to improve the development of positive mental health in children while improving the family environment, benefiting the individual and community as a whole[267]. The Triple-P Positive Parenting program is a clear example of the positive impact these programs have. The triple P-Positive Parenting Program is a comprehensive, multi-level approach to promote positive parenting, with the overarching goal to enhance the knowledge, skills, and confidence of parents ultimately reducing the incidence of adverse mental health outcomes in our society[291]. A comprehensive meta-analysis of the effectiveness of this program was conducted by Nowak and Heinrichs, which clearly indicated several strengths of the Triple P-Program, most notably its ability to create meaningful improvements within the family[292].

Furthermore, the findings of this study indicate that efforts should be made to foster a positive peer environment for children, beginning within the home and extending to the school setting. Targeted interventions that aim at building pro-social behaviours while simultaneously reducing victimization may be an essential factor in reducing the incidence of mental health disorders later in life[264]. The province of British Columbia has implemented a province wide program, FRIENDS, a preventative program that focuses on increasing the emotional health of children in the school environment, facilitated by classroom teachers using hands on, peer-supported learning[293]. Main components of this program include emotional awareness, relaxation, problem solving, goal setting, inter-personal communication, and creating positive support networks[293].

This low risk, low cost program may have meaningful, long-term positive effects on child and youth mental health.

The engagement of youth in physical activity and extracurricular activities has been identified to protect the child from developing adverse mental health outcomes within this study as well as previous research[112]. In a systematic review conducted by Sluijs et al, it was indicated that although a number of interventions were found to be effective in promoting physical activity in youth, this trend was less seen in those from low socioeconomic backgrounds and ethnic minorities[294]. The findings from the systematic review suggest, in accordance with Spence et al[295], that providing more equitable access to physical activity programs through a combination of refundable tax credits and subsidized programming is a vital step to promoting physical activity for our youth community as a whole, in an inclusive manner. This suggestion runs true for the implementation of extracurricular activities for youth, as low-income families are significantly less likely to participate in extra-curricular activities outside of the school environment[296]. It is imperative that schools persistently promote existing extra curricular at schools including band, school council, or science club, among others. The findings of this research can facilitate efforts to promote and support the need for youth engagement in their community, ultimately supporting positive youth development in the areas of competence, confidence, connections, character, and caring.

Further research should continue to use large, prospective, well-powered studies to advance the body of knowledge surrounding risk factors and protective factors that work towards the development of mental health. Large, longitudinal studies with

representative samples will lend additional evidence towards the temporality and causal pathways between early life stressors, childhood protective factors, and adolescent mental health. Additionally, research focusing on the optimal operationalization of protective factors will advance and improve existing targeted interventions while providing empirical evidence for the construction of new interventions. Finally, improved measures of exposure and outcome data would be favourable, examples being objective measures of physical activity such as the measure within ALSPAC, physician diagnosed outcome measures, and more finely tuned measure of positive friendships.

4.7 LIMITATIONS

Although efforts were made to reduce the risk of bias and error within the present study, there were limitations that must be acknowledged when interpreting the presented findings. The most noteworthy limitations of the present study include: Selection bias, the measurement of protective factors, social desirability bias, residual confounding, and availability of data.

4.7.1 SELECTION BIAS

When working with longitudinal survey data, loss to follow up is considerably unavoidable, and must be acknowledged as a limitation when interpreting the results of this study. As a result of the weighting of the NLSCY dataset, listwise deletion was used to address missing data. This method was also applied within the ALSPAC analysis, so as to remain consistent between both analyses. Participants with missing data were removed and were compared to remaining participants on a variety of socio-demographic variables. As noted in the results section, statistically significantly higher

proportions of males (within both datasets) and non-participators in extra-curricular activities did not have outcome data within this analysis. It is important to note early life stressors, including prenatal and postnatal, within the ALSPAC and NSLCY analysis were not statistically significantly associated with dropout, as indicated by chi-Square analysis p- values. It has been indicated in the literature that females are more likely to report depressive symptoms in adolescence, so in this respect, the present study may have overestimated the true rates of depressive symptoms[297,298]. On the same note, it has been indicated that males are more likely to be diagnosed with externalizing disorders such as ADHD and conduct disorder[299]. As males were more likely to drop out of the study, the present study may have underestimated the true rates of ADHD and conduct disorder, especially within the ALSPAC dataset, as the number of participants diagnosed with ADHD and conduct disorder was sometimes too low to have statistical power. The indication that those who experience low levels of protective factors (extra-curricular activities) were more likely to be lost to follow up suggests a differential bias, as those who experienced low levels of protective factors are also more likely to have experienced higher levels of early life stressors as well as higher levels of mental health disorder outcomes, ultimately biasing results towards the null.

4.7.2 MEASUREMENT OF PROTECTIVE FACTORS

As mentioned previously, the measurements of the investigated protective factors may have introduced error within this study, as most of the measures have not been previously validated in the literature. Although hypothesized trends were found, the results may not be entirely valid if the measures are not accurately capturing the items necessary to investigate the roles of protective factors. The measurement of protective

factors effects both exposure groups equally in that the protective factors were measured the same for all levels of early life stressors, therefore indicating a non-differential bias, biasing our results towards the null. Although these measures were not highly valid, and may have contributed to the null findings regarding the modifying effect, they were able to provide evidence supporting the hypothesis that these factors have a protective effect on the development of adolescent mental health disorders.

4.7.3 SOCIAL DESIRABILITY BIAS

The nature of the exposure and outcome of interest within this study is that of a sensitive matter. It is likely that parents reporting on early life stressors may under report their experiences, as they may feel pressured to respond in a socially desirable manner. Questions regarding alcohol, financial strains, child abuse, and job loss have been noted to be commonly underreported in survey data, as the respondent may be embarrassed or may fear punishment and judgement[300]. In serious cases of child abuse the parent may also feel like they may lose custody of their child. It has widely noted in the literature that items of a sensitive nature specifically encompassing parenting are often under-reported[301,302,303]. Furthermore, as the child self-reported the majority of the outcome measures, outcomes may have been underreported, in fear of judgment and stigma[304]. The underreporting of early life stressors as well as the outcome measure ultimately dilutes the true association, biasing results towards the null. It is worth noting that literature suggests that although parents are the best informant for both internalizing and externalizing disorders when the child is younger, it have been noted that older children and adolescents are stronger informants for internalizing and externalizing disorders[305]. While social desirability bias is highly likely due to the nature

of the items investigated, extensive steps were taken within both the NLSCY and the ALSPAC data collection to reassure the participants that their responses are private, anonymous, and confidential. Collection strategies used within both the NLSCY and ALSPAC have been suggested as useful precautions, mitigating potential bias. Furthermore, research has indicated the validity of adolescent self-reports on the mental health outcomes involved in this study.

4.7.4 RESIDUAL CONFOUNDING

As in any study, there is a level of residual confounding that may have affected the results found within this study. The first element of residual confounding may be present when measuring early life stressors at the prenatal and postnatal levels. Underlying coping skills or undiagnosed anxiety and depression may have influenced the mother's ratings of the severity of experienced stressors. In a recent study conducted by Kingsbury et al[42], investigating stressful life events during pregnancy and offspring depression within the ALSPAC dataset, this residual confounding was also noted as a possible limitation. In order to address this possibility, the authors calculated the mean severity for each event among those who experienced the event and assigned that score to each individual who had reported an event, ultimately equalizing the severity and coping skills of each mother. It was found that there were no substantial changes in the strengths of associations between stressful live events and depression status, depressive symptoms, or trajectories. Additionally, adjusting for maternal history of depression and anxiety as well as prenatal anxiety and depression lends confidence to the notion that the measures of early life stressors within this study are valid and do not effect the results. Additionally, another potential source of residual confounding within

this study is within the measures of protective factors. Although socioeconomic status was controlled for at the time of the exposure measurement, and literature has noted that socioeconomic status often remains stable throughout the life course[306], it is possible that participant's socioeconomic status did change from the timing of their exposure to the time of the measures of the protective factors. Literature has noted that childhood physical activity and extracurricular activity is associated with higher levels of socioeconomic status[307,308] , therefore it is possible that participation in the physical activity and extra-curricular activities may be confounded by the socioeconomic status of the participant.

4.7.5 AVAILABLE DATA

A final, yet noteworthy limitation of the present study is the availability of data as well as the inconsistencies within the two datasets. Firstly, outcome measures were only measured between the ages of 12-15. The logic behind this timing was based on the fact that at the age of 12 the child was able to self-report on their mental health status. As noted previously, self reports of mental health disorders at this age have been noted to be highly valid, that said it would have been beneficial to have a cross validation of the self-reported outcome measures with clinical diagnoses. Furthermore, after the age of 15, adolescents were able to self-consent to participate in the research study, leading to a steep drop in sample size. Additionally at the age of 16, outcome measures differ from the outcome measures used between the ages of 12-15. This is considered a limitation within this study as it has been indicated that 16-24 years of age remain critical periods for the onset of mental health disorders, as noted by Kessler et al.[309]. Moreover, an inconsistency worth noting within this thesis is the measure of maternal depression as a

covariate and as a risk factor. Within the NLSCY dataset, maternal depression was measured as a risk variable as it was measured as an early life stressor. In light of this, maternal depression was measured as a covariate when the child was between the ages of 12-13. Contrarily within the ALSPAC dataset, maternal depression was not explicitly measured as an early life stressor; therefore it was measured as a covariate at the time of the early life stressors measurements. Furthermore, the datasets were limited in regards to paternal measurements, which would have allowed for a higher breadth of analysis. Finally, as the majority of measurements were reported by the mother, it is possible that elements of the child's protective factors may have been missed, specifically in regards to positive friendships in regards to early experiences of bullying and victimization[310].

4.8 STRENGTHS

The limitations discussed above were offset by multiply noteworthy strengths including strong generalizability, prospective design, and a broad range of risk factor and protective factor data.

4.8.1 NATIONALLY REPRESENTATIVE

A key strength of this research included the national representativeness of both the NLSCY and the ALSPAC dataset. The NLSCY is a nationally representative cohort, including samples from all Canadian provinces[213]. Additionally, survey weights ensure that the representativeness is accounted for. Although the ALSPAC dataset is not weighted, it represents the general population with a high breadth and frequency of data collection. Literature regarding the representativeness of the ALSPAC cohort to the population of Britain show that the study population is broadly representative of the

British population[161]. The representative nature of these studies ultimately allow the results of this study to be highly generalizable to both the Canadian and British population.

4.8.2 PROSPECTIVE DESIGN

The prospective design of both the NLSCY and the ALSPAC studies allow this research to better disentangle the causal and temporal pathway in regards to the trajectory of risk factors, protective factors, and mental health outcomes. Additionally, as the variables were measured frequently and prospectively, the likelihood of recall bias was generously reduced.

4.8.3 HIGH BREADTH OF DATA

A final yet noteworthy strength within this study is the high breath of variables available for analysis. Extensive measures of prenatal and postnatal stressors were available covering a wide range of stressor categories including loss of a loved one, socioeconomic stress, and exposure to abuse. Furthermore, when exploring the objectives of this research, important health and socio-demographic confounders could be controlled for, reducing the risk of bias, ultimately supporting a true observed association.

4.9 CONCLUSION

The present study used longitudinal data from the NLSCY and ALSPAC in order to identify the effects of early life stressors and childhood protective factors on the development of adolescent mental health disorders. This research has contributed to our understanding of the complex development of mental health disorders across the life course. It identified the risks of early life stressors, while highlighting the protective

nature of childhood modifiable factors. This research lends support to the fetal programming hypothesis, the life course theory, and the positive youth development theory. While this thesis was not able to identify any modifying effect of childhood protective factors, the evidence gained from the analyses suggest that the implementation of modifiable protective factors, regardless of past experience of early life stressors can reduce the likelihood of adolescent mental health disorders. Further research is needed to help further understand the roles and optimal timing of protective factors across the life course.

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APPENDICES

APPENDIX A. LIST OF EARLY LIFE STRESSORS – ALSPAC & NLSCY

EARLY LIFE STRESSORS IN ALSPAC

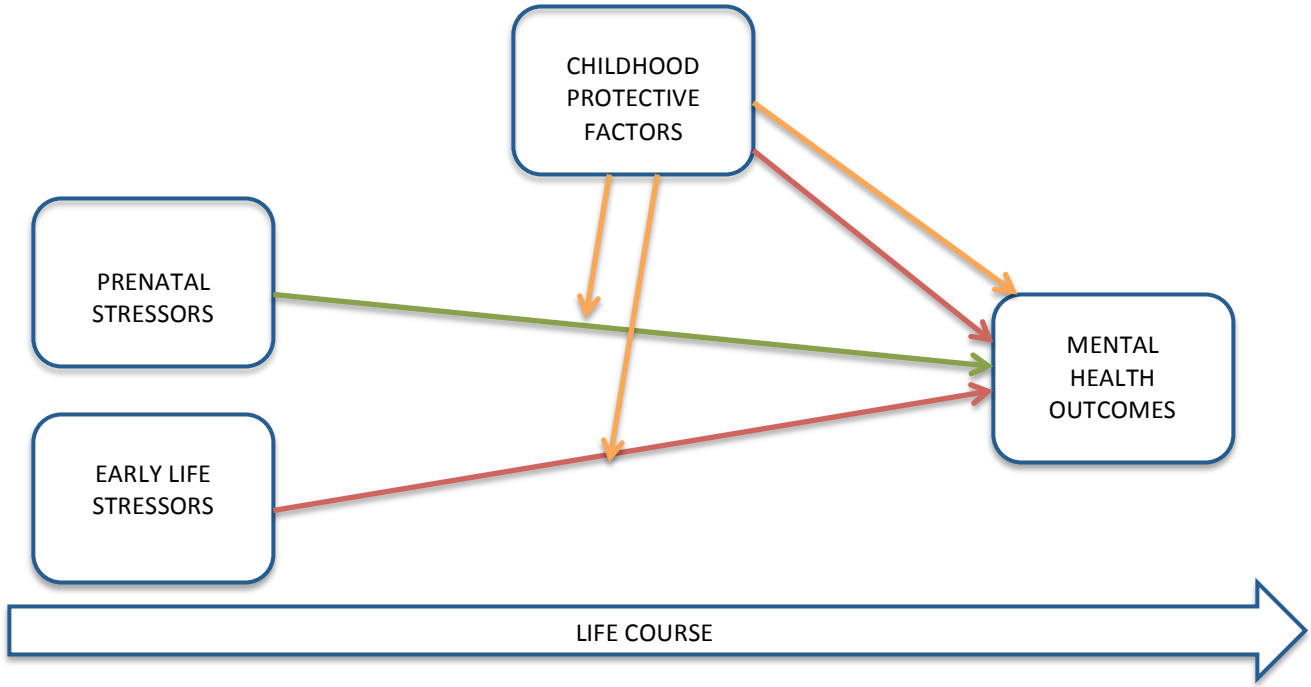
- Your partner died
- One of your children died
- A friend or relative died
- One of your children was ill
- Your partner was ill
- You were admitted to hospital
- You were in trouble with the law
- You were divorced
- You found out that your partner didn't want your child
- You were very ill
- Your partner lost his job
- Your partner had problems at work
- You had problems at work
- You lost you job
- Your partner went away
- Your partner was in trouble with the law
- You and your partner separated
- Your income was reduced
- You argued with your partner
- You had arguments with your family or friends
- You moved houses
- Your partner hurt you physically
- You became homeless
- You had major financial problems
- You got married
- Your partner hurt your children physically
- You attempted suicide
- You were convicted of an offence
- You were bleeding and thought you might miscarry
- You started a new job
- You had a test to see if your baby was abnormal
- You had a result on a test that suggested your baby might not be normal
- You were told you were going to have twins
- You heard that something that had happened might be harmful to the baby
- You tried to have an abortion
- You took and examination
- Your partner was emotionally cruel to you

- Your partner was emotionally cruel to your children
- Your house or car was burgled
- You had an accident
- Other

EARLY LIFE STRESSORS IN NLSCY

- Death of a parent
- Death of a family member
- Divorce of separation of parents
- Move of house
- Hospital stay
- Stay in foster home
- Other separation from parents
- Illness of injury of child
- Illness of injury of family member
- Abuse or fear of abuse
- Change in household members
- Alcoholism or mental health disorder in family
- Conflict between parents
- Death of a pet
- Problems in school
- Other traumatic events
-

APPENDIX B.
CONCEPTUAL FRAMEWORK



	LIFE COURSE THEORY
	FETAL PROGRAMMING HYPOTHESIS
	POSITIVE YOUTH DEVELOPMENT THEORY

APPENDIX C.
PREVALENCE OF MENTAL HEALTH DISORDERS

Table C.1 ALSPAC Prevalence of Mental health disorders between the ages of 12-15

	Prevalence (%) n=2673	Standard Error
Depression	5.08%	0.75
Anxiety	2.3%	0.98
ADHD	1.56%	1.12
Conduct Disorder	1.72%	1.67

Table C.2 NLSCY Weighted Prevalence of Mental health disorders between the ages of 12-15

	Prevalence (%) n=3432	Standard Error
Mood Disorder		
Minimal	44.64	1.05
Mild	33.83	1.01
Moderate	12.85	0.67
Severe	8.63	0.61
ADHD	2.79	0.19
Conduct Disorder	2.83	0.18

APPENDIX D.
SUMMARY OF RESULTS

Table D.1 ALSPAC Summary of Results

		DEPRESSION OR(95% CI)	ANXIETY OR(95% CI)	CONDUCT OR(95%CI)
Prenatal & Postnatal Stressors	Mild	1.36 (1.05-1.76)	--	--
	Moderate	1.57 (1.21-2.03)	--	--
	Severe	2.29 (1.78-2.95)	--	--
Prenatal Stressors	Mild	1.02 (0.69-1.52)	--	--
	Moderate	1.52 (1.03-2.24)	--	--
	Severe	1.03 (1.38-2.99)	--	--
Postnatal Stressors	Mild	1.45 (1.12-1.87)	--	--
	Moderate	1.65 (1.27-2.13)	--	5.27 (1.04-9.49)
	Severe	2.50 (1.92-3.25)	--	9.43 (1.98-16.87)
Physical Activity	Moderate	0.72 (0.52-0.91)	--	--
	Vigorous	0.58 (0.41-0.83)	--	--
Positive Parenting	High Score	0.75 (0.64-0.88)	0.76 (0.49-1.20)	--
Positive Friendships	Moderate	0.77 (0.37-1.61)	0.43 (0.07-0.82)	--
	High	0.47 (0.24-0.92)	0.24 (0.05-0.41)	--
Extracurricular Activity	Participant	--	0.64 (0.46-0.83)	--

Table D.2 NLSCY Summary of Results

		MOOD DISORDER[1] OR[a] (95% CI)	**ADHD[2] OR[a] (95%CI)**	**CONDUCT[3] OR[a] (95% CI)**
Early Life Stressors	Two or More ELS	Mild 1.07 (1.03-1.11) Moderate 1.00 (0.97-1.03) Severe 1.78 (1.72-1.84)	1.13 (1.06-1.20)	1.27 (1.23-1.32)
Family Dysfunction	High Dysfunction	Mild 1.11 (1.08-1.13) Moderate 2.23 (2.17-2.29) Severe 1.09 (1.05-1.12)	1.22 (1.16-1.30)	1.36 (1.33-1.40)
Physical Activity	Physically Active	--	1.12 (1.09-1.16)	0.84 (0.81-0.86)
Positive Parenting	High Score	Mild 0.85 (0.80-0.88) Moderate 0.80 (0.76-0.84) Severe 0.90 (0.87-0.93)	1.36 (1.25-2.47)	1.35 (1.29-1.41)
Positive Friendships	High Score	Mild 0.70 (0.62-0.78) Moderate 0.85 (0.77-0.92) Severe 0.66 (0.60-0.71)	0.82 (0.72-0.92)	0.74 (0.72-0.75)
Extracurricular Activity	Participant	Mild 0.70 (0.62-0.78) Moderate 0.85 (0.77-0.92) Severe 0.29 (0.27-0.31)	0.89 (0.87-0.92)	0.77 (0.75-0.80)