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Associations of Cumulative Family Risk with Academic Performance and Substance Involvement: Tests of Moderation by Child Reading Engagement

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Abstract

Background: Exposure to cumulative contextual risk within the family early in life increases children's risk for substance involvement and related difficulties, including school failure, in

Informed consent

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Research involving human participants and/or animals

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The NFBC1986 study was approved by the ethical committee of the Northern Ostrobothnia Hospital District.

Informed consent was obtained from all individual participants included in the study.

adolescence and young adulthood. However, potential protective factors that buffer these risk associations are relatively untested, yet such tests are needed to improve existing preventive interventions for enhancing resilience among vulnerable children.

Objectives: This study tested child reading engagement with parents at home as a moderator of cumulative family risk associations with adolescent substance use and academic performance as well as young adult substance abuse.

Methods: Population register data as well as parent-report and adolescent-report data from 6,963 participants of the 1986 Northern Finland Birth Cohort study were analyzed via structural equation modeling with latent variable interactions.

Results: Results showed that child reading engagement moderated the associations of cumulative family risk with both adolescent academic performance and young adult substance abuse, but not with adolescent substance use. The highest levels of academic performance were observed under conditions of low risk and high reading engagement. Interestingly, cumulative family risk had a small positive association with substance abuse when reading engagement was low and a negative association with the young adult outcome when reading engagement was high.

Conclusions/Importance: Moderation tests revealed complex interaction forms that may have implications for both theory and family-based preventive interventions.

Keywords

reading engagement; cumulative risk; protective factors; substance abuse; academic performance

Adolescent use of alcohol, cigarettes, and other substances is associated with diminished psychosocial functioning in key areas of development (Bonomo et al., 2001; Newcomb & Bentler, 1988), including academic performance (Bachman et al., 2008), and increases risk for substance abuse in young adulthood (Mason & Spoth, 2012). A great deal of longitudinal research has been conducted to identify factors that either increase or decrease risk for adolescent substance use and young adult substance abuse (Hawkins, Catalano, & Miller, 1992). This research has led to the development of evidence-based preventive interventions with demonstrated effects on delayed substance initiation (Spoth, Redmond, Shin, & Azevedo, 2004; Trudeau, Spoth, Lillehoj, Redmond, & Wickrama, 2003) and reduced substance involvement (Botvin, Griffin, Paul, & Macaulay, 2003). Encouraging as this progress has been, there is room for improvement. In their overview of meta-analyses of prevention trials, Sandler et al. (2014) reported a statistically significant but relatively small summary effect size of .14 for the prevention of any substance use. Enhanced knowledge of the developmental etiology of substance use and abuse can provide a more nuanced understanding of how to intervene, potentially informing program modifications that can strengthen preventive intervention effects.

Research shows that children's exposure to contextual risks within the family, such as poverty and parental alcohol use, early in life can have lasting adverse consequences for development (Kiff et al., 2012). Such risks rarely occur in isolation, but often cluster together. According to the cumulative risk (Rutter, 1979; Sameroff, Seifer, Zax, & Barocas, 1987) and adverse childhood experiences (Felitti et al., 1998) research traditions, the sheer

number of contextual risk factors, typically operationalized as a count of dichotomous risk indicators, is a robust predictor of poor outcomes for children. In support of these research traditions, numerous studies have documented significant associations between cumulative contextual risk and a range of negative developmental outcomes (Evans, Li, & Whipple, 2013), including substance use (Newcomb & Felix-Ortiz, 1992). For example, a prior analysis from the current study found that a measure of cumulative contextual risk within the family at the prenatal/birth period had a statistically significant positive association with a latent substance use factor indicated by regular cigarette use, drunkenness, and other substance use in mid-adolescence (Mason et al., 2016). In a separate project analysis (January et al., 2017), the same cumulative risk index had a long-term negative association with academic performance. To date, however, factors that might buffer cumulative contextual risk influences are understudied; therefore, potential protective processes are poorly understood.

The identification of protective factors helps elucidate resilience processes (Masten, 2001), which enable individuals to overcome risk factors that otherwise can lead to adolescent substance use and related psychosocial difficulties, such as school failure, and the development of young adult substance abuse. Protective factors are understood only within the context of risk (Zimmerman, 2013). There are four types of resilience processes that differ in how they impact functioning (Luthar, Cicchetti, & Becker, 2000). Whereas a main effect shows that a basic protective factor benefits both high and low risk groups, interaction effects can reveal differential benefits for the high-risk group. For example, protective stabilizing factors are those that prevent youth with risk from experiencing poorer outcomes that they would otherwise experience in the absence of that factor. Protective enhancing factors confer better outcomes for youth with high risk; however, those with low risk experience poor outcomes. Finally, protective but reactive factors are those that result in better outcomes, but less so for those with high risk.

Despite long-standing calls to increase research on protective factors, studies of such factors remain few in number in the substance use prevention literature. Recent evidence suggests that children's engagement in academic work, both at school and in the home, may serve as a valuable protective factor that promotes positive youth development and resilience for children who experience high levels of risks within a family (Morrison, Robertson, Laurie, & Kelly, 2002; Rae-Grant, Thomas, Offord, & Boyle, 1989). Engagement is the level of cognitive involvement that a person invests in a process (Guthrie, Wigfield, & You, 2012). Theory and research provide evidence that lower levels of school-focused engagement are associated with deviant behaviors, such as substance abuse, conduct disorders, and school drop-out in adolescence (Wang & Fredricks, 2014). Higher levels of engagement, on the contrary, may buffer the negative impacts of cumulative family risk by promoting intrinsic motivation for learning and self-education. Several studies indicated that higher levels of academic engagement were associated with lower risk of delinquent behavior and delayed initiation of substance use in adolescence (Bryant, Schulenberg, O'Malley, Bachman, & Johnston, 2003; Li et al., 2011).

Reading engagement, broadly defined as interest in books and choosing to spend time actively reading (Gambrell, 2011), is one of the main elements of academic engagement. In

early childhood, reading engagement at home with parents may be particularly important since, in contrast to the school setting, it can represent an active choice among alternative activities, and also may reflect an academically enriched home environment. As outlined by Ng, Bartlett, and Elliott (2018), reading engagement is important for positive youth development, because it reflects commitment of time and sustained effort, and is associated with better academic outcomes. It also is associated with better social outcomes and more proactive behaviors in students (Christenson, Reschly, & Wylie, 2012). Finally, reading engagement empowers self-education and development of aspirations (Ng et al., 2018). Taken together, reading engagement may serve as a buffering factor for kids at-risk for underachievement and negative developmental outcomes. Research has shown that reading engagement compensates for low family income and educational background, such that engaged readers from families with a higher number of such risks were higher in achievement compared to less engaged students from families with a lower number of these risks (Campbell, Voelkl, & Donahue, 1997; Gambrell, 2011). Similarly, a study by Guthrie, Schafer, and Huang (2001) revealed that among students from families with a higher number of educational and income-related risks, those with higher reading engagement outperformed students with lower reading engagement and the same background characteristics. As stated by Gambrell (2011), this research suggests that "reading engagement is more important than student's family background" (p. 172).

Despite these positive findings, there is still a clear lack of studies examining the buffering role of reading engagement with respect to a wider range of outcomes. For instance, it is still unknown if reading engagement with parents in early childhood buffers the association of cumulative family risk with later substance involvement and academic performance. Consistent with a developmental cascades model, which emphasizes cross-domain longitudinal associations between variables (Masten et al., 2005), it is important to investigate the long-term associations of reading engagement in early childhood with outcomes in adolescence and young adulthood. This information will help elucidate one potential malleable protective factor that may mitigate the negative impact of cumulative risk on adolescent and young adult outcomes.

Using data from the Northern Finland Birth Cohort 1986, this study fills gaps in the literature by examining longitudinal relationships leading from cumulative family risks in early childhood (age 7 years) to both substance use and academic performance in mid-adolescence (ages 15 and 16 years) and, ultimately, to substance abuse in young adulthood (up to age 28 years). Importantly, early child reading engagement with parents was considered as an additional predictor and also as a potential moderator. In addition to the well-documented role of reading engagement in promoting academic performance, reading engagement was expected to lower risk for substance use in mid-adolescence and substance abuse in young adulthood. Furthermore, based on reviewed research, reading engagement was expected to buffer the influences of cumulative family risk on the adolescent and adult outcomes. Analyses also controlled for both childhood academic difficulties (Guthrie et al., 2012), which captures individual differences in aptitude, and gender (Gibb, Fergusson, & Horwood, 2008).

Method

Data Source and Participants

The Northern Finland Birth Cohort 1986 (NFBC1986) served as the data source for this study. A population-based study of individuals born during a one-year period, the NFBC1986 original cohort included 9,432 children born alive, whose expected date of birth fell between July 1, 1985 and June 30, 1986 (98.5% of all deliveries taking place in the two northernmost provinces of Finland). NFBC1986 data collection details are available elsewhere (Järvelin, Hartikainen-Sorri, & Rantakallio, 1993; Miettunen et al., 2014). The current analyses used data collected at prenatal/birth, childhood, adolescence, and young adulthood.

Prenatal/Birth.—Study data collection began with expectant mothers' first antenatal visit to the local prenatal clinic (on average at the 12th gestational week), where they were asked to complete a prenatal background questionnaire and return it by their 24th gestational week. A subsequent pregnancy questionnaire was completed by midwives at the last antenatal visit to the clinic, or during the first home visit by the midwife after delivery. Additional information on pregnancy and delivery was completed by midwives and/or medical staff at the prenatal clinics.

Childhood.—In 1992 – 1993, when children were 7 years old, a postal questionnaire was sent to parents in the fall of their first year of school. This age 7 parent survey covered children's growth, development, health, school, family and social situation (90% completion rate). In 1993-94, when children were 8 years old, postal questionnaires were sent to parents and homeroom teachers in the spring of their first year of school. The age 8 parent questionnaire included items about their child's behavior, learning difficulties, and school attendance (90% completion rate). The teacher survey covered children's school behavior and performance (92% completion rate).

Adolescence.—In 2001-2002, a postal questionnaire was mailed to the 15 - 16 year old participants. This survey covered topics such as family, school, behavior, health, and activities (80% completion rate). During this same time, participants were also invited to a clinical examination where adolescents filled in an additional survey on eating habits, stress, sexual behavior, substance use, and mental well-being (76% participation rate).

Young Adulthood.—Finnish national registers provided substance-related diagnoses through 2013. Court criminal records on substance-related sanctions from 2003 through 2005 were also obtained. These data can be missing due to immigration or deaths, but otherwise are complete.

The final analysis sample of 6,963 participants included all consented youth with adolescent self-report data (74% of live births), with one randomly selected child from each set of participating non-singletons. Participants in the final analysis sample were 51% female and had an average age in adolescence of 16.0 (14.58 to 16.96) years. Attrition analyses showed that the final analysis sample has more females (51% v. 48%; X^2 (1, N= 16395) = 10.41, p

< .05) than the original live-born birth cohort. The NFBC1986 study was approved by the ethical committee of the Northern Ostrobothnia Hospital District.

Measures

Child reading engagement.—Indicators of children's reading engagement have commonly included an interest in reading and book seeking. Following procedures outlined by Guthrie, Schafer, and Huang (2001), we selected an item to represent a child's interest in reading. Specifically, *likes to read/asks parent to read* was measured using the question, "Does your child like to read or ask you to read him/her children's books or magazines?" with response options of "hardly ever" (1), "sometimes" (2), and "often" (3). Another aspect of engagement is book seeking. Engaged readers typically have well-formed reading interests, and they pursue those interests by reading (McLoyd, 1979). To represent that aspect of reading engagement, we selected an item *particularly likes books*, which was culled from a stem asking "What does your child particularly like (you can choose more than one):" with "books" as an option. A latent construct of child reading engagement was created using these two parent-reported items from the age 8 postal questionnaire ($\alpha = .53$).

Childhood cumulative family risk.—Guided by cumulative contextual risk indices used in prior studies (Evans et al., 2013), an 8-indicator index was created to reflect cumulative contextual risk within the family by early childhood. Three indicators were collected during the pregnancy questionnaires, while the parent age 7 postal questionnaire contributed the remaining 5 indicators. The indicators, described in more detail below, were: 1) teenage mother, 2) smoking while pregnant, 3) drinking while pregnant, 4) single parenthood, 5) maternal unemployment, 6) paternal unemployment, 7) low maternal education, and 8) low paternal education. Each indicator was coded 1 to represent presence of the risk and 0 to represent absence of the risk (i.e., the reference category). For a single-parent mother-only family, father-related items (items 6 and 8) were coded as missing. The index was computed as the sum of the 8 dichotomous indicators. The number of risk indicators was distributed as follows: 51.2% (n = 3,563) with zero risks; 29% (n = 2,019) with one risk, 14.2% (n = 986) with two risks, 3.9% (n = 270) had three risks, 1.3% (n = 93) had four risks. Less than one percent had five (n = 31) or six (n = 1) risks.

Teenage mother was coded 1 if the mother gave birth to the participant at age 19 or younger. *Smoking while pregnant* was coded 1 if the mother smoked after the first trimester during pregnancy. *Drinking while pregnant* was coded 1 if the mother drank alcohol during pregnancy. *Single parenthood* was coded 1 if at age 7 the family structure was one parent not in a cohabitating union (e.g., unmarried, widowed, or divorced). *Maternal unemployment* was coded 1 if the mother was unemployed or receiving benefits for unemployment when the child was age 7. *Paternal unemployment* was coded 1 if the father was unemployed or receiving benefits for unemployed or receiving benefits for unemployment when the child was age 7. *Low maternal education* was coded 1 if when the child was age 7, the mother had completed fewer than 9 years of comprehensive schooling (Grades 1-9). *Low paternal education* was coded 1 if when the child was age 7, the father had completed fewer than 9 years of comprehensive schooling (Grades 1-9).

Adolescent academic performance.—A four-indicator latent variable ($\alpha = .76$) based on self-reported performance in *Finnish* (native language), *Humanities* ("general subjects such as history, religion"), *Math*, and *Science* ("biology, physics, chemistry") was used to measure academic performance. The question stem was, "Compared to other pupils your age, how well are you doing in . . .", with response options of "really badly" (1), "worse than average" (2), "average" (3), and "better than average" (4).

Adolescent substance use.—Based on prior project analyses (Mason et al., 2016), three indicators from adolescent self-report formed a substance use latent variable ($\alpha = .54$): 1) regular cigarette use, 2) lifetime drunkenness, and 3) lifetime illegal drug use. *Regular cigarette use* was collected on the postal questionnaire using the question, "Do you smoke now?," with response options of "not at all" (0), 1 "occasionally" (1), "one day a week" (2), "2-4 days a week" (3), "5-6 days a week" (4), and "7 days a week" (5). Frequency of *lifetime drunkenness* was collected on the clinic questionnaire using the question, "How many times in your life have you been drunk?," with response options of "never" (0), "1-2 times" (1), "3-5 times" (2), "6-9 times" (3), "10-19 times" (4), "20-39 times" (5), and "40 times or more" (6). From the clinic questionnaire, *lifetime illegal drug use* was measured with three questions coving marijuana, hard drugs, and intravenous drug use. Response options were never, once, 2-4 times, 5 times or more, or regular user. Due to low prevalence rates, these three items were collapsed into a single dichotomous lifetime illegal drug use (1) or non-use (0) variable.

Young adult substance abuse.—Three indicators representing diagnosed substance use disorders and one representing documented substance-related criminal sanctions into adulthood formed the latent construct *young adult substance abuse*. Using ICD-10 substance abuse and dependence diagnoses available from national health registries, three dichotomous indicators were created: *any alcohol diagnosis, any cannabis diagnosis, and any other drug diagnosis*. These data reflect diagnoses through 2013, or when participants were 27 – 28 years of age. Four registers provided source data: 1) Care Register for Health Care (inpatient treatments until 2013), 2) Finnish outpatient registers (specialized care 1998-2013, primary care 2011-2013), 3) Social Insurance Institution registers: reimbursable medicines (until 2005), and 4) Finnish Center for Pensions: disability pensions (until 2013). Official court data on criminal sanctions provided the fourth indicator, *Driving Under the Influence (DUI)*. These court data are based on events from January 1, 2003 through December 31, 2005 when the participants ranged from age 16.5 to 20.7 years old. Individuals cannot have a criminal record in Finland until age 15. The variable is a dichotomization of the count of DUI sanctions disposed in criminal court.

There is a long tradition (e.g., Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996; Newcomb & Felix-Ortiz, 1992) of reliably and validly representing both substance use and substance abuse in structural equation models as reflective (rather than formative) latent variables (Kline, 2015). In these measurement models, substance use and substance abuse are conceptualized as broad unobserved or unobservable constructs that "cause" observable behaviors captured through responses to questions about the quantity and frequency of substance intake and substance-related difficulties (i.e., the manifest latent variable

indicators). For this reason, arrows in the measurement model (i.e., estimated factor loadings) extend from each latent variable to its indicators.

Early academic difficulties.—Three survey items collected from postal questionnaires at age 8 were used to create a count of childhood academic difficulties from two reporters. All three items used response options of "yes" (1) and "no" (2). Teachers answered two items: "Has the child got difficulties in learning to read?", and "Has the child got difficulties in learning to write?", while parents answered one item, "Do you think your child has an illness or disability which influences his/her ability to learn?" An *early academic difficulties* score was computed by counting the "yes" responses to the three items ($\alpha = .65$).

Gender.—Participant gender was coded 1 for males and 0 for females.

Data Analyses

The primary analysis was a structural equation model (SEM) with latent variable interaction effects conducted in Mplus 7.4 (Muthén & Muthén, 1998-2017). The approach implemented by Mplus estimates interactions involving one or more continuous latent variables (cumulative family risk X child reading engagement) via maximum likelihood estimation with robust standard errors (MLR) using a numerical integration algorithm (Klein & Moosbrugger, 2000). We also conducted a sensitivity analysis that included quadratic terms for both cumulative family risk and child reading engagement, in addition to their product term, as recommended by Lubinski and Humphreys (1990) to avoid potentially spurious conclusions in support of hypothesized moderation.

Currently, Mplus does not output traditional fit statistics, including the chi-square statistic, for latent variable interaction analyses. Thus, to evaluate the measurement model, a preliminary confirmatory factor analysis (CFA) was conducted with parameter estimates generated using the Weighted Least Squares Mean- and Variance-adjusted (WLSMV) estimator. This same approach was used to conduct a main effects SEM that examined hypothesized paths before the addition of interaction effects. Although the chi-square statistic is reported, it is often statistically significant in large samples; therefore, the root mean square error of approximation (RMSEA) and the comparative fit index (CFI) are provided as alternative fit indices for the CFA and main effects SEM. As a rule of thumb (Hu & Bentler, 1998), RMSEA values around .06 or lower and CFI values around .95 or higher reflect acceptable fit between the data and the model.

Missing data in the primary analysis were handled via full-information maximum likelihood estimation, which yields more efficient and less biased parameter estimates than traditional missing data approaches (Schafer & Graham, 2002). Note that cases without any data collected during adolescence were dropped from the analysis sample to avoid including individuals who were completely missing on key outcome variables; no such exclusions were made based on the young adult measures, as the population register data were complete.

Results

Descriptive Statistics

Table 1 provides correlations (Pearson and its special cases, depending on the distribution of each variable) and descriptive statistics for the study variables. The pattern of relationships was generally as expected. For example, cumulative family risk had statistically significant (p < .05) negative associations with indicators of reading engagement and academic performance and positive associations with indicators of substance use and abuse (with the exception of cannabis abuse/dependence diagnosis).

Confirmatory Factor Analysis

Fit between the data and the CFA was acceptable, X^2 (86 *df*, N = 6,963) = 1275.21, p < .05, CFI = .940, RMSEA = .045. As shown in Table 2, all factor loadings were statistically significant, ranging in standardized value from .66 to .87. Although not reported in full to conserve space, there were expected statistically significant (p < .05) correlations among factors. For example, reading engagement had a positive association with academic performance ($\beta = .27$) and negative associations with substance use ($\beta = -.14$) and substance abuse ($\beta = -.13$). By contrast, cumulative family risk had a negative association with academic performance ($\beta = .20$) and positive associations with substance use ($\beta = .18$) and substance abuse ($\beta = .13$).

Main Effects SEM

Fit between the data and the main effects SEM was acceptable, X^2 (86 *df*, N= 6,963) = 1271.77, p < .05, CFI = .940, RMSEA = .044. Results from this model are not reported in full, but are available on request. All factor loadings were statistically significant, ranging in standardized value from .66 to .87. Paths from cumulative family risk were as follows: substance use (b = .224, p < .05; β = .17), academic performance (b = -.115, p < .05; β = -. 16), and substance abuse (b = .016, p > .05; β = .02). Paths from child reading engagement were as follows: substance use (b = -.214, p < .05; β = -.15), academic performance (b = . 185, p < .05; β = .23), and substance abuse (b = .038, p > .05; β = .17). Both substance use (b = .248, p < .05; β = .42) and academic performance (b = -.172, p < .05; β = -.16) had statistically significant associations with substance abuse. The model explained an estimated 6% of the variance in substance use.

Interaction Effects SEM

SEM results for all hypothesized paths are reported in Figure 1. All factor loadings were statistically significant (p < .05), ranging in standardized value from .63 to .89. Cumulative family risk had a positive association with adolescent substance use that was not moderated by reading engagement, which itself had a negative association with substance use. By contrast, the associations of cumulative family risk with both academic performance and substance abuse were moderated by reading engagement. Figure 2 provides a plot of the relation between cumulative family risk and academic performance at one standard deviation above and below the mean of reading engagement. The highest levels of academic

performance were observed under conditions of low cumulative family risk and high reading engagement. Academic performance decreased as risk increased, regardless of the level of reading engagement. Simple slope analyses indicated that the slopes for high (t= -10.29, df=6959, p < .001) and low (t= -2.82, df=6959, p=.005) reading engagement group were statistically different from zero. Figure 3 provides a plot of the relation between cumulative family risk and substance abuse at different values of the moderator. Interestingly, there was a significant negative relation between cumulative family risk and substance abuse, when reading engagement was high (t= -2.67, df= 6959, p= .008). When reading engagement was low, the relation between CCR and substance abuse was positive, but not-significant (t= 1.31, df= 6959, p= .19).

Adolescent substance use had a positive association with young adult substance abuse, whereas adolescent academic performance had a negative association with the young adult outcome. Expected associations were observed for the covariates. For example, both academic difficulties ($\beta = .09$) and male gender ($\beta = .28$) had positive associations with the young adult outcome ($p_s < .05$). Taken together, variables in the model explained an estimated 7% of the variance in substance use, 14% of the variance in academic performance, and 40% of the variance in substance abuse.

Sensitivity Analysis

A sensitivity analysis was conducted by extending the model depicted in Figure 1 with the addition of two quadratic terms (cumulative family risk X cumulative family risk and child reading engagement X child reading engagement). The purpose of this analysis was to test for curvilinear associations of cumulative family risk as well as child reading engagement with the adolescent and young adult outcomes, and to evaluate the extent to which such associations, if present, might account for the significant interaction effects identified in the primary model. Results from this analysis are not reported in full, but are available on request.

Two of the quadratic effects were statistically significant. The quadratic cumulative family risk term had a statistically significant negative association with substance use (b = -.031, s.e. = .013, p < .05; β = -.08), indicating that the positive link between the predictor and the outcome decreased in magnitude with increasing family risk. The quadratic child reading engagement term had a statistically significant positive association with academic performance (b = .033, s.e. = .01, p < .05; β = .11), indicating that the positive link between the predictor and the outcome increased in magnitude with increasing reading engagement. Importantly, the interaction of cumulative family risk with child reading engagement remained statistically significant in relation to both academic performance (b = -.050, s.e. = .018; β = -.07) and substance abuse (b = -.020, s.e. = .006; β = -.16), and the patterns of the interaction effects were the same as described above.

Discussion

Significant progress has been made in understanding the etiology of youth substance involvement and related psychosocial difficulties, such as school failure (Bachman et al., 2008; Mason & Spoth, 2012; Newcomb & Bentler, 1988). This has led to the development

of effective substance use preventive interventions (Botvin et al., 2003; Spoth et al., 2004; Trudeau et al., 2003); however, the magnitude of intervention effects has been relatively small (Sandler et al., 2014). A more nuanced understanding of the development of adolescent substance use and young adult substance abuse could help guide the refinement of existing interventions, holding promise for achieving stronger effects on targeted outcomes. Toward this end, the current study examined child reading engagement as a potential protective factor that buffers risk for substance involvement and low academic performance for children exposed to cumulative family risk early in life using longitudinal data from a large birth cohort.

We hypothesized that child reading engagement would buffer associations between cumulative contextual risk and adolescent academic performance, substance use, and young adult substance abuse. The benefits of reading engagement commonly include greater opportunities for social and personal development, higher academic achievement, and empowered self-directed learning (Ng et al., 2018). For students from challenging environments characterized by a high number of contextual risks in a family, these benefits are limited because they are facing numerous obstacles preventing them from engagement (e.g., poorer physical environment, lack of cognitive stimulation, high levels of stress, and limited learning opportunities at home) (Guo & Harris, 2000). Thus, improving reading engagement for children in need may redefine their approach to learning, promote social engagement, and reduce their chances for developing deviant behaviors, such as substance use or school drop-out (Jensen, 2013; Wang & Fredricks, 2014).

Results from our study showed that childhood cumulative family risk had a positive direct association with adolescent substance use (see also Mason et al., 2016), which was not moderated by child reading engagement. Reading engagement did moderate the associations of cumulative family risk with both adolescent academic performance and young adult substance abuse. These interaction patterns were complex. Cumulative family risk was associated with low academic performance at both high and low levels of reading engagement. There were benefits of child reading engagement for adolescent academic performance, as demonstrated in prior research (Guthrie et al., 2012; Wigfield et al., 2008), but only at low levels of cumulative family risk, representing a protective but reactive factor (Luthar et al., 2000). In this sense, reading engagement did not serve to protect the most vulnerable children, but appeared to have a beneficial association under conditions of low risk. This perhaps suggests the benefit of helping parents engage their children in reading within the context of universal family-focused preventive interventions, but such efforts may have less impact on their own in selective interventions targeted at children exposed to early risks.

The small positive association between childhood cumulative family risk and young adult substance abuse was only present when reading engagement was low. It was hypothesized that high reading engagement would buffer this relationship. Interestingly, under conditions of elevated reading engagement, cumulative family risk had a negative association with substance abuse; that is, as the number of risks increased, the level of substance abuse decreased for reading engaged children. This finding is difficult to classify clearly according to the criteria put forth by Luthar et al. (2000), but is at least suggestive of a mitigating role

of reading engagement as cumulative family risks increase. Studies to replicate this finding are needed.

Strengths of this study include the large prospective birth cohort, the long-term follow-up, the multi-method data, the latent variable interaction analyses, and the Finnish context. The context also raises questions about generalizability. The patterns observed here are presumed to represent general developmental processes, but this needs to be tested in replication studies in different populations. Substance abuse indicators reflected diagnosed substance use disorders and official criminal sanctions that were captured in official records. It is uncertain how the results might apply to individuals with significant substance-related impairments that escape detection by mental health professionals and law enforcement personnel. Rates of substance abuse diagnoses and of substance-related criminal sanctions were low, as expected in this community-based study, which may have influenced the analyses; however, an advantage of the birth cohort design is that the large sample size permits an examination of lower base rate phenomena. As a secondary analysis, the current project was restricted to the use of existing measures, which were brief in order to reduce the burden on data collectors and participants in this large birth cohort study, and not always optimal in terms of timing. For example, data from different population registers accessed in different years for the larger study were used to obtain indicators of substance abuse; therefore, the problems assessed did not always occur in the same developmental period and could have occurred concurrently with adolescent substance use. Replication studies should incorporate expanded assessments. Some of the effects sizes, as reflected in the standardized regression coefficients, although statistically significant in this large sample study were relatively small in magnitude. In some cases, this was not unexpected, given the distal processes under investigation.

Results may have implications for prevention practice. Cumulative family risk generally appears to have lasting adverse consequences for children. Prevention-oriented policies and universal interventions offered at a population level to raise up the socioeconomic standing and well-being of families hold promise for reducing children's exposure to cumulative family risks. Where such exposure has already occurred, preventive interventions can work to decrease risk processes and enhance protective processes in vulnerable boys and girls. Regarding protection, there is some indication from the current study that such interventions could incorporate attempts to promote child reading engagement as a way to reduce risk for substance involvement and promote academic success. Indeed, reading engagement has been shown to be a malleable behavior (Wigfield et al., 2008); therefore, relevant components might be integrated into existing evidence-based parenting-training and family-focused interventions.

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Disclosure of Interest

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they have no conflict of interest. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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Figure 1.

Model of the interaction of cumulative contextual risk and child reading engagement in relation to adolescent substance use and academic performance and young adult substance abuse

Note: Statistically significant unstandardized (standardized) path coefficients are presented. Childhood academic difficulties and gender are included as covariates. * p < .05.



Figure 2.

Estimated effects of cumulative contextual risk on adolescent academic performance at different levels of child reading engagement. Dashed lines represent the standard error of the mean.



Figure 3.

Estimated effects of cumulative contextual risk on young adult substance abuse at different levels of child reading engagement. Dashed lines represent the standard error of the mean.

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	variables
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	orrelations,

Vari	iable	1	7	3	4	S	9	٢	8	6	10	11	12	13	14	15	16
1.	Gender $^{ au}$																
6.	Early academic difficulties	.11*															
Э.	Cumulative contextual risk	00	.07*														
4	Likes to read/asks parent to read	12*	16*	08													
5.	Particularly likes books †	11*	12*	04 *	.36*												
9.	Finnish	21*	22*	12*	.15*	.13 *											
7.	Humanities	01	10^{*}	14 *	.12*	$.10^*$.48*										
%	Math	.11*	16*	13*	$.10^*$.07*	.37 *	.36*									
9.	Science	.08	12*	14 *	.08	.08	.39*	.49*	.56*								
10.	Regular cigarette use	06*	.03*	$.16^{*}$	08*	05*	19*	22*	21*	26^{*}							
11.	Lifetime drunkenness	05*	02	.14 *	08*	08*	16*	19*	19*	24 *	.51*						
12.	Lifetime illegal drug use	03*	02	.03*	00.	.01	04*	06*	08*	* 60'-	.30*	.32 *					
13.	DUI≁	.13*	.05 *	.05 *	06*	05*	10^{*}	06*	05*	05 *	.13*	$.13^{*}$.06 [*]				
14.	Alcohol diagnosis $^{ au}$.04	.04	.03*	02	.01	05*	04*	08*	08*	.10*	* 60.	.06*	.12*			
15.	Cannabis diagnosis $^{ au}$.04	.01	.01	00.	.01	03*	01	02	02	.03 *	.03 *	.08*	.07*	.19*		
16.	Other drug diagnosis $\dot{\tau}$.03 *	.03*	.04*	.01	01	05*	04*	06*	05 *	.10*	*80.	* 60 [.]	.08	.31 *	.29 *	
	Mean	.49	.28	LL.	2.76	.60	3.18	3.15	3.05	3.06	1.05	2.41	.06	.02	.02	00.	.01
	Standard Deviation	.50	.65	76.	.46	.49	.59	.63	.78	.68	1.80	2.19	.24	.15	.15	.05	H.
	Ν	6963	6113	6963	6339	6329	6511	6506	6491	6477	6443	6152	0609	6952	6963	6963	6963
Note.																	
* p<.\	05;																

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 $\dot{\tau}$ - represent a categorical variable.

Table 2

Factor loadings from the confirmatory factor analysis model

Factor/indicator	þ	S.E.	β
Childhood reading engagement			x
Likes to read/asks parent to read	1.00^{r}		.87
Particularly likes books	.76	90.	99.
Adolescent academic use			
Finnish	1.00^{r}		.70
Humanities	1.05	.02	.74
Math	1.03	.02	.72
Science	1.19	.02	.83
Adolescent substance use			
Regular cigarette use	1.00^{r}	ī	.72
Lifetime drunkenness	1.38	.08	.82
Lifetime illegal drug use	.53	.03	.68
Young adult substance abuse			
DUI	1.00^{r}		LL.
Alcohol diagnosis	.95	.07	.73
Cannabis diagnosis	1.09	.10	.84
Other drug diagnosis	1.11	.08	.85

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Note. 1.0^{F} = reference indicator fixed for scaling purposes. All factor loadings were statistically significant (p < .05).

b = unstandardized coefficient, S.E. = standard error, $\beta =$ standardized coefficient