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Regular Article

Longitudinal relationships across emotional distress, perceived emotion regulation, and social connections during early adolescence: A developmental cascades investigation

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Abstract

Early adolescence is a vulnerable period for emotional distress. Both emotion regulation and social connection to peers and family adults are understood to be associated with distress. However, existing longitudinal work has not explored these constructs jointly in a way that estimates their reciprocal relationships over adolescence. We present a three-wave random-intercepts cross-lagged panel model of reciprocal relationships between emotional distress, perceived emotion regulation, and social connections during early adolescence, among 15,864 participants from education settings in disadvantaged areas of England, over three annual waves (at ages 11/12, 12/13, and 13/14 years). Findings showed that emotional distress and perceived emotion regulation share a negative relationship over time, and that higher perceived emotion regulation predicts greater family connection in the initial stages of early adolescence (from age 11–12 to 12–13 years). Findings also indicated that connection to peers is positively associated with family connection, but also positively predicts slightly *greater* distress in the later stages of early adolescence (from age 12–13 to 13–14 years). Findings indicate a risk of negative spiral between emotional distress and perceived emotion regulation in early adolescence, and that social connection may not necessarily play the role we might expect in reducing distress.

Keywords: adolescent mental health; developmental cascades; emotional distress; emotion regulation; social connection

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Developmental cascades theory suggests that domains of functioning are developmentally intertwined, with particular functions and behaviors interacting over time to create complex chain reactions (Masten & Cicchetti, 2010). A growing body of research has explored such relationships over time, although recent investigation has highlighted fundamental flaws with the modelling approach traditionally used in this area (Hamaker et al., 2015). In the current study, we explore mental health development in the critical early adolescent period, examining developmental cascades in emotional distress, perceived emotion regulation, and social connections, using a large sample and robust analytic methods to explore within-person cascades over time. Existing longitudinal work has not yet explored these constructs jointly within a developmental cascades framework, and their influence on one another over time is unclear.

Adolescence is a developmental period conceptualized by the World Health Organization (2021) as occurring between ages 10 and 19 years, and by others as up to age 24 years (Sawyer et al., 2018), with discrete early, mid, and late adolescence/young adulthood stages. This period is transformative, and includes important developments: biological changes, including puberty and heightened synaptic pruning (Blakemore, 2019); psychological changes such as increasing capacity for complex thought and heightened emotionality (Arnett, 1999); and, social shifts including a widening social world, emphasizing peer connection (Umberson et al., 2010), with increasing concerns about one's standing in the social group alongside a need for intimacy with a close friend (Qualter et al., 2015). Theory and research have demonstrated that adolescence is also a critical and vulnerable period for the development of mental health. Evidence indicates that 75% of lifetime case of mental health disorders begin by age 24 (Kessler et al., 2005), with a peak age-of-onset of 14.5 years (Solmi et al., 2021).

Early adolescence, between 10 and 14 years, appears particularly pivotal in depressive and anxious symptomatology and disorder trajectories (Costello et al., 2011; Jones, 2013). Depressive and anxious symptoms are distinct but closely related, often presenting comorbidly in adolescence (Balázs et al., 2013). They can be conceptualized as a shared construct of *emotional distress*[1] wherein individuals experience symptoms such as low mood and feelings of worry. Research has indicated that adolescent emotional distress poses a short- and long-term risk for other outcomes, including negative health behaviors/disorders (e.g., eating disorders;

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[1]Emotional distress is also sometimes referred to as emotional symptoms, problems, or difficulties, or as psychological distress. Emotional distress may also be referred to as internalizing difficulties, which can be considered a wider category of symptoms that can be conceptualized as also capturing, for instance, obsessive behaviors or suicidal ideation and behaviors. We use 'emotional distress' to aid specificity (e.g., the oft-used term emotional symptoms does not semantically clarify what symptoms relate to, as 'emotional' encompasses a wider range than mood and worry) and to avoid implicit problematizing adolescents for their experiences (as is implied in 'symptoms', 'problems', and 'difficulties).

Lewinsohn et al., 2000), deliberate self-harm (Moran et al., 2011), suicidal ideation and behaviors (Kandel et al., 1991; Murphy, 2014), and broader mental health difficulties (Kessler et al., 2005; Roza et al., 2003). Thus, there is a need to explore etiological pathways contributing to emotional distress in early adolescence and, in turn, examine how distress influences wider adolescent life and development.

Emotion regulation and adolescent psychopathology

Emotion regulation may be an important transdiagnostic risk factor for psychopathology, including emotional distress (Bradley, 2000; Southam-Gerow & Kendall, 2002). Emotion regulation is not consistently defined, but refers broadly to efforts to manage one's emotions and emotion expression (Castro et al., 2016; Gross & Muñoz, 1995). This involves varied knowledge and skills, including (a) knowing that one's emotions *can* be controlled and (b) awareness of possible strategies and associated advantages/limitations (Castro et al., 2016), such as suppressing emotions, reappraising situations, or pre-emptively modifying one's experiences and environment to reduce or increase the probability of particular feelings (Castro et al., 2016; Gross & Muñoz, 1995). Emotion regulation develops throughout childhood and adolescence and then across adulthood, with individual differences in the extent and nature of knowledge, skills, and strategies. Notably, emotion regulation appears to develop relatively linearly over the course of adolescence as a whole, and across the period researchers have observed a complex pattern of both growth and decline in specific aspects of regulation, such as in use of specific strategies (even after accounting for heightened emotionality; Zimmermann & Iwanski, 2014). This complex process of emotion regulation development may not effectively match the rapid changes adolescents experience more widely, including heightened emotionality. That is, adolescents' emotional processes and experiences may exceed the capacity of still-developing and potentially fluctuating regulatory systems, potentially then relating to distress and other difficulties among those for whom this imbalance is more pronounced (Casey et al., 2010; Dahl, 2001; Hollenstein & Lougheed, 2013).

There is a distinction between a) specific regulatory strategy usage, and b) an individual's *perception of* their regulatory skills as effective or sufficient. Emotion regulation is an individualized process contextually embedded in experience, and individuals vary in their perception of what is appropriate or efficient (Hollenstein & Lougheed, 2013; Thompson, 2011). That is, individuals who may externally be judged to have low or high emotion regulation on a skills-based assessment may not necessarily perceive themselves to perform in that way (Qualter et al., 2017). These distinct emotion regulation constructs need to be investigated separately to understand their distinct influence upon, and possible reciprocal relationships with, emotional distress. In the current study, we focus upon individuals' perception of their emotion regulation, in order to understand how this relates to experiences of emotional distress during early adolescence.

Various studies, spanning self-report, behavioral, and neurological designs, have investigated the relationship between emotion regulation components and emotional distress. There is evidence of cross-sectional associations between emotion regulation and depressive and/or anxious symptoms in adolescence, often focusing upon specific knowledge and strategies (Garnefski et al., 2007; Schäfer et al., 2017; Shapero et al., 2016; Silk et al., 2003; Tortella-Feliu et al., 2010). A small number of longitudinal studies have reported that emotion regulation predicts emotional distress over time, including both self-reported emotion dysregulation (poor emotion understanding, dysregulated emotion expression, and rumination; McLaughlin et al., 2011) and self-reported difficulties (Schneider et al., 2018). Although this longitudinal work has offered some insight, further investigation is needed. Specifically, we need exploration that capitalizes on recent advances in statistical analytic techniques that more accurately measure change over developmental periods, as prior work has not effectively isolated change at the *within-person* level (as discussed later in this section). This is critical to inform adolescent prevention efforts, which frequently target regulatory knowledge and skills (Young et al., 2019). In the current study we build on this gap, exploring reciprocal relationships over time between perceived emotion regulation and emotional distress using robust modelling and data from a very large sample of adolescents.

Social connections and emotional processes in adolescence

Emotional distress and emotion regulation happen within the context of social relationships. Social interaction and relationships encompass a range of components; we focus here on connection, or perceived interpersonal closeness with others, which itself is a multifaceted construct, encompassing a range of structures (i.e., type of relationship), functions and behaviors (e.g., support), and quality considerations in terms of positive and negative aspects (Berkman et al., 2000; Holt-Lunstad et al., 2017). Emotion regulation is shaped and developed through social experience with others. Parents/carers play a key role through modelling, parenting practices, providing a secure attachment base, and their setting of the wider family climate (Bariola et al., 2011; Morris et al., 2007). In turn, emotion regulation appears critical to developing and maintaining social relationships. Such skills facilitate optimistic expectations about social interactions, affect the tone of interactions, and support wider skills often favored socially (e.g., better decision-making in stressful situations), all of which can facilitate acceptance by, and connection with, others (Blair et al., 2016; Lopes et al., 2005). Evidence suggests perceived connection to others in childhood and adolescence is also associated with lower rates of emotional distress and wider internalizing difficulties (Bond et al., 2007; Ewell Foster et al., 2017; Malaquias et al., 2015), while feelings of loneliness predict *greater* distress (Hall-Lande et al., 2007; Harris et al., 2013; Qualter et al., 2010, 2013). Likewise, there is indication that emotional distress may have the capacity to negatively impact upon aspects of adolescents' social engagement and perceptions; for instance, a recent longitudinal study indicated that distress predicts lowered social self-efficacy over time (Kristensen et al., 2021). Given evidence of such links between social connections and emotion regulation and distress, respectively, it is crucial to explore interplay across these constructs within a singular model and to examine their longitudinal relationships (Ladd, 2017).

Here, we explore respective connections to school peers and family adults, given that, in early adolescence, individuals place increasing emphasis on peer relationships, but retain close relationships with parents/carers (Umberson et al., 2010). We would expect to see concurrent relationships between family and peer relationships within timepoints, given that positive relationships with family adults provide a foundation for the development of social skills and thus for peer relationships (Brown & Bakken, 2011; Pallini et al., 2014). Indeed, there may also be reciprocal relationships over time as social behaviors and aspects of both family

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and peer relationships evolve over adolescence (Brown & Bakken, 2011)

Developmental cascades

Theory and research suggest a complex interplay between emotional distress, emotion regulation, and social connections during the critical early adolescent period. This reflects the concept of *developmental cascades,* "the cumulative consequences for development of the many interactions and transactions occurring in developing systems that result in spreading effects across different levels, among domains at the same level, and across different systems or generations" (Masten & Cicchetti, 2010, p. 491). This theory suggests that functioning within and across domains, levels, and systems is developmentally intertwined, and particular functions and behaviors 'spread' over time into other functions and behaviors through complex chain reactions. Greater competence in one aspect of development may provide a scaffold for functioning within this and other aspects at a later time; conversely, difficulties could lead to negative consequences within the same and other functions.

There has been considerable interest in empirically exploring developmental cascades in relation to aspects of adolescent psychopathology, including emotional distress. However, very few studies have investigated distress in relation to social connections, and we have been unable to identify developmental cascades studies exploring how emotion regulation and distress interact over time in adolescence, though related work provides a useful empirical foundation for our study. For example, Murray et al., (2021) found self-reported peer relationships prospectively predicted lower levels of internalizing difficulties (a wider construct that includes emotional distress) across a two-year period in adolescence, although difficulties did not predict peer relationships. A recent study by Antony et al., (2022) showed that emotion dysregulation predicted later internalizing problems in *childhood*, including mediating the relationship between attention-deficit/hyperactivity disorder (ADHD) symptoms and internalizing problems. In addition, there is some evidence of some *adjacent* social constructs in relation to distress, such as that social competence and peer victimization link to internalizing difficulties in childhood and early adolescence (Bornstein et al., 2010; Vaillancourt et al., 2013). However, there has been little attention given to cascading effects with social *connections* specifically. There is also little work in this area that has explored cascade effects between distress and aspects of emotion regulation *or* social connections relate over time, although available research does offer some insight into mechanisms linking emotion regulation and peer-level connection. For instance, Blair et al. (2015) identified that, among children, emotion regulation had cascading effects into greater social skills and, in turn, greater relationship quality and peer acceptance.

Despite emotion regulation being considered a central factor in the development of psychopathology, and the emphasis on social *connection* as a critical protective factor, to our knowledge no study has examined reciprocal relationships between these constructs in relation to emotional distress, either generally or within early adolescence. This is not to say there has been no longitudinal evidence whatsoever. As noted earlier, for instance, Schneider et al. (2018) found that emotion regulation prospectively predicted anxious symptoms among children and adolescents; however, this and other studies cited above have not been undertaken within a cascades model to offer insights into complex, interwoven longitudinal relationships.

Finally, and most critically, recent investigation highlighted a fundamental flaw in the predominant analytic approach in developmental cascades studies (including some, though not all, of the studies cited above). Such research traditionally relied upon traditional cross-lagged panel modelling (CLPM) to model relationships between constructs over time, controlling for temporal stability in constructs ('autoregressives') and relationships between constructs within time ('concurrent relationships'), to examine their interplay over time ('cross-lagged pathways'). However, Hamaker et al. (2015) indicated that CLPM pathways capture stability and changes in *group* means, assuming that people varied over time around the same mean, thus failing to account for stable individual differences present within most psychological constructs. Hence, traditional CLPM pathways do not show change across functioning *within* individuals (the primary level of interest).

Hamaker et al. (2015) proposed an alternative: the random intercepts cross-lagged panel model (RI-CLPM). In RI-CLPM, a variable is estimated to separate participants' time-invariant deviation from the grand mean, and a second variable captures the difference between a participant's *actual* measurement and *expected* measurement. Pathways are modelled using this second latent variable, capturing *within-person* stability and change within and across constructs. Thus, in the RI-CLPM, it is possible to investigate cascading effects across individual-level functioning. Hamaker et al.'s (2015) simulations, alongside recent empirical investigations (e.g., Burns et al., 2020) showed that the traditional CLPM can produce spurious results when compared to RI-CLPM, including the wrong construct identified as the causally dominant in cascade effects, misidentification of statistical significance and of the sign (+/−) of relationships, and differing effect sizes. Thus, much of the existing developmental cascades evidence (including across emotional distress, emotion regulation, and social connections) is likely confounded by between-person relationships and fails to adequately identify cascades *within* individuals. Here, we contribute to efforts to narrow that gap by exploring these relationships using RI-CLPM.

The current study

In the current study, we explore reciprocal relationships between self-reported emotional distress, perceived emotion regulation, and the family and peer domains of social connection across early adolescence. Figure 1 presents a conceptual diagram showing the modelled cross-lagged relationships between variables (note that this figure does not show autoregressive or concurrent relationships for ease, as the key focus in our hypotheses is upon cross-lagged relationships; in the following section a detailed statistical diagram is shown).

Specifically, we have four hypotheses regarding cross-lagged relationships between these constructs:

H1: Emotional distress will negatively predict later perceived emotion regulation and social connections;

H2: Perceived emotion regulation will *negatively* predict later emotional distress and *positively* predict social connections;

H3: Social connections will *negatively* predict later emotional distress and *positively* predict perceived emotion regulation; and

H4: Peer and family social connections will positively predict one another over time.

We use RI-CLPM to investigate within-person change over time, which can offer important insights into how these aspects of functioning affect one another across early adolescence and

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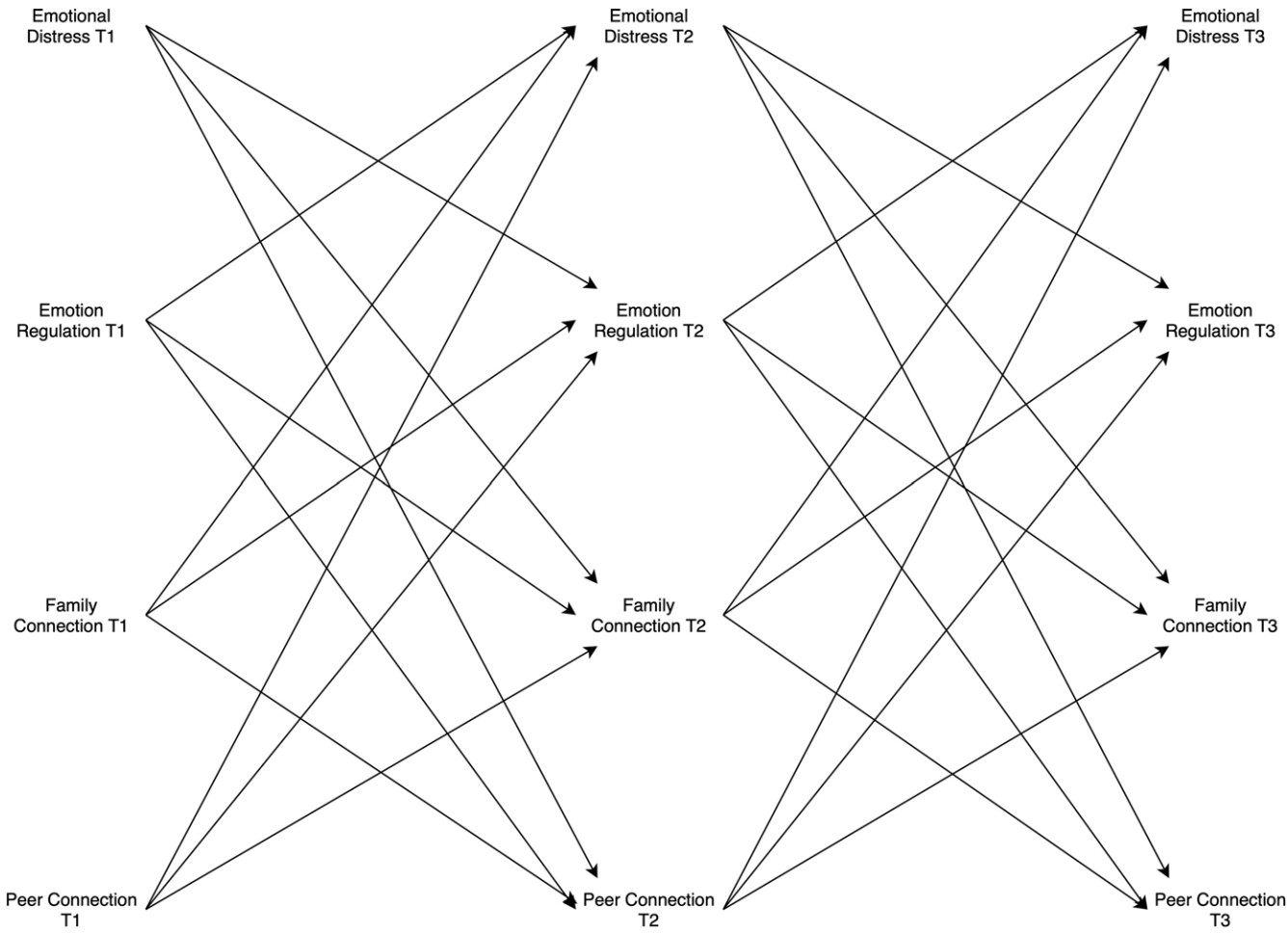

Figure 1. Conceptual model for developmental cascades showing cross-lagged pathways only. Model shows cross-lagged pathways between emotional distress, emotion regulation, and family and peer connection. For simplicity we have not shown autoregressive pathways over time or concurrent relationships, or detailed statistical features (see Figure 2 for a detailed statistical model).

inform both prevention and treatment in addressing emergent distress among adolescents. These specific domains, of course, do not occur uniformly among individuals and are influenced by a range of individual characteristics and contextual features; we control for a range of such factors in our analysis. For instance, evidence shows greater risk of emotional distress among particular groups, such as girls (Kessler, 2003; Kuehner, 2017; Zahn-Waxler et al., 2006); those who have experienced low family income and poverty during childhood (Palacios-Barrios & Hanson, 2019; Wadsworth et al., 2016); and (in the current generation) White young people (Patalay & Fitzsimons, 2021; Sadler et al., 2018; Terhaag et al., 2021). Similarly, there are factors commonly found to be associated with components of functioning including emotion regulation and social connections, such as low academic attainment (Graziano et al., 2007; Kwon et al., 2018). The influence of these factors can occur in various ways that are closely intertwined over time; as an example, for individuals with particular special educational needs (SEN), evidence suggests that among adolescents with a history of childhood language difficulties there is a stronger relationship between poor emotion regulation and emotional problems, as well as peer difficulties (Forrest et al., 2020). Thus, we control for various factors at the variable level in exploring these relationships, to account for their potential influence.

Method

Data are from the HeadStart longitudinal cohort study (see National Lottery Community Fund, n.d.) HeadStart is a 6-year program set up by The National Lottery Community Fund that explores and tests ways to improve the mental health and wellbeing of young people aged 10-16 years across six disadvantaged areas of England. A variety of low intensity interventions have been implemented in HeadStart. These can be summarized through five discrete categories of whole-school wellbeing promotion, staff training, targeted wellbeing and/or mental health interventions, and parent/carer interventions (see Bear et al., 2020). Summative evidence to date, which has been limited to targeted interventions, indicates modest impact that varies as a function of implementation quality (see for example Gill et al., 2019; Humphrey & Panayiotou, 2020).

As part of the evaluation of HeadStart, a sample of adolescents from these areas have been surveyed annually since 2017, beginning in Year 7 (age 11–12 years). Here, we used data across the first three waves of data generation (2017 to 2019). We note that Authors Demkowicz, Panayiotou, and Humphrey are researchers on the HeadStart evaluation and have been involved in various design, data generation, and analysis decisions for this; this is the first cross-lagged panel model we have fitted to this data.

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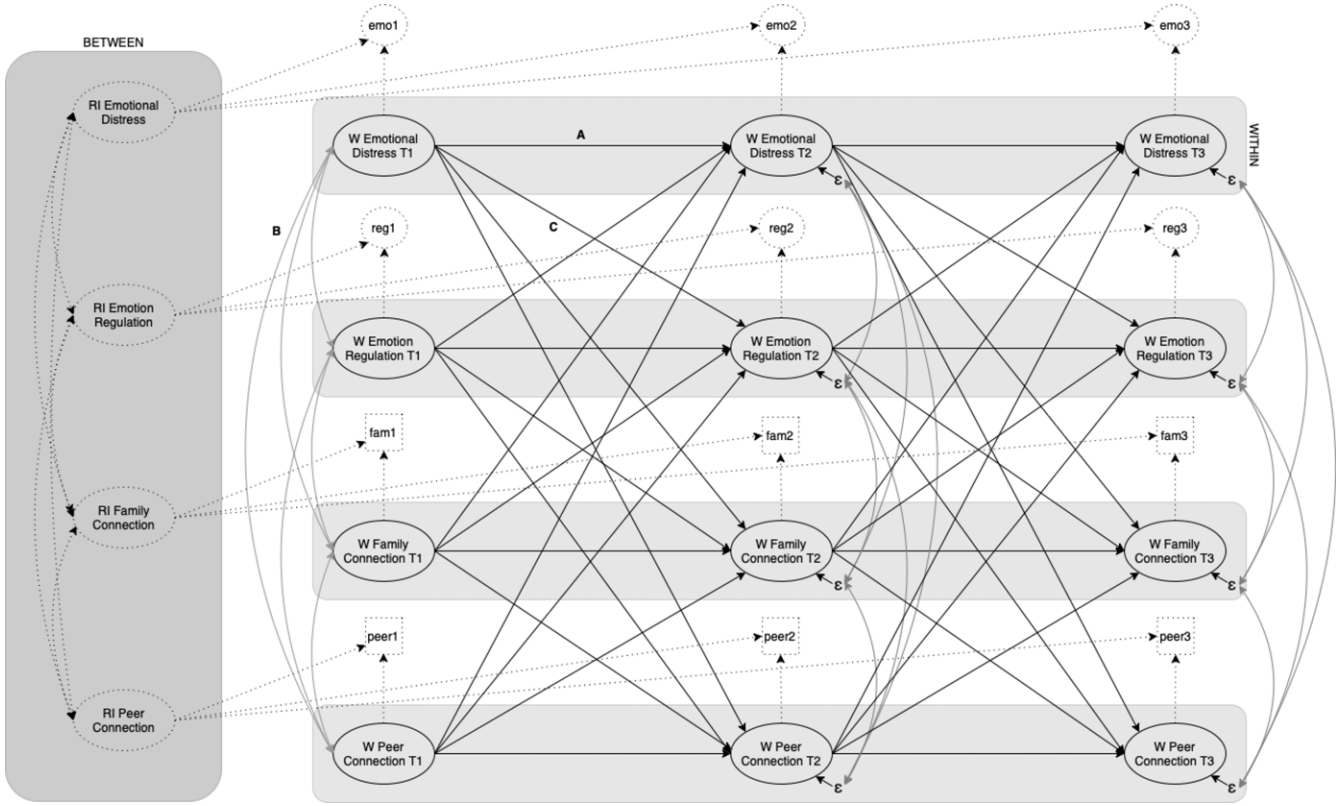

Figure 2. Statistical model for main RI-CLPM developmental cascades analysis. A = autoregressive effects; B = concurrent relationships; C = within-person cross-lagged effects. Left-hand panel shows between-person differences; panels across the model show within-person components specified as latent variables; grand means used to estimate these shown in dotted lines. Some features not shown here for simplicity, including covariates and the items for emotional distress and emotion regulation.

Participants

Our sample comprised 15,864 participants. Their characteristics are presented in Table 1, alongside national norms. Because data were drawn from a project focused on disadvantaged areas of England, sampling was not undertaken to be representative against national norms and our sample characteristics reflect a range of sociodemographic contexts (for this reason, we have not applied weights in the current sample, because the intention was not to create a representative dataset and sampling was not random, and indeed weights do not currently exist for this dataset). However, as can be seen in Table 1, the sample generally reflects national norms, although we note a slightly higher prevalence of SEN and slightly lower prevalence of free school meal eligibility in our sample.

Measures

Participants completed a range of self-report measures annually for the evaluation of HeadStart, including measures for emotional distress, perceived emotion regulation, and family adult and peer connection. The survey was administered using a secure online system in teacher-facilitated sessions in participating schools at a time convenient to the school during the March to July periods of 2017 (Timepoint 1; T1), 2018 (Timepoint 2; T2), and 2019 (Timepoint 3; T3). Data generation processes were informed through piloting and wider guidance (see Demkowicz et al., 2020). Demographic data were obtained from the National Pupil Database (NPD) in 2017 and reflect information recorded for participants as of 31st March 2017.

Emotional distress. This was assessed using the 'emotional symptoms' subscale of the Strengths and Difficulties Questionnaire (SDQ; Goodman et al., 1998). The subscale includes five items (e.g., "I am often unhappy"; see Table S1 in Supplementary Materials, Appendix A for all items in the current study) and participants respond on a three-point scale: 0 = "not true", 1 = "somewhat true", and 2 = "certainly true". Scores are summed to total 0–10, where higher scores indicate greater distress. Research from Goodman et al. (1998) indicated that the SDQ can distinguish between community and clinical samples and that the emotional symptoms subscale demonstrates satisfactory internal consistency. In the current sample, we found acceptable internal consistency (T1 $\alpha = .72$; T2 $\alpha = .74$; T3 $\alpha = .76$) and confirmatory factor analysis (CFA) model fit (see Table S2, Appendix B, in Supplementary Materials).

Perceived emotion regulation. This was measured using a revised subscale from the Trait Emotional Intelligence Questionnaire – Adolescent Short Form (TEIQue-ASF). The original TEIQue is a measure of self-perceived trait emotional intelligence facets, and the TEIQue-ASF is a shorter, simplified version that can be used for adolescents aged 11+ years (Petrides, 2009). Participants respond on a seven-point scale from "disagree" to "agree"; higher summed scores reflecting greater perceived emotion regulation skills. While participants responded to six items from the TEIQue-ASF, following inspection of item content and factor analysis, we reduced these to four items, removing two relating to impulsiveness (see Appendix C in Supplementary Materials for a more detailed overview of this process). We conceptualize this construct more narrowly as 'perceived emotion regulation' in line with retained item content (e.g., "I find it hard to

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Table 1. Sample characteristics and national norms

Characteristic	Sample distribution	National norms (%)
Gender*		
Girls	52.7% ($n = 8,358$)	
Boys	47.0% ($n = 7,453$)	
Unclassified/missing	0.3% ($n = 53$)	
Ethnic group		
White	74.2% ($n = 11,763$)	75.2%[a]
Black	5.7% ($n = 899$)	5.6%
Asian	9.3% ($n = 1,472$)	10.7%
Chinese	0.2% ($n = 27$)	0.4%
Mixed	4.0% ($n = 634$)	5.0%
Any other ethnic group	1.6% ($n = 255$)	1.7%
Unclassified/missing	5.1% ($n = 803$)	
Special educational needs provision		
Yes	12.0% ($n = 1,904$)	14.4%[b]
No	83.2% ($n = 13,184$)	
Unclassified/missing	4.8% ($n = 765$)	
Free school meal eligibility		
Yes	16.7% ($n = 2,654$)	14.0%[a]
No	79.7% ($n = 12,641$)	
Unclassified/missing	3.5% ($n = 558$)	
First language		
English	80.2% ($n = 12,720$)	16.2%[a]
Other	16.2% ($n = 2,563$)	
Unclassified/missing	3.6% ($n = 570$)	

Note. All characteristics were recorded in Spring 2017 at the cohort baseline, gathered from the National Pupil Database (NPD). * Note that the NPD uses gender to refer to 'female' and 'male'. We use 'girls' and 'boys' here in alignment with gender (rather than sex) language, and use this data as an imperfect proxy for gender information.
[a]Department for Education and Office for National Statistics (2017). *Schools, pupils, and their characteristics: January 2017.*
[b]Department for Education and Office for National Statistics (2017). *Special educational needs in England: January 2017.*

control my feelings"; see Table S1 in Appendix A, Supplementary Materials). This revised four-item subscale showed good fit (see Table S2 in Supplementary Materials) and acceptable internal consistency (T1 $\alpha = .69$; T2 $\alpha = .70$; T3 $\alpha = .71$).

Family adult and peer connection. Connection to family and peers was measured using two subscales from the Student Resilience Survey (SRS),[2] a self-report measure for adolescents aged 11+ years capturing self-perceived exposure to potential protective factors (i.e., factors expected to be associated with resilience; Sun & Stewart, 2007). We used Lereya et al.'s (2016) slightly adapted version, where wording on a small number of items was edited to suit English schoolchildren (e.g., using "join in" rather than "play"). We measured family adult connection using the family support subscale, which includes four items asking respondents to reflect on a relationship with an adult 'at home' (e.g., "at home, there is an adult who believes that I will be a success"), and peer connection using the peer support subscale, with thirteen items asking respondents to reflect on relationships with their school-based peers (e.g., "are there students at your school who would choose you on your team at school?"); see Table S1 in Supplementary Materials for all items. Participants respond to items on a five-point scale from 1 for "never" to 5 for "always", with higher summed scores denoting greater perceived protective factor exposure. The SRS has shown good construct validity and acceptable internal consistency (Lereya et al., 2016; Sun & Stewart, 2007). In the current sample, good internal consistency was observed for the family subscale (T1 $\alpha = .76$; T2 $\alpha = .81$; T3 $\alpha = .84$) and peer subscale (T1 $\alpha = .93$; T2 $\alpha = .94$; $\alpha = .95$), and acceptable CFA model fit for both subscales (see Table S2 in Supplementary Materials).

Covariates and demographic information. Demographic variables were collected from the NPD and recorded as up to date as of March 2017, at the start of baseline data generation. We included gender, ethnicity, SEN, low family income, and academic attainment as covariates. A brief justification and overview of measurement approaches for each are outlined below. We note that the dataset also had available information on looked after status, caregiving responsibilities, more detailed special educational needs information, neighborhood deprivation, school absences, and exclusions. However, it is important to be selective in including covariates in RI-CLPM to reduce burden in the model, rather than including all available information, and we deduced the greatest justification for selection of the included covariates outlined below.

Gender. We relied on male/female data as an imperfect proxy for gender, in the absence of a more precise or inclusive measurement approach in available data. This is recorded as a binary 'gender' variable by the NPD and we do not have access to data that is inclusive of those outside of that binary.

Ethnic group. We converted ethnic group to a binary variable, grouping a) White and b) UK ethnic minority backgrounds. This has been implemented in past mental health studies that have shown significant difference across this binary, with children and adolescents from UK ethnic minority groups reporting lower emotional difficulties than their White peers (Patalay & Fitzsimons, 2021; Sadler et al., 2018; Terhaag et al., 2021). Additionally, the small number of participants from some groups in our sample (e.g., just 27 participants were identified as Chinese) necessitated treatment of ethnic group as binary rather a more granular variable.

Special educational needs status. 'Special educational needs' (SEN) is a term in the English education system capturing a range of additional needs, with common categories such as learning difficulties, speech, language and communication needs, autism, physical disability, and social, emotional, and mental health needs. SEN status was designated for participants identified by the NPD as having SEN.[3] By early adolescence, individuals are more likely to have been formally identified as having SEN, with a peak in identification around aged ten years (Department for Education & Office for National Statistics, 2021).

Low family income. We identified low family income using free school meal eligibility. Pupils are entitled to receive free school meals in England if their parents have low income or receive income-related support (Department for Education, 2018a). We

[2]Our construct/subscale names differ slightly from the original SRS, where names refer narrowly to 'support' but item content captures connection more broadly. Thus, these subscales appropriately capture our constructs of interest, and we use these conceptual terms to aid content validity and specificity in results and interpretations. We also highlight that peer connection items refer to school-based peers, and family connection items to 'an adult at home' rather than wider family (e.g., siblings).

[3]Here, we grouped together those identified as having SEN both with and without formal designation of need via an Education, Health, and Care plan (previously known as a statement of SEN), as some pupils are identified as having SEN without this kind of plan (Department for Education, 2018b).

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included those were recorded as having been eligible for free school meals at any point since 2011, even if they were no longer eligible as of March 2017, given the long-term implications of low income and poverty in childhood.

Prior academic attainment. We measured assessment using scores from Key Stage Two Statutory Assessment Tests (SATs), which participants undertook approximately one year prior to baseline survey data generation. The SATs are a set of assessments that pupils undertake in England in the final year of primary education, at aged 11 years. Research has indicated that English and Mathematics SAT scores have good predictive validity for later academic performance, showing strong relationships with assessment scores at ages 14 and 16 years (Education Endowment Foundation, 2013; Strand, 2006); thus, SATs performance could be considered to function as a relatively stable proxy in the absence of ongoing attainment data during the timepoints under investigation. We followed guidance from the Department for Education (2016) to create a composite score by deriving the mean of scaled scores, which are converted test scores reflecting standardized expectations, across English reading, English writing (grammar, punctuation, and spelling), and Mathematics scores, double weighting Mathematics.

Ethical considerations

Ethical approval was granted for the HeadStart evaluation by University College London's ethics committee (reference 8097/003), also covering secondary analysis of data generated in the evaluation, such as the current study. Information sheets were provided to parents/carers and participants. Parents/carers were able to opt their child out of the study and participants were asked to provide assent via a tick box before completing measures; 222 young people, 1.38% of possible participants, were opted out by parents/carers. Measures relating to more sensitive constructs such as emotional distress were presented in the middle of the survey, with more 'positive' measures (e.g., social connection) positioned at the beginning and end of the survey (Demkowicz et al., 2020).

Data analysis plan

Main analyses were undertaken in Mplus Version 8.7 and various preliminary analysis in both SPSS Version 25 and Mplus. We reviewed data to explore normality, multicollinearity, and missingness. No major normality violations were identified; an overview is shown in Supplementary Materials (Appendix D, Table S4). Descriptive statistics and bivariate correlations are shown in Table 2; these showed statistically significant relationships across all variables, although none exceeded the .70 level that would indicate multicollinearity (Tabachnick & Fidell, 2013).

Missing data across item-level survey data varied from 2.9% to 6.0% at T1, 16.6% to 20.0% at T2, and 26.5% to 28.6% at T3, with 25.0% of participants (n = 3,965) showing missing data across all items at T3. We performed a binary logistic regression to examine whether there were systematic differences between the individuals lost through attrition at the final timepoint (i.e., those with missing data on all T3 items) and those still engaged at T3, including a range of demographic variables as predictors, namely gender, ethnic group, first language, SEN status, free school meal eligibility, and academic attainment.[4] Results and odd ratio (OR) values indicated that participants had a greater likelihood of being lost to follow-up if they were White (OR = 1.19, $p < .01$), spoke English as their primary language (OR = 1.25, $p < .01$), had a history of free school meal eligibility (OR = 1.39, $p < .001$), and had low academic attainment relative to their peers (OR = 1.43, $p < .001$). Gender ($p = .16$) and SEN status ($p = .02$) was not a significant predictor of missingness using an alpha threshold of .01; see later in this section for decision-making around p-values and sample size). Thus, data were assumed missing at random (wherein missingness is predicted by other available variables) and we used multiple imputation to treat missingness. We opted for imputation over full information maximum likelihood (FIML) because we are using robust weighted least squares (WLSMV) as the estimator in the main analysis (see later in this section) and this relies on pairwise presence and not FIML. To do this, we used the imputation feature in Mplus and generated 100 datasets, in line with guidance (Graham et al., 2007), and included ethnicity, language, free school meal eligibility, attainment, and SEN to predict missing values.

Longitudinal measurement invariance. Prior to testing the RI-CLPM model the longitudinal measurement invariance of the variables was explored. Given the sensitivity of the chi-square difference test to large samples, such as the one of the current study, the measurement invariance was explored for both categorical items with WLSMV and continuous with MLR (Sass et al., 2014). This followed a 3-step (baselines, configural, scalar) and a 4-step (baselines, configural, metric, scalar) procedure for the WLSMV and MLR models, respectively. The fit of the baseline and configural models was judged against typical model fit indices, as described below and only models with acceptable model fit received measurement invariance testing. Metric and scalar models with a CFI difference <.01 (Chen, 2007) were considered to indicate full metric and scalar longitudinal measurement invariance, respectively. All latent constructs achieved this (see Supplementary Materials, Appendix E).

RI-CLPM. As outlined in the introduction we used an RI-CLPM approach to modelling data, drawing on guidance from Hamaker et al. (2015) and Mulder and Hamaker (2021); code is shown in Appendix F in Supplementary Materials. Figure 2 shows a simplified statistical diagram for our developmental cascades analysis using this approach. Here, we briefly outline the key features modelled in this RI-CLPM analysis to guide the reader. **Between-person differences** (shown in the left-hand panel of Figure 2) are isolated through the estimation of latent variables, constrained to equality across timepoints, to partial out each participant's time-invariant deviation from a given construct's grand mean, thus capturing stable between-person differences. These between-person latent factors are allowed to covary. **Within-person components** (shown in Figure 2 in panels spanning the width of the model) are then identified by specifying a latent variable for each measurement (i.e., each individual construct at a single timepoint). **Autoregressive effects** (paths labelled A in Figure 2) are modelled as the within-person carry-on effects over time, based on the relative increase or decrease of one's score over time. **Concurrent relationships** (labelled B in Figure 2) are modelled as the covariance between the within-person component residuals at each timepoint; that is, the relationships between constructs within individuals at each timepoint. **Cross-lagged effects** (labelled C in Figure 2) show within-person cascading effects across constructs over time, based on a deviation in individuals' expected score on a given construct showing an association with an earlier score on a second construct. By partialling out between-person differences, constructing within-person variables

[4]Here, we converted multigroup and continuous demographic variables into binary variables to facilitate analysis: we created a binary ethnic group variable with White and UK ethnic minority group categories; and low academic attainment was converted by identifying those in the lowest quartile (99 and below on the 80–120 range) as having low academic attainment

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Table 2. Descriptive statistics and bivariate correlations (r)

1.	Emotional distress T1	3.85 (2.52)	–										
2.	Emotional distress T2	3.89 (2.60)	**.57**	–									
3.	Emotional distress T3	4.14 (2.67)	**.48**	**.61**	–								
4.	Emotion regulation T1	18.50 (5.94)	−.47	−.33	−.28	–							
5.	. Emotion regulation T2	18.37 (5.73)	−.38	−.50	−.39	**.50**	–						
6.	Emotion regulation T3	18.10 (5.66)	−.32	−.41	−.54	**.40**	**.54**	–					
7.	Family adult connection T1	17.83 (2.73)	−.16	−.11	−.09	.29	.20	.15	–				
8.	Family adult connection T2	17.55 (3.09)	−.14	−.18	−.14	.22	.31	.21	**.46**	–			
9.	Family adult connection T3	17.71 (2.94)	−.14	−.17	−.20	.19	.23	.32	**.38**	**.50**	–		
10.	Peer connection T1	52.71 (11.36)	−.21	−.13	−.07	.29	.17	.13	.39	.25	.22	–	
11.	Peer connection T2	52.56 (11.48)	−.19	−.21	−.12	.23	.28	.17	.27	.41	.27	**.52**	–
12.	Peer connection T3	52.46 (11.53)	−.16	−.16	−.18	.19	.20	.27	.23	.29	.43	**.42**	**.53**

Note. T1 = Timepoint 1; T2 = Timepoint 2; T3 = Timepoint 3. All bivariate correlations significant at the .001 alpha level. Within-domain correlations across time are shown in bold type.

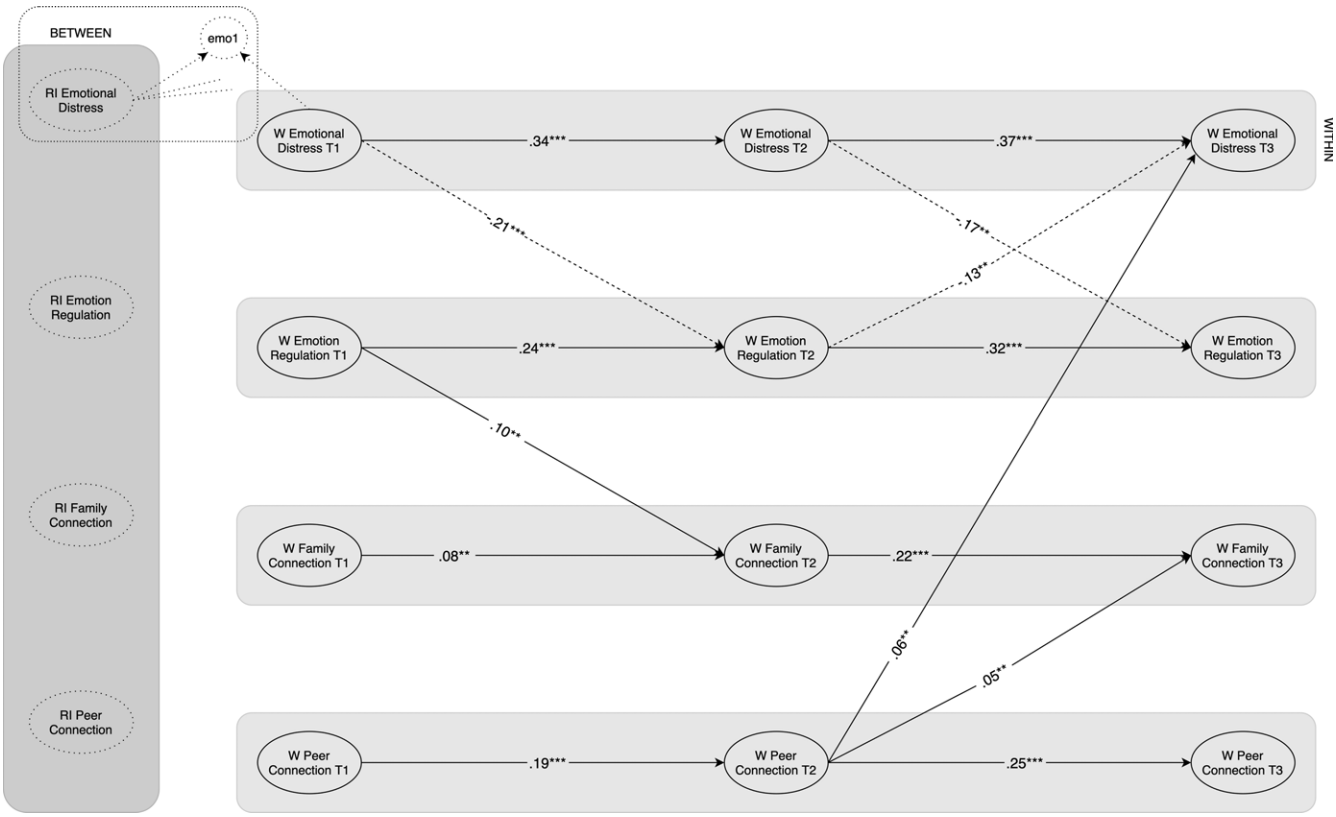

Figure 3. RI-CLPM developmental cascades results. Model shows statistically significant standardized (β) autoregressive and cross-lagged pathways; concurrent relationships shown separately in Table 3. Solid lines show positive relationships and dotted lines show inverse relationships. Some features not shown for simplicity, including covariates and the modelling of random intercepts and within-person latent factors from the grand means (indicated as reminder in upper left corner). ** p < .01. *** p < .001.

for each construct, and then controlling for autoregressive effects (Pathways A) and concurrent relationships (Pathways B), the RI-CLPM approach allowed us to isolate of cross-lagged effects (Pathways C) as the primary area of interest and therefore assess whether and how emotional distress, emotion regulation, and peer and family adult social connections predict one another over time.

In specifying the original construct variables upon which to base the RI-CLPM, we found that it was not feasible to specify all four constructs as latent variables given the complexity of the model (i.e., the model could not converge). As such, we opted to specify only emotional distress and emotion regulation as latent variables, given the complexity of these constructs and the close relationship between them and given that both the family and peer connection variables showed good unidimensional and highly uniform factor loadings for all items (see Supplementary Materials Appendix B). Following the full longitudinal measurement

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invariance of the constructs (see above), we constrained the factor loadings and thresholds of each categorical indicator to equality across timepoints, in line with guidance (Mulder & Hamaker, 2021). We reviewed a measurement model prior to the RI-CLPM, allowing these two latent variables to freely correlate and found this to be acceptable (see Supplementary Materials Appendix G and Table S6).

A WLSMV estimator was utilized because emotional distress and emotion regulation were modelled as a latent variable with categorical indicators (Brown, 2015; Li, 2016). As outlined in our introduction, these relationships do not occur uniformly among individuals; we included covariates capturing individual characteristics and contextual features that evidence suggests could influence the constructs in our panel model or the relationships between them. Namely, we included as covariates: gender (Kessler, 2003; Kuehner, 2017; Zahn-Waxler et al., 2006), low family income, (Palacios-Barrios & Hanson, 2019; Wadsworth et al., 2016), ethnicity (Patalay & Fitzsimons, 2021; Sadler et al., 2018; Terhaag et al., 2021), academic attainment (Graziano et al., 2007; Kwon et al., 2018), and SEN (Forrest et al., 2020), which were available at baseline, following guidance (Mulder & Hamaker, 2021). Specifically, these covariates were specified as predictors of all constructs (at the main factor level) at all timepoints, with the exception of attainment, which was specified as a predictor of constructs at the first timepoint only, as this was assessed one year before data collection began. The stable individual demographic factors were entered as predictors of all constructs (again, at the main factor level) at all three timepoints, the effects of which were set to be equal. As participants took part in surveys within their education settings, thus we controlled for the school clustering in all SEM analyses, using the Type = Complex command in Mplus. This accounts for the non-independence of observations by adjusting the standard errors and goodness-of-fit statistics (intracluster correlations at the item level ranged from .01 to .04, $M = .02$).

In reviewing model fit, we followed guidance from Hu and Bentler (1999) and considered root mean square error of approximation (RMSEA) values below .06, Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values greater than .95, and root mean square residual (SRMR) values below .08 indicative of good fit. We report chi-square for reference. In interpreting specific pathways and relationships between variables in the RI-CLPM, we considered an alpha of < .01 to indicate statistical significance, to correct for multiple comparison and given our large sample size and the influence these features can have for p-values (Abdi, 2007; Sullivan & Feinn, 2012). We were guided by Adachi and Willoughby (2015) in interpreting cross-lagged parameters dynamically in the context of the wider model. Cohen's (1992) widely used thresholds for standardized beta coefficients were not developed for longitudinal autoregressive models, meaning that dramatically smaller relationships between constructs not only are common but can be meaningful. Thus, in presenting our results we offer commentary on these cross-lag relationships with attention to how these sit contextually within the wider model.

Results

The RI-CLPM model showed good fit to the data: χ^2 (605) = 9,484.72 (Standard Deviation [SD] = 124.27); RMSEA = .03 (SD = .00); CFI = .93 (SD = .00), TLI = .92 (SD = .00); SRMR = .04 (SD = .00). Results are presented in Figure 3, which shows statistically significant autoregressive effects and cross-lagged pathways. Concurrent relationships are presented separately for ease in Table 3. As they are not of primary interest in our study, we report on covariate effects on within-level constructs in our Supplementary Materials (see Table S7, Appendix H).

Autoregressive effects

Results indicated stability for all within-person constructs, with scores on each construct predicted by earlier scores at the preceding timepoint (Figure 3). The largest autoregressive effects were present for emotional distress, followed by emotion regulation and peer connection. Notably, family connection showed smaller autoregressive effects relative to other constructs; scores at T1 predicted scores at T2 with a beta (β) of .08 ($p = .001$) and scores at T2 predicted those at T3 with a beta (β) =of .22 ($p < .001$).

Concurrent relationships

As can be seen in Table 3, statistically significant within-person concurrent relationships were observed across all constructs, with similar effect sizes observed in these respective relationships at each timepoint. At each stage, emotional distress showed strong inverse relationships with emotion regulation and small relationships with both connection variables, while emotion regulation, family adult connection, and peer connection each showed moderate relationships with one another. We also note that associations between the random intercept latent factors representing between-person differences (also shown in Table 3) were moderate to large, with differences in emotional distress and regulation showing an especially large relationship, family relationships showing moderate relationships with distress and regulation, and peer connection showing large relationships with distress, regulation, and family connection.

Cross-lagged pathways

Inspection of cross-lagged pathways showed several statistically significant pathways; some pathways were nonsignificant and those are not shown in Figure 3 for ease of reader interpretation.

H1: Emotional distress will negatively predict later emotion regulation and social connections. Greater levels of emotional distress at T1 and T2 significantly predicted lower levels of emotion regulation at subsequent timepoints ($\beta = -.21$ [$p < .001$] and $\beta = -.17$ [$p = .003$], respectively). Greater emotional distress did not significantly predict change in perceived connection to family adults or peers at any timepoints.

H2: Emotion regulation will *negatively* predict later emotional distress and *positively* predict social connections. Greater emotion regulation at T2 predicted lower distress at T3 ($\beta = -.13$, $p = .008$), although this was not observed across T1 to T2. Greater emotion regulation at T1 predicted greater family connection at T2 ($\beta = .10$, $p = .002$). Wider autoregressive relationships show relative instability in family connection across these timepoints, indicating change in this area is more likely than other constructs. Thus, this kind of small effect may be less informative than it may be in the context of other relationships where there is greater stability over time, but it does indicate that regulation may act as one potential contributor to the instability in family connection at this time. This relationship was not present from T2 to T3, with no statistically significant relationship across this stage. Finally, emotion regulation did not significantly predict later peer connection at any timepoint.

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Table 3. Concurrent Relationships between variables (includes across between-person difference random intercept factors, and between within-person variables within each timepoint; β)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Between-Person Differences															
1. Emotional distress RI	–														
2. Emotion regulation RI	−.73***	–													
3. Family adult connection RI	−.27***	.40***	–												
4. Peer connection RI	−.41***	.44***	.56***	–											
Timepoint 1															
5. Emotional distress T1					–										
6. Emotion regulation T1					−.65***	–									
7. Family adult connection T1					−.11**	.24***	–								
8. Peer connection T1					−.20***	.26***	.27***	–							
Timepoint 2															
9. Emotional distress T2									–						
10. Emotion regulation T2									−.71***	–					
11. Family adult connection T2									−.14***	.26***	–				
12. Peer connection T2									-.17***	.25***	.31***	–			
Timepoint 3															
13. Emotional distress T3													–		
14. Emotion regulation T3													−.74***	–	
15. Family adult connection T3													−.16***	.29***	–
16. Peer connection T3													−.13***	.24***	.33***

Note. RI = random intercepts; T1 = Timepoint 1; T2 = Timepoint 2; T3 = Timepoint 3. ** p < .01. *** p < .001.

H3: Social connections will *negatively* predict later emotional distress and *positively* predict emotion regulation. Family connection did not predict emotional distress or emotion regulation at any subsequent timepoints, and peer connection at T1 did not predict emotional distress or emotion regulation at T2. However, peer connection at T2 did predict emotional distress at T3, but not in the expected direction, with greater perceived connection predicting *greater* distress ($\beta = -.06$, $p = .003$). We highlight that concurrent relationships showed more theoretically expected signs and indeed moderate relationships, wherein greater perceived peer connection was instead associated with *lower* levels of distress and *greater* emotion regulation, as might be more theoretically anticipated.

H4: Peer and family social connections will positively predict one another over time. Greater peer connection at T2 predicted greater family connection at T3 ($\beta = .05$, $p = .006$). No other significant cross-lagged relationships were observed across these constructs. In the absence of evidence for *reciprocal* effects, H4 could not be supported.

Discussion

We sought to explore possible reciprocal relationships between emotional distress, emotion regulation, and family adult and peer social connection over the course of early adolescence. Theory and past research have indicated a complex interplay between these constructs, especially during early adolescence as a vulnerable period for the emergence of psychopathology. However, to our knowledge, no previous study had directly examined developmental cascades across these areas in combination and with an emphasis on this developmental stage. Thus, we set out to offer a robust empirical investigation of these complex relationships, with a large sample and a longitudinal design examining within-person change over time. We found that a) emotional distress and emotion regulation share a reciprocal negative longitudinal relationship, b) emotion regulation predicts greater family connection in the initial stages of early adolescence, and c) connection to peers positively predicts family connection, but also slightly greater distress, in the later stages of early adolescence. Findings indicate a risk of a negative spiral between emotional distress and emotion regulation in early adolescence, and that social connection may not necessarily play the role we might expect it to in reducing difficulties over time.

Before considering reciprocal effects across emotional distress and emotion regulation, we comment briefly here on the temporal stability of these constructs observed in autoregressive effects (as shown in Figure 3). The large autoregressive effects for emotional distress (T1→T2 $\beta = .34$, T2→T3 $\beta = .37$) are relatively unsurprising. Previous research has similarly indicated that distress and wider internalizing difficulties tend to be stable during adolescence (e.g., Danneel et al., 2019); our results further contribute to this evidence by showing that distress tends to persist over time at the *within*-person level. Emotion regulation showed moderate stability at T1 to T2 ($\beta = .24$) and stronger stability from T2 to T3 ($\beta = .32$). This lower stability across the initial two timepoints perhaps echoes suggestions that the changes during early adolescence may exceed young people's current regulatory capacity (Casey et al., 2010; Dahl, 2001; Hollenstein & Lougheed, 2013). This finding also

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indicates that although emotion regulation does show some stability, this is amenable to change over time in early adolescence and could be targeted through intervention, as explored later in this section.

We found greater emotional distress was related to reductions in self-reported emotion regulation over time, across both T1 to T2 ($\beta = -.21$) and T2 to T3 ($\beta = -.17$). Considering these relationships against Adachi & Willoughby's (2015) guidance to interpret effect sizes dynamically in the context of the wider model, we note these are considerable effect sizes; these constructs each show moderate to strong stability over time (Distress T1→T2 $\beta = .34$, T2→T3 $\beta = .37$; Regulation T1→T2 $\beta = .24$, T2→T3 $\beta = .32$) *and* a strong concurrent relationship with one another (T1 = −.65, T2 = −.71, T3 = −.74). This may highlight that, for many young people, emotional distress can change the way they think about emotional situations, and whether they think they can respond in effective ways. The cognitive model of depression holds that wider negative self-perception and self-evaluation may feature as a key depressive symptom, and, indeed, there is evidence to support this among adolescents experiencing depression (Orchard et al., 2017, 2019). It may however be useful for researchers to explore this connection further to better elucidate such potential mechanisms for distress affecting perception of regulation (e.g., whether changes to emotional reactivity may play a role), and to understand how this may also relate to more objectively measured emotion regulation behaviors and capacity.

Further, given our finding that emotion regulation at T2 also negatively predicted later emotional distress at T3 ($\beta = -.13$), it seems this reciprocal relationship between emotional distress and emotion regulation could potentially lead to a spiral of negative effects during adolescence. Because we did not examine directly observed emotion regulation behaviors or skills, but explored self-perceptions of emotion regulation abilities, our findings focus attention on the fluidity of emotional self-beliefs (that may or may not match actual skills). Thus, we recommend that intervention efforts should be focused on teaching children and young people to manage shifting self-beliefs during times of emotional distress, which could facilitate more optimal transitions during the stressful adolescent years. This is, for instance, a common feature of CBT for child and adolescent depression (Kennard et al., 2016). However, such targeted interventions should be underpinned and preceded by earlier, preventive interventions, especially given the context of our findings (e.g., very large community sample as opposed to clinical sample). In this vein, universal school-based social and emotional learning interventions that emphasize the development of emotional awareness and management skills offer considerable promise (Durlak et al., 2011). As above, it would be helpful to explore and understand whether this is also replicated for more objectively measured emotion regulation.

Findings in relation to family adult connection were notable in two respects. First, autoregressive effects were smaller than for other variables (T1→T2 $\beta = .08$, T2→T3 $\beta = .22$), with effect sizes being, substantially smaller than those observed for emotional distress, emotion regulation, and peer connection. This relative lack of temporal stability may have a developmental explanation, given that the time period covered (ages 11–12 to 13–14) is one of significant flux and transformation in terms of family relationships. For example, the transition from childhood to adolescence is often marked by increased conflict with, and reduced attachment to, parents and carers (Allison, 2000; Nickerson & Nagle, 2005). However, such changes are typically transient, and likely reflect a 'relational discontinuity' caused by the reorganization of responsibilities and a move towards a more egalitarian relationship (Branje, 2018).

Second, there was little evidence that family adult connection exerted any kind of within-person influence on later emotional distress, perceived emotion regulation, or peer connection. Indeed, it appeared to be *influenced by* perceived emotion regulation and peer connection, from T1 to T2 ($\beta = .10$) and T2 to T3 ($\beta = .05$). These are small effect sizes and when viewed in the context of the observed stability and concurrent relationships may not be especially meaningful, though should not be set aside altogether. That is, if a variable shows less stability, as family connection does from T1 to T2 here, this suggests there is considerable change in this variable over time, and so an effect of this size may not be practically significant (Adachi & Willoughby, 2015). This broad pattern of findings may have methodological explanations, including that our RI-CLPM approach accounted for stable between-person differences, and that we made use of a community sample, rather than a clinical sample of those identified as having a heightened level of difficulties. Our reasoning here is that the former is known to attenuate within-person cross-lagged effects (Hamaker et al., 2015), while the latter likely means that the prevalence of adolescent-parent conflict and related difficulties of a magnitude strong enough to trigger, for example, the onset of later emotional distress, would be relatively low.

Finally, we highlight several features of our findings in relation to peer connection. First, we found peer connection was not prospectively predicted by any other constructs included in the model. However, there were concurrent relationships between peer connection and all other variables within timepoints, to varying extents (β absolute values range = .13–.33). Taken together, it seems that while those who feel more connected to their peers are at the same time more likely to feel more connected to their family, more capable in managing their emotions, and less distressed, these constructs are not necessarily in turn *predicting* how connected one feels to peers over time – or at least not at one-year intervals. Wider research examining this relationship longitudinally is scarce, and varied conceptualizations, foci, and measurement approaches have complicated the ability to draw comparisons with our findings. For instance, English et al. (2012) reported that emotion regulation strategy usage has long-term social effects, but this study captures *strategy* rather than perception of one's ability to manage emotions effectively as in our study, and focuses on late adolescence. Furthermore, as noted above, our use of a RI-CLPM approach modelling within-person effects has more accurately estimated these cross-lagged relationships, which are often attenuated in this approach (Hamaker et al., 2015).

Second, we highlight that like family connection, peer connection showed limited impact on other constructs over time, which is somewhat surprising given the increasing emphasis on peers during early adolescence. One possible explanation is the focus in item content on *school* peers along with the timing of our first wave; the first wave of our data corresponds with the first year of secondary school in England, where adolescents experience an expanded peer group and a range of changes in their friendships (Jindal-Snape et al., 2020). This period of flux could have had implications for the meaningfulness of connectedness to peers. However, there were two exceptions: a positive prediction of later family connection from T2 to T3 (as discussed above) and, surprisingly, a positive prediction of later emotional distress from T2 to T3 ($\beta = -.06$). While both can be considered small relationships in the context

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of the wider model, the stability of emotional distress suggests that the effects of peer connection upon this outcome should be given close consideration. That is, greater perceived connection to one's peers predicted *greater* levels of emotional distress 1 year later, which directly contradicts our hypothesis and basic interpersonal theory expectations. We are unclear what the explanation for this relationship may be. We cannot rule out methodological contributors, although cannot find a satisfying explanation in this regard. Our sample is particularly large, which *could* lead to spurious results, but this is not a very small relationship (e.g., $\beta = .01$) easily explainable as a quirk of increased test sensitivity. We wondered whether this was the result of treating peer connection as manifest rather than latent, but CFA of the peer connection variable had shown this to be a good unidimensional model with highly uniform factor loadings (see Appendix B in Supplementary Materials). While we therefore doubt treatment of these as manifest variables would influence findings, we cannot rule this out, since a model with peer connection as a latent factor was not possible, as this could not converge.

If we assume this effect is genuine, there are several possible explanations. One is that these relationships were modelled at the within-person level; it *could* be that experiencing a fluctuation in peer relationships over time creates personal pressure to retain heightened connection and avoid rejection, since adolescent peer relationships can be 'high stakes' (Blakemore, 2018). However, we might expect such relational insecurity to translate into lowered connection scores, suggesting this is likely not a driver. Alternatively, there may be a dynamic in which relationships with peers at school include aspects of conflict and drama that are difficult to navigate over time. Certainly adolescents are navigating increasingly complex social situations and circles, and evidence suggests that *negative* friendship qualities are associated with adolescent depressive symptoms (Schwartz-Mette et al., 2020). Another possible explanation is co-rumination, a dyadic process wherein individuals excessively discuss, rehash, dwell on, and speculate about problems (Rose et al., 2014). Evidence suggests a greater tendency toward co-rumination in adolescence and that this can be associated with emotional distress (Rose et al., 2014; Stone et al., 2011). Interestingly, a recent study showed that within-person shifts in social communication mediated the relationship between stressful life events and internalizing difficulties, suggesting that co-rumination may play a key role in psychopathology processes (Rodman et al., 2021). Thus, it may be that those with greater connection also show a tendency toward co-rumination in the current sample, and it would be helpful to explore this further in a sample with available co-rumination data. Despite these methodological and conceptual considerations, then, we cannot confidently explain this finding. We encourage researchers to examine such relationships using RI-CLPM and similar within-person approaches within other samples to see if this result is replicated. One potential avenue here could be examining whether there is evidence of a U-shaped relationship between peer connection and emotional distress, wherein both low *and* high levels of social connection increase risk of distress over time.

Strengths and limitations

This study is a robust empirical investigation of a complex developmental trajectory, with many methodological strengths to aid confidence in findings. Our investigation focuses on a large sample, uses a longitudinal design to offer insight into the way these constructs interact over time, benefits from a RI-CLPM-approach modelling relationships at the within-person level, and includes covariates to aid precision in estimates.

However, although the demographics of our sample are broadly similar to national patterns, this should not be considered a representative sample, as the HeadStart programme and evaluation from which we draw our data has been implemented across six disadvantaged areas of England. Thus, readers should be cautious in generalizing findings, and it would be valuable to further explore these relationships in a large-scale representative sample. Having said this, we highlight value in understanding these relationships among a sample of young people living in disadvantaged areas and thus at greater risk of experiencing worsened mental health outcomes (though of course we do not suggest this is representative of adolescents in *all* disadvantaged areas).

We note some limitations in our measurement approaches. The SDQ subscale is brief and so captures a narrow grouping and range of emotional distress symptoms; future research could investigate these relationships using more comprehensive assessments. Similarly, the TEIQue-ASF subscale required some revision to be viable as a single-factor construct of perceived emotion regulation, and it would be valuable to further explore this relationship with other regulation measures. This includes complementary use of more objective approaches akin to skills testing, to more fully understand the respective roles of perceived *and* actual emotion regulation (Qualter et al., 2017). Similarly, all variables used here are self-report, and future research could explore wider strategies, such as use of multiple informants and observation approaches. Furthermore, our measures capture specific functions within regulation and social domains. While this is not a limitation per se—it is valuable to understand the role these particular functions play—it may be helpful to explore these relationships with other aspects of these regulation and social domains. For instance, reviews and meta-analyses have indicated that specific emotion regulation behaviors may influence rates of distress to differing extents (Shapero et al., 2016; Young et al., 2019); such different components are not captured in our construct of perceived emotion regulation at a more overarching level. Ongoing investigation drawing on varied measurement approaches and constructs, such as approaches that more directly assess emotion regulation skills and behaviors, or measures of social competence, could offer useful alternative insights into how these complex domains of functioning interact developmentally with psychopathology across adolescence.

Analytically, although use of RI-CLPM allows modelling of within-person relationships, this does still provide a summation of an overarching pattern, rather than capturing more individualistic trajectories. In future work it would be helpful to use latent class analysis to understand individual-level trajectories in the stability of particular constructs and how they may express alongside one another (Petersen et al., 2019). Further, we note that the RI-CLPM is vulnerable to the effects of unobserved *time-varying* confounders that might affect these relationships, meaning that if individual differences in changes over time are related to such confounders then cross-lagged parameters may produce biased estimates (Usami et al., 2019). A recent variant of panel modelling, the general cross-lagged panel modelling (GLCM), can be specified to control for such confounders, but this approach does not partial out stable between-person differences in the way that RI-CLPM does (Usami, 2021).

Finally, we recognize that readers may wonder about the role of the HeadStart programme in the reciprocal relationships we report here, given that our data is drawn from the evaluation of this

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program, which aims to explore and test ways to improve the mental health and wellbeing of young people. This means that individuals in our sample were likely exposed to a range of embedded provision and potentially more targeted interventions, including approaches that may target their emotion regulation or peer relationships. However, we emphasize that this is not at all unusual for adolescents in English schools, given a continued emphasis on schools as a site for mental health prevention and promotion (Department of Health & Department for Education, 2017; Public Health England, 2021). Thus, we would not expect that our participants' engagement with the HeadStart programme would render these findings contextually specific, and indeed would not expect the nature of *relationships* between such constructs to be markedly affected by such a program (e.g., an intervention targeting emotion regulation may increase perceived regulatory capacity, which *could* in turn predict lower distress, but we would not expect it to affect *how* this predicted distress). Nevertheless, we note that ongoing investigation across different samples and contexts would be valuable.

Conclusion

The current study has provided evidence of reciprocal relationships over time between emotional distress and perceived emotion regulation in early adolescence in a large sample and using robust modelling techniques. We note risk of a negative spiral for those experiencing initial distress in adolescence, which may become self-perpetuating over time by contributing to feeling less in control of one's emotions. It would be helpful to explore and better understand the extent to which this is related to negative self-evaluation for those experiencing distress or whether feelings of distress are genuinely disrupting and/or overwhelming regulatory capacity—or, more likely, a combination of the two. Our findings raise questions regarding the role of social connection in relation to these emotional experiences, given that family connection did not exert a great deal of influence over distress and regulation over time, and it appeared connection to one's peers may potentially *increase* distress. This emphasizes the need for ongoing research examining specific dimensions of relationships in relation to such functions in adolescence to better understand such processes. Taken together, the current study emphasizes the importance of early intervention for those with emergent difficulties and the importance of providing support in positive self-belief and regulatory strategies during early adolescence as a potentially difficult transition.

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