DIFFERENTIAL EFFECTS OF MULTISYSTEMIC FACTORS ON THE DEVELOPMENTAL TRAJECTORIES OF EMOTION REGULATION

KRYSTA MC DONALD

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Abstract

The current study investigated the development of emotion regulation (i.e., managing one's emotions in order to meet a goal; Gross et al., 2019) within a multisystemic context across the sensitive periods of adolescence and emerging adulthood. It adds to current literature by including the entire sensitive period (i.e., age 12-29 years), incorporating the influence of multisystemic factors on different emotion regulation developmental pathways, and extending investigations of posttraumatic adjustment within an integrated framework. Participants were a subsample from the National Longitudinal Study of Adolescent Health (Add Health; $N = 13414$), a longitudinal nationally representative database that follows youth from adolescence into adulthood. Growth mixture modelling was applied to elicit unique trajectories of emotion regulation development (i.e., depressive symptoms) each with unique relationships to multisystemic covariates (i.e., biological sex, pubertal timing, self-esteem, adverse childhood experiences [ACEs], parent closeness, friendship support, parental socioeconomic status, neighbourhood safety, changes in household parental figures). Four non-linear trajectories were found: low (normative), low-increasing, increasing-decreasing, and high-decreasing. The multisystemic factors had differential effects on each pathway that, with the exception of ACEs, tend to wane in influence as youth age. Self-esteem, perceived parental closeness, and perceived neighbourhood safety most tended to be protective, whereas seeking support from a friend, experiencing (an) ACE(s), and changes to household parental figures tended to confer vulnerability. Emotion regulation development and posttraumatic adjustment do vary, with lasting impacts. A multisystemic, integrated framework showed what factors confer risk or protection within these trajectories, and helps explain previously mixed findings. Implications for identifying at-risk youth, preventative measures, and intervention are also discussed.

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Table of Contents

List of Tables

List of Figures

Differential Effects of Multisystemic Factors on the Developmental Trajectories of Emotion Regulation

Adolescence is an important period of development with many life-long processes being established, particularly key aspects of emotional functioning such as emotion regulation (Rawana et al., 2010; Schulenberg et al., 2004). Emotion regulation has been defined as strategies by which emotions are managed in order to meet an individual's goal in a socially acceptable manner (Gross & Thompson, 2007; Gross et al., 2019). As such, these strategies include initiating, maintaining, and modifying the occurrence, intensity, or duration of feelings (Gross & Thompson, 2007; Gross et al., 2019). One example of an emotion regulation strategy is cognitive reappraisal, defined briefly as thinking about a situation in a way to alter its emotional influence (Gullone et al., 2010). For instance, Sarah, who is happy in her current romantic relationship, is confronted by her romantic partner, who expresses his wish to end the relationship. Utilizing a cognitive reappraisal strategy, Sarah could use the opportunity to express concern and compassion for her partner and discuss reasons for her partner's wish to end the relationship, as opposed to being emotionally overwhelmed and distressed. This strategy may then encourage more dialogue, and they may engage in mutually satisfying next steps. In general, emotion regulation is particularly important because it is implicated across psychological disorders, including depression and trauma-related disorders (e.g., Gross et al., 2019; Kring & Sloan, 2009; Vine & Aldao, 2014; Weissman et al., 2019). As such, emotion regulation is becoming a common target for treatment across diagnostic categories or transdiagnostically (e.g., Gross et al., 2019; Kring & Sloan, 2009; Neacsiu et al., 2014).

Emotion regulation difficulties can often result in depressive symptomatology (e.g., Betts Gullone, & Allen, 2009; Bullis et al., 2019). For example, a meta-analysis found that

maladaptive or ineffective emotion regulation strategy use (i.e., emotion dysregulation) was associated with depressive symptoms (Aldao, Nolen-Hoeksema & Schweizer, 2010). The effect was generally stronger among adults than youth, indicating a possible developmental trajectory or time-dependent pathway for the development of depressive symptoms. Further, data from the limited number of longitudinal studies indicate that maladaptive emotion regulation strategy use in childhood and adolescence tends to predict the experience of depressive symptoms later on. To this end, an experience-sampling-method study found that among adults' effective emotion regulation strategy use predicts mood improvement, while ineffective emotion regulation strategy use predicts depressive symptoms (Heiy & Cheavens, 2014). Importantly, depressive symptoms increase among both boys and girls during mid-adolescence, although girls show higher levels of depressive symptoms throughout adolescence (Van Oort et al., 2009), just as emotion regulation transitions from a more relational to a more independent process. Importantly, adolescent depressive symptoms often recur in adulthood (Kessler, 2011), further suggesting that emotion regulation difficulties in youth carry into adulthood.

Unfortunately, many individuals experience a traumatic event during the time they are developing emotion regulation skills. Indeed, the main mechanism through which traumatic experiences have an effect is currently understood as disturbed emotion regulation due to a prolonged heightened stress response (Ehring & Quack, 2010; Hopper et al., 2007; Lim et al., 2019; Weissman et al., 2019). The definition of a traumatic experience varies, but in general relates to those experiences in which there is an actual or perceived threat to physical and/or psychological well-being, or moral integrity (Tedeschi et al., 2018). In childhood, trauma can occur following what has been termed, adverse childhood experiences, stemming from an early longitudinal study linking reported past specific adverse childhood events (ACEs; i.e., abuse,

neglect, and/or family dysfunction) to adult health issues, including depression, suicidality, and substance abuse, among other negative outcomes (Felitti et al., 1998). Prevalence rates are high, with about half of all community members, and most adults seeking mental health services, reporting at least one ACE (Cusack et al., 2006; Rossiter et al., 2015). Given that ACEs occur during developmentally sensitive periods, are relatively common, and influence emotion regulation development, it is important to look at these adverse experiences and emotion regulation concurrently.

Accordingly, the current study took a prospective developmental person-centered integrated approach to the investigation of emotion regulation, as measured by depressive symptoms, throughout adolescence and emerging adulthood. Potentially influential variables from within the individual (i.e., biological sex, pubertal timing, self-esteem, ACEs), their relationships (i.e., parental, friendships), and their environment (i.e., neighbourhood safety, parental socioeconomic status, household family member changes) were examined, as these factors are all important for development within these periods of life (Arnett, 2012; Grusinger & Blatt, 1994). In addition, the role of potentially traumatic experiences on emotion regulation development was investigated through examining the interaction between ACEs and individual, relational, and environmental factors.

Emotion Regulation

Emotion regulation has been described by Gross and Thompson (2007) as the effortful or automatic employment of strategies, such as cognitive reappraisal or expressive suppression, which results in a general increase or decrease of either positive or negative emotion, depending on the goals of the individual at the time. As both individuals and social beings, these strategies can be categorized as intrapersonal or interpersonal (Gross & Thompson, 2007; Marroquin et al.,

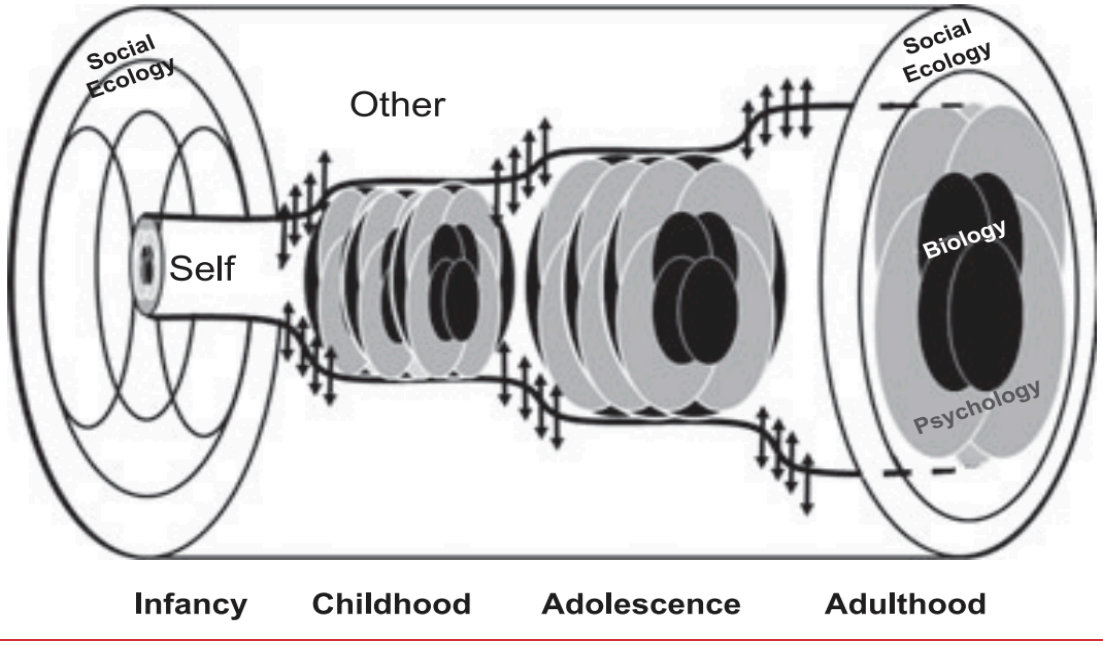
2017; Zaki & Williams, 2013). Intrapersonal emotion regulation involves invoking internal or cognitive strategies for the purpose of regulating emotion to reach a desired goal. Interpersonal emotion regulation involves seeking out an interaction with another, typically trusted, person or people for the same purpose, and is sometimes referred to as co-regulation (Barthel et al., 2018). Gross and Thompson (2007) also note that multiple emotion regulation strategies may be invoked simultaneously and exert influence on each other. Appropriate and effective emotion regulation from both intraindividual and interindividual processes tends to lead to well-being (e.g., Marroquin et al., 2017). Likewise, emotion dysregulation is a result of strategy use that is inappropriate or ineffective in modifying emotional experience to the current goals of the individual. Emotion dysregulation may lead to psychopathology, and in particular, depression (Aldao, Nolen-Hoeksema & Schweizer, 2010; Betts Gullone, & Allen, 2009; Gross et al., 2019; Heiy & Cheavens, 2014; Neacsiu et al., 2014). To this end, depression is associated with high levels of negative affect, low levels of positive affect, and altered emotional processing (e.g., Watson et al., 1988). Altered emotion regulation strategy use has even been identified as a trait-like marker for psychopathology in children and adolescents (Weissman et al., 2019) and depression in adults (Gross et al., 2019; Kanske et al., 2012). For these reasons, depressive symptoms are understood as a key indicator of underlying emotion dysregulation.

Development of emotion regulation can be specifically conceptualized by the transactional developmental ice-cream-cone-in-a-can model (Sameroff, 2010; Sameroff & Fiese, 2000). In this model, emotions are mainly regulated by others initially, but are increasingly self-regulated as time goes on and development progresses. Other-regulation or co-regulation is largely accomplished by the main caregivers but can be anyone or anything from an individual's environment or context. In relation to Bronfenbrenner's ecological systems theory (1979), other-

regulation may come from any of the systems described. Importantly, emotion regulation always depends on other-regulation to some degree, including caregivers and friends, as other-regulation provides the developmental basis for self-regulation (Barthel et al., 2018; Eisenberg, 1996; Sameroff, 2010; Sameroff & Fiese, 2000; see Figure 1 below). The current study aimed to capture this dynamic complexity by examining the influence of parents and friends on emotion regulation over time.

Figure 1.

Sameroff's Unified Theory of Development Model Applied to Emotion Regulation Development [Image taken from Sameroff (2010)]



Development within Adolescence and Emerging Adulthood

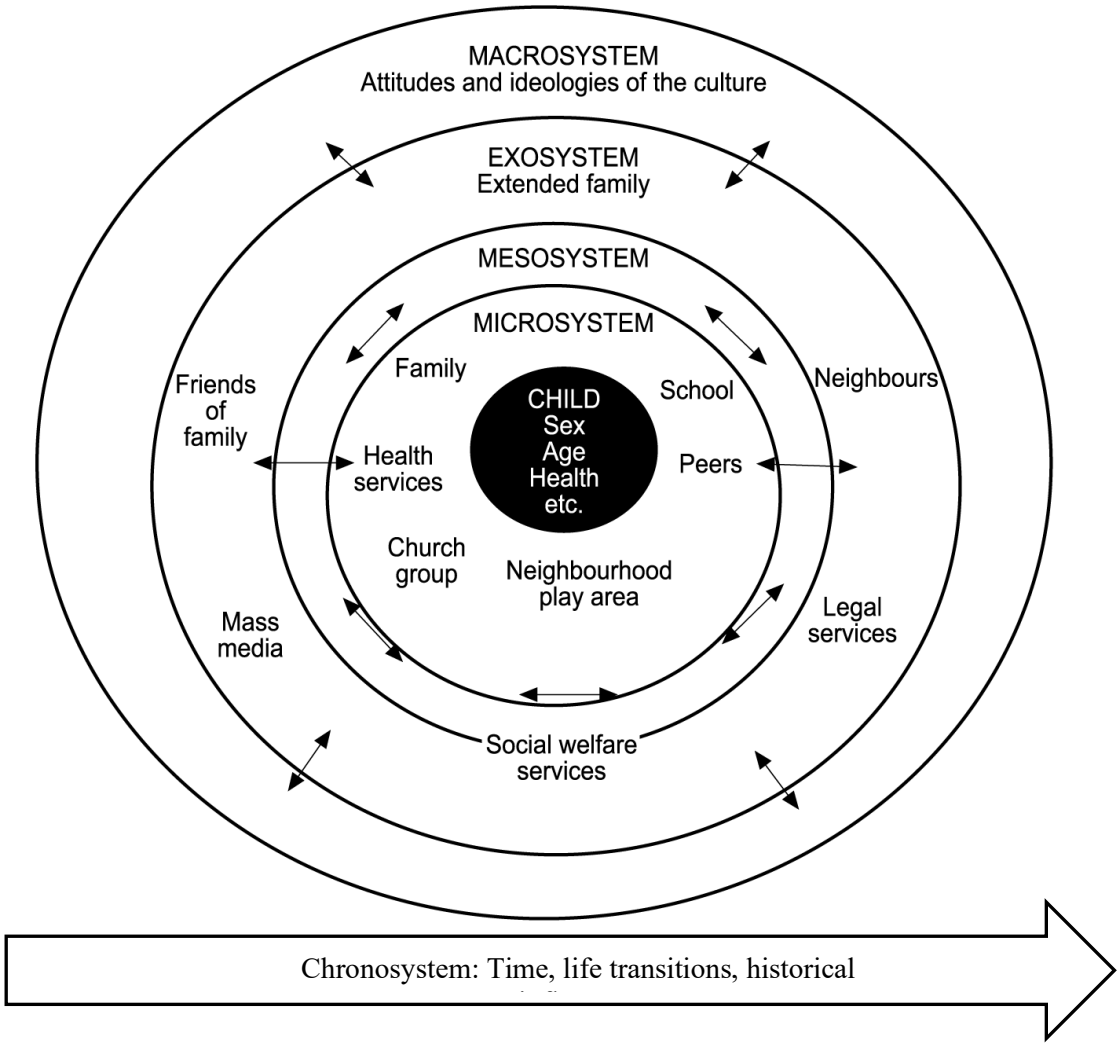
Two developmentally sensitive periods for emotion regulation are adolescence and emerging adulthood (Collins & Steinberg, 2006; Gross & Thompson, 2007; Rutter, 1996; Schulenberg et al., 2004). Also, during this time, specifically in mid-adolescence, depressive symptoms generally increase and many adolescents experience depressive symptoms that often

recur in adulthood (Kessler, 2011). Depressive symptoms in adolescence are commonly associated with difficulties in emotion regulation (Betts Gullone, & Allen, 2009). Adolescence is broadly defined as occurring between the ages of 10 and 18 years (Sawyer et al., 2012). There are many transitions and developmental goals in adolescence, including puberty and biological maturation, cognitive development, emotion regulation ability, forming an identity, taking on increasing responsibility, balancing independence and interdependence, and beginning to form romantic relationships (Collins & Steinberg, 2006; Sawyer et al., 2012). Emerging adulthood is a relatively newer period of development identified mainly in industrialized developed countries and is defined as occurring between the ages of 18 and 29 years (Arnett, 2012). Transitions and developmental goals are similar to that of adolescence and include neurological changes in frontal lobe, limbic system, and dopamine systems, cognitive development (i.e., perspective taking), emotion regulation ability, continuing identity formation, self-direction, experimentation with roles, greater responsibility, experiencing achievement, balancing independence and affiliation, particularly with parents and authority figures, and continuing to develop romantic relationships (Arnett, 2012; Rutter, 1996; Schulenberg et al., 2004). The end of required education combined with a general lack of personal commitment and the freedom to experiment with roles sometimes results in uncertainty and an overall feeling of floundering among emerging adults (Schulenberg et al., 2004). Successful management throughout both of these developmental periods depends, in part, on the resources and strengths of the individual within their developmental context (Schulenberg et al., 2004). The current study focused on these two developmental periods because of their sensitivity to emotion regulation and depression, as well as their potential continuing impact into adulthood.

Development through adolescence and emerging adulthood can be theoretically conceptualized using Bronfenbrenner's (1979) ecological systems model (see Figure 2). In this transactional model, the individual (e.g., genetics, biology, temperament) is at the center and environmental influences are circled around the individual in four increasingly removed and overarching layers, the microsystem, mesosystem, exosystem, and macrosystem. The microsystem refers to the direct relationships between an individual (including biological factors) and family members, siblings, peers, teachers, religious leaders, and neighbours. The mesosystem refers to relations between institutions within the microsystem, including that between school and church. The exosystem refers to the larger social setting, including mass media and local politics. Finally, the mesosystem refers to cultural influences, specifically, the ideologies, attitudes, and beliefs of the culture. Bronfenbrenner also added the chronosystem to account for sociohistorical variables and changes over time within and between each of the ecological levels (Bronfenbrenner, 1986). Indeed, the development of an individual progresses by building upon itself, or scaffolding (Sameroff, 2010; Schulenberg et al., 2004; see Figure 2 below). As such, difficulties with emotion regulation, or the experience of depressive symptoms, in adolescence and emerging adulthood may persist into adulthood.

Figure 2.

Bronfenbrenner's Bioecological Model [Image modified from Dockrell and Messer (1999)]



Emotion dysregulation in adolescence can transfer into emerging adulthood, with consequences such as psychopathology, problematic relationships, and low academic success, for example (Berzin, 2010; Chaiton et al., 2013; Compas et al., 2011; Kessler, 2011; Weissman et al., 2019). These outcomes are especially important for many reasons. In terms of psychopathology, emotion dysregulation is common to many disorders, and specifically to all mood disorders (Aldao, Nolen-Hoeksema & Schweizer, 2010; Compas et al., 2017). Relationships are a primary support throughout the many changes in emerging adulthood and

disruptions in relationships could impede the developmental goals of emerging adulthood and beyond (Kessler, 2011; Marroquin et al., 2017; Zaki & Williams, 2013). Finally, low academic success could seriously limit future vocational opportunities, in addition to having other consequences (Kessler, 2011). Although difficulties from emerging adulthood are likely to carry into adulthood, this is not always the case and trajectories may change at any time as they are only probabilistic (Schulenberg et al., 2004; Tedeschi et al., 2018).

There is increasing interest in sophisticated statistical methods that can integrate a prospective transactional developmental framework that incorporates many different variables over a long period of time and also allows for individual differences to be identified (e.g., Day & Wiesner, 2019). One such method is growth mixture modeling (GMM), which allows for the investigation of both baseline data and changes over time for population subgroups (Field, 2009). These and similar techniques have been applied to the investigation of depressive symptoms over time in community samples. Results generally indicate the existence of three or four statistically different trajectories of development, with most individuals displaying low depressive symptoms across adolescence or emerging adulthood (e.g., Costello et al., 2008; Frye & Liem, 2011; Mezulis et al., 2014). In addition, three other trajectories have been identified in most or some studies: a low-to-high group (Costello et al., 2008; Dekker et al., 2007; Frye & Liem, 2011), a consistently high group (Frye & Liem, 2011; Sterba et al., 2007), and a high-to-low group (Costello et al., 2008; Frye & Liem, 2011).

The current study also sought to identify whether multiple trajectories of depressive symptoms, as an indicator of emotion regulation difficulties, are identifiable (e.g., Betts Gullone, & Allen, 2009; Bullis et al., 2019; Gross et al., 2019; Kanske et al., 2012; Weissman et al., 2019). Furthermore, the current study aimed to integrate individual differences into the analyses

of any identified trajectories in order to understand the probabilistic nature of these trajectories by identifying factors that make an individual more or less likely to follow a given trajectory (Lerner, 2004). The current study focused on factors from across Bronfenbrenner's (1979) individual and microsystem, as these are most salient to the individual.

Developmental Influences: Risk and Protective Factors

The development of emotion regulation across adolescence and emerging adulthood is influenced by internal, relational, and environmental factors that can be supportive (i.e., protective) or interfere with (i.e., risk) this development. As the current study examines the interplay of both risk and protective factors, the theoretical foundations for both are described below, followed by the theoretical foundations for studying the interplay between the two. Similar developmental investigations have also been undertaken for other processes and outcomes (e.g., Day & Wiesner, 2019).

Risk factors, or variables that increase the probability of a maladaptive or negative outcome, may also be referred to as vulnerabilities and may be biological, psychological, cognitive, relational, or environmental in nature. The developmental psychopathology framework, certainly the most widely known and applied framework for understanding psychopathology, provides a comprehensive explanation of risk factors (Cicchetti & Cohen, 1995). Cicchetti and Cohen (1995) propose that development scaffolds itself over time, resulting in the effects of early experience being carried forward. Accordingly, early intervention and prevention are emphasized because previous maladaptive responses place restraints on future adaptation, and the longer a maladaptive trajectory continues, the more difficult it will be to change. Applying this concept to the current study, a risk is something that occurs and increases the chance of emotion dysregulation and therefore depressive symptoms. However, development

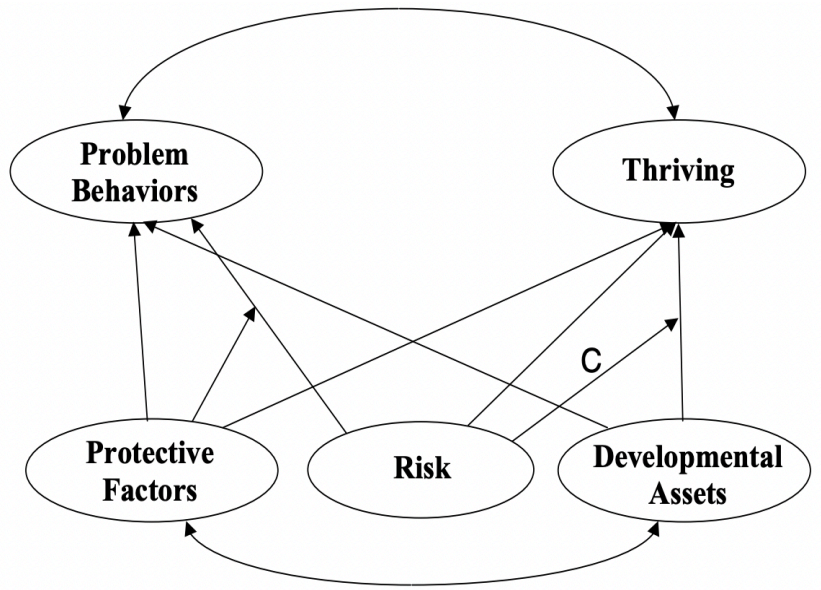
involves more than the accumulation of risk factors. Protective factors are also salient and influential.

Developmental psychopathology outlines the importance of protective factors and defines them as variables that increase the probability of a positive or adaptive outcome (Cicchetti & Cohen, 1995). Further emphasizing this concept, positive youth development (PYD) focuses on protective factors and provides a comprehensive framework for understanding them. As described by Lerner et al.(2005), PYD takes a strengths-based approach that seeks to identify personal assets that can be developed to promote positive development (Duckworth et al., 2005). Under this model, when difficulties are experienced, negative or maladaptive outcomes are only one of many potential outcomes that may alternatively be neutral or even positive. This theory is focused on optimizing individual or ecological resources and promoting mutually beneficial relationships to overcome adversities as opposed to developmental psychopathology's focus on repairing individuals (Cicchetti & Cohen, 1995; Lerneret al., 2005). Protective factors include resiliency factors and may also be referred to as strengths. Strengths have been defined as characteristics and competencies that are valued by both the individual and their society (Rawana & Brownlee, 2009). Specifically, characteristics refer to the fundamental qualities of an individual, whereas competencies refer to purposefully developed skills (Rawana & Brownlee, 2009). In terms of depression, strengths support appropriate emotion regulation development irrespective of the presence of risks, thereby decreasing the likelihood of experiencing depressive symptoms. However, both developmental psychopathology and positive youth development are insufficient on their own as an individual both experiences and accumulates both strengths and risks throughout development. The relative contributory value and interaction between these influences must be accounted for.

To address this, an integrated approach has been developed by Schwartz et al. (2007). This framework generally combines both developmental psychopathology and positive youth development, as the conceptual bases of both theoretical orientations are quite similar. It is important to observe both risks and strengths together in order to capture the interaction between them. Specific strengths may have more or less of a buffering action depending on the specific risks present and the overall context of the individual. Accordingly, this theory integrates the principle of differential susceptibility (Bakermans-Kranenburg & van Ijzendoorn, 2011). Not all instances described as risks will act as risks for every individual and this is likely because their specific strengths prevent or counteract any negative influence of the instance. Research using this approach seeks to identify conditions under which strengths may become more or less effective, or alternatively, conditions under which risk factors truly confer risk (Schwartz et al., 2007). This approach may help individuals adapt best within their current risk factors by promoting the most impactful strengths. The advantage of this theory is that it integrates a more dynamic and ecologically valid model of risks and protective factors and accounts for individual differences (Day & Wiesner, 2019; Lerner, 2004). In addition, it acknowledges that there are additional individual and contextual variables that may moderate the impact of a risk. See Figure 3 below for an illustration of the model. For these reasons the integrated approach is the theoretical framework of the current study, as it encompasses key concepts from both developmental psychopathology and positive youth development.

Figure 3.

Integrative Model Developed by Schwartz, Pantin, Coatsworth, and Szapocznik [Image copied from Schwartz et al. (2007)]



Integrated Approach: Posttraumatic Adjustment and Emotion Regulation

Childhood trauma is a particularly common and potent risk factor that has the potential to severely disrupt the typical development of emotion regulation, particularly across these developmentally sensitive periods (Barboza, 2017; Cowellet al., 2018; Copeland et al., 2018; Russotti et al., 2021; Stern & Thayer, 2019; Warmington et al., 2022; Weissman et al., 2019). However, even with the occurrence of such a strong risk factor, heterogenous outcomes are seen (Boanno & Mancini, 2012; Weissman et al., 2019). Three main outcomes following childhood trauma, potentially through ACEs, are found: resilience (e.g., Broekman, 2017), distress or maladaptive response (e.g., PTSD; Weissman et al., 2019), or psychological growth (i.e., posttraumatic growth; Tedeschi et al., 2018). To this end, when traumatic experiences are not sufficiently buffered by strengths and/or resilience, the disruption of emotion regulation has been

posited as the foundational mechanism for both maladaptive responses and psychological growth (e.g., Barboza, 2017; Compas et al., 2017; Gross et al., 2019; Tedeschi et al., 2018; Warmington et al., 2022; Weissman et al., 2019).

In response to adversity, resilience implies that the individual is not significantly affected by the experience(s) as their strengths have allowed them to meet the experience with the ability to cope and regulate their emotions effectively, thereby mitigating the risk for maladaptive outcomes (Broekman, 2017; Compas et al., 2017; McRae & Mauss, 2016; Zimmer-Gembeck & Skinner, 2016). Individuals with resilience are not unaffected per se but are able to effectively move through the experience without significant impact on their daily emotional, psychological and behavioural functioning (Beutel et al., 2017; Broekman, 2017; Compas et al., 2017; McRae & Mauss, 2016; Vieselmeyer et al., 2017; Zimmer-Gembeck & Skinner, 2016).

Individuals who experience a maladaptive response to adversity have effectively had their coping and emotion regulation skills overwhelmed by the experience, such that their particular strengths could not buffer the risks inherent to the experience, resulting in a maladaptive response (APA, 2013; Brown et al., 2016). This maladaptive response interferes with typical daily functioning, or goal-directed behaviour, to such a degree that it becomes classified as a disorder (e.g., DSM-5; ICD-11). Within the DSM-5 (APA, 2013), multiple trauma- and stressor-related disorders have been specified, including reactive attachment disorder and disinhibited social engagement disorder that may occur in infancy or childhood, and posttraumatic stress disorder, acute stress disorder, adjustment disorder, other specified and other unspecified trauma- and stressor-related disorders that may occur throughout the life course. A potential new diagnosis that captures the more developmentally complex outcomes of multiple or chronic traumatic experiences has been proposed, termed developmental trauma disorder (van

der Kolk, 2005). In addition, psychopathology from categories outside of trauma- and stressor-related disorders may also develop, including depression (e.g., Amone-P'Olak et al., 2019; Dunn et al., 2017; Nishikawa et al., 2018), substance abuse (e.g., Arpawong et al., 2015; Lim et al., 2019), and personality disorders (e.g., Copeland et al., 2018; Guilé et al., 2018). These different manifestations of maladaptive responses to adversity may be due to different individual profiles of strengths and risk factors (e.g., Brown et al., 2016; Bullis et al., 2019; Crandall et al., 2020; Mclaughlin & King, 2015).

Individuals who experience posttraumatic growth are theorized to have undergone a difficult process of rebuilding their internal representations of reality following an adversity due to the irreconcilable nature of the adversity experienced to their previous internal representations (Tedeschi et al., 2018). The process is marked by distress and struggle as an individual redevelops their internal representations of reality in order to integrate the adverse experience(s) before the outcome of posttraumatic growth (Tedeschi et al., 2018). Such reconstruction relies heavily on cognitive and emotional regulation (Tedeschi et al., 2018; Wolchik et al, 2008; Zhang et al., 2018). Potential positive outcomes of posttraumatic growth include becoming open to new possibilities for one's life, relating to others more positively and deeply, increased personal strength, more appreciation for life, and spiritual change (Tedeschi & Calhoun, 1996). It is also theorized that posttraumatic growth confers resilience going forward (Tedeschi et al., 2018). Most research into posttraumatic growth has come from adult survivors reporting on ACEs or other childhood stressors, as well as war veterans. Recently, researchers have begun looking at this outcome among children and adolescents themselves following adversities such as childhood illness (Devine et al., 2010; Schepers et al., 2019), natural disasters (e.g., Kilmer & Gil-Rivas,

2010; Zhang et al., 2018; Zhou et al., 2019), refugees (e.g., Sleijpen et al., 2016), and parental bereavement (e.g., Wolckik et al., 2008).

Given the potentially severe risk inherent to ACEs, the prevalence of ACEs, the developmental sensitivity of childhood to emerging adulthood for emotion regulation development, and the potential for emotion regulation difficulties to carry across development, the current study looked directly at the impact of ACEs on emotion regulation with a prospective, developmental, integrated lens. This is in line with two recent reviews (Kilmer et al., 2014; Meyerson et al., 2011) calling for an increase in prospective developmentally-focused studies of posttraumatic adjustment with larger sample sizes, longer time frames, adequate ACE timing records, and a broader range of adjustment indicators. The current study also expanded upon one study's longitudinal investigation of the protective factors on emotion regulation in the context of ACEs across development (Crandall et al., 2020).

Additional Influences on Emotion Regulation

Some studies have investigated the roles of risk and protective variables from a person-centered approach by using various latent class analyses to identify different trajectories of emotion regulation (e.g., Barboza, 2017; Costello et al., 2008; Frye & Liem, 2011; Mezulis, Salk et al., 2014; Olson, 2017). Research suggests that youth exposed to ACEs are likely to experience more psychological distress (i.e., depressive symptoms) during adolescence (Guerry & Hastings, 2011; van der Kolk et al., 2017) and into adulthood (e.g., Felitti et al., 1998), in line with the proposition that emotion regulation is central to mediating the traumatic impact of adverse events. However, the additional variables below have yet to be investigated simultaneously and in the context of traumatic experience. To this end, recent research has called for more longitudinal studies into a wider range of adjustment indicators among those who have

experienced ACEs (Kilmer et al., 2014; Myerson et al., 2011). It is important to examine these specific variables simultaneously because, although each have previously been implicated in emotion regulation development (i.e., depressive symptoms) and/or ACEs, there is the potential for unique interactional effects among them, as the integrated approach outlines. In addition, as research has found, these interactional effects may even differ both across subgroups and within subgroups over time (e.g., Costello et al., 2009; Day & Wiesner, 2019).

Biological Sex

From around adolescence onward, there is a large discrepancy between boys and girls in the experience of depression and depressive symptoms in general, with girls reporting approximately twice that of boys (e.g., Gonçalves et al., 2019; Rawana & Morgan, 2013; Bearman & Stice, 2008). To account for this, a 'gender additive model' has been proposed, with gender referring to biological sex (Bearman & Stice, 2008). This model states that some risks are gender-invariant, being experienced the same by both boys and girls, but also that some risks are girl-specific. In this way, girls are exposed to more risk than boys, resulting in the overrepresentation of girls. Along the same line, there may be gender-specific emotion regulation strategies that are less effective for girls, more effective for boys, or some combination. For example, when researching emotion regulation strategies, girls are more likely to engage in rumination (Nolen-Hoeksema & Jackson, 2001) and boys are more likely to engage in catastrophizing, while both are equally as likely to engage in self-blame (Rawana, 2013). Taken together, the suggestion is that either rumination is less effective at regulating emotion in girls when compared to the use of catastrophizing in boys, or that self-blame is less effective for girls than for boys, or a combination of the two. Findings of sex differences such as these are in line with theories of gender socialization, wherein individuals are socialized into dichotomous

gendered roles, practice gendered behaviour, and internalize gendered identities based on their biological sex from birth onward (for review, see Carter, 2014).

Importantly, empirical evidence for this model is conflicting, implying that this model is either incorrect or requires some changes in order to sufficiently account for the dynamic developmental processes involved. This model accounts for the existence of sex differences as noted by the literature but does not account for differential underlying developmental processes between the sexes. In order to be most useful and informative, the model should incorporate mechanisms of action as well. Unfortunately, an alternative has not yet been accepted by the field. Empirical findings will continue to accumulate and likely inform future modification by investigating the role of biological sex in emotion regulation as well as the role of biological sex as it interacts with risk and protective factors.

Pubertal Timing

Another biological variable of interest is pubertal timing. Puberty occurs in adolescence and induces substantial changes in an individual's life that may play into the sex differences seen in depressive symptoms (Ge et al., 2001). Research indicates that both early and late pubertal timing, in comparison to one's peers, has been linked to difficulty adjusting, including the experience of depressive symptoms (Susman & Rogol, 2004). Specifically, early puberty has been associated with greater internalizing symptoms in girls during adolescence (Black & Klein, 2012; Crockett et al., 2013) and through to young adulthood (Mendle et al., 2017), although this is not always found (Gaysina et al., 2015; Opoliner et al., 2014), but increased prosocial behavior at home in boys (Carlo et al., 2012). Higher rates of depressive symptoms have been found for adolescents who report looking "older than most" in their high school class (Resnick et al., 1997). Late pubertal timing in boys has been linked to substance abuse disorders and disruptive

behavior in emerging adulthood (Graber et al., 2014), as well as affective symptoms in adulthood (Gaysina et al., 2015). In addition, early or late maturation may affect the socialization of the individual. Adults may place somewhat different demands on youth who look more than less physically mature (Carlo et al., 2012). ACEs, too, have been found to influence pubertal timing. Specifically, ACEs that are experienced as threatening are associated with early pubertal timing, and ACEs that are experienced as deprivation are associated with late pubertal timing (Sumner et al., 2019). Given the social and emotional effects of puberty, and its potential interaction with ACEs and biological sex, it was worthwhile to further investigate the influence of pubertal timing on emotion regulation across development.

Self-Esteem

Self-esteem is another important individual factor throughout development, defined as what a person thinks and how a person feels about themselves (Rosenberg et al., 1989), which generally acts as a protective factor (Carteret al., 2016; Orth, Robins, & Widaman, 2012). Self-esteem displays both sex differences, with findings indicating that girls report lower levels than boys (Puskar et al., 2010), and age effects, with research showing these sex differences decrease with age (Kling et al., 1999). In addition, early pubertal timing has been linked to lower self-esteem in girls (Williams & Currie, 2000), although this is not always found (Benoit et al., 2013). In boys, late pubertal timing is generally associated with lower self-esteem (Brack et al., 1988), although this is less well studied. In addition, youth who have experienced trauma report lower self-esteem (Nelson-Goff et al., 2007; Valerio & Lepper, 2009) and self-efficacy (Cook et al., 2005) in adulthood when compared to adults who did not experienced childhood trauma. With the relationship between ACEs, biological sex, pubertal timing, and self-esteem currently

unclear, it was important to include self-esteem in a model of emotion regulation development in order to better understand its role.

Closeness to Parental Figures

Going beyond the level of the individual, relationships with parents or parental figures continues to be important in adolescence and emerging adulthood, although the nature of the relationship may be changing. Recent research has shown that perceived closeness to parents may act as a protective factor against youth's depressive symptoms (e.g., Andersson, 2016; Costello et al., 2008; Traylor et al., 2016; Van Voorhees et al., 2008), although there may be a sex difference here as well (e.g., Branje et al., 2010; Gariépy et al., 2016; Smojver-Ažić, & Bezinović, 2011). Family belonging (King et al., 2018) and high-quality relationships with parents, step-parents and nonresidential parents were also found to be protective against depressive symptoms in adolescence, emerging adulthood, and young adulthood (Jensen & Lippold, 2018). In contrast, low-quality relationships across these developmental periods presented risk for depressive symptoms (Jensen & Harris, 2017; Jensen & Lippold, 2018).

During adolescence, perceived parental closeness and support acts as a protective factor against depressive symptoms among those students who report looking "older than most" in their high school class (Resnick et al., 1997). Andersson (2016) found that the parenting relationship quality in adolescence buffered the link between socioeconomic status and mental health, such that a moderate to high socioeconomic status had a diminished protective effect on mental health when parental relationships were compromised. Furthermore, this effect has been found mainly for men (Wilkinson & Andersson, 2019). Among boys, closeness to fathers has been found to be protective against depressive symptoms (Lombardi et al., 2019). In addition, parental factors have been shown to influence the effect of pubertal timing on self-esteem differently for each

biological sex (Stojković, 2013). Family attachments have also been found, longitudinally, to be protective against depressive symptoms as well as self-esteem in young adulthood following physical abuse in childhood (Kuper & Turanovic, 2019). Finally, a recent systematic review indicates that improving the parent-child relationship acts as a protective factor for the negative sequelae of ACEs in 15 of 17 included studies (Marie-Mitchell & Kostolansky, 2019). The importance of both caregiver relationship closeness as well as their associations with biological sex, pubertal timing, socioeconomic status, self-esteem, and ACEs warranted inclusion into the investigation of emotion regulation development.

Friendship Support

Friendships play an important role in the development of emotion regulation. Some research has found that friendships and social support from friends can have a protective effect on depressive symptoms (Brady et al., 2009; Traylor et al., 2016), although this is not always found (Gariépy et al., 2016). Willburn and Smith add that friendship support is also associated with higher self-esteem and social competence (2009). However, some studies have not found this link (Stice et al., 2004), and others find a positive association between friendship closeness and depressive symptoms in girls (Brechwald & Prinstein, 2011; Lombardi et al., 2019). Negative relationship quality with friends has been identified as a risk factor for depressive symptoms in adolescence (La Greca & Harrison, 2010). One review focuses on the necessity of emotion regulation skill development following ACEs in order to allow for healthy future peer relationships (Leitch, 2017). This is in line with previous research aimed at determining causality relationships between peer relationships and depressive symptoms, finding that depressive symptoms often preceded peer relationship difficulties (Kochel et al., 2012). Although there have been some investigations into the role of friendships on emotion regulation development,

particularly regarding biological sex and self-esteem, the relationship remains unclear. With such a relatively small amount of research into this area, it was worthwhile to include this factor in an investigation of emotion regulation in order to more fully understand its associations.

Socioeconomic Status

Socioeconomic status (SES) has long been linked to well-being across the lifespan. During adolescence and young adulthood, family socioeconomic status has been found to influence mental health (for review, see Evans & Erikson, 2019). As these are developmentally sensitive periods, the effects may persist into the lifespan (Miller et al., 2011; Turner et al., 2016; Wu et al., 2018), perhaps more so for women (e.g., Adkins et al., 2009; Vaughan et al., 2010), and even for those individuals who experience upward social mobility (Wickrama et al., 2016). Andersson (2016) found that the links between socioeconomic status and mental health were partially moderated by parental relationship quality, such that a moderate to high socioeconomic status had a diminished protective effect on mental health when parental relationships were compromised. Childhood poverty, or low socioeconomic status, has been identified as a primary risk factor for ACEs specifically (e.g., Chung et al., 2016). Given both the long- and short-term influences of socioeconomic status, and its associations with parental relationship quality and ACEs risk, it was important to include this factor in a model of emotion regulation development.

Neighbourhood Safety

Neighbourhood characteristics have also been investigated with regards to emotion regulation and ACEs. Dawson and colleagues (2019) found a positive association between both parental-perceived neighbourhood disorder and neighbourhood concentrated poverty and adolescent depressive symptoms. In addition, the two neighbourhood indicators were found to overlap (Dawson et al., 2019). Barr (2018) also found an association between low

neighbourhood safety and physical conditions, and adolescent depressive symptoms that continued into young adulthood, above and beyond the risk conferred by low family socioeconomic status in adolescence. Considering the adolescents' perspective, the association between structural disadvantage and depressive symptoms was moderated by perceived social cohesion within the neighbourhood, indicating a potential protective factor of neighbourhood social cohesion (Dawson et al, 2019b). Neighbourhood safety and support have also been identified as a protective factor against depressive symptoms in adolescence (Traylor et al., 2016). In addition, quality of parent-child relationship moderated the effect of neighbourhood factors on depressive symptoms (Williams & Merten, 2015). Neighbourhood safety has been found to moderate adjustment after ACEs, such that unsafe neighbourhoods represented risk and decreased individual level protective factors (Jaffee et al., 2007). With the relationship between socioeconomic status, parental relationships, ACEs, and individual level protective factors, it was important to include perceived neighbourhood safety in an investigation of emotion regulation development.

Current Study

The current study investigated emotion regulation development, as measured by depressive symptoms, throughout adolescence (i.e., 12-18 years old) and emerging adulthood (i.e., 18-29 years old) in those with and without disclosed ACEs. The study had four aims. First, it investigated whether there are different developmental trajectories of depressive symptoms across time. Second, it evaluated the between-trajectory differences in ACEs, biological sex, pubertal timing, self-esteem, perceived parental closeness, friendship support, parental SES, perceived neighbourhood safety, and changes in household parental figures over time between each trajectory. Third, it investigated the influence of these potentially moderating variables

across time within each trajectory. Fourth, it investigated whether having experienced ACEs changes the presence and influence of the remaining potentially moderating factors across time.

These aims were addressed using a large national database, the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris et al. 2009), which provides longitudinal data for a breadth of variables across the adolescent and emerging adult periods. Approximately 20,000 participants entered the study as early as 12 or 13 years old and have completed 5 waves of data collection, spanning approximately 22 years of participant's lives. The majority of participants, then, have data recorded across both developmentally sensitive periods. This made it ideal for a trajectory-based investigation of depressive symptoms across multiple developmental periods. Specifically, the current study employed Growth Mixture Modeling (GMM), a sophisticated technique that uses both latent class modeling and structural equation modeling, to model the different subgroups (i.e., trajectories) of emotion regulation development over time, and the interactions within those specific trajectories. This was one of the first studies to directly investigate ACEs through a developmental and integrated framework, and to include participants followed across these two stages that are particularly important for emotion regulation development. The study also incorporates a developmental and ecological perspective, while integrating developmental psychopathology, positive youth development, and an integrated framework (i.e., differential susceptibility), in order to further understand the dynamic processes involved from a person-centered perspective.

Hypotheses

Five general research questions drove the current study: 1) does emotion regulation develop differently for certain groups of individuals across adolescence and emerging adulthood; 2) what factors, if any, differentiate these different groups across adolescence and emerging

adulthood; 3) what factors, if any, influence the development of emotion regulation across adolescence and emerging adulthood within each group; 4) within each group, does the influence of each factor change over time; and 5) what role, if any, do ACEs play in modulating the influence of each of these factors over time. Following the reviewed literature, it was hypothesized that a minimum of three distinct trajectories will be identified in the current study. It was specifically hypothesized that inexperience with ACEs, medium-to-high SES, male gender, pubertal timing that is perceived as coinciding with peers, high self-esteem, high perceived closeness to parents, and perceived neighbourhood safety would act as protective factors against depressive symptoms. Similarly, ACEs, low SES, female gender, pubertal timing that is perceived as early or late as compared to peers, low self-esteem, low perceived closeness to parents, and perceived unsafe neighbourhood were hypothesized to act as risk factors for depressive symptoms. It was also hypothesized that, when looked at under conditions of having experienced ACEs, the protective and risk factors for emotion regulation development would be similar, however, this specific interaction has not yet been studied directly across these developmental periods. The role of friendship support and the interplay of these variables over time are considerably less well studied, particularly in a longitudinal design. Current literature does not point to a clear hypothesis; however, it does indicate the need for the current study.

Methods

Participants

The current study used a sub-sample from the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris et al. 2009). Add Health is a US-based large and comprehensive investigation into adolescent health and development that includes approximately 20,000 participants chosen from 80 high schools and 52 middle schools with unequal probability

of selection (i.e., systematic sampling methods and implicit stratification) to ensure representativeness of US schools with respect to region of country, urbanicity, school size, school type, and ethnicity. Participants entered the study at 12 to 17 years of age (1994-1995; *N* = 20, 745), and the study has now completed five waves of data collection spanning 22 years. The current study focused on the developmental periods of adolescence and young adulthood, and so the first four waves were included in the current study. Participant data is collected up to age 24 to 32 years old. Add Health provides data on a number of diverse developmental domains, including biological sex, pubertal timing, self-esteem, ACEs, relationships with parents and friends, parental SES, neighbourhood safety, and household parental figures, among many others. Participants with information collected on the domains important to the current study, as outlined below, were included. This resulted in a final sample size of 13, 414 participants. Sample means are provided in the domain descriptions and in Table 7.

Measures

Add Health collects data on a number of diverse developmental domains. The outcome of interest (i.e., dependent variable) is self-reported depressive symptoms (9-item CES-D; Radloff, 1977). The current study also included data on the following domains: biological sex, pubertal timing, self-esteem, ACEs, perceived parental closeness, friendship support, parental SES, perceived neighbourhood safety, and family array. All data was self-reported by the youth. All decisions were guided by an attempt to include the most valid and reliable measures of each variable as close in time to first CES-D data collection and ACE, when applicable, as possible.

Emotion regulation. Emotion regulation was defined as depression symptoms, which were measured using the 9-item short form of the Center for Epidemiologic Studies Depression Scale (CES-D; Needham, 2007). See Table 1 below for items. Each item is rated on a 4-point

Likert-type scale that measures the frequency of experiencing each item, ranging from 0 (never or rarely) to 3 (most of the time or all of the time). Specific to the 9-item CES-D measure within Add Health data, an indication of clinical levels of depression is a score of 10 or above (e.g., Primack et al., 2009). Previously reported reliability alphas ranged from 0.80 to 0.83 (Brummett et al., 2014; Needham, 2007), indicating good internal consistency. This was treated as the dependent variable. The grand mean CES-D score in the current sample was 5.2, indicating that symptoms of depression were low for most participants.

Table 1.

Items from the Centres for Epidemiologic Studies-Depression Scale (CES-D 9-item) Included in the Add Health Survey

CES-D item	Item Score Range
You were bothered by things that don't usually bother you.	0 - 3
You felt that you could not shake off the blues, even with help from your family and your friends.	0 – 3
You felt that you were just as good as other people.	0 – 3*
You had trouble keeping your mind on what you were doing.	0 – 3
You felt depressed.	0 – 3
You felt that you were too tired to do things.	0 – 3
You enjoyed life.	0 – 3*
You felt sad.	0 – 3
You felt that people disliked you.	0 – 3

** = item is reverse-scored to obtain total score.*

Biological sex. Biological sex was determined by the interviewer who asked the participant what their biological sex is. The two options were male or female. This covariate was treated as time-invariant. Ratings were taken from Wave one as these are the ratings closest to

reported adverse childhood experiences. In the current sample, 53% of participants identified as male.

Pubertal timing. Pubertal timing was measured with one item, "How advanced is your physical development compared to other (girls/boys) your age?" that is rated on a 5-point likert-type scale, from 1 (I look younger than most) to 5 (I look older than most; Cavanagh et al., 2007; Schreck et al., 2007). This item has been used previously to determine pubertal timing relative to same-age peers within the Add Health database with the average rating being 3.3 (Schreck et al., 2007). This finding suggests that it is a valid measure of relative pubertal timing as, in line with expectations, most participants considered themselves on par with their peers. This covariate was treated as time-invariant. The mean pubertal timing score in the current sample was 3.2 (*SD* = 1.2), indicating that most participants identified as having average pubertal timing as measured by relative outward appearance.

Self-esteem. Self-esteem was measured using 6 items. Each item is rated on a 5-point likert-type scale that measures the degree of agreement with each item, ranging from 1 (strongly disagree) to 5 (strongly agree; Costello, 2007; Rawana, 2013). This measure has good internal consistency, as indicated by previously reported reliability alphas of 0.86 (Galliher et al., 2004; Rawana, 2013) and 0.85 (Costello, 2008). Ratings were taken from Wave one and were treated as a time-invariant covariate. The mean for the current sample was 4.1 (*SD* = .4), indicating that most participants had moderately high self-esteem.

Adverse childhood experiences (ACEs). ACEs were measured using a method published and described by Brumley et al. (2019). In wave three and four, participants were asked a set of questions pertaining to previous mistreatment by adults before grade six, focusing on instances of abuse (i.e., physical, sexual, emotional), neglect (i.e., physical, supervisory), and

the involvement of social services. Each question is asked in terms of frequency of occurrence, ranging from 0 to more than 10. In the current sample, 15% endorsed physical abuse, 5% endorsed sexual abuse, 10% endorsed emotional abuse, 7% endorsed physical neglect, 8% endorsed supervisory neglect, and 4% endorsed the involvement of social services. These six maltreatment variables were dummy coded (0 = not endorsed; 1 = endorsed) before being grouped into two factors each encompassing three variables: factor one encompassed physical abuse, emotional abuse, and supervisory neglect experiences (25% of the current sample); and factor two encompassed sexual abuse, physical neglect, and social services investigation experiences (12% of the current sample). These two latent variable covariates were treated as time-invariant.

For the purposes of investigating the interaction between ACEs and all other risk and protective factors, one variable was created and dummy coded to reflect whether a participant endorsed having experienced any ACE across the six identified maltreatment variables (0 = not endorsed; 1 = endorsed). Continuous variables were centered on the sample mean for interaction terms. In the current sample, 32% of participants endorsed having experienced any ACE.

Perceived parental closeness. Perceived parental closeness was measured using one item per parental figure, “How close do you feel towards your (resident mother/father)?”, that is rated on a 5-point likert-type scale, ranging from 1 (not at all) to 5 (very much; Needham, 2008). When participants rated two parental figures, the highest of the two ratings was used in the analyses in order to ensure participants that only reported on one parental figure would remain included in the current study. This measure has face validity and has been used previously as a measure of parental closeness (Schnettler & Steinbach, 2011; Scott et al., 2007). Ratings were taken from Wave one and were treated as a time-invariant covariate. The mean for the current

sample was 4.6 (*SD* = .5), indicating that most participants felt quite close to at least one parental figure.

Friendship support. Friendship support was measured using one item, "Did you talk to [your friend] about a problem during the past seven days?", that is rated using a dichotomous scale indicating yes (1) or no (0). The question focused on their first reported best friend. This measure has face validity and the current study aims to investigate its empirical utility as a measure of friendship support. Ratings were taken from Wave one and were treated as a time-invariant covariate. In the current sample, 70% of participants endorsed having spoken to a friend about a problem over the past week, indicating that most participants sought out peer support.

Parental socioeconomic status. Socioeconomic status was measured using a latent variable determined by using a method published by Belsky et al., 2018. The method incorporates four variables reported in Wave one, including parental education, parental occupation, household income, and household receipt of public assistance. This latent variable was transformed into a z-score and treated as time-invariant.

Perceived neighbourhood safety. Neighbourhood safety was measured using one item, "Do you usually feel safe in your neighborhood?", that is rated using a dichotomous scale (0 = no; 1 = yes). This measure has face validity and the current study aims to investigate its empirical utility as a measure of perceived neighbourhood safety. Ratings were taken from Wave one and were treated as a time-invariant covariate. In the current sample, 89% of participants endorsed feeling safe in their neighbourhood.

Family Array. Household family array over time was measured using a constructed longitudinal household family structure array variable developed and published by Gaydosh and

Harris (2018). The authors used data reported in waves one and two to create a measure of family structure at each age from 0 to 18 years. This measure reflects the in-home presence and/or absence of biological mother, biological father, step-mother(s), and step-father(s), and ranges in coded value from 1 to 9, reflecting the various family structure arrays at each age. From this, the family array variable was constructed, representing the number of unique values across ages 0-18 years, which was treated as a time-invariant covariate. The mean for the current sample was 1.6 (*SD* = .8), indicating that most participants experienced stable household parental figures throughout their childhood and adolescence.

The percentage of participants excluded due to missing data on one or more of the included domains were as follows: 0.4% due to depressive symptoms, 0% due to sex, 1.5% due to pubertal timing, 0.1% due to self-esteem, 2.1% due to parental closeness, 2.3% due to peer support, 14.8% due to Abuse Factor 1, 27.9% due to Abuse Factor 2, 0.5% due to neighbourhood safety, 6.8% due to parental SES, and 0.6% due to changes in household parental figures. Importantly, ACEs data was collected during the third and fourth waves, which included approximately 73% and 76% of participants from wave one, respectively. Given the larger percentage of missing data for the two Abuse factors, a two-sided *p*-value t-test was run to identify significant group differences between those who did and did not provide data on these items. These sample sizes were quite uneven. Accordingly, only those differences that were both significant ($p < .05$) and reflective of a small effect size of greater (i.e., Cohen's $d > .15$) are described. Participants with missing data for Abuse Factor 1 tended to endorse similar depressive symptom levels initially, then more from age 20-21 to age 28-29 ($d = .15$ to $.44$). They were also more likely to be male ($d = .22$) and have parents with lower SES ($d = .17$). Participants with missing data for Abuse Factor 2 tended to endorse similar depressive symptom levels, with the

exception of endorsing more at age 20-21 (d = .40). They were also more likely to be male (d = 1.7) and experience more changes to household parental figures throughout childhood (d = .16).

Data Analysis

The data were first transformed from wave-based to age-based and to include all data available across the ages of 12 to 29 years from the identified domains as described above (i.e., emotion regulation, biological sex, pubertal timing, self-esteem, ACEs, perceived parental closeness, friendship support, parental SES, perceived neighbourhood safety, and family array). This data transformation resulted in significant missing data for the continuous dependent variable (i.e., 9-item CES-D total score), which was addressed by binning two-year spans for a total of nine age-based time points (i.e., ages 12-13, 14-15, 16-17, 18-19. 20-21, 22-23, 24-25, 26-27, 28-29 years; Costello et al., 2008). The 18 independent variables (i.e., risk and protective factors) were: ACEs (2), biological sex (1), pubertal timing (1), self-esteem (1), perceived parental closeness (1), friendship support (1), parental SES (1), perceived neighbourhood safety (1), family array (1), and the interaction between experiencing any ACEs and the remaining independent variables (8). A correlation matrix was run to identify any multicollinearity between these 18 variables. Descriptive statistics were run using SPSS v.28. Growth mixture modeling (GMM) and additional descriptive statistics were run using Mplus v.8.4 statistical software (Bauer, 2003; Muthen & Muthen, 1998-2012). Robust maximum likelihood (MLR) estimation was used for missing data given that this estimator best accounts for the non-normality in the data. Modelling followed the recommended steps as outlined by Ram and Grimm (2009).

Growth models were constructed to determine the shape of the overall trajectory across time (i.e., growth factors) to be used in subsequent analyses. Fit statistics from a linear, quadratic, and cubic model of the included data were compared to determine the best estimated

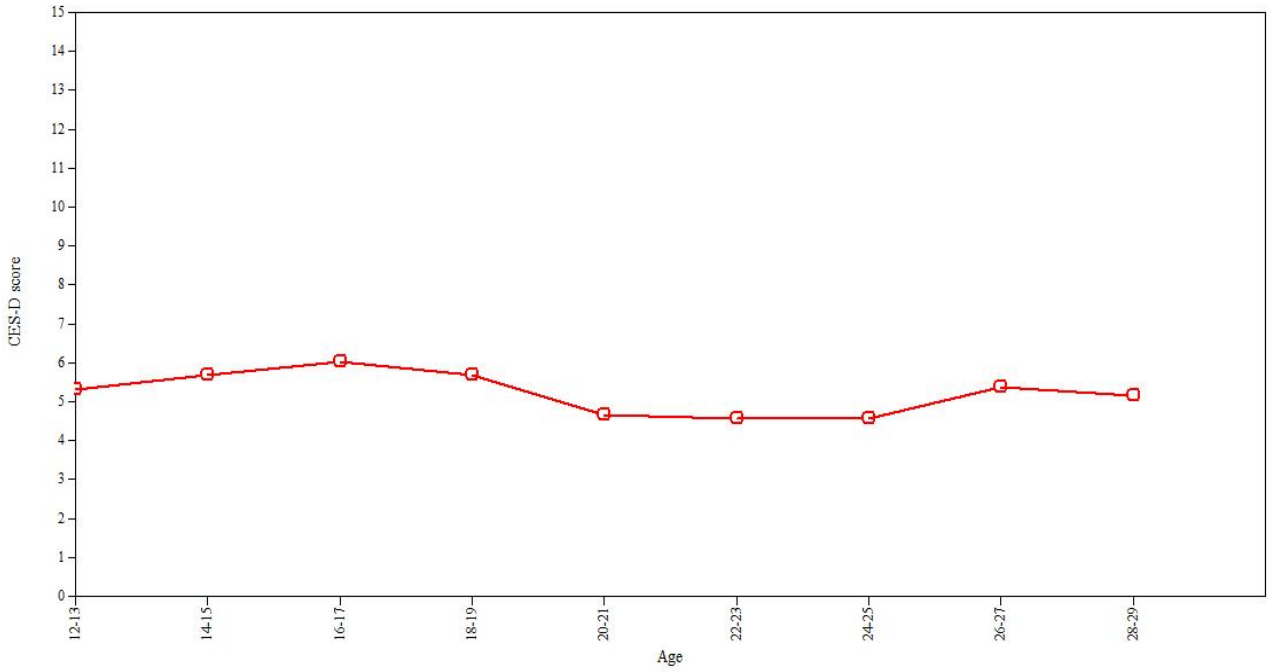
fit across time. GMMs were then fit to the data in order to represent linear and non-linear change at both baseline and across time (Bauer, 2003; Muthén & Muthén, 2000). Then, unconditional GMMs with 2, 3, 4, 5, and 6 latent categorical classes (i.e., trajectories) were fit to the data. Theoretical considerations, clinical considerations, and fit statistics were compared across models to determine the number of unique trajectory patterns that best estimated the data. Finally, a conditional GMM that regressed 10 independent non-interaction variables (i.e., time-invariant covariates that were not interactions) and eight independent interaction variables (i.e., time-invariant covariates that were interactions between ACEs and all other domains) on each categorical trajectory separately. Trajectory-specific means, intercepts, growth factors, and growth factor regression coefficients revealed any differential risk and protective factors associated with trajectory membership over time both independently and under conditions of having endorsed experiencing ACEs.

Results

A correlational matrix evaluated the linear relationship among the outcome variables and covariates across all participants, presented in Table 2 in the Appendix. Resulting correlations between covariates ranged from r = -.260 (i.e., between biological sex and peer support) to r = .271 (i.e., between perceived parental closeness and self-esteem). This indicated that multicollinearity was not present in the data as all correlations were smaller than .70 (Tabachnick & Fiddell, 2001). Longitudinal plotting of the mean depression score by age revealed a trajectory of low CES-D scores at baseline that increased from age 12-13 to age 16-17, decreased from 16-17 to 20-21, remained similar from 20-21 to 24-25, increased from 24-25 to 26-27, and finally decreased slightly to age 28-29 (see Figure 4 below).

Figure 4.

Mean Sample CES-D (Center for Epidemiologic Studies – Depression Scale, 9-item) Scores by Age



Importantly, the standard deviations at each time point were quite high, ranging from 3.8 to 4.2 (see Table 3 below), indicating statistically and clinically significant variability in depressive symptomatology at each time point. This variability confirmed that more sophisticated statistical analyses would be appropriate. A GMM was applied in a stepwise fashion as recommended by Ram and Grimm (2009).

Table 3.

Mean CES-D (Centres for Epidemiologic Studies - Depression Scale, 9-item) Score Descriptive Statistics by Age

Age	N	Mean	Standard Deviation	Maximum
12-13	2028	4.94	3.79	23
14-15	5814	5.56	4.04	27
16-17	7217	6.11	4.18	27
18-19	5110	5.72	4.21	27
20-21	4106	4.62	4.10	24
22-23	5133	4.64	4.10	26
24-25	3305	4.56	3.95	25
26-27	3317	5.24	4.11	26
28-29	4315	5.19	4.10	27

Growth Models

The plot pattern of mean depressive symptoms suggested a non-linear growth model would fit the data best, specifically, a quadratic (i.e., adding age^2) or cubic (i.e., adding age^2 and age^3) growth function model. Accordingly, a linear, quadratic, and cubic growth model were fit to the data and resulting fit indices were compared to find the best fitting model (see Table 4 below). Despite multiple model modifications, the cubic model could not be fit adequately to the data and was deemed inappropriate.

Table 4.

Model Fit Indices for Linear and Quadratic Growth Models

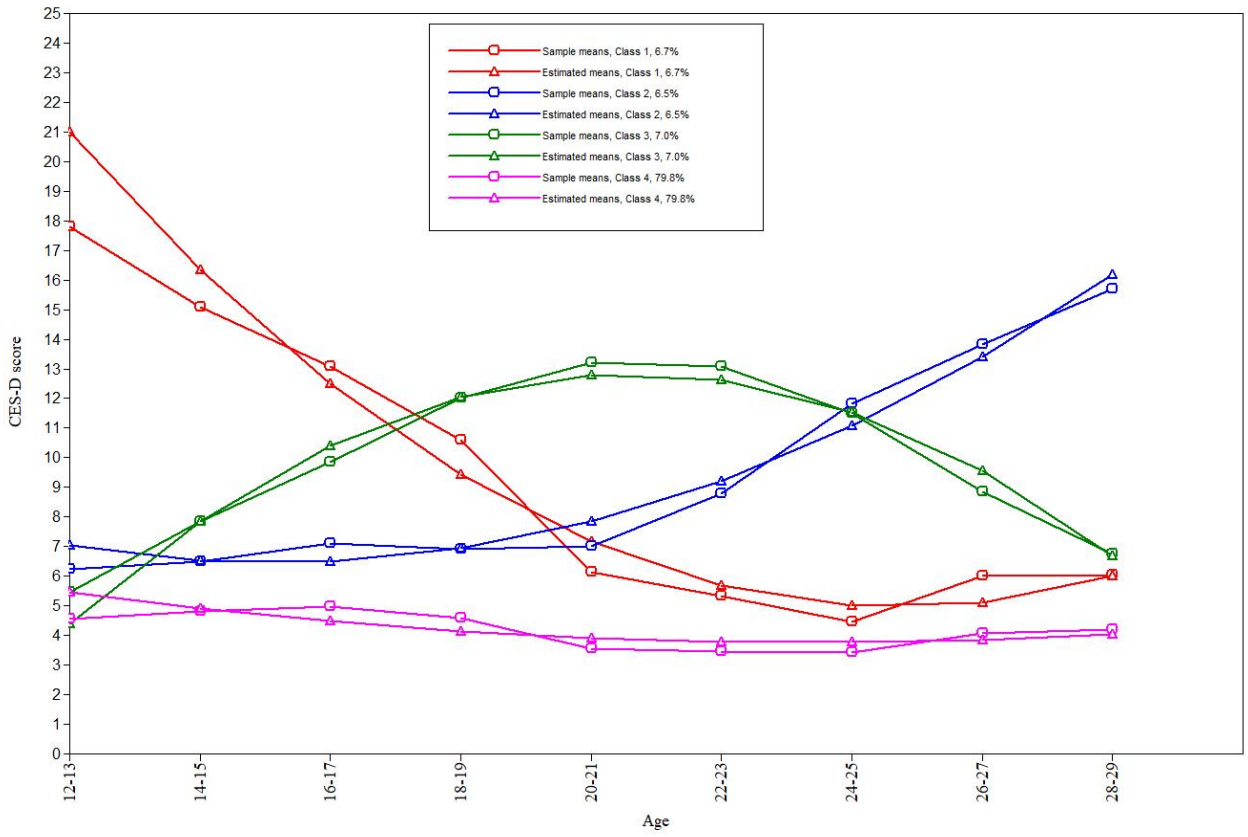
Growth Model	MLL[a]	SABIC[b]	AIC[c]	RMSEA[d] (90% CI)	SRMR[e]	CFI[f]	TLI[g]
Linear	-111589	223206	223146	.040 (.038 - .042)	.087	.831	.851
Quadratic	-111438	222989	222911	.037 (.034 - .040)	.082	.872	.872

[a] = Maximum loglikelihood; [b] = Sample-size adjusted Bayesian Information Criteria; [c] = Akaike Information Criteria; [d] = Root Mean Square Error of Approximation; [e] = Standardised Root Mean square Residual; [f] = Comparative Fit Index; [g] = Tucker–Lewis Index.

Both growth models had acceptable RMSEA values (< .06), SRMR values that approach the suggested cut-off value of < .08, and CFI and TLI values that approached the suggested values of > .95. Comparatively, maximum loglikelihood was greater for the quadratic model, and the SABIC and AIC were lower in the quadratic model. Complimenting this, the RMSEA, SRMR, CFI, and TLI values all reflected better fit for the quadratic model. Model fit indices indicate that a quadratic model has better goodness of fit to the data than a linear model. The quadratic growth function was applied in subsequent models.

Figure 5.

Four-class Unconditional Growth Mixture Model Estimated and Sample CES-D (Center for Epidemiologic Studies - Depression Scale, 9-item) Score Means by Age



Unconditional Growth Mixture Models

Previous research using latent class analysis or growth mixture modeling has typically found three or four trajectories. Accordingly, two, three, four, and five class unconditional GMMs were fit to the data and compared on model fit indices, theoretical considerations, and clinical considerations (Jung & Wickrama, 2008; Muthén & Muthén, 2000; Nylund et al., 2007). Across models, growth factors (i.e., latent variables specified by the intercept, linear slope, and quadratic slop) were unconstrained between classes with specification to be freely estimated within each class. Model fit indices for each unconditional GMM are presented in Table 5.

Table 5.

Model Fit Indices for Unconditional Growth Mixture Models

Classes	MLL[a]	SABIC[b]	AIC[c]	Entropy	VLMRT[d]	LMRT[e]	R-squared Min - Max	Posterior Probabilities
2	-110439	221018	220922	.852	$p < .001$	$p < .001$	.245 - .778	.987 .716
3	-109890	219945	219831	.817	$p < .001$	$p < .001$	.239 - .652	.976 .722 .586
4	-109531	219251	219122	.811	$p < .001$	$p < .001$	.179 - .744	.973 .678 .612 .569
5	-109310	218835	218688	.794	$p = .014$	$p = .015$	.028 - .761	.965 .790 .704 .561 .533

[a]MLL = Maximum loglikelihood; [b] = Sample-size adjusted Bayesian Information Criteria; [c] = Akaike Information Criteria; [d] = Vuong-Lo-Mendell-Rubin likelihood ratio test for *k*-1 classes; [e] = Lo-Mendell-Rubin adjusted likelihood ratio test for *k*-1 classes.

As the number of classes increases, the maximum log likelihood increases and the SABIC and AIC both decrease. Entropy decreases with increasing number of classes, dropping below the suggested cut-off of > .80 in the five-class model. Statistical testing comparing each unconditional GMM to an identical model with one fewer classes indicated that each contained an appropriate number of classes ($p < .05$). Posterior probabilities representing the likelihood of correct classification into a given trajectory did not always meet the suggested cut-off value of .700 (Costello et al., 2008). One normative trajectory was found across models. The two, three, and four class model posterior probabilities showed a bias to classify participants into the

normative trajectory when compared to other non-normative trajectories (< 5%). The five-class model posterior probabilities showed bias toward the normative and one non-normative trajectory. For this reason, as well as the smaller entropy value and smaller r-squared minimum, the five-class unconditional GMM was ruled out. A four class GMM was chosen for the conditional GMM given its goodness of fit indices, displayed in Figure 2. Although posterior probabilities are not all above the suggested cut-off, these values may improve when the covariates are added in the conditional GMM (Muthén & Muthén, 2000).

Theoretical and interpretive considerations also favoured the four-class model. Specifically, finding four classes is in line with most previous trajectory-based research. The four trajectories make their most significant changes at or near the middle of the chosen age range, reflecting late adolescence or the initial early adulthood years, which is consistent with developmental period theory and research. The distinctiveness of each trajectory lends them well to unique interpretation, and furthermore, the means of each of the three non-normative trajectories differ significantly from the normative trajectory. The final four-class quadratic GMM produced four trajectories described as: low (i.e., normative trajectory; n = 10, 709), low-increasing (n = 873), increasing-decreasing (n = 937), and high-decreasing (n = 895; see Figure 5 above).

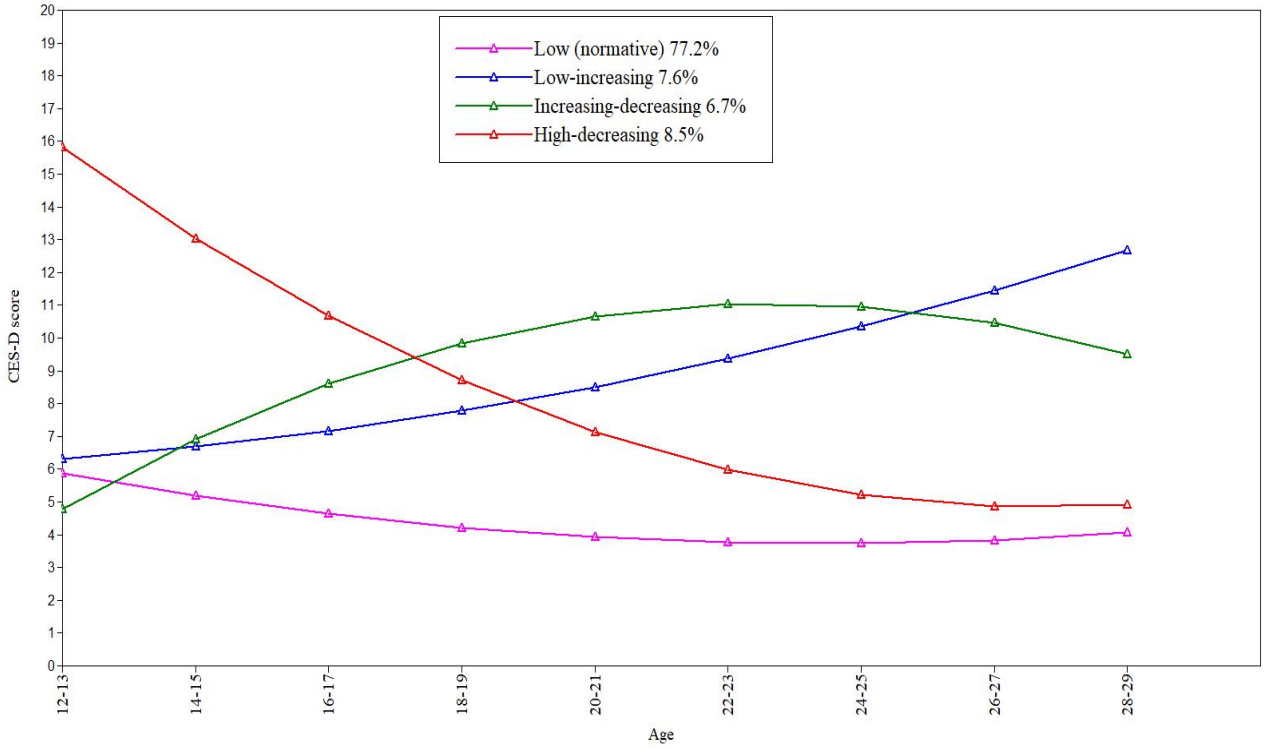
Conditional Growth Mixture Model

A conditional GMM was constructed from the four-class unconditional quadratic GMM by regressing each of the 18 time-invariant covariates described above on the growth factors (i.e., intercept, linear slope, and quadratic slope) within each of the four trajectories. This produced a model that estimates the influence (i.e., coefficients) each of the risk and protective factors have on depressive symptomatology at both baseline and over time separately for each

trajectory (i.e., unconstrained). The posterior probabilities were again not all above the suggested cut-off of .700, ranging from .461 to .970, and again tended to become pulled toward the normative trajectory. There was also some change in trajectory shape, such that the low-increasing trajectory increased less over time (n = 1016), the increasing-decreasing trajectory both increased and decreased less over time (n = 903), and the high-decreasing trajectory intercept was lower (n = 1139; see Figure 6 below). The normative trajectory maintained a similar shape (i.e., low; n = 10356).

Figure 6.

Four-class Conditional Growth Mixture Model Estimated CES-D (Center for Epidemiologic Studies - Depression Scale, 9-item) Score Means by Age



R-squared values estimating the amount of variance in observed (i.e., CES-D scores by age) and latent (i.e., intercept and growth factors) variables accounted for by the model and covariates are presented in Table 6 below.

Table 6.

R-squared Values for the Conditional Growth Mixture Model

Trajectory	Observed Variables									Latent Variables		
	12-13	14-15	16-17	18-19	20-21	22-23	24-25	26-27	28-29	I	S	Q
Low	80%	52%	34%	22%	21%	21%	29%	43%	72%	47%	24%	13%
Low-increasing	81%	59%	57%	58%	61%	58%	57%	65%	89%	51%	81%	87%
Increasing-decreasing	83%	53%	48%	47%	48%	39%	31%	59%	91%	55%	85%	90%
High-decreasing	95%	82%	64%	45%	40%	37%	40%	49%	79%	89%	88%	85%

The means for each of the 18 covariates are presented in Table 7 below. Specific to the 10 primary covariates, group means from the normative trajectory tended to be most similar to the overall group means. Overall and group means for the eight interaction covariates indicate the impact of ACEs (n = 4242) on the remaining eight variables. The interaction between ACEs and sex revealed that female participants were slightly overrepresented when compared to the overall sample. The interaction between ACEs and pubertal timing was not significantly different from the overall sample. The interaction between ACEs and self-esteem, perceived parental closeness, and parental SES all showed lower values when compared to the overall and group means. The interaction between ACEs and peer support, perceived neighbourhood safety, and change in household parental figures all showed higher values when compared to overall and

group means. Model estimates differed by trajectory and are described below (see Table 8 in the Appendix for complete model regression coefficients).

Table 7.

Sample Means and Conditional Growth Mixture Model Mean Estimates by Trajectory

Variable	Sample Means[a]	Trajectory			
		Low[b]	Low-increasing[c]	Increasing-decreasing[d]	High-decreasing[e]
Intercept	n/a	5.860	6.320	4.790	15.820
Linear growth factor	n/a	-.741	.299[a]	2.341	-2.977
Quadratic growth factor	n/a	.064	.062	-0.219	.202
Sex	.470	.481	.436	.417	.449
Pubertal Timing	3.212	3.204	3.246	3.238	3.237
Self-esteem	4.077	4.097	4.044	4.002	3.981
Abuse Factor 1	.250	.243	.272	.286	.262
Abuse Factor 2	.123	.118	.155	.138	.131
Parental Closeness	4.600	4.615	4.580	4.450	4.535
Peer Support	.696	.691	.713	.718	.707
Parental SES	.000	.027	-.106	-.134	-.046[f]
Neighbourhood Safety	.893	.897	.872	.860	.898
Family Array	1.595	1.582	1.646	1.655	1.613
ACE x Sex	.152	.154	.154	.144	.144
ACE x Pubertal Timing	.002	-.005[f]	.015[f]	.044[f]	.012[f]
ACE x Self-esteem	-.026	-0.17	-.021	-.069	-.075
ACE x Parent Closeness	-.045	-.038	-.036	-.073	-.086
ACE x Peer Support	.228	.220	.264	.268	.238
ACE x Parental SES	-.040	-.028	-.092[f]	-.101	-.052
ACE x Neighbourhood	.277	.270	.311	.300	.287
ACE x Family Array	.557	.537	.652	.641	.588

[a] = N = 13414; [b] = n = 10356; [c] = n = 1016; [d] = n = 903; [e] = n = 1139; [f] = non-significant at $p < .05$.

Low (normative) trajectory. Participants classified into this trajectory reported an initial mean CES-D score of 5.9 at age 12-13 years then decreased some until age 24-25 before

increasing slightly to approximately 4.1 at age 28-29 years (s = -.741, q = .064, both $p < .001$). R-squared results showed that the included covariates accounted for 20.7% to 80.1% of the variance in CES-D scores over time, and 13% to 47% of the variance in growth factors (all $p < .001$). Self-esteem, perceived parental closeness, and parental SES were all statistically significant on all growth factors, including the intercept (-2.713, -.857, -.467), linear slope (.614, .266, .113), and quadratic slope (-.046, -.022, -.011, respectively). Peer support and perceived neighbourhood safety were both statistically significant on the intercept (1.311, -1.676) and linear slope (-.308, .051, respectively). The interaction between having experienced any ACEs and self-esteem as well as neighbourhood safety were both statistically significant on the intercept (-.591, .797). The remaining covariates did not have a statistically significant effect on any of the growth factors.

This pattern of results indicates that the low initial CES-D scores are associated with self-esteem, perceived parental closeness, parental SES, perceived neighbourhood safety, and the interaction between having experienced an ACE and self-esteem. Higher initial scores within this trajectory were associated with peer support. The interaction between having experienced an ACE and perceived neighbourhood safety decreased the overall effect of neighbourhood safety, however, the degree of this effect allowed this factor (i.e., neighbourhood safety) to maintain its association with lower CES-D scores. Across adolescence, perceived neighbourhood safety is associated with an accelerated decrease in CES-D scores and peer support is associated with a slower decrease, although both effects wane into emerging adulthood. Self-esteem, perceived parental closeness, and parental SES are all associated with accelerated decreases in CES-D scores across both adolescence and emerging adulthood.

Low-increasing trajectory. Participants classified into this trajectory reported an initial mean CES-D score of 6.3 at age 12-13 years that increased to surpass clinically significant levels around age 18-21 years and continued to increase until age 28-29 years, when the mean CES-D score was approximately 12.7 (s = .299, *n.s.*, q = .062, $p < .001$). R-squared results showed that the included covariates accounted for 57% to 89% of the variance in CES-D scores over time, and 51% to 87% of the variance in growth factors (all $p < .001$). Self-esteem, abuse factor 2, peer support, parental SES, and the interaction between ACEs and parental closeness were all statistically significant on the intercept (-2.741, 2.575, 1.578, -.677, 1.874, respectively). Abuse factor 1, the interaction between ACEs and parental closeness, and the interaction between ACEs and peer support were all statistically significant on the linear slope (2.772, -1.411, 1.735), and quadratic slope (-0.411, 0.153, -0.198, respectively). The remaining covariates did not have a statistically significant effect on any of the growth factors.

This pattern of results indicates that the initially low CES-D scores are associated with higher self-esteem and parental SES, whereas experiencing abuse from factor 2, seeking peer support, and the interaction between having experienced an ACE and parental closeness were associated with higher initial CSE-D scores. Having experienced abuse described in factor 2 and the interaction between having experienced an ACE and peer support were associated with accelerated initial increases in CES-D scores, and the interaction between having experienced ACEs and parental support was associated with a slower increase in CES-D scores over time. These effects decreased slightly over time, however, did maintain their overall association with accelerating or decelerating CES-D scores across adolescence and emerging adulthood.

Increasing-decreasing trajectory. Participants classified into this trajectory reported an initial mean CES-D score of 4.8 at age 12-13 years that increased to surpass clinically significant

levels by age 20-21 years, continued to increase until age 22-23 years, and decreased thereafter until age 28-29 years, when the mean CES-D score dropped slightly below clinically significant levels to approximately 9.5 (s = 2.341, q = -.219, p < .001). R-squared results showed that the included covariates accounted for 31% to 91% of the variance in CES-D scores over time, and 55% to 90% of the variance in growth factors (all p < .001). Having experienced an ACE from factor 2 was statistically significant on the intercept (-2.033), linear slope (1.565), and quadratic slope (-.183). Having experienced an ACE from factor 1 was statistically significant on the linear slope (-4.958) and quadratic slope (.725). Neighbourhood safety was also statistically significant on the quadratic slope (.131). The remaining covariates did not have a statistically significant effect on any of the growth factors.

This pattern of results indicates that the initially low CES-D scores are associated with having experienced ACEs from factor 1. Having experienced ACEs as described in factor 2 then became associated with accelerated increase and increasingly decelerated decrease over time. Conversely, having experienced ACEs as described in factor 1 was associated with decelerated increase and increasingly accelerated decrease in CES-D scores over time. Perceived neighbourhood safety was also associated with increasing deceleration in CES-D scores over time.

High-decreasing trajectory. Participants classified into this trajectory reported an initial mean CES-D score that was clinically significant. 15.8, at age 12-13 years, decreased to below clinically significant levels by age 18-19 years, continued to decrease until age 26-27 years before increasing very slightly at age 28-29, when the mean CES-D score was approximately 4.9 (s = -2.977, q = .202, p < .001). R-squared results showed that the included covariates accounted for 37% to 95% of the variance in CES-D scores over time, and 85% to 89% of the variance in

growth factors (all $p < .001$). Self-esteem and abuse factor 1 were both statistically significant on the intercept (-6.101, -6.770), linear slope (1.854, 4.027), and quadratic slope (-.151, -.445, respectively). Peer support, perceived neighbourhood safety, and family array were statistically significant on the intercept (5.115, -7.560, 1.906) and linear slope (-1.466, 2.603, -1.073, respectively). Parental closeness was also statistically significant on the intercept (-2.137). The interaction between having experienced ACEs and peer support was significant on the linear slope (-4.664) and quadratic slope (.527). Abuse factor 2 and the interaction between having experienced ACEs and family array were both statistically significant on the quadratic slope (0.287, -.144, respectively). The remaining covariates did not have a statistically significant effect on any of the growth factors.

This pattern of results indicates that the initial CES-D scores, which were clinically significant, were associated with lower self-esteem, experiencing ACEs described by factor 1, less perceived parental closeness, seeking peer support, perceiving the neighbourhood as unsafe, and experiencing changes in household parental figures. Higher self-esteem, having experienced abuse as described by factor 1, and perceived neighbourhood safety were associated with decreasing CES-D scores whereas seeking peer support, changes in household parental figures, and the interaction between having experienced ACEs and peer support were associated with a slower decrease in CES-D scores. Over time, higher self-esteem, having experienced abuse as described by factor 1, and the interaction between having experienced ACEs and changes to household parental figures were associated with increasing deceleration of CES-D scores, whereas experiencing abuse as described by factor 2, experiencing changes in household parental figures, and the interaction between having experienced ACEs and seeking peer support were associated with a slower decline in CES-D scores.

Discussion

The objective of the present study was to investigate emotion regulation (Gross & Thompson, 2007), as measured by depressive symptoms, throughout adolescence (i.e., 12-18 years old) and emerging adulthood (i.e., 18-29 years old) in those with and without disclosed ACEs using a representative community sample. The study had four aims. First, it investigated whether there are different developmental trajectories of emotion regulation across time, as represented by depressive symptoms. Second, it evaluated the between-trajectory differences in multisystemic factors, including ACEs, biological sex, pubertal timing, self-esteem, perceived parental closeness, perceived friendship support, family array, parental socioeconomic status, and perceived neighbourhood safety between each trajectory at both the intercept and the end point. Third, it investigated the influence of these risk and protective factors at baseline and across time within each trajectory. Fourth, it investigated whether having experienced ACEs changes the influence of the remaining risk and protective factors directly at both baseline and over time.

These aims were addressed using a large national database, the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris et al. 2009), which provides longitudinal data for a breadth of variables across the developmental periods of adolescence and emerging adulthood. Data collected throughout the first four waves were transformed from wave-based into age-based, then binned into two-year spans to reduce missing data, resulting in data for ages 12-13 through to 28-29. Growth mixture modelling was then applied in a stepwise fashion (Ram & Grimm, 2009) to model the different pathways (i.e., classes or trajectories) of emotion regulation development, as measured by depressive symptoms, over time in the context of individual, relational, and environmental variables both independently and in combination

with having experienced ACEs. Previous literature points to the importance of these developmental periods as well as the included multisystemic factors on the development of emotion regulation.

Summary of Results

Overall, rates of depressive symptoms across adolescence and emerging adulthood were found to be low. Over time, emotion regulation showed a non-linear (i.e., quadratic) developmental pathway with CES-D scores increasing after age 12-13 until age 16-17, after which they begin decreasing until age 24-25 before increasing again until age 28-29. However, depression scores varied greatly at every time point, which suggested that a single trajectory may not be accurately representing the developmental pathway of emotion regulation for all youth. With this in mind, a person-centered statistical approach (i.e., GMM) was adopted in order to identify unique pathways (i.e., classes or trajectories) of individuals whose depression scores change across time similarly within their group but differently than any other group identified (Muthén & Muthén, 2000). Essentially, this approach facilitated a more accurate representation of the unique developmental pathways of emotion regulation within a multisystemic context.

The first hypothesis of identifying a minimum of three distinct trajectories was supported. Model fit indices suggested that the four-class model best represented the data in comparison to a two-class, three-class, or five-class model (see Table 5). The four-class model was in line with previous research reviewed above and presented four distinct trajectory shapes that each provided clinically relevant information, and so was accepted as the basis for the conditional GMM that incorporated contextual variables. These four trajectories were named based on their shape over time: low (i.e., normative); low-increasing; increasing-decreasing; and high-decreasing (see Figure 6). This finding is consistent with previous research by showing that four

unique trajectories are representative of the developmental pathways of emotion regulation across the sensitive periods of adolescence or emerging adulthood (e.g., Costello et al., 2008; Dekker et al., 2007; Frye & Liem, 2011; Mezulis et al., 2014; Sterba et al., 2007). The shape of the trajectories generally confirms previous findings. It extends previous research by confirming these trajectories do span across 17 years, from the beginning of adolescence to the end of emerging adulthood.

The second hypothesis was generally supported, with the normative trajectory means showing a pattern of increased levels of protective factors and decreased levels of risk factors when compared to the three non-normative trajectories. Specifically, the means across trajectories (see Table 7) show that youth in the normative trajectory are slightly less likely to endorse having experienced (an) ACE(s), perceive experiencing pubertal slightly more similarly in timing to their peers, experience slightly more self-esteem, perceive their parental relationship as slightly closer, have parents with higher SES, perceive their neighbourhood as just as safe or slightly safer, and experience slightly fewer changes in household parental figures. Unexpectedly, the normative trajectory also included more female participants than non-normative trajectories, and these youth also sought peer support slightly less frequently.

Not all of the included factors showed a reliable association with emotion regulation across adolescence and emerging adulthood. Identified biological sex and perceived pubertal timing both did not reliably confer significant risk or protection for emotion regulation in any trajectory. This was surprising given the amount of literature emphasizing the importance of biological sex leading to the hypothesis that having a biological sex of male would be protective (e.g., Bearman & Stice, 2008; Carter, 2014; Gonçalves et al., 2019; & Rawana & Morgan, 2013). This finding does not offer support for the gender additive model (Bearman & Stice, 2008).

Rather, it seems to undermine that there are inherent gender-invariant risks as well as gender-specific risks to emotion regulation at the group level. It may be that the outcome of emotion dysregulation is better accounted for by the additional multisystemic factors in the model as opposed to gender per se, which is in line with the integrated model (Schwartz et al., 2007). In other words, with increased context, biological sex is no longer a risk or protective factor for emotion regulation development. The same can be said for perceived pubertal timing. Despite most literature finding a link between perceived pubertal timing and emotion regulation development (e.g., Black & Klein, 2012; Carlo et al., 2012; Crockett et al., 2013; & Mendle et al., 2017), the current study adds to those that did not (e.g., Gaysina et al., 2015; Opoliner et al., 2014).

The role of friendship support as a protective interpersonal emotion regulation factor was consistently the opposite of what was hypothesized, acting as an indicator of risk as opposed to acting protectively (e.g., Brady et al., 2009; Kochel et al., 2012; Traylor et al., 2016). This finding adds to the growing literature that finds no (Gariépy et al., 2016; Willburn & Smith, 2009) or a detrimental association (La Greca & Harrison, 2010) between seeking friendship support and emotion regulation development.

The remaining five independent factors of self-esteem, perceived parental closeness, parental SES, perceived neighbourhood safety, and changes in household parental figures, showed reliably significant risk or protective influence in the anticipated directions. The 10 included factors were differentially influential on emotion regulation development by trajectory, as is described below. Importantly, these differential effects may help to explain any mixed findings in the literature.

The experience of ACEs specifically did have an effect on the level and influence of the included factors, above and beyond their direct effects. Specifically, having experienced ACEs was more likely for female youth than male youth when compared to the overall distribution of the sample, consistent with the gender additive model (Bearman & Stice, 2008), although this gender difference was small. Having experienced ACEs was also associated with somewhat lower self-esteem, perceived parental closeness, parental SES, and perceived neighbourhood safety. It was also associated with seeking out more peer support and more changes to household parental figures over time. Among those who endorsed having experienced (an) ACE(s), perceived pubertal timing was not significantly different from those who had not endorsed this experience. This, too, was unexpected given a relationship has been found in the literature (Sumner et al., 2019). This discrepancy may be due to measurement and conceptualization differences regarding ACEs, as they were measured and grouped differently in the current study. Nonetheless, the current finding offers an important perspective on the influence of ACEs on perceived pubertal timing within a multisystemic, integrated framework to a relatively new area of study.

Not all of these differences showed a reliable association with emotion regulation development across adolescence and emerging adulthood, either. Under the condition of endorsing (an) ACE(s), biological sex, pubertal timing, and parental SES all did not show a significant relationship with emotion regulation development in any trajectory. This is an important contribution as it suggests that, in a multisystemic, integrated framework, after having experienced an ACE, both biological sex and pubertal timing continue to not significantly impact emotion regulation development. In addition, under these same conditions, parental SES unexpectedly does not further impact emotion regulation development (i.e., is not a specific risk

factor; Chung et al., 2016). These are important perspectives on the interaction between ACEs and biological sex, perceived pubertal timing, and parental SES within a multisystemic, integrated framework to a relatively new area of study.

Of those that did, self-esteem showed a protective influence whereas seeking peer support and changes in household parental figures conferred a risk to emotion regulation development. The remaining factors of perceived parental closeness and neighbourhood safety showed variable influences on emotion regulation development. The differential relationships are described below by trajectory. Importantly, these differential effects may help to explain any mixed findings in the literature.

Trajectories of Emotion Regulation

Low (normative) trajectory. Youth classified into this trajectory (77%) showed effective emotion regulation throughout adolescence and emerging adulthood. The mean depressive symptom score began low in early adolescence and remained well below clinically significant levels until the end of emerging adulthood. Initially, for youth with this developmental pathway, self-esteem, perceived parental closeness, parental SES, and perceived neighbourhood safety have been protective. In addition, if an ACE has occurred, self-esteem has been particularly protective and perceived neighbourhood safety became less protective. On the other hand, at the time adolescence begins, having sought out support from a friend has been a risk factor. As the process of emotion regulation continues to develop, self-esteem, perceived parental closeness, and parental SES continue to be particularly protective across both adolescence and emerging adulthood. Perceived neighbourhood safety also continues to be an important protective factor, although this protection wanes into emerging adulthood. Alternatively, seeking support from a friend continues to confer risk across adolescence but

begins to wane into emerging adulthood. Importantly, this is the only developmental pathway wherein there were no direct effects of having experienced either type of ACE on emotion regulation development, and the indirect effects were overall protective.

Low-increasing trajectory. Youth classified into this trajectory (8%) showed effective emotion regulation in early adolescence but increasing difficulty regulating emotion across adolescence that, on average, become clinically significant in emerging adulthood. Initially, for youth with this developmental pathway, self-esteem and parental SES had been protective. However, these two factors did not maintain protection over time. On the other hand, having experienced sexual abuse, physical neglect, or social services involvement as well as having sought support from a friend, and perceiving the parental relationship as close when ACEs have been experienced had all conferred early risk. Throughout adolescence and emerging adulthood, these youth experience significant difficulty with the process of emotion regulation. During this time, perceiving the parental relationship as close when ACEs have been experienced becomes the only protective factor, and it loses some protection over time. Having experienced physical abuse, emotional abuse, or supervisory neglect as well as having sought support from a friend confer risk that also becomes less influential over time.

Within this developmental pathway, only direct and indirect impacts from ACEs were influential on the change in emotion regulation development over time. Furthermore, their effects were largely detrimental to emotion regulation, with the exception of perceiving a close relationship with a parental figure under the conditions of having experienced ACEs. The finding that this initially confers risk may reflect the role of parental figures in the ACE, given that ACEs, by nature, are likely to occur in or near the home environment. It is also possible that feeling close to a parental figure, as is normative in childhood, creates challenges for emotion

regulation when such ACEs occur as there remains a feeling of closeness as well as a necessary dependency that the youth must balance with more difficult feelings towards the parental figure. Alternatively, if the parental figure was not responsible for the ACE, the youth may feel like confiding in the parental figure they feel close to, but doing so brings on challenges with emotion regulation.

Youth in this trajectory also experienced ACEs of physical abuse, emotional abuse, and/or supervisory neglect that became detrimental to their emotion regulation development over time. It is possible that this delay reflects that these types of ACEs are less immediately traumatic, in the sense that they cause less immediate emotion dysregulation, and/or youth engage in emotion regulation strategies that create and maintain avoidance. Regardless, these ACEs lead to increased and lasting emotion dysregulation for youth in this developmental pathway. In addition, there may also be important differences in the impact and context of the included ACEs from within these two factors that are not identifiable in the current study.

Increasing-decreasing trajectory. Youth classified into this trajectory (7%) showed early challenges with emotion regulation that became clinically significant throughout most of emerging adulthood before dropping just below clinically significant levels at the end of this developmental period. Initially, for youth in this developmental pathway, having experienced sexual abuse, physical neglect, and/or the involvement of social services had been protective. Across adolescence and emerging adulthood, this type of ACE then served as a risk to emotion regulation. Conversely, having experienced physical abuse, emotional abuse, or supervisory neglect conferred protection over time. Perceiving their neighbourhood as safe was an additional protective factor around emerging adulthood.

This is the only trajectory wherein self-esteem was not protective and seeking support from a friend was not a risk factor. Again there is a pattern of the two types of ACEs differentially affecting the initial emotion regulation status and the change in emotion regulation over time. However, youth in this trajectory experience an unexpected initial protective effect from childhood sexual abuse, physical neglect, and/or the involvement of social services that then becomes detrimental to emotion regulation across adolescence and emerging adulthood. It is possible that the initial protective effect reflects initial avoidance, as described before. It may also reflect that this type of ACE was not initially experienced as abuse or neglect initially, and became so over time. At the same time, having experienced physical abuse, emotional abuse, and/or supervisory neglect is protective for emotion regulation across adolescence and emerging adulthood. This lack of impact on emotion regulation may reflect that this type of ACE is easier for these youth to integrate into their existing schemas. As previously noted, there may also be important differences in the impact and context of the included ACEs from within these two factors that are not identifiable in the current study.

High-decreasing trajectory. Youth classified into this trajectory (9%) showed clinically significant challenges with emotion regulation throughout most of adolescence that improved over time and became effective throughout emerging adulthood. Initially, for youth in this developmental pathway, self-esteem, having experienced physical abuse, emotional abuse, and/or supervisory neglect, perceiving the parental relationship as close, and perceiving the neighbourhood as safe had all been protective. Conversely, seeking support from a friend and experiencing changes in household parental figures had conferred risk. This pattern was generally maintained over time. Self-esteem, having experienced physical abuse, emotional abuse, and/or supervisory neglect continued to be quite protective across adolescence and

emerging adulthood, with perceived neighbourhood safety and experiencing changes in household parental figures when ACEs have occurred also acting as protective factors. Conversely, seeking support from a friend when ACEs have been experienced and experiencing changes in household parental figures were continuing risk factors throughout adolescence and emerging adulthood. Additionally, seeking support from a friend was an early risk factor and having experienced sexual abuse, physical neglect, and/or social services involvement was a later risk factor.

In this developmental pathway, too, there is a pattern of the two types of ACEs differentially affecting the initial emotion regulation status and the change in emotion regulation over time. For these youth, too, having experienced physical abuse, emotional abuse, and/or supervisory neglect is protective for emotion regulation across adolescence and emerging adulthood. This lack of impact on emotion regulation may reflect that this type of ACE is easier for these youth to integrate into their existing schemas. Additionally, having experienced childhood sexual abuse, physical neglect, and/or the involvement of social services only becomes detrimental to emotion regulation near emerging adulthood. It is possible that initial avoidance, as described before, may cause this delay. It may also reflect that this type of ACE was not experienced as abuse or neglect initially, and became so over time. There may also be important differences in the impact and context of the included ACEs from within these two factors that are not identifiable in the current study.

Implications

The four unique developmental pathways of emotion regulation each with differential influences of multisystemic factors emphasize the importance of person-centered analyses that incorporate individual differences across systems (e.g., Bronfenbrenner, 1986). These analyses

allowed the current study to add a relatively new perspective to areas of emotion regulation research with conflicting findings. Namely, that the impact of traditionally labelled risk and protective factors change when in the context of each other (i.e., multisystemic integrated approach) and change differently within different developmental pathways. Such an approach and analysis improves ecological validity by becoming increasing closer to representing the interpersonal variability in emotion regulation development and the dynamic interplay experienced throughout this development. This approach requires larger sample sizes and more advanced statistical techniques; however, it is worthwhile to build a more individualized model that can provide a more accurate understanding across psychological processes and lead to a better understanding of emotion regulation development and more personalized and therefore effective identification, prevention, and intervention efforts. To this end, in the current study, incorporating individual, familial, relational, and environmental factors led to fewer individuals being classified in the normative trajectory. This is in line with developmental models (e.g., Bronfenbrenner, 1986; Sameroff, 2010) and the integrative approach (Schwartz et al., 2007) that emphasizes the role of context, including time, when investigating a process within a person.

Developmentally Sensitive Periods. The four different developmental pathways show differential impacts of transitioning from childhood into adolescence, from adolescence into emerging adulthood, and from early emerging adulthood into later emerging adulthood (Collins & Steinberg, 2006; Gross & Thompson, 2007; Kessler, 2011). The normative trajectory (77%) was also characterized by this pattern, although to a much lesser degree. This is consistent with both theory and research indicating that adolescence can be tumultuous for some youth (e.g., Kessler, 2011; Van Oort et al., 2009) and provides some support for emerging adulthood ending at age 25 as opposed to age 29 (e.g., Arnett, 2000; Arnett, 2010). Despite the vast majority of

youth (91%) transitioning from childhood into adolescence with effective emotion regulation, the most change was evident thereafter across adolescence. Specifically, while most adolescents experienced a slight improvement in emotion regulation over time (i.e., normative trajectory), three other pathways evidenced more extreme change. Two pathways emerged from otherwise effective emotion regulation at childhood to show increasing challenges, one more significantly than the other. A third pathway showed very clinically significant emotion regulation challenges at the transition out of childhood that improved to below clinical levels by the end of adolescence.

Emerging adulthood also involved change in emotion regulation development across trajectories but to a lesser degree than across adolescence, in line with developmental theories (e.g., Arnett, 2011). For most youth (i.e., normative trajectory; 77%), emotion regulation was effective and remained stable across this developmental period, with a very slight improvement at the beginning of, and very slight decrease near the end of, emerging adulthood. This general stability was not characteristic of the remaining three trajectories that entered into emerging adulthood with sub-clinical emotion regulation challenges. The patterns of change that began in adolescence continued into emerging adulthood, such that the two trajectories showing increasing challenges in emotion regulation continued to do so, in line with theory and previous research (e.g., Berzin, 2010; Chaiton et al., 2013; Compas et al., 2011; Kessler, 2011; Van Oort et al., 2009; and Weissman et al., 2019). These two developmental pathways showed clinically significant challenges at different times in emerging adulthood, with one showing more challenges early (i.e., increasing-decreasing) before returning to sub-clinical levels at late emerging adulthood, and one showing more challenges in late emerging adulthood (i.e., low-increasing) that persisted. This provides empirical evidence reflective of the disagreement about

when emerging adulthood ends at 25 years or at 30 years (e.g., Arnett, 2000; Arnett, 2010). At the end of emerging adulthood, most youth developed (16%) or maintained (77%) effective or subclinical emotion regulation. Importantly, challenges with emotion regulation in adolescence generally did not improve to the levels seen in the normative trajectory.

Taken together, these results provide additional evidence that both developmental periods serve as important sensitive periods for emotion regulation development (Collins & Steinberg, 2006; Gross & Thompson, 2007; Rutter, 1996; Schulenberg et al., 2004). Most youth maintain effective emotion regulation, however, both developmental periods encompassed risk for clinically significant challenges for different subgroups of youth. Results extend our current understanding by showing that youth with clinically significant emotion regulation challenges in adolescence were generally not the same youth experiencing clinically significant emotion regulation difficulties in emerging adulthood, which diverges from the current literature that assumes one elevated subpopulation across adolescence and emerging adulthood (Berzin, 2010; Chaiton et al., 2013; Compas et al., 2011; Kessler, 2011; Weissman et al., 2019). They do show that emotion regulation challenges in adolescence persist, to varying degrees, across emerging adulthood. Youth who experienced emotion regulation challenges in adolescence did not achieve or return to normative-level functioning in emerging adulthood, even when emotion regulation improved through this developmental period. Finally, results show that there is an important change in emotion regulation across the last few years of emerging adulthood, around age 26-27 years.

Risk and Protective Factors. The multisystemic contextual factors that were investigated included biological sex, perceived pubertal timing, self-esteem, having experienced two different types of ACEs (addressed in the following section), perceived parental closeness,

seeking peer support, parental SES, perceived neighbourhood safety, and changes to household parental figures. The low (i.e., normative) and high-decreasing trajectories are influenced by the highest number of different contextual factors. This may reflect the tendency to dichotomize research samples into normative or clinical. Throughout most of adolescence, only the high-decreasing trajectory looks significantly different from the remaining three trajectories. As a consequence, the research-supported multisystemic factors included in this study can be expected to preferentially explain these two trajectories (i.e., low and high-decreasing), highlighting the need for statistical analyses that are longitudinal and sophisticated enough to identify individual differences.

The multisystemic factors have differential effects on each pathway, with some similarities nonetheless, that tend to wane in influence as youth age. One of the strongest protective factors across trajectories was self-esteem, which is consistent with research (Carteret al., 2016; Orth et al., 2012). Also protective across more than one trajectory was having a close parental relationship (i.e., interindividual emotion regulation), parental SES, and perceiving the neighbourhood as safe, in early adolescence. The remaining multisystemic factors influenced emotion regulation development over time in the research-supported direction, acting as either protective or risk factors, in one or more trajectory. There were three exceptions to this. Both biological sex and perceived pubertal timing did not show any significant influence within any developmental pathway. This was not expected given the body of research supporting these factors as important for emotion regulation development. One explanation may be that the other non-biological factors (e.g., self-esteem, relational, neighbourhood, SES) account for enough of the variance often attributed to these more biological factors (e.g., moderate or mediate) that in this multisystemic context, they are no longer significantly contributing to emotion regulation

development across adolescence and emerging adulthood (e.g., Schwartz et al., 2007). In other words, perhaps biological sex and perceived pubertal timing influence their environment in ways that have been sufficiently accounted for by the included factors from other systems. Seeking peer support seemed to reflect distress and vulnerability as opposed to the protective effects hypothesized based on research. The operationalization of peer support with the Add Health item chosen was an inappropriate one for this concept. Furthermore, adolescent friends may not be in a position to be supportive of a youth in distress, and so attempts at interpersonal emotion regulation through friends during this developmental period may not be particularly effective (Zaki & Williams, 2013). Importantly, however, seeking support from a friend does seem to be a reliable indicator of difficulty with emotion regulation.

Role of ACEs. One multisystemic factor of particular interest, and with few developmental investigations (Kilmer et al., 2014; Meyerson et al., 2011), was ACEs. Across trajectories, some youth did experience one or both types of ACEs (i.e., physical abuse, emotional abuse, and/or supervisory neglect (25%), and sexual abuse, physical neglect, and/or social service involvement (12%)) and these ACEs did have a direct, indirect, or combined impact on emotion regulation development across adolescence and emerging adulthood. ACEs do not seem to have a direct effect on the normative trajectory of emotion regulation development, and only one indirect association through its relationship with less perceived neighbourhood safety. In combination with this pathway maintaining effective emotion regulation, this is consistent with the concept of resilience to the potentially traumatic impact of ACEs. Youth in this developmental pathway seem to experience resiliency in the face of ACEs. In other words, the protective factors noted seem to buffer the detrimental effects of ACEs to a degree that emotion regulation development can continue effectively.

Conversely, ACEs have a significant direct and indirect impact on emotion regulation development for the remaining three developmental pathways across both adolescence and emerging adulthood. In addition, specific relationships between ACEs and emotion regulation differed across these three trajectories, as described above. It is difficult to know what is driving these differential relationships given the ACEs measurement utilized in the current study, as differences in specific ACE type, timing, and chronicity (Cowell et al, 2015; Russotti et al., 2021) as well as their relationship with other risk and protective factors may all play a role that is unknowable in the current study. Within the two trajectories that increased across adolescence, the relative impact of the two types of ACEs on emotion regulation development switched when comparing baseline to change across these two developmental periods. To this end, youth in these trajectories go on to experience clinically significant emotion dysregulation in emerging adulthood. Furthermore, these trajectories (i.e., low-increasing and increasing-decreasing) show a pattern consistent with the concept of a maladaptive posttraumatic response. Youth in these developmental pathways seem to experience a maladaptive response following ACEs, reflecting that these were indeed traumatic. Importantly, one trajectory shows some signs of recovery, or growth, by the end of emerging adulthood (i.e., increasing-decreasing). Within the trajectory that begins with clinically significant emotion dysregulation, experiencing physical abuse, emotional abuse, and/or supervisory neglect was unexpectedly protective for emotion regulation development. The reasons for this, too, remains unclear, but this finding in combination with significant emotion regulation challenges from childhood, is consistent with the concept of posttraumatic growth. Youth in this developmental pathway seem to experience posttraumatic growth by emerging adulthood following their traumatic ACEs.

ACEs are associated with overall changes in the factors important for emotion regulation, generally, decreases in protective factors and increases in risk factors. Of note, this included reduced self-esteem and perceived parental closeness, and increased peer support, with all three changes conferring some degree of risk for emotion regulation challenges. This is in line with previous research. Under the condition of ACEs, biological sex, perceived pubertal timing, and parental SES did not have any additional significant influence on emotion regulation development. This was also unexpected given the literature; however, it may again be that the influence on emotion regulation development from these factors is better accounted for by their relationship with the remaining identified multisystemic factors.

Overall, most youth experience strengths that tend to promote emotion regulation resiliency in the face of ACEs. For almost a quarter of youth, experiencing one or more ACEs was associated with emotion dysregulation in adolescence or emerging adulthood. Youth with early emotion dysregulation seem to experience enough protective factors to promote posttraumatic growth by emerging adulthood. Youth without these protective factors become vulnerable to clinically significant emotion regulation difficulties in emerging adulthood.

Identification. These findings can aid in identification of youth at risk of emotion regulation difficulties. Specifically, they suggest that effective emotion regulation in adolescence is not always protective against emotion regulation challenges in the future. Although the majority of adolescents present without challenges, some can be expected to develop them over time. One clear indicator of risk for all youth is having sought support from a friend in the last week. This is an important indicator of distress and can be formally or informally screened for relatively easily across settings, including at home, in schools, community and private programs, health settings, and mental health settings. It may be particularly helpful for youth who are not

aware of or ready to disclose the source of their distress, as can happen when youth experience ACEs. Identifying those adolescents and emerging adults who have experienced one or more ACEs may be important, particularly when these youth do not report strong protective factors (e.g., self-esteem, close parental relationship, average or above parental SES, a safe neighbourhood, and stability in household parental figures). In addition, youth who have parents with a relatively lower SES, experience their neighbourhood as unsafe and experience changes in household parental figures may be identified as at-risk, particularly if these youth also experience ACEs.

Prevention. Prevention efforts can benefit children's emotion regulation development. These efforts may best be targeted to childhood in order to be most effective. Promoting self-esteem and a close parental relationship can be beneficial for all youth, and protective against emotion regulation challenges. Self-esteem can be promoted by getting youth involved in extra-curricular or curricular activities that they do well in and enjoy, encouraging skill development in an area important to the youth, and discouraging social comparison, for example. Promoting a close parental relationship may involve having parents involved in those enjoyed activities, spending formal and informal time together, and encouraging effective communication patterns, for example. Once a youth has been identified as seeking support from a friend, it may be preventative for adults in that youth's life to develop a stronger relationship with the youth, one that they can be comfortable confiding in. Through this relationship, additional risk factors may be identified and mitigated, if possible, and protective factors can be developed or bolstered. Prevention can also occur at through parenting programs and resources that target the parent-child relationship as well as awareness of the potential impact of the above-mentioned factors, ACEs, changes to household parental figures, and neighbourhood safety. Increased awareness of

the effect of these on emotion regulation development may be helpful and can lead to a more purposeful and sensitive actions. Prevention can also occur at the governmental level in the form of increased financial, mental health, and social support for struggling families, as low parental SES is a risk factor and this support may also benefit the parent-child relationship.

Intervention. Intervention is appropriate for youth experiencing clinically significant emotion regulation challenges. Early intervention may be important given the lasting or worsening effects having experienced emotion dysregulation at any time across adolescence and emerging adulthood. These youth and their families may benefit from more individualized help to promote protective factors, including self-esteem, a close parental relationship, and stable household parental figures, particularly if the youth experienced ACEs. Intervention may be more beneficial if these areas are targeted directly. For example, a professional can work together with the family or parents to discover and facilitate things the youth can do to improve self-esteem; to improve communication and positive interactions between the parent and child; and to sensitively approach the youth through the process of changes in household parental figures occur, if possible. Importantly, this approach can be helpful transdiagnostically (e.g., Gross et al., 2019; Kring & Sloan, 2009; Neacsiu et al., 2014).

When ACEs have occurred, the parent-child relationship can become more important and may warrant additional resources through intervention to improve. Changes to household parental figures may be necessary given the type of ACEs experienced, which can be helpful for emotion regulation development over time. Neighbourhood safety may also need to be addressed, if possible, for the same reason. Youth who seek support from their friends after experiencing ACEs may benefit from redirecting their support-seeking to professionals or other trustworthy adults. Specific to ACEs, there are many different formal interventions that aim to

help the youth process the trauma and integrate what happened to them in a way that reduces the overwhelming impact of the ACEs on emotion regulation development. These interventions range in their directness, from the direct approaches of trauma-focused CBT (e.g., Cary & McMillen, 2012), to EMDR (Shapiro, 1995), to the indirect approach of art therapy e.g., Berberian & Davis, 2019), for example. Given that experiencing ACEs has a particularly lasting effect on emotion regulation development, emotion regulation may need to be directly targeted through intervention. Emotion regulation is targeted across many different therapeutic approaches, including trauma-focused CBT, and this alone or in combination with targeting ACEs and/or protective factors may help to buffer the impact of ACEs. Also for intervention, government may play a helpful role by funding or reimbursing the cost of these interventions, particularly as lower parental SES is a risk factor and these families are less likely to have the means to access private intervention.

Limitations and Future Research

There are limitations to the current study. This study used the Add Health database that typically employs truncated measures or single-item indicators in its emphasis on breadth of information. As was seen with the operationalization of close friendships, these Add Health measures may not always be complete or appropriately reflective of the intended concept. Another example concerns the perceived parental closeness item, which was coded based on the closest self-reported parental figure of up to two parental figures, which may impact reliability. However, these limitations were outweighed by the large sample of youth that is nationally representative, use of a longitudinal design, and the collection of information across a wide array of factors similarly at each data collection point. This lent the data particularly well to the dynamic developmental theoretical models applied through GMM, leading to an increased

understanding of the dynamic interplay of multisystemic factors over time. Future research can address this limitation by further investigating these relationships with more robust measures. Classification accuracy was below the suggested .700 cutoff for three trajectories. Classification using Bayseian statistics to find the most likely trajectory an individual belongs to based on prior information. This prior information is heavy loaded on the normative trajectory, which may have had an impact on classification accuracy. To this end, most or the remaining probability loaded on the normative trajectory. Taken together with the four-class model providing theoretically and clinically relevant information, the four-class model was chosen. The four-class model also provided more individualized information about the dynamic interplay of multisystemic factors. Future research should focus on improving posterior probabilities to lead to more accurate classification indices.

In the current study, risk and protective factors were selected based on literature showing a potentially dynamic relationship among multisystemic factors as well as database and statistical constraints. For example, interactions were limited in order to abide by suggested ratios for participants to freely estimated parameters (Kenny, 2015; Bentler & Chou, 1987). Furthermore, ACEs were operationalized in a way that was consistent with literature and provided a rich overview but nonetheless prevented a more nuanced understanding of the relationship between individual ACEs and emotion regulation development. While the current study does approximate a more ecologically valid representation of personal context and help clarify why current research has many mixed findings, future research may aim to further improve our understanding of emotion regulation development by including additional factors and the impact of changes in these factors over time and investigating the mechanism of action these associations have. This is

particularly true for youth who experience clinically significant emotion dysregulation in emerging adulthood (i.e., increasing-decreasing & low-increasing trajectory).

Conclusion

Current study findings show that most youth share a similar, effective emotion regulation development pathway across adolescence and emerging adulthood (77%). Those that diverged from this normative pathway showed significant and important differences in their pattern of emotion regulation development across time and context. Adolescence and emerging adulthood are indeed sensitive periods for emotion regulation development, and the different trajectories bore that out. Adolescents with clinically significant emotion dysregulation (9%) typically improved by emerging adulthood to near-normative emotion regulation, contrary to typical research findings. Youth experiencing increasing emotion regulation challenges across adolescence did develop clinically significant challenges at some point during emerging adulthood, where this elevation then become sub-clinical (7%) or continued to decline (8%). Overall, adolescence involved more changes in emotion regulation trajectories and informed emotion regulation outcomes in emerging adulthood, in line with current research. Additionally, adolescence informed emerging adulthood emotion regulation development through multisystemic factors. Although there were differences across trajectories, self-esteem, perceived parental closeness, and perceived neighbourhood safety most tended to be protective, whereas seeking support from a friend, experiencing ACEs, and changes to household parental figures tended to confer vulnerability. Some of these patterns were unexpected. Also contrary to current literature, biological sex and pubertal timing did not impact emotion regulation within any trajectory, likely due to the additional multisystemic factors accounting for the influence typically assigned to biological sex and/or pubertal timing. Furthermore, the impact of ACEs is

particularly lasting in those youth whose emotion regulation develops atypically at any point across adolescence and emerging adulthood. The patterns of ACE impact lend support to the three unique outcomes of trauma as described in the literature, specifically, that the typical response may be resilience (i.e., normative trajectory), that some youth experience posttraumatic growth over time (i.e., high-decreasing), and that some youth develop a lasting maladaptive response (i.e., increasing-decreasing and low-increasing). Taken together, these findings can be used to help identify at-risk youth, develop and implement preventative measures, and intervene more effectively.

That there were differential impacts of risk and protective factors on the multiple developmental pathways strongly supports the multisystemic and integrated models, and highlights that the added resources required for a person-centered developmental longitudinal investigation of psychological processes are worthwhile and necessary. Research that assumes a normative and a clinical sample, each with only one trajectory, and/or perhaps even a linear relationship, may overlook important subgroup-specific information, which may prevent clearly understanding this developmental process. Indeed, this may be a source of conflicting findings. Additionally, characteristics and aspects of an individual's life that are often 'controlled for' in some research were included directly in the analyses. Findings point to these being important aspects to include in the analysis itself in order to understand the important relationships more accurately for a given outcome.

This was one of the first studies to include participants followed across these two stages that are particularly important for emotion regulation development directly, to investigate the role of multisystemic factors across different subpopulations, and to investigate ACEs through a developmental and integrated framework. The study also incorporates a developmental and

bioecological perspective, while integrating developmental psychopathology, positive youth development, and an integrated framework (i.e., differential susceptibility), in order to further understand the dynamic processes involved from a person-centered perspective. This strengthened the ecological validity of the current study, which enhances the understanding of emotion regulation development, helps clarify mixed research findings, furthers the understanding of ACEs, and improves the accuracy and effectiveness of evidence-based applications.

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Appendix

Table 2.

Linear Correlation Values Among Outcome Variable by Age and Covariates.

	CESD 12-13	CESD 14-15	CESD 16-17	CESD 18-19	CESD 20-21	CESD 22-23	CESD 24-25	CESD 26-27	CESD 28-29	Sex	Puberty	Self-Esteem	Parental Closeness	Peer Support	Abuse Factor 1	Abuse Factor 2	Neighbourhood Safety	Parental SES
CESD 14-15	.608																	
CESD 16-17	.464	.554																
CESD 18-19	.448	.414	.561															
CESD 20-21	.298	.351	.382	.530														
CESD 22-23	.242	.317	.339	.369	.302													
CESD 24-25	.294	.253	.296	.363	.406	.199												
CESD 26-27	.301	.341	.373	.439	.381	.339	.223											

	CESD 12-13	CESD 14-15	CESD 16-17	CESD 18-19	CESD 20-21	CESD 22-23	CESD 24-25	CESD 26-27	CESD 28-29	Sex	Puberty	Self-Esteem	Parental Closeness	Peer Support	Abuse Factor 1	Abuse Factor 2	Neigh-bourhood Safety	Parental SES
CESD 28-29	.250	.303	.330	.380	.432	.408	.305	.266										
Sex	-.123	-.177	-.150	-.131	-.097	-.074	-.114	-.125	-.092									
Relative Puberty	-.005	.008	.011	-.037	-.024	-.022	-.029	-.004	-.013	-.023								
Self-Esteem	-.502	-.436	-.405	-.340	-.195	-.162	-.172	-.219	-.175	.167	-.001							
Parental Closeness	-.272	-.239	-.201	-.169	-.134	-.080	-.079	-.131	-.095	.111	-.023	.271						
Peer Support	.176	.195	.147	.128	.064	.048	.014	.042	.029	-.260	.096	-.100	-.107					
Abuse Factor 1	.116	.111	.110	.099	.148	.119	.093	.152	.113	-.005	.029	-.093	-.149	.055				
Abuse Factor 2	.092	.117	.135	.136	.152	.168	.149	.131	.128	.012	-.022	-.043	-.053	-.003	.182			
Neigh-bourhood Safety	-.160	-.138	-.147	-.130	-.116	-.098	-.076	-.132	-.116	.024	.036	.072	.035	-.009	-.019	-.059		
Parental SES	-.174	-.169	-.133	-.157	-.117	-.099	-.132	-.165	-.145	.020	.057	.037	.013	.056	-.013	-.126	.140	

	CESD 12-13	CESD 14-15	CESD 16-17	CESD 18-19	CESD 20-21	CESD 22-23	CESD 24-25	CESD 26-27	CESD 28-29	Sex	Puberty	Self-Esteem	Parental Closeness	Peer Support	Abuse Factor 1	Abuse Factor 2	Neighbourhood Safety	Parental SES
Family Array	.101	.105	.081	.063	.095	.076	.057	.071	.087	-.010	.014	-.047	-.085	.046	.124	.130	-.046	-.174

Table 8.

Conditional Growth Mixture Model Regression Coefficient Results by Trajectory

Outcome	Covariate	Trajectory			
		Low[a]	Low-increasing[b]	Increasing-decreasing[c]	High-decreasing[d]
	Intercept	5.86*	6.32*	4.79*	15.82*
Initial Status, π_{0i} (intercept)	Sex	-0.002	0.116	-1.352	-1.007
	Pubertal Timing	-0.008	0.315	-0.144	-0.249
	Self-esteem	-2.713*	-2.741*	-2.322	-6.101*
	Abuse Factor 1	-0.113	0.377	2.766	-6.770*
	Abuse Factor 2	0.370	2.575*	-2.033*	-1.952
	Parental Closeness	-0.857*	-0.525	-0.641	-2.137*
	Peer Support	1.311*	1.578*	1.353	5.115*
	Parental SES	-0.467*	-0.677*	-0.054	-0.660
	Neighbourhood Safety	-1.676*	-1.101	0.509	-7.560*
	Family Array	0.139	-0.158	0.181	1.906*
	ACE x Sex	-0.161	-1.892	0.960	-0.950
	ACE x Pubertal Timing	-0.030	-0.516	0.547	-0.113
	ACE x Self-esteem	-0.591*	0.542	-0.808	1.165
	ACE x Parent Closeness	0.123	1.874*	-0.154	0.210
	ACE x Peer Support	0.200	-2.062	0.448	7.042
	ACE x Parental SES	0.023	-0.026	-0.105	1.133
	ACE x Neighbourhood	0.797*	-0.940	-1.836	3.754
	ACE x Family Array	-0.177	0.214	0.286	-1.655
Rate of Change, π_{1i} (linear slope)	Age	- .741*	0.299	2.341*	-2.997*
	Sex x Age	-0.063	0.150	-0.333	0.296

Outcome	Covariate	Trajectory			
		Low[a]	Low-increasing[b]	Increasing-decreasing[c]	High-decreasing[d]
	Pubertal Timing x Age	-0.040	-0.190	0.324	-0.058
	Self-esteem x Age	0.614*	-0.153	0.581	1.854*
	Abuse Factor 1 x Age	0.137	2.772*	-4.958*	4.027*
	Abuse Factor 2 x Age	0.237	-0.450	1.565*	2.311
	Parental Closeness x Age	0.266*	0.304	0.226	0.470
	Peer Support x Age	-0.308*	-0.418	-0.481	-1.466*
	Parental SES x Age	0.113*	0.185	-0.146	0.087
	Neighbourhood Safety x Age	0.284*	-0.319	-0.868	2.603*
	Family Array x Age	-0.019	0.049	0.070	-1.073*
	ACE x Sex x Age	-0.033	0.271	0.662	0.143
	ACE x Pubertal Timing x Age	-0.018	0.098	-0.489	0.280
	ACE x Self-esteem x Age	0.181	0.535	-0.023	-0.530
	ACE x Parent Closeness x Age	-0.053	-1.411*	-0.026	0.276
	ACE x Peer Support x Age	0.000	1.735*	-0.477	-4.664*
	ACE x Parental SES x Age	-0.021	0.060	0.258	-0.425
	ACE x Neighbourhood x Age	-0.206	1.069	1.117	-1.219
	ACE x Family Array x Age	0.051	-0.346	-0.430	1.149
Rate of Change, π_{2i} (quadratic slope)	Age^2	.064*	.062*	-0.219*	0.202*
	Sex x Age^2	0.001	-0.707	0.053	-0.020
	Pubertal Timing x Age^2	0.004	0.025	-0.045	0.001
	Self-esteem x Age^2	-0.046*	0.049	-0.032	-0.151*
	Abuse Factor 1 x Age^2	-0.008	-0.411*	0.725*	-0.445*
	Abuse Factor 2 x Age^2	-0.020	0.077	-0.183*	-0.287*
	Parental Closeness x Age^2	-0.022*	-0.029	-0.029	-0.023
	Peer Support x Age^2	0.015	0.007	0.034	0.101

Outcome	Covariate	Trajectory			
		Low[a]	Low-increasing[b]	Increasing-decreasing[c]	High-decreasing[d]
	Parental SES x Age^2	-0.011*	-0.034	0.017	-0.003
	Neighbourhood Safety x Age^2	-0.020	0.028	0.131*	-0.242
	Family Array x Age^2	0.000	-0.001	-0.011	0.127*
	ACE x Sex x Age^2	0.009	0.004	-0.101	-0.019
	ACE x Pubertal Timing x Age^2	0.004	-0.012	0.067	-0.041
	ACE x Self-esteem x Age^2	-0.018	-0.076	-0.001	0.052
	ACE x Parent Closeness x Age^2	0.005	0.153*	0.035	-0.059
	ACE x Peer Support x Age^2	0.000	-0.198*	0.072	0.527*
	ACE x Parental SES x Age^2	0.005	0.004	-0.029	0.045
	ACE x Neighbourhood x Age^2	0.012	-0.154	-0.140	0.168
	ACE x Family Array x Age^2	-0.005	0.039	0.062	-0.144*

[a] = n = 10356; [b] = n = 1016; [c] = n = 903; [d] = n = 1139.