Cumulative Risk Exposure and Emotional Symptoms among Early Adolescent Girls

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Abstract

Background

From early adolescence, girls and women report the highest rates of emotional symptoms, and there is evidence of increased prevalence in recent years. We investigate risk factors and cumulative risk exposure (CRE) in relation to emotional symptoms among early adolescent girls.

Methods

Using structural equation modelling, risk factors were identified in relation to symptoms and collated into a CRE index to investigate associations among 8,327 girls aged 11–12 years.

Results

Four risk factors were identified: Low academic attainment, special educational needs, low family income, and caregiving responsibilities. CRE was positively associated with symptoms.

Conclusions

Findings offer insight into the epidemiology of emotional symptoms among adolescent girls during a vulnerable period, offering a timely contribution given current evidence of increased prevalence. Results suggest that several factors in day-to-day life are associated with emotional symptoms among early adolescent girls. Furthermore, early adolescent girls experiencing higher CRE are likely to experience greater emotional distress, highlighting the need for identification and intervention for of those facing greater adversity in daily life.

Background

In early adolescence, evidence suggests that girls begin to experience greater levels of emotional distress (i.e., depressive and anxious symptoms) than boys, typically around the age of 12 years (1). Studies show this disparity exists throughout the lifespan; girls and women twice as likely to report depressive symptoms and disorder from mid-adolescence compared to boys and men (1). They are also more likely to experience anxious symptoms and disorders, though this fluctuates based on type of anxiety (2). Depressive and anxious symptoms are distinct but strongly inter-related, with high comorbidity rates among adolescents (3). Worryingly, research indicates a significant increase in emotional symptoms and disorder among adolescent girls in recent years, in the United Kingdom (4–7) and other Western and non-Western countries (8,9), necessitating urgent research into the factors associated with such difficulties. We set out to investigate the risk factors associated with emotional symptoms among girls aged 11–12 years, and, as risk factors tend to co-occur (10), whether exposure to a greater number of risk factors corresponds to increased symptoms. We focus on symptoms rather than disorder given the reported increase in general symptomatology among girls (4–7) and current perspectives that psychopathology is experienced beyond diagnostic disorders.

Existing evidence relating to risk factors for emotional symptoms in childhood and adolescence (e.g., low family income (11)) suffers from key gaps and limitations. First, it is critical that in this area of work patterns are established across different populations and contexts, as the extent to which a factor is “risky” for an outcome can vary substantially (e.g. by gender and ethnicity; (10)). Only a few studies have investigated risk factors for emotional symptoms in early adolescence, and there is sparse evidence for girls specifically, despite their vulnerability. Furthermore, the extent and quality of evidence varies across different theorised risk factors. For example, studies examining associations between special educational needs (SEN) and symptoms are scarce and typically focused on specific conditions and small samples. Indeed, past investigations have often focused on single risk factors, failing to control for the confounding effects of other factors, despite evidence that risk factors co-occur (10,12). In this secondary data analysis, we sought to address these major gaps by examining the effects of multiple

risk variables. Specifically, we assessed eight candidate risk factors within our dataset for which there was varying levels of theoretical and/or empirical precedent of a relationship with higher levels of emotional symptoms:

- **Young relative age**: There is some evidence of greater symptoms among those youngest relative to peers in their academic year [14, 15], likely due to differences in schooling experiences (14). However, evidence is limited with only one study focusing on UK early adolescents (13).
- **Low academic attainment**: Research indicates an association between low attainment and symptoms, thought to be the result of perceived failure (15,16). Evidence suggests this relationship is stronger among girls (15,17), perhaps due to growing discourses of girls as naturally academic, necessitating replicative work to build a robust cumulative evidence base.
- **High academic attainment**: Conversely, feminist theory notes that *high* achievement and/or cognitive ability could be problematic for girls and women due to increased pressure (18), but empirical investigation has been scant (19).
- **SEN**: SEN (e.g., moderate learning difficulties, speech, language and communication needs, and Autistic Spectrum Disorder) status has been shown to be related to emotional symptoms, partially due to stress caused by challenges in navigating education and peer relationships (20,21). However, evidence is based primarily on small samples with specific SEN conditions, limiting generalisability. There is some evidence of greater effects for girls than for boys in samples with specific conditions, such as dyslexia (21), but evidence about SEN as a broad category is lacking.
- **Low family income**: Evidence consistently indicates a relationship between low income and symptomatology, with multiple possible mediating pathways including poverty-related stress (e.g., 11). A range of effect sizes have been reported, depending on specific population characteristics including gender (22), warranting further investigation.
- **Caregiving responsibilities**: A small amount of research suggests that young people providing emotional and physical caregiving typically performed by an adult may be at greater risk of mental health difficulties, potentially due to unmet needs or associated stress (23). Investigation has, however, been hindered by the small proportion of those with caregiving responsibilities within the general population and difficulties in identifying such individuals, while findings are often specific to caregiving around specific conditions/circumstances.
- **Adverse childhood experiences (ACEs)**: Research indicates an association between ACEs, characterised by family dysfunction and childhood maltreatment, and adult symptoms, understood to be due to chronic stress. Research in adolescence is limited (24).
- **Neighbourhood socioeconomic deprivation**: Neighbourhood socioeconomic deprivation, comprising dimensions including low household income, low levels of education, and overcrowding, correlates with emotional symptoms in childhood and adolescence, potentially due to increased stressors including lack of resources, inadequate housing, and violence (25). Those in deprived neighbourhoods are often exposed to a greater number of other domains, which can produce compound effects and necessitates ongoing examination alongside other factors (26).

Beyond identifying specific risk factors, it is also important to explore how cumulative risk exposure (CRE) relates to outcomes. Cumulative risk theory (12) posits that the more risk factors one is exposed to, the greater the negative effects on outcomes, and that the *number* of risk factors one is exposed to, rather than their *nature*, best predicts outcomes. Researchers have theorised that the impact of CRE could be attributable to chronic stress, mediational mechanisms (e.g., maternal responsiveness) and/or disruption of proximal development systems (10). Methodologically, this is assessed by identifying sample-specific risk factors, dichotomising (1 = risk present, 0 = risk absent) and summing these additively to create an unweighted composite score of the number of risk factors to which each individual is exposed (10). Studies show associations between CRE and worsened outcomes, including some evidence for concurrent and longitudinal emotional symptoms and internalising difficulties (15,27). However, like risk factors, evidence suggests CRE is contextually specific (10); CRE studies examining emotional symptoms have rarely focused on early adolescence, and associations have not been examined specifically among early adolescent girls, despite an urgent need to do so.

Methods

Aim and Setting of the Study

Given the above, we set out to: (a) investigate the risk factors associated with emotional symptoms among girls aged 11–12 years, examining these jointly to isolate their unique contributions; and (b) assess whether exposure to a greater number of risk factors corresponds to higher levels of symptoms in this population. Such investigation contributes to knowledge by isolating unique risk associations with emotional symptoms, overcoming various methodological challenges present in prior evidence, and offering population-specific estimates of risk within a vulnerable group. We focus on girls specifically, rather than seeking to establish gender differences, given consistent evidence of high rates of symptoms among girls and women and indications of early adolescence as a vulnerable period. Thus, investigation of the particular factors contributing to symptoms among early adolescent girls offers insights into a specific phenomenon within a vulnerable group, rather than offering a "comparative" discussion. We draw on data collected in 2017 for the evaluation of HeadStart, a large-scale programme exploring ways to improve young people's mental health and wellbeing. Use of secondary data offers several strengths; this dataset comprises a variety of explanatory variables and a large sample spread across a range of settings in England. We also note a key limitation inherent to all secondary analyses: as study variables were predetermined, we were unable to capture all factors of potential interest (e.g., biological factors, such as adrenal hormones).

Participants

The sample comprised 8,327 girls aged 11–12 years (M = 12.04, SD = 0.29) across 100 English education settings. Ethnicity was similar to the national secondary school composition (28); most participants were White (n = 6,217; 75.9%), followed by Asian (n = 885; 10.8%), Black (n = 472; 5.8%), mixed (n = 344; 4.2%), other (n = 131; 1.6%), and Chinese (n = 15; 0.2%). The remaining 1.5% (n = 122) had incomplete ethnicity information. Free school meal (FSM) eligibility (n = 1,436; 17.2%) was higher than national levels (14% (28)).

Measures

Emotional symptoms

The self-report Strengths and Difficulties Questionnaire (SDQ) emotional symptoms subscale (29) was used. There are five items (e.g., "I worry a lot") with three responses: "not true" (0), "somewhat true" (1), and "certainly true" (2). Summed scores range from 0–10, with higher scores indicating greater symptoms. Research has indicated acceptable psychometric properties for this subscale (30). Here, Cronbach's α was .72 and confirmatory factor analysis indicated acceptable fit: c^2 (5) = 255.28, p < .001; root mean square error of approximation (RMSEA) = .08, 90% CI [.07, .09], p < .001; comparative fit index (CFI) = .98, Tucker-Lewis Index (TLI) = .95.

Risk variables

Table 1 shows the measure used for each candidate risk factor, along with the approach to dichotomising data; all risk variables were obtained from the National Pupil Database (NPD), except caregiving responsibilities, which was self-reported.

[Insert Table 1 here]

Procedure

Ethical approval was granted for the HeadStart evaluation by University College London's ethics committee (reference 8097/003). Participants completed self-report measures in March–July 2017. Information sheets were provided to parents/carers and opt-out parental consent was used (114 girls opted out). Participants were presented with age-appropriate information and gave informed assent prior to completing by ticking a box to proceed. Surveys were administered online in teacher-facilitated sessions in participating schools.

Statistical Analysis

Analysis was undertaken using structural equation modelling in Mplus 8.1, using a robust weighted least squares (WLSMV) estimator to model emotional symptoms as a latent variable with categorical indicators (31). As data were gathered from participants across 100 settings (mean cluster = 83), clustering was controlled for using Type = Complex (intracluster correlation coefficients = .00–.40). RMSEA values below .06 and/or with 90% confidence intervals below 1.0, and CFI and TLI values above .95, indicated acceptable model fit (32,33). First, a linear multiple regression model was specified with risk variables predicting emotional symptoms. Variables were confirmed as risk factors where coefficients were positive and significant ($p < .05$).

Next, confirmed risk factors were collated to create a CRE index, in line with guidance that a CRE index should comprise only empirically confirmed sample-specific risk factors (rather than all theorised variables) given the contextual specificity of risk (10). Factors are coded as "1 = risk present" and "0 = risk absent" and summed (wherein a score of 1 denotes exposure to one risk factor, a score of 2 exposure to two risk factors, etc.). This index was then modelled as a predictor of symptoms to examine whether greater CRE is associated with increased symptomatology (10). Risk factors were then added in turn as covariates to confirm that any effects were not driven by any one factor (10).

Results

Preliminary Analysis

No normality violations were identified. Missingness was low (2.3–3.0% for survey items and

0–7.2% for demographic variables). Little's (1988) missing completely at random test was significant ($p < .001$) and item-level missingness was predicted by SEN status and low academic attainment; as such, data was presumed missing at random. As this amount of missingness is generally considered acceptable with large samples and data assumed to be missing at random (35), this was not considered problematic. However, sensitivity analysis using maximum likelihood with robust standard error estimates (MLR), which uses full information, allowed confirmation that results were not affected by the use of the WLSMV estimator. Table 2 presents descriptive statistics.

[Table 2 here]

Risk Factors

The first model in which the hypothesised candidate risk factors were modelled as predictors of emotional symptoms was shown to have a good fit : c^2 (41) = 321.03, $p < .001$; RMSEA = .03, 90% CI [.03, .03], $p = 1.00$; CFI = .97, TLI = .95; MLR sensitivity analysis yielded similar results. Table 3 shows regression coefficients.

[Table 3 here]

Results indicated four confirmed risk factors that were positively associated with emotional symptoms and statistically significant: (a) Low academic attainment, (b) SEN, (c) low family income, and (d) caregiving responsibilities.

Neighbourhood socioeconomic deprivation was also found to be significant ($p = .04$) but was rejected as this relationship was in the *opposite* direction to that theoretically expected. Three remaining candidate risk factors were rejected as they were not significant: (a) Young relative age within academic cohort (both young [$p = .58$] and middle [$p = .06$] groups); (b) high academic attainment ($p = .41$); and (c) ACEs ($p = .60$).

Cumulative Risk

The four confirmed risk factors were summed to create a CRE index ($M = 0.82$, $SD = 0.90$). On an initial index ranging 0–4, less than one percent of participants ($n = 69$) had a score of 4, so the upper two categories were collapsed to create an index

spanning 0 to 3+, consistent with previous CRE research (12,15). The largest proportion of the sample presented no risk factors, with incrementally fewer participants represented at each level of exposure (45.3% = 0 risk factors; 33.0% = 1 risk factor; 15.7% = 2 risk factors; 5.9% = 3+ risk factors), consistent with previous studies (10). Floor effects (45.3%) were present and so the index was treated as categorical rather than continuous in interpreting results (36). No other normality violations were identified and missingness across the full index was low (0.2%). Figure 1 shows a line chart of the relationship between CRE and symptoms.

Next, the CRE index was modelled as a predictor of symptoms, with acceptable model fit: c^2 (9) = 430.25, $p < .001$; RMSEA = .08, 90% CI [.07, .08], $p < .001$; CFI = .96; TLI = .93. MLR analysis yielded similar results. Results showed a statistically significant association between CRE and emotional symptoms (b = .09 [SE = .01]; β = .17 [SE = .02]). Inclusion of each covariate did not affect the significance of this relationship, suggesting that it was attributable to the CRE index (10).

Discussion

Our analyses identified four risk factors associated with emotional symptoms among early adolescent girls: low academic attainment, SEN, low family income, and caregiving responsibilities. In line with cumulative risk theory (12), greater levels of CRE corresponded to worsened symptoms. This research offers insight into the epidemiology of emotional symptoms among adolescent girls during a vulnerable period, offering a timely contribution given evidence of increased prevalence and a growing policy emphasis on understanding this phenomenon (37).

These findings build on previous research identifying risk factors in relation to emotional symptoms, offering evidence specific to early adolescent girls, and overcoming methodological issues that have limited prior evidence. Our inclusion of multiple factors allows isolation of the unique contributions (or lack thereof) each factor makes to symptoms among early adolescent girls. Furthermore, studies investigating heterogeneous circumstances, including SEN and caregiving responsibilities, have often focused on narrowed circumstances; our examination of these factors as broader categories offers insight into potential effects of managing such circumstances more generally. Notably, prior investigation of caregiving responsibilities in relation to emotional symptoms has been rare; our finding that this variable was the strongest predictor warrants further research to explore population-specificity and offer qualitative insight.

Young relative age, high academic attainment, ACEs, and neighbourhood socioeconomic deprivation were not found to function as risk factors. As these variables were included based on theoretical and/or empirical precedence, findings perhaps offer further indications of the contextual nature of risk. For instance, the focus on *early* adolescence may be relevant; high academic attainment may be more problematic in later educational stages where high stakes examinations come into play . However, some findings may also be methodological artefacts. Accounting for co-occurring risk variables may have offered more precise estimates than in previous research, while use of proxy measurement may have influenced results, such as use of child in need status to indicate ACEs rather than the checklists more typically used. Future work should explore factors across varying circumstances and populations, including among girls across developmental stages.

Our findings offer evidence of small CRE effects in relation to early adolescent girls' emotional symptoms. This adds to growing evidence suggesting that CRE has negative implications for outcomes, including child and adolescent emotional symptoms (15,27), and offers novel insight at a critical juncture for girls. Notably, the particular risk factors identified are each understood to affect mental health at least partially through the daily stress they introduce. This may reflect the theory that CRE leads to overwhelming stress levels, in turn impacting outcomes (10), and echoes theory that chronic stress might explain gender imbalances in emotional difficulties (38). These findings highlight a need to consider how support and treatment can be facilitated in a manner that is sensitive to the daily context of these difficulties, while also working to alleviate stressors.

Generalizability

Limitations should be noted in relation to the generalizability of these findings. First, although most candidate risk factors were measured prior to self-report of symptoms (except caregiving responsibilities), causality cannot be established given the inability to control for prior symptoms. Future studies should adopt longitudinal designs to establish directionality. Secondly, although use of routinely recorded NPD data means risk information is relatively reliable, this also represents proxy variables for more complex phenomena. For instance, ACEs are typically measured using a cumulative checklist rather than a present/absent dichotomy. Though the summed index in CRE research means binary information is not considered problematic, it may be useful to explore risk factors using varied measurement to create cumulative evidence. Third, although self-report is an appropriate means of measuring adolescent mental health, it can be subject to issues including social desirability; future research may benefit from a multi-informant approach. Furthermore, the use of secondary data analysis meant we were unable to use a comprehensive measure of symptoms, though evidence suggests the SDQ emotional symptoms subscale shows good known groups validity in distinguishing between healthy samples and those with psychiatric disorder (39). Cumulative risk theory and methods also have limitations. Though the additive approach mirrors the way risk factors co-occur, this is perhaps reductionist (40); treating risks as equal is inconsistent with differential risk factor effects, while statistically collapsing variables may reduce predictive power (10,40). Finally, confirmation of only four risk factors here precluded more nuanced CRE investigation that would require a more extensive index (e.g., the functional form of the CRE-symptom relationship).

Conclusions

This research highlights several factors within home and school life associated with emotional symptoms among early adolescent girls. Moreover, where individuals are exposed to several such factors, symptoms are likely to be worsened. Findings demonstrate the need to identify girls experiencing stressful daily challenges and provide intervention and support, particularly given the apparently growing vulnerability to emotional symptoms among adolescent girls. However, such actions should be sensitive to individual circumstance, as although varying risk profiles can similarly contribute to worsened outcomes, daily experiences may differ greatly. Future research should examine whether particular constellations of combined risk more greatly influence symptoms and investigate underlying mechanisms for CRE.

Abbreviations

ACEs = adverse childhood experiences

CFI = comparative fit index

CRE = cumulative risk exposure

FSM = free school meals

MLR = maximum likelihood with robust standard error estimates

NPD = National Pupil Database

RMSEA = root mean square error of approximation

SDQ = Strengths and Difficulties Questionnaire

SEN = special educational needs

TLI = Tucker-Lewis Index

WLSMV = robust weighted least squares

Declarations

Ethics approval and consent to participate

Ethics approval was granted by the University College London Research Ethics Committee (Ref. 8097/003). Written consent for participation was obtained from participants and from their parents/carers.

Consent for publication

Written consent included consent for publication of findings.

Availability of data and materials

The HeadStart survey data on mental health and wellbeing belongs to the Evidence Based Practice Unit (a collaboration between UCL and the Anna Freud National Centre for Children and Families, AFNCCF), who led the HeadStart evaluation. The authors accessed this survey data via membership in a consortium involved with the HeadStart evaluation. As collaborators on the main HeadStart evaluation, the authors were granted secure remote access to this data by the principal investigator of the main HeadStart evaluation, Dr. Jessica Deighton. HeadStart data cannot be made publicly available, since consent was not obtained from participants for the public sharing of their survey responses. However, an anonymised version of the survey dataset used in the present paper is available on request from Dr. Jessica Deighton (Jessica.DeightonPhD@annafreud.org) or Dr. Tanya Lereya (Tanya.lereya@annafreud.org) under the following terms: 1. Schedule and arrange for site visit to AFNCCF to analyse data (password to user account supplied). 2. Analysis to be worked on in situ. 3. Results (but not data) taken away. In the event that either of these individual leaves the AFNCCF, updated contact information for new guardians of the data will be provided to BMC Women's Health.

Competing interests

The authors have declared that they have no competing or potential conflicts of interest.

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Authors' contributions

The current study was led by the first author (OD), who had full access to the data and takes responsibility for the integrity of the data and accuracy of analysis), with MP and NH providing supervisory assistance in undertaking the research, interpreting results, and developing the manuscript.

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Tables

Table 1

Measurement of candidate risk factors

Candidate Risk Factor	Measurement
Young relative age	Three categories based on birth month: youngest (May–August; n = 2,921; 35.1%), middle (January–April, n = 2,565; 30.8%) and eldest (September–December; n = 2,810; 33.7%), with youngest and middle groups assessed as risk variables.
Low and high academic attainment	Average Point Scores from Key Stage Two Statutory Assessment Tests, undertaken one year before self-report. As both high and low attainment were assessed as risk factors it was necessary to isolate risk groups in advance of analysis; those in the lowest quartile were considered low attainers (*n* = 1,902; 22.8%) and those in the upper quartile as high attainers (*n* = 1,917; 23%).
SEN	Having SEN with or without a statement of SEN or Education, Health and Care plan (*n* = 609; 8.3%), excluding participants identified as having SEN due to mental health needs given overlap with the outcome variable.
Low family income	Current or past FSM eligibility (*n* = 2,982; 35.8%).
Caregiving responsibilities	Participants responded yes or no to: "Young carers are children and young people under 18 who provide regular or ongoing care to a family member who has an illness, disability, mental health condition or drug/alcohol dependency. Are you, or have you ever been, a young carer?".
ACEs	Measured by proxy using binary Child in Need (CIN) status (*n* = 446; 5.4%), which captures elements of family dysfunction and childhood maltreatment and offers current information rather than relying on participant recall. A child or young person is considered 'in need' if it is deemed that: (a) They are not likely to achieve or to maintain reasonable health and development without local authority services and support, (b) their health and development is likely to be substantially impaired without local authority services and support, or (c) they have a disability. This may be due to factors including abuse or neglect, child disability, and family in acute stress.
Neighbourhood socioeconomic deprivation	Income Deprivation Affecting Children Index score, a continuous variable where greater values denote greater deprivation.[a]

Note. SEN = special educational needs; ACEs = adverse childhood experiences

[a] Risk variables treated as continuous in risk factor analysis (here, neighbourhood socioeconomic deprivation) found to be statistically significant risk factors are typically dichotomised to allow integration into a CRE index by isolating the upper or lower quartile as appropriate [10].

Table 2

Descriptive Statistics and Bivariate Correlations

Variable	*N*	%	1	2	3	4	5	6	7	8	9
1. Emotional symptoms [a]	—	—	—								
2. Young relative age (youngest)	2,921	35.1	.01	—							
3. Young relative age (middle)	2,565	30.8	-.02	-.49***	—						
4. Low academic attainment	1,902	22.8	.07***	.06***	.01	—					
5. High academic attainment	1,917	23.0	-.05***	-.08***	.01	-.32***	—				
6. SEN	609	8.3	.06***	.03**	.01	-.28***	-.13***	—			
7. Low family income	2,982	35.8	.07***	.00	-.01	-.17***	-.17***	.12***	—		
8. Caregiving responsibilities	1,399	16.8	.12***	.03*	-.02	.10***	-.10***	.07***	.15***	—	
9. ACEs	446	5.4	.02***	.03*	-.02	-.07***	-.07***	.05***	.21***	.10***	—
10. Neighbourhood socioeconomic deprivation [b]	—	—	.03*	.01	-.01	-.15***	-.15***	.10***	.37***	.11***	.15***

Note. SEN = special educational needs; ACEs = adverse childhood experiences. [a] M = 4.28, SD = 2.52 (range = 0–10); [b] M = .24, SD = .14 (range = .01-.81).

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Regression Beta Coefficients and Standard Errors for Hypothesised Candidate Risk Factors as Predictors of Symptoms (*n* = 7,326)

	Unstandardised		Standardised	
Candidate risk factor	b	SE	β	SE
Young relative age (youngest)[a]	-0.01	0.02	-.02	.04
Young relative age (middle)[a]	-0.04	0.02	-.07	.04
Low academic attainment	**0.06****	**0.02**	**.11****	**.04**
High academic attainment	-0.01	0.02	-.03	.04
SEN	**0.08****	**0.02**	**.15****	**.05**
Low family income	**0.05****	**0.02**	**.10****	**.03**
Caregiving responsibilities	**0.17*****	**0.02**	**.33*****	**.04**
ACEs	0.01	0.03	.02	.06
Neighbourhood socioeconomic deprivation	-0.11*	0.05	-.03*	.02

Note. Confirmed risk factors are shown in bold type. SEN = special educational needs; ACEs = adverse childhood experiences.

[a] Eldest young relative age within academic cohort group (born September – December) utilised as reference category for dummy variables.

*$p < .05$. ** $p < .01$. *** $p < .001$.

Figures

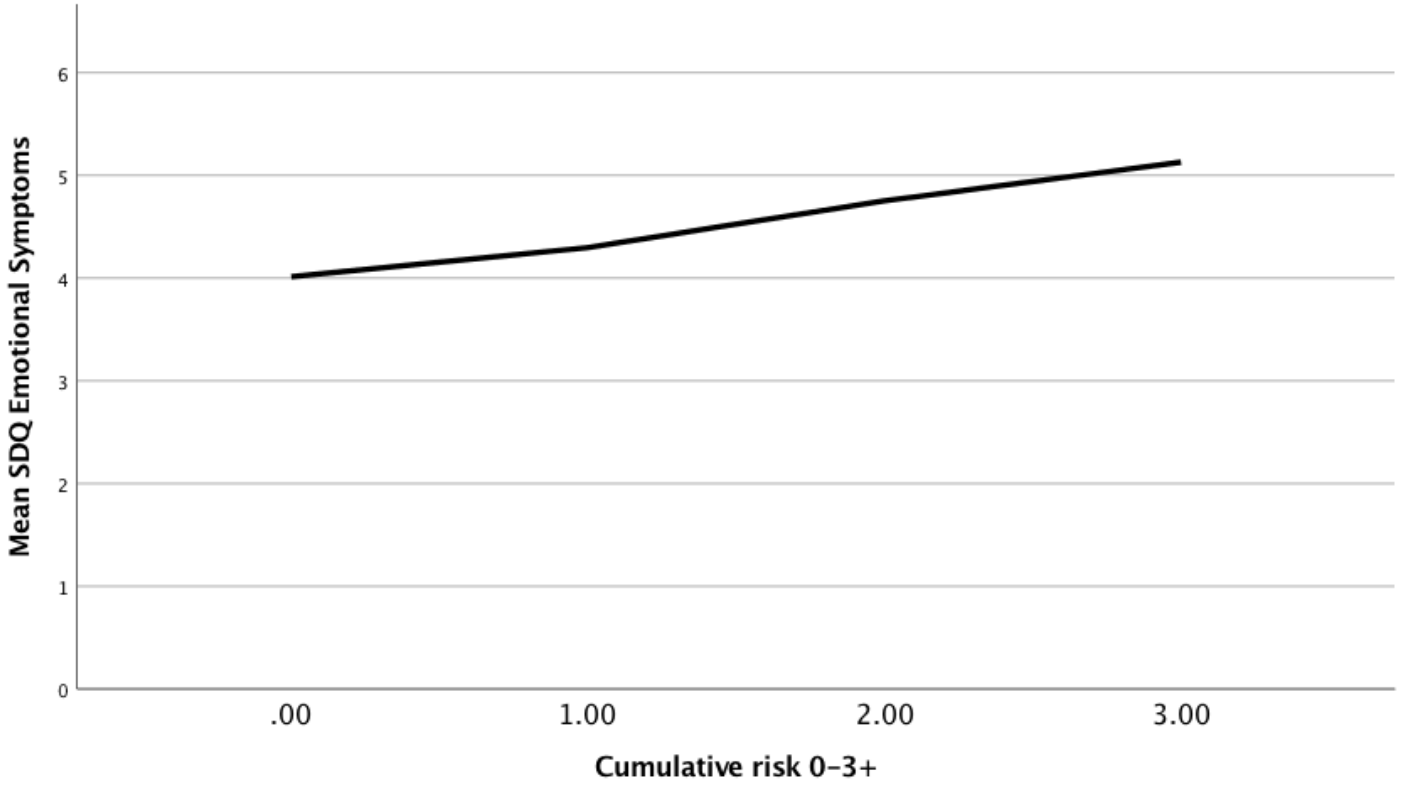

Figure 1

Line chart for emotional symptoms and the cumulative risk exposure (CRE) index.