Longitudinal Pathways from Cumulative Contextual Risk at Birth to School Functioning in Adolescence: Analysis of Mediation Effects and Gender Moderation

Stacy-Ann A. January[1*]

W. Alex Mason[2]

Jukka Savolainen[3]

Starr Solomon[4]

Mary B. Chmelka[2]

Jouko Miettunen[5,6]

Juha Veijola[7,8]

Irma Moilanen[9,10]

Anja Taanila[11]

Marjo-Riitta Järvelin[12,13,14]

[1]University of South Carolina, Columbia, SC, USA

*Corresponding Author. Please direct correspondence to Stacy-Ann A. January, Department of Psychology, University of South Carolina, 1512 Pendleton St., Columbia, SC 29208. Phone: 1-803-777-2418, Email: sajanuary@sc.edu

[2]Boys Town National Research Institute of Child and Family Studies, Boys Town, NE, USA

[3]Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

[4]School of Criminology and Criminal Justice, University of Nebraska–Omaha, Omaha, NE, USA

[5]Center for Life Course Epidemiology and Systems Medicine, University of Oulu, Oulu, Finland

[6]Medical Research Center Oulu, Research Unit of Clinical Neurosciences, Department of Psychiatry, Oulu University Hospital, Oulu, Finland

[7]Department of Psychiatry, Unit of Clinical Neuroscience, University of Oulu, Oulu, Finland

[8]Department of Psychiatry, Oulu University Hospital, Oulu, Finland

[9]PEDEGO Research Center, Child Psychiatry, Medical Research Center, University of Oulu, Oulu, Finland

[10]Oulu University Hospital, Oulu, Finland

[11]Center for Life Course Epidemiology and Systems Medicine, University of Oulu, Oulu, Finland

[12]Department of Epidemiology and Biostatistics, MRC-PHE Centre for Environment and Health, School of Public Health, Imperial College London, London, UK

[13]Center for Life Course Epidemiology and Biocenter Oulu, University of Oulu, Oulu, Finland

[14]Unit of Primary Care, Oulu University Hospital, Oulu, Finland

Abstract

Children and adolescents exposed to multiple contextual risks are more likely to have academic difficulties and externalizing behavior problems than those who experience fewer risks. This study used data from the Northern Finland Birth Cohort 1986 (a population-based study; N = 6,961; 51% female) to investigate (a) the impact of cumulative contextual risk at birth on adolescents' academic performance and misbehavior in school, (b) learning difficulties and/or externalizing behavior problems in childhood as intervening mechanisms in the association of cumulative contextual risk with functioning in adolescence, and (c) potential gender differences in the predictive associations of cumulative contextual risk at birth with functioning in childhood or adolescence. The results of the structural equation modeling analysis suggested that exposure to cumulative contextual risk at birth had negative associations with functioning 16 years later, and academic difficulties and externalizing behavior problems in childhood mediated some of the predictive relations. Gender, however, did not moderate any of the associations. Therefore, the findings of this study have implications for the prevention of learning and conduct problems in youth and future research on the impact of cumulative risk exposure.

Keywords: cumulative contextual risk, adolescence, learning difficulties, externalizing behavior problems

Introduction

Children and adolescents who are exposed to a specific contextual risk factor such as poverty, being raised in a single-parent family, or having a parent with low education may have impaired functioning in a variety of domains, including academic achievement and behavior (Aikens and Barbarin 2008; Carlson and Corcoran 2001; Jimerson et al. 1999). However, risks tend to cluster in the most vulnerable families/individuals, and are often interrelated. Extant research indicates that the cumulative effect of exposure to multiple risk factors increases the likelihood of maladaptive outcomes such as conduct problems (Deković 1999; Lanza et al. 2010), substance use (Adelmann 2005; Roberts et al. 2009), and academic difficulties (Buehler and Gerrard 2013; Gutman et al. 2003). Despite a rich literature, very few studies have examined the effects of cumulative risk exposure across three developmental periods, or the intervening mechanisms linking children's exposure to multiple contextual risks very early in development with later functioning in adolescence. Further, evidence of gender differences in the impact of cumulative risk exposure is mixed. Using a Finnish birth cohort, this study addressed three important gaps in the literature by investigating (a) the longitudinal impact of exposure to multiple contextual risks at birth, a critical period in development, on early-onset substance use as well as functioning in school during adolescence, another key developmental period; (b) academic difficulties and externalizing behavior problems in childhood as potential intervening mechanisms (i.e., mediators) in the association of cumulative risk and school functioning in adolescence; and (c) youth gender as a potential moderator of the aforementioned relations.

Cumulative Risk Exposure and Development

The cumulative risk hypothesis posits that the effect of a child being exposed to multiple risks increases the likelihood of negative outcomes as compared to children experiencing fewer risks (Rutter 1979; Sameroff et al. 1998). That is, it is the sheer *quantity* of risks that is salient when predicting the likelihood of undesirable outcomes (Lanza et al. 2010; Sameroff et al. 1993). This finding has been replicated across numerous studies and a variety of outcomes, which were summarized in a recent systematic review of the literature on cumulative risk exposure and its impact on child development

(Evans et al. 2013). Bronfenbrenner's (1977) ecological systems theory provides a framework for understanding why and how the accumulation of risks is disruptive to development. Ecological systems theory posits that human development occurs through processes of bidirectional, sustained interactions between an individual and their immediate environment (Bronfenbrenner and Evans 2000; Bronfenbrenner and Morris 1998). Thus, the likelihood of a single risk factor negatively impacting development is low (Evans et al. 2013). However, exposure to several risks is more likely to interfere with the multiple bidirectional exchanges between the individual and the environment. That is, cumulative risk exposure is hypothesized to initiate a cascade of processes that negatively impacts children's development (Masten and Cicchetti 2010).

An extensive body of research provides evidence that exposure to cumulative risks is associated with academic and externalizing behavior difficulties (Evans et al. 2013). Cross-sectional studies of the impact of cumulative risk suggest that more risk exposure in childhood and adolescence is associated with lower academic achievement (Buehler and Gerrard 2013; Rouse and Fantuzzo 2009), absences from school (Gutman et al. 2002), conduct problems (Adelmann 2005; Deković 1999; Gutman et al. 2002), and substance use (Adelmann 2005; Kliewer and Murrelle 2007). Cumulative risk exposure also has long-term associations with a variety of outcomes from infancy through adolescence (Evans et al. 2013). For instance, infants exposed to cumulative risks are more likely to have impaired cognitive development at age 4 years (Laucht et al. 1997). Likewise, cumulative risk exposure in preschool or kindergarten is associated with failing grades, lower academic achievement, grade retention, and receiving special education services three to four years later (Lanza et al. 2010; Mâsse and Tremblay 1999). In addition to impacts on academic functioning, exposure to multiple risks also predicts later conduct problems, which may occur in a variety of contexts, including school. For example, multiple risk exposure during early childhood is associated with conduct problems during late elementary school (Lanza et al. 2010). During the teen years, exposure to cumulative risk increases the likelihood of externalizing behavior problems and substance use later in adolescence (Buehler and Gerrard 2013; Newcomb et al. 1986; Roberts et al. 2009).

Despite empirical evidence that cumulative risk has negative effects on children's and adolescents' academic and behavioral functioning, significant gaps remain. For instance, existing cumulative risk research is largely cross-sectional (e.g., Gutman et al. 2002; Kliewer and Murrelle 2007) or short-term longitudinal (e.g., Lanza et al. 2010; Roberts et al. 2009) in nature. With a few exceptions, studies have spanned only one or two developmental periods (e.g., Horan and Widom 2015 – childhood, adolescence, and adulthood). Thus, less is known about the extent to which cumulative risk exposure early in development, at birth, has long-term impacts on functioning in adolescence in general, and within the school context specifically. Indeed, according to ecological systems theory, school is a salient socialization influence for youth.

Based on our review of the literature, only two studies have examined the impact of exposure to multiple risks early in development and later functioning in school during adolescence. Gutman, Sameroff, and Cole (2003) measured the accumulation of risk factors at age 4 years in a sample of 145 children that were followed into adolescence. Their findings indicated that in high school, children with multiple early contextual risks were more likely to have lower grade point averages and be absent from school. Using a sample of 171 children, Appleyard, Egeland, van Dulmen, and Sroufe (2005) investigated the impact of cumulative risk exposure in preschool on functioning in childhood and adolescence. The results indicated that multiple early risks predicted conduct problems in elementary and high school. The findings from both Gutman et al. (2003) and Appleyard et al. (2005) also provided support for the cumulative risk approach, given that as the number of risk factors to which children were exposed increased, so did the likelihood and severity of poor academic and behavioral functioning in childhood and adolescence.

Although emerging evidence indicates that cumulative risks during childhood have long-term impacts on functioning in adolescence, even less is known about the impact of multiple risk exposure very early in development (e.g., during prenatal development, at birth) on adolescent outcomes. This is an important gap in the literature because birth represents a sensitive period of development during which children are especially vulnerable to adversity (Shonkoff et al. 2009). Adolescence is another critical

developmental period wherein successful completion of school is essential for the transition to adulthood and either postsecondary education/training or entry into the workforce. One recent study from the current project found that exposure to multiple contextual risks at birth increased the likelihood of substance use and co-occurring difficulties (e.g., conduct problems) in adolescence (Mason et al. 2016). Although this study provided initial support for the long-term impact of multiple contextual birth risks, it did not consider the school context; therefore, it remains unknown how cumulative risk exposure at birth impacts long-term functioning in school. Moreover, extant research on the impact of cumulative risk very early in development has not investigated its impact on early-onset substance use, which is associated with more problematic outcomes than initiation of substance use later in adolescence (Grant 1998; Grant et al. 2001; Gruber et al. 1996; Johnson et al. 2000). Finally, it is likely that the long-term effects of cumulative risk at birth result from a developmental process in which early exposure to multiple risks is linked to later difficulties in adolescence through intervening mechanisms in childhood, representing compromised functioning in salient ecological domains. However, the *intervening processes* involved in these associations are relatively untested (Evans et al. 2013). That is, after systematically reviewing the literature, Evans et al. (2013) acknowledged this gap and concluded that in order to advance the field, researchers "… should ideally conduct mediational tests of [cumulative risk] effects with indices of different mediating constructs in order to discern if there is one or more shared underlying mechanism(s) capable of explaining [cumulative risk] effects on the outcome." (p. 1387).

Academic and Externalizing Behavior Problems: Possible Intervening Mechanisms

In light of evidence that cumulative risk exposure in childhood is related to academic achievement and conduct problems in school during adolescence (e.g., Gutman et al. 2003; Lanza et al. 2010), it is plausible that early manifestations of these outcomes, in the form of childhood academic difficulties and externalizing behavior problems, represent intervening mechanisms and distinct pathways in the link between cumulative contextual risks at birth and school functioning in adolescence. However, these pathways have not yet been tested. Regarding the academic difficulties pathway, youth who experience academic problems in childhood are known to be at greater risk for future problems. For

example, learning difficulties in first grade are associated with later grade retention, receipt of special education services, and poor grades in adolescence (Darney et al. 2013; Savolainen et al. 2012; Taanila et al. 2014). Continuity of academic difficulties into adolescence is a concern, given that low academic achievement in high school is one of the strongest predictors of dropout (Battin-Pearson et al. 2000; Jimerson et al. 2000; Kaplan et al. 1997). Therefore, there is a need to study the pathway from early cumulative risk to academic performance in childhood and into adolescence.

Externalizing behavior problems are characterized by observable, negative reactions to the environment, which may manifest in ways such as rule-breaking behaviors, disruptive behaviors, and/or negative interpersonal interactions. Evidence suggests that early conduct difficulties may be indicative of an externalizing behavior pathway that leads to future misbehavior and substance use. For instance, disruptive behavior problems in elementary school are predictive of conduct problems (e.g., suspensions, aggression) during adolescence (Darney et al. 2013; Dodge et al. 2008; Tremblay et al. 1992). Furthermore, externalizing problems in childhood may manifest as early-onset substance use later in development (Colder et al. 2013; Kaplow et al. 2002; King et al. 2004). Early-onset substance use, in turn, is associated with poor functioning in school, such as academic and conduct problems (Bachman et al. 2008; Ellickson et al. 2003; Stiby et al. 2015). Given the negative impact of externalizing problems, investigations of the pathway from early cumulative risks to conduct problems in childhood and early-onset substance use and, ultimately, to behavior difficulties in school during adolescence is warranted.

It is well-established that academic difficulties and externalizing behavior problems are inter-related and tend to co-occur (Hinshaw 1992; Maguin and Loeber 1996). Moreover, evidence suggests that children with early academic difficulties are more likely to exhibit conduct problems in high school (Darney et al. 2013; Dodge et al. 2008; Valdez et al. 2011). Research also indicates that early externalizing difficulties put children at risk for academic problems in the future, such as poor grades (Masten et al. 2005) and dropping out of high school (Jimerson et al. 2000; McLeod and Kaiser 2004). Therefore, consistent with the bidirectional influences associated with ecological systems theory, early academic difficulties may set children on a pathway to experience later conduct problems, and early

externalizing behavior problems may put children at risk for later academic difficulties. However, simultaneous investigations of these predictive associations are uncommon. Thus, it is important that examinations of academic and behavior problems as potential mediators in the association of cumulative contextual risk at birth with adolescent school functioning be considered contemporaneously, within a multivariate framework.

Gender Differences

Gender differences are an important consideration in understanding youth's academic and behavioral functioning. Research suggests that boys achieve at lower levels than girls (Gibb et al. 2008), and are more likely than girls to drop out of high school (Gibb et al. 2008; Jimerson et al. 2000), exhibit conduct problems (Flannery et al. 1994; Gerard and Buehler 2004; Tremblay et al. 1992), and engage in substance use (King et al. 2011; Sobeck et al. 2000). However, other research suggests no gender differences in academic achievement (Mâsse and Tremblay 1999) or substance use (Colder et al. 2013). Research has also investigated potential gender differences in the impact of cumulative risks on future academic difficulties and conduct problems; however, the findings are mixed. For instance, some evidence suggests that exposure to multiple risks is associated with higher levels of conduct problems in girls (Ribeaud and Eisner 2010). Conversely, others suggest no gender differences in the impact of cumulative risk on risk of externalizing problems (Gerard and Buehler 2004), academic difficulties (Buehler and Gerard 2013), or substance use (Griffin et al. 2000; Mason et al. 2016). Mixed evidence regarding whether there are gender differences across studies may be due to a variety of factors, including low power to detect moderation effects and selectivity bias from using convenience samples, suggesting the need for large population studies. It could also be that researchers investigated gender as a moderator and found no differences, but did not report these findings. Nonetheless, given the contradictory evidence, it remains unclear whether the pathways from cumulative risks at birth to school functioning in childhood and adolescence are similar for boys and girls.

Purpose and Hypotheses

Although it is well documented that exposure to cumulative risks has deleterious effects on youth's functioning across a number of domains (Evans et al. 2013; Rutter 1979; Sameroff et al. 1993), there are significant gaps in the literature. Namely, few studies have investigated the impact of cumulative risk very early in development, the intervening processes that might explain why and how cumulative risk influences functioning, or the effects of cumulative risk in more than two developmental periods. The purpose of this study was to extend the existing cumulative risk literature by examining the direct and indirect effects of multiple contextual risk exposure at the prenatal/birth period on early-onset substance use as well as academic performance and school misbehavior in adolescence, while also testing for gender moderation in a Finnish birth cohort. By using a birth cohort, it is possible to examine the strength of these associations in a population, as opposed to a high-risk or convenience sample, and test for gender group differences. The Finnish context is another strength of this study, given that most of the cumulative risk research has been conducted with individuals in the U.S. or the U.K. Moreover, Finland is a Nordic welfare state where residents have access to comprehensive support systems designed to reduce the negative impact of risks in vulnerable families.

This study was guided by three research questions. First, does cumulative contextual risk exposure at birth impact academic performance and school misbehavior during adolescence (age 16 years)? Second, is the relation of cumulative contextual risk exposure at birth with academic achievement or school misbehavior in adolescence mediated by learning difficulties in first grade (academic difficulties pathway) and/or conduct problems in first grade and early-onset substance use (externalizing behavior pathway)? Third, does gender moderate the predictive associations among variables?

On the basis of existing literature, specific hypotheses were developed (see Figure 1). Previous research indicates that exposure to cumulative risk in early childhood is related to functioning in elementary and high school (Appleyard et al. 2005; Gutman et al. 2003), and that cumulative risk exposure at birth is associated with substance use and co-occurring problems in adolescence (Mason et al. 2016). Therefore, it was hypothesized that exposure to cumulative contextual risk at birth would have a negative association with academic performance and a positive association with school misbehavior in

adolescence (Hypothesis 1). Extant literature also provides evidence that learning difficulties and conduct problems in first grade persist into adolescence (Darney et al. 2013; Dodge et al. 2008). Thus, it was expected that academic difficulties in first grade and externalizing behavior problems (conduct problems in first grade, early-onset substance use) would mediate the longitudinal association of cumulative contextual risk at birth with academic performance and school misbehavior in adolescence (Hypothesis 2). Finally, given mixed evidence regarding gender differences in the impact of cumulative risk (e.g., Buehler and Gerard 2013; Mason et al. 2016; Ribeaud and Eisner 2010), we offer no specific hypotheses about gender moderation.

Method

Data Source and Participants

This study utilized data from the Northern Finland Birth Cohort 1986 (NFBC1986), which is a population-based study of individuals whose expected birthdate fell between July 1, 1985 and June 30, 1986. Criteria for inclusion in the current analysis sample consisted of all consented individuals with adolescent self-report data and one randomly-selected individual of the twin/triplet sets. Of the 9,479 individuals initially recruited for the study, there were 9,432 live births (99.5% of the recruited sample) that constituted the children in the NFBC1986. Consent from both parents and youth to use the data for research was provided by 8,755 (92.8%) of the sample. Of those who consented, 7,039 (80.4%) participated in the adolescent data collection period. Included in the 7,039 individuals were 74 sets of twins and 1 set of triplets. For each set of non-singletons, one child was randomly selected for the analysis dataset, thus dropping 76 children and yielding a sample of 6,963 individuals. Finally, two individuals were not included in the current study because they did not have any data on the childhood or adolescent variables that were used in this study. Thus, the final analysis sample of the current study included 6,961 children (49% male) who were 7.81 years old (*SD* = 0.23 years) in childhood and 15.99 years old (*SD* = 0.38 years) in adolescence.

Procedures

Prenatal/birth. Expectant mothers in the NFBC1986 study received a background questionnaire during their first visit to the prenatal clinic (at the 12th gestational week, on average) that was returned prior to the 24th gestational week. This questionnaire included several items related to the education, employment, income, and substance use for both mother and father, as well as the mother's pregnancy and relationship history. Medical staff (e.g., midwives) at the hospital documented information regarding the delivery.

Childhood. During the spring of the children's first year of formal schooling (1993-1994), teachers completed a questionnaire regarding each child's school behavior and performance as part of a learning disabilities study. Of the 9,298 children who were living in Finland with a known residence, 8,525 (92.7% participation rate) had complete teacher-report data in first grade.

Adolescence. In 2001-2002, adolescents completed a questionnaire regarding their health, social background, and living habits, which was returned via postal mail. Adolescents were invited to an in-person clinical exam, during which they completed another questionnaire about their mental health, substance use, stress, and eating habits. Of the 9,215 adolescents who were alive and had a known residence during this data collection period, 7,344 (79.7%) completed the postal questionnaire and 6,985 (75.8%) completed the clinic exam and questionnaire.

Additional details regarding the data collection procedures are provided elsewhere (Hurtig et al. 2007; Järvelin et al. 1993). The NFBC1986 study was approved by the ethical committee of the Northern Ostrobothnia Hospital District. Prior analyses from this project have tested for selective attrition. The results indicated that, as compared with the original live-born cohort, the analytic sample had slightly fewer females.

Measures

Cumulative contextual risk. The prevailing approach to measuring cumulative risk is to create a summary score of factors that have been dichotomized to indicate the presence of risk (Evans et al. 2013). Compared to an individual risk factor approach, this method improves measurement precision and validity, as well as enhances statistical power (Evans et al. 2013), given that the aim is to measure the

accumulation of risk. Moreover, research suggests that disadvantages associated with dichotomization (e.g., attenuation of effects) are much less likely to occur when using data that are not continuous, not normally distributed, or not on an equal interval scale (Farrington and Loeber 2000), as is the case in this study. Therefore, consistent with extant literature, the cumulative contextual risk index was a count of 10 contextual risk indicators from the prenatal/birth developmental period. These indicators of cumulative contextual risk (described below) were selected because individually, they are associated with a host of problem behaviors in adolescence, including poor academic functioning (O'Callaghan et al. 2010; Pagani et al. 1999), substance use (Fergusson et al. 1998; Hawkins et al. 1992), and conduct problems (Côté et al. 2006; Fergusson et al. 1998; Pagani et al. 1999). Furthermore, the indicators chosen have been used in extant cumulative risk research (see Table 1). Each indicator was coded 1 to indicate the presence of risk or 0 to indicate the absence of that risk factor, as described below.

Low birth weight was coded 1 if the child weighed less than 2,500 g (approximately 5.51 lb) at birth (Zegers-Hochschild et al. 2009). *Teenage mother* was coded 1 if the mother gave birth to the participating child at age 19 years or younger. *Single mother* was coded 1 if the child's mother was unmarried, widowed, divorced, or not cohabiting with a partner. In Finland, all cohabiting unions (in addition to marriages) are officially registered, enabling us to include mothers with multiple partners as a risk factor. *Multiple unions* was coded 1 if the mother had at least one prior registered union (i.e., a prior history of either being married or cohabiting with a different partner), which excluded those in their first relationship, who were not in a relationship, or who had no prior relationship. *Maternal cigarette use* was coded 1 if the mother smoked cigarettes after the first trimester of pregnancy. *Maternal alcohol use* was coded 1 if the mother consumed alcohol at any time during pregnancy. *Paternal alcohol use* was coded 1 if the mother reported that the child's father consumed more than four alcoholic drinks in the typical week. In some cultures, this amount of drinking would not be considered as problematic. However, Finland (and especially Northern Finland in 1985-1986) epitomizes a "dry" drinking culture where moderate drinking is rare, and where intoxicated drinking remains the dominant form of alcohol consumption (Felson et al. 2011; Room and Mäkelä 2000). In this cultural context, it is safe to assume

that an overwhelming majority of the men who consumed five or more drinks per week did so in the course of a single occasion. *Low maternal education* was coded 1 if the mother dropped out of school before completing the ninth grade. *Occupational exclusion* was coded 1 if the highest occupational status of a parent in the household was either an unskilled worker (i.e., manual laborer), unemployed, or receiving disability pension. *Material deprivation* was coded 1 if the household was missing three of these four essential items: indoor bathroom, flushing toilet, washing machine, or telephone.

In this population-based sample, the cumulative contextual risk index had an observed range of 0-6 ($M = 0.65$, $SD = 0.94$), with 58% of children experiencing no risks. Given that the cumulative risk index is a count variable, a measure of internal consistency (i.e., coefficient alpha) is inappropriate (Streiner 2003).

Learning difficulties. Learning difficulties in childhood was measured as a latent variable with three single-item indicators: (1) reading difficulties, (2) writing difficulties and (3) mathematics difficulties. First-grade teachers responded to three questions such as, "Does the child have difficulties learning to read?" Responses were coded 0 (no) or 1 (yes). Together, the observed variables had an internal consistency (coefficient alpha) of .76.

Conduct problems. Conduct problems in childhood was represented as a latent variable comprised of four items from the Rutter scale for teachers, a widely used measure of children's behavior problems (Elander and Rutter 1996; Rutter 1967). For each item included in this study, teachers responded on a 3-point Likert-type scale: 0 (does not apply), 1 (applies somewhat), or 2 (certainly applies) to indicate the extent to which the child destroyed things, fought with others, teased other children, and disobeyed the rules. Internal consistency of the conduct problems observed variables was .85.

Early-onset substance use. Consistent with previous research (e.g., Gruber et al. 1996), early-onset substance use was conceptualized as occurring before age 13 years, as the teen years are a normative period for the initiation of substance use (Faden 2006; Miech et al. 2016). Furthermore, pre-adolescence (younger than 13 years) is a developmental period in which youth have increased vulnerability to the short- and long-term problematic outcomes (e.g., substance disorder in adulthood) associated with

substance use in adolescence (Grant 1998; Grant et al. 2001; Gruber et al. 1996; Johnson et al. 2000). Therefore, early-onset substance use was measured as a dichotomous variable. Early-onset substance use was represented as a latent variable comprised of two single-item indicators: early-onset alcohol use and early-onset cigarette use. Early-onset alcohol use was coded 1 if adolescents reported having their first alcoholic drink at age 11 or 12 years, and 0 if adolescents reported either initiating alcohol use after age 12 years or abstaining from alcohol use. Early-onset cigarette use was coded 1 if adolescents reported initiating cigarette use at age 11 or 12 years, and 0 if adolescents reported smoking their first cigarette after age 12 years or if they did not use cigarettes. The internal consistency of the two early-onset substance use observed variables was .53.

Academic performance. Academic performance during adolescence was measured as a latent variable with four indicators representing grades in secondary school. Adolescents self-reported their grades in Finnish, Humanities, Mathematics, and Science. The question stem was, "Compared to other pupils your age, how well are you doing in the following school subjects?" with response sets of "better than average," "average," "worse than average," and "really badly." Responses were coded on a 4-point scale so that 4 represented high academic performance and 1 represented the lowest level of academic performance in each course. The indicators comprising the academic performance observed variables had an internal consistency of .76.

School misbehavior. Conduct problems in adolescence was represented as a school misbehavior latent variable with two indicators that were drawn from the Achenbach Youth Self Report (Achenbach 1991): "I cut classes or skip school" and "I disobey at school." For each item, the youth selected a response from 0 "not at all true" to 2 "very true or often true." These two observed variables had an internal consistency of .55.

Gender. Participants' gender was coded 0 for female and 1 for male.

Data Analysis Plan

Descriptive statistics and correlations among indicators were obtained. Primary latent variable analyses were conducted in two stages. First, a confirmatory factor analysis (CFA) was conducted to

evaluate the measurement model and estimate the covariances among variables. The CFA included the latent variables of learning difficulties, conduct problems, early-onset substance use, academic performance, and school misbehavior, as well as the observed cumulative contextual risk (CCR) Index and gender variables. Next, structural equation modeling (SEM) was conducted to evaluate the predictive associations between the CCR Index and the learning difficulties, conduct problems, early-onset substance use, academic performance, and school misbehavior latent variables (see Figure 1 for the conceptual framework of the paths tested). Tests for gender moderation were conducted using multiple-group SEM. All structural paths were estimated simultaneously, thus a Type I error rate of .05 was used in this study.

The CFA and SEM were estimated in Mplus v7.4 (Muthén and Muthén 1998-2016). The weighted least squares mean- and variance-adjusted (WLSMV) estimator was used to derive parameter estimates, as several latent variable indicators were dichotomous or ordered categorical (i.e., Likert-type response options). Mplus employs a pairwise missing data approach on the exogenous (predictor) variables with the WLSMV estimator. Given that each participant had complete CCR data, the entire sample was retained. The chi-square statistic, comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used to estimate model fit. However, the chi-square statistic is sensitive to small differences in the covariance structures of large sample sizes (Marsh et al. 1988). Therefore, although chi-square (χ^2) values are reported, the interpretation of model fit focused on the CFI and RMSEA, which are less sensitive to sample size. Model fit was evaluated using well-established guidelines (see Hu and Bentler 1999) that suggest a CFI value of around .95 or greater and a RMSEA value less than .06 is indicative of adequate model fit. For the SEM, the MODEL INDIRECT command in Mplus was used, and bias-corrected bootstrapped 95% confidence intervals were obtained using 1,000 bootstrap samples to determine statistical significance of the indirect effects (MacKinnon et al. 2004). Confidence intervals that do not include zero are statistically significant at $p < .05$.

Gender moderation was investigated by first testing for factorial invariance across genders with a multiple-group CFA model to determine if the indicators measured the latent variables in the same

manner for females and males, and then testing for differences in path estimates with a multiple-group SEM. More specifically, measurement invariance across genders was tested in Mplus by first conducting a CFA in which all parameters were freely estimated using gender as the grouping variable (i.e., configural invariance). Then loading invariance was tested by conducting a CFA in which factor loadings were constrained to be equal across groups. Finally, because the WLSMV estimator was used, significant differences were evaluated using the DIFFTEST function in Mplus, which allowed for comparisons between the fit of the unconstrained model and the constrained model. For moderation testing, we were interested in whether the path coefficients were significantly different for males as compared with females. Therefore, comparisons between a fully constrained model (i.e., all structural paths between latent variables were set to be equal across gender groups) and an unconstrained model (i.e., all structural paths between latent variables were freely estimated for each gender) were made using the DIFFTEST function and examining differences in CFI (Cheung and Rensvold 2002).

Results

Descriptive Statistics

Spearman's rank correlations, means, and standard deviations of observed study variables and latent variable indicators are reported in Table 2. The CCR Index had small but statistically significant associations with all observed variables (r = -.10 to .10) with the exception of gender (r = -.02). Gender was associated with all other observed variables (r = .20 to .23) except mathematics difficulties and grades in Humanities.

Multiple Group Analyses

The results of the measurement model invariance tests from the multiple-group CFAs conducted across gender groups suggested no significant differences between the constrained and unconstrained models (these results available on request). This finding indicated that the measurement model was factorially invariant across genders and; therefore, moderation testing in the structural paths within SEM was appropriate. Next, an unconstrained SEM that allowed all structural paths to be freely estimated across groups, χ^2 (199 df, N = 6,961) = 1404.908, p < .001, CFI = .982, was compared to an SEM in

which structural paths were constrained to be equal across gender groups, χ^2 (212 *df*, *N* = 6,961) = 1173, *p* < .001, CFI = .985. The results of the chi-square difference test indicated that the path coefficient constraints did not significantly reduce model fit, χ^2 (13 *df*, *N* = 6,961) = 13.77, *p* = .390. Additionally, the change in CFI was less than .01 (Cheung and Rensvold 2002), which provided further support that the constrained model did not significantly reduce model fit. Finally, in an effort to investigate whether gender moderation was present for specific paths, additional analyses were conducted in which each of the 13 paths in the SEM were singly freed across groups and then constrained across groups to examine whether gender moderation in specific paths was present. These results indicated no significant differences (*p* > .05) in the chi-square test statistic or CFI for all structural paths (available upon request). Therefore, the findings provided no evidence of gender moderation in the predictive relations among the CCR Index, learning difficulties and conduct problems in childhood, early-onset substance use, or academic performance and school misbehavior in adolescence. Given these results, subsequent analyses (described below) were based on the pooled, total sample, and gender was included as a covariate rather than a grouping variable.

Confirmatory Factor Analysis

The results of the pooled-sample CFA, including the observed variables (i.e., CCR Index, gender) and all latent variables (i.e., learning difficulties, conduct problems, early-onset substance use, academic performance, school misbehavior), suggested the fit between the data and the model was acceptable, χ^2 (100 *df*, *N* = 6,961) = 1781.568, *p* < .001, CFI = .978, RMSEA = .049 (90% CI [.047, .051]). All factor loadings were statistically significant (see Table 3) and standardized coefficients ranged from .72 to .96. The results of the zero-order correlations indicated the CCR Index had small, but statistically significant (*p* < .05*)* positive correlations with school misbehavior (*r* = .08), learning difficulties (*r* = .07), conduct problems (*r* = .08), and early-onset substance use (*r* = .08). The CCR Index was significantly negatively associated with academic performance (*r* = -.10). Furthermore, all latent variables had statistically significant zero-order intercorrelations in the expected directions. That is, learning difficulties had a

modest positive association with conduct problems (r = .25) in childhood and with academic performance (r = -.27) in adolescence. Small, but statistically significant correlations between learning difficulties and early-onset substance use (r =.05) and school misbehavior (r = .05) were also observed. The significant correlations between conduct problems and early-onset substance use (r = .17), academic performance (r = -.14), and school misbehavior (r = .16) were also in the small range.

Structural Equation Modeling Analysis

Unstandardized and standardized estimates of the direct effects of the pooled-sample SEM are displayed in Figure 2. The SEM including gender as a covariate demonstrated acceptable fit to the data, χ^2 (100 *df*, N = 6,961) = 1464.064, $p < .001$, CFI = .980, RMSEA = .044 (90% CI [.42, .46]). The results indicated that the CCR Index was significantly associated with academic performance in adolescence, but not with school misbehavior (p = .103). Further, the CCR Index had a statistically significant positive relation with learning difficulties and conduct problems in childhood, as well as with early-onset substance use. Learning difficulties in childhood were not related to early-onset substance use; however, learning difficulties were associated with lower academic performance in adolescence. Moreover, conduct problems in childhood were positively associated with early-onset substance use and negatively related to academic performance in adolescence. Early-onset substance use had a significant positive association with school misbehavior and negative relation with academic performance in adolescence. Finally, gender was significantly associated with learning difficulties (β = .145) and conduct problems (β = .362) in childhood, early-onset substance (β = .113), as well as school misbehavior (β = -.121) and academic performance (β = .122) in adolescence (estimates not displayed in Figure 2). Together, the predictors explained an estimated 23% of the variance in the academic performance latent variable and an estimated 36% of the variance in the school misbehavior latent variable.

The results of the unstandardized total, direct, and indirect effects and their 95% confidence intervals are presented in Table 4. The indirect effect of CCR on adolescent academic achievement through learning difficulties (b = -.023; β = -.029) was statistically significant. Likewise, the effect of CCR on academic performance in adolescence was mediated by conduct problems (b = -.006; β = -.008),

early-onset substance use (*b* = -.019; β = -.024), and the conduct problems → early-onset substance use path (*b* = -.005; β = -.006). However, the indirect effect of CCR through the learning difficulties → early-onset substance use path (*b* = .000; β = .000) was not significant. Moreover, although the direct effect of CCR on school misbehavior was not statistically significant, the results indicated a significant indirect effect through conduct problems (*b* = .012; β = .015), early-onset substance use (*b* = .044; β = .055), and the conduct problems → early-onset substance use pathway (*b* = .011; β = .014). There was not a significant indirect effect of CCR on school behavior through learning difficulties (*b* = .000; β = .001) or the learning difficulties → early-onset substance use path (*b* = -.001; β = -.001). Finally, the results indicated that the effect of CCR on early-onset substance use was mediated by conduct problems (*b* = .019; β = .024), but not learning difficulties in childhood (*b* = -.001; β = -.002).

Discussion

Previous research suggests that early exposure to cumulative contextual risks has lasting, negative impacts on youth's academic achievement and externalizing behaviors, including substance use (e.g., Appleyard et al. 2005; Gutman et al. 2003; Mason et al. 2016). Additionally, early academic difficulties and conduct problems are likely to persist and are related to poor functioning in both domains (e.g., Masten et al. 2005). Using a Finnish birth cohort, this study extended the literature by investigating (a) the impact of cumulative contextual risk exposure at birth on adolescents' functioning in school, (b) learning difficulties and externalizing behavior problems in childhood as mediators in the association of cumulative contextual risk at birth with adolescent school functioning, and (c) potential gender moderation in any of the predictive associations. The findings from this study provide support for the cumulative risk tradition, and given the Finnish context, the results suggest that the negative impact of multiple contextual risks is indicative of a general developmental process not limited to a single socio-cultural environment. Finland is an egalitarian welfare state that offers collective systems of support to high-risk families that are more extensive than the supports available in other advanced countries such as the U.S. and the U.K. (Esping-Andersen 1990). Therefore, evidence of the long-term negative impact of

cumulative contextual risk exposure *in spite of* the comprehensive supports available in Finland is compelling.

Consistent with hypothesis 1, the findings from this study suggest that exposure to multiple contextual risks at birth has a negative association with children's functioning 16 years later, as evidenced by significant total effects on academic performance and school misbehavior in adolescence. Although the coefficients were generally within the small range (≤ .10), these results are meaningful, given the length of time between measurement of the contextual risks and subsequent functioning (i.e., 16 years), that this study represents a population sample, and that the effects persisted despite the substantial societal supports available in Finland. These findings are consistent with previous research demonstrating that contextual risk exposure during early childhood is associated with an increased likelihood of academic underachievement and externalizing behavior problems during adolescence (Appleyard et al. 2005; Gutman et al. 2003). However, we extend existing research by establishing that the negative effects of multiple prenatal- and birth-related contextual risks continue into adolescence. Furthermore, it is interesting that within this multivariate model, the direct effects of multiple risks at birth persisted, negatively impacting academic performance but not school misbehavior in adolescence. This suggests that exposure to multiple risks at birth may have a stronger long-term impact on academic underachievement as compared with externalizing behavior problems, at least in Finland. This study also adds to the literature by demonstrating that contextual risks at birth are related to learning difficulties and conduct problems in childhood. These findings are congruent with previous cross-sectional and longitudinal research indicating that children experiencing multiple contextual risks during early childhood tend to have lower academic achievement and greater behavior problems in early elementary school (Appleyard et al. 2005; Rouse and Fantuzzo 2009).

To our knowledge, this was the first study to investigate two distinct pathways – an academic difficulties pathway and an externalizing behavior pathway – to identify potential intervening mechanisms in the effects of cumulative contextual risk exposure at birth to school functioning in adolescence. The results indicated partial support for the second hypothesis, in that the relation between

multiple birth risks and academic performance in adolescence was partially mediated by learning difficulties in childhood; however, there was no evidence that learning difficulties in childhood had an indirect effect on the association between cumulative contextual risk at birth and school misbehavior in adolescence. Thus, the findings did not support the presence of an academic pathway from contextual risk exposure at birth to poor school functioning (i.e., lower academic performance and conduct problems in school) in adolescence. In contrast, externalizing behaviors (i.e., conduct problems in childhood, early-onset substance use) accounted for nearly all of the predictive relation of cumulative contextual birth risks with school misbehavior in adolescence, as well as partially mediated the association of contextual birth risks with academic performance in adolescence. Therefore, the results from this study provided support for an externalizing behavior problems pathway from cumulative contextual at birth to academic performance and school conduct problems in adolescence.

By investigating both academic and behavior problems in childhood simultaneously, this study adds to the literature on the long-term impact of early difficulties in school. Specifically, externalizing behaviors demonstrated continuity throughout development and increased the likelihood of lower grades eight years later. These results are consistent with some previous research suggesting that early conduct problems are predictive of poor functioning in both the academic and behavior domains (e.g., Valdez et al. 2011). Furthermore, similar to prior studies (e.g., Darney et al. 2013), academic difficulties in first grade persisted and had a direct effect on adolescents' academic performance. Interestingly, learning difficulties in childhood was not significantly related to school conduct problems in adolescence, which is somewhat inconsistent with extant literature (e.g., Masten et al. 2005). Indeed, the zero-order correlation between the learning difficulties and school misbehavior latent variables was positive and statistically significant. However, within the multivariate SEM framework, this relation was no longer significant, highlighting the importance of concurrently examining academic and behavior problems when predicting functioning.

The final finding of this study is that gender did not moderate any of the predictive associations among variables. That is, consistent with previous research (Buehler and Gerard 2013; Gerard and

Buehler 2004; Mason et al. 2016) the impact of multiple birth risks on externalizing problems, academic difficulties, and early-onset substance use did not differ as a function of gender. Likewise, despite evidence suggesting mean-level gender differences in academic achievement and externalizing behavior problems (e.g., Gibb et al. 2008; Tremblay et al. 1992), the direct effects from learning and conduct problems in childhood to school functioning in adolescence were not moderated by gender. No evidence of gender moderation is an important finding, as it suggests the developmental disruptions conferred by multiple contextual risk exposure at birth as well as the negative impact of early academic and conduct difficulties is very similar for boys and girls.

Limitations

The findings of this study should be considered in light of several limitations. First, it is possible other variables that were not measured (e.g., parenting) might impact the relations among the variables in this study. Furthermore, although the Finnish context is a strength of this study, the fact that the ethnic background of all participants was the same may limit the external validity of the findings from this study. Third, the data were drawn from a single source at each developmental period studied and were primarily self-report (i.e., mothers, adolescents). The findings may differ if data were gathered from multiple raters across domains. However, given the large scope of this birth cohort study, it was not possible to obtain multiple sources of information for each variable of interest. A fourth potential limitation is that the observed variables comprising two latent variables (i.e., early-onset substance use, school misbehavior) had reliability coefficients that were lower than expected, which is due in part to those variables having only two indicators. Nonetheless, the results of the CFA (i.e., measurement model) were strong, as all latent variables had high factor loadings. Moreover, one strength in analyzing data within an SEM framework is that the use of latent variables helps to account for measurement error in the indicators (Kline 2015), because the factor extracts the reliable common variance of the indicators. A final limitation is that adolescents retrospectively reported their first use of alcohol or cigarettes; therefore, these data may be susceptible to recall biases.

Future Directions

The findings from this study suggest important avenues for future research and implications for practice. First, future research should continue investigating additional underlying mechanisms that explain the predictive associations between cumulative contextual risk very early in development and future school functioning. For example, research might examine the impact of cumulative contextual risks on other constructs related to performance in school (e.g., executive functioning). Research is also needed that examines the impact of variables that might mediate the relation between multiple risk exposure and performance in elementary school such as parenting and the parent-child interaction. Another important avenue for future research is continued investigations of the impact of contextual risk exposure in a variety of cultural contexts, including direct country comparisons, as well as examining its effects on functioning in young adulthood (e.g., employment, postsecondary education attainment). Future research should investigate the potential protective factors that promote resilience in adolescents exposed to multiple risks very early in development. Current findings also have implications for practice. Given the lasting impact of cumulative risk exposure, it is important that practitioners engage in early screening of academic and behavioral difficulties. Further, the findings from this study underscore the need for early interventions to promote success in school and delay the onset of substance use, particularly for those youth who are exposed to multiple risks very early in development.

Conclusion

Research conducted within the cumulative risk approach indicates that it is the sheer *quantity* of risk factors that leads to adverse outcomes (Lanza et al. 2010; Rutter 1979). Exposure to cumulative risks negatively impacts development, and increases the likelihood that children and adolescents exhibit conduct problems, engage in substance use, and have low academic achievement (Appleyard et al. 2005; Gutman et al. 2003; Mason et al. 2016). Despite decades of research, significant gaps in the cumulative risk literature exist. This study addressed gaps in the literature by prospectively measuring cumulative contextual risk exposure very early in development, at birth, and investigating its impact 16 years later on school functioning during adolescence, while testing for gender differences. Furthermore, this study extended extant research by focusing on two intervening mechanisms (i.e., academic difficulties and

externalizing behavior problems in childhood) that may explain how and why exposure to multiple risks later influences adolescent functioning. The results of this study add to the research on cumulative risk and adolescence (e.g., Buehler and Gerard 2013; Mason et al. 2016), indicating that cumulative contextual risk exposure during the prenatal/birth developmental period is predictive of poor academic performance and conduct problems in school during adolescence (age 16 years). Moreover, an externalizing behavior problems pathway (conduct problems at age 8 years, substance use prior to age 13 years), but not learning difficulties at age 8 years, mediated the association of multiple contextual risk exposure at birth with school functioning in adolescence. Interestingly, there was no evidence of gender differences in any of the predictive associations among variables, suggesting that girls and boys are similarly impacted by the developmental changes conferred by exposure to cumulative contextual risks at birth, and the negative impact of early academic and conduct difficulties in childhood. The findings from this study, coupled with further research in this area, have implications for prevention and early intervention programs targeting families and youth exposed to multiple contextual risks.

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Authors' Contributions

S-AJ formulated the research questions and data analysis plan, conducted data analyses, and developed the initial manuscript draft. WM contributed to the research questions and data analysis plan, and contributed to writing the manuscript. JS contributed to the research questions and writing the manuscript. SS tabled the results and contributed to writing the manuscript. MC contributed to writing the manuscript and managed the data. JM was involved with data collection and contributed to writing the manuscript. JV was involved with data collection and contributed to writing the manuscript. IM was involved with data collection and contributed to writing the manuscript. AT was involved with data collection and contributed to writing the manuscript. M-RJ was involved with data collection and contributed to writing the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors report no conflicts of interest.

Compliance with Ethical Standards

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Ethical Approval

All procedures performed in this study 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

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

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Table 1

Indicators Included in the Cumulative Contextual Risk Index and Relevant Citations

Indicator	Examples of Studies Using Indicators as Measures of Cumulative Risk
Low birth weight	Alaimo et al. 2001; Johnson et al. 2006; Rouse and Fantuzzo 2009
Teenage mother	Alaimo et al. 2001; Pasco Fearon and Belsky 2004; Stouthamer-Loeber et al. 2002
Single mother	Cadima et al. 2010; Gutman et al. 2003; Horan and Widom 2015; Lanza et al. 2010
Multiple unions	Ackerman et al. 2004; Phillips et al. 2005
Maternal cigarette use	Alaimo et al. 2001; Vega et al. 1993
Maternal alcohol use	Adelmann 2005; Horan and Widom 2015; Vega et al. 1993
Paternal alcohol use	Adelmann 2005; Horan and Widom 2015
Low maternal education	Buehler and Gerrard 2013; Horan and Widom 2015; Rouse and Fantuzzo 2009; Sameroff et al. 1993
Occupational exclusion	Gutman et al. 2003; Lanza et al. 2010; Sameroff et al. 1993
Material deprivation	Adelmann 2005; Horan and Widom 2015; Rouse and Fantuzzo 2009

Table 2

Intercorrelations, Means, and Standard Deviations Among Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. CCR Index	–																
2. Male	-.02	–															
3. Destroys	.06***	.16***	–														
4. Fights	.05***	.21***	.41***	–													
5. Disobeys	.05***	.23***	.44***	.61***	–												
6. Teases	.05***	.23***	.43***	.71*	.63*	–											
7. Read. Diff.	.05***	.10***	.12***	.11***	.13***	.12***	–										
8. Write Diff.	.05***	.12***	.15***	.13***	.16***	.14***	.73***	–									
9. Math Diff.	.06***	.00	.09***	.07***	.09***	.08***	.41***	.40***	–								
10. Finnish	-.08***	-.20***	-.12***	-.12***	-.13***	-.20***	-.21***	-.22***	-.16***	–							
11. Humanities	-.09***	-.01	-.08***	-.06***	-.10***	-.07***	-.10***	-.09***	-.10***	.48***	–						
12. Math	-.09***	-.11***	-.05***	-.06***	-.09***	-.07***	-.13***	-.16***	-.20***	.37***	.36***	–					
13. Science	-.10***	.08***	-.06***	-.06***	-.08***	-.06***	-.10***	-.12***	-.13***	.40***	.49***	.56***	–				
14. Alcohol	.09***	.13***	.07***	.10***	.08***	.08***	.03*	.03*	-.01	-.09***	-.09***	-.07***	-.12***	–			
15. Tobacco	.04**	.09***	.07***	.13***	.11***	.11***	.04**	.05**	-.01	-.11***	-.11***	-.09***	-.13***	.36***	–		
16. Cuts Class	.10***	-.06***	.04**	.06***	.07***	.06***	.02	.03*	.02	-.14***	-.15***	-.18***	-.21*	.17***	.18***	–	
17. Disobeys	.03**	.10***	.08***	.12***	.13***	.13***	.03*	.04**	-.02	-.18***	-.18***	-.18***	-.20***	.20***	.22***	.36***	–
Mean	0.65	0.49	1.06	1.21	1.20	1.18	0.12	0.16	0.09	3.17	3.15	3.05	3.06	0.30	0.31	1.22	1.30
SD	0.94	0.50	0.26	0.47	0.46	0.43	0.32	0.37	0.28	0.59	0.63	0.78	0.68	0.46	0.46	0.46	0.50

Note. CCR Index = cumulative contextual risk index.
*$p < .05$
** $p < .01$
*** $p < .001$

Table 3

Factor Loadings from the Confirmatory Factor Analysis Model

Factor/Indicator	*b*	*s.e.*	β
Childhood Variables			
Learning Difficulties			
Reading Difficulties	1.00[r]		0.96
Writing Difficulties	1.02	.02	0.98
Math Difficulties	0.77	.02	0.74
Conduct Problems			
Destroys Things	1.00[r]		0.85
Fights	1.10	.02	0.94
Disobeys	1.06	.02	0.90
Teases Others	1.13	.02	0.96
Pre-Adolescent Variables			
Early-Onset Substance Use			
Alcohol Use	1.00[r]		0.72
Tobacco Use	1.07	.06	0.77
Adolescent Variables			
Academic Performance			
Finnish Grades	1.00[r]		0.73
Humanities Grades	1.00	.02	0.73
Mathematics Grades	0.99	.02	0.73
Science Grades	1.13	.02	0.82
School Misbehavior			
Cuts Class	1.00[r]		0.72
Disobeys at school	1.08	.05	0.78

Note. *b* = unstandardized coefficient, *s.e.* = standard error, β = standardized coefficient. 1.0[r] = reference indicator fixed for scaling purposes. All factor loadings were statistically significant ($p < 0.05$).

Table 4

Total, Direct, and Indirect Effects from CCR to Early-Onset Substance Use, Academic Performance, and School Misbehavior

	Learning Difficulties	Conduct Problems	Early-Onset Substance Use	Academic Performance	School Misbehavior
Variable/Path	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]	*b* [95% CI]
Total Effects					
CCR Index	–	–	.092* [.065, .121]	-.113* [-.135, -.090]	.090* [.060, .118]
Learning Difficulties	–	–	-.015* [-.060, .029]	-.269* [-.302, -.236]	-.010 [-.057, .035]
Conduct Problems	–	–	.186* [.135, .234]	-.109* [-.150, -.071]	.229* [.180, .276]
Early-Onset Substance Use	–	–	–	-.252* [-.308, -.199]	.588* [.505, .662]
Direct Effects					
CCR Index	.085* [.047, .118]	.100* [.072, .129]	.074* [.047, .104]	-.060* [-.082, -.035]	.025 [-.006, .053]
Learning Difficulties	–	–	-.015 [-.060, .029]	-.272* [-.306, -.240]	-.001 [-.049, .046]
Conduct Problems	–	–	.186* [.135, .234]	-.063* [-.107, -.022]	.119* [.066, .174]
Early-Onset Substance Use	–	–	–	-.252* [-.308, -.199]	.588* [.505, .662]
Indirect Effects					
CCR→ Learning Difficulties	–	–	-.001 [-.005, .002]	-.023* [-.033, -.013]	.000 [-.004, .004]
CCR→ Conduct Problems	–	–	.019* [.012, .028]	-.006* [-.012, -.002]	.012* [.006, .019]
CCR→ Early-Onset Substance Use	–	–	–	-.019* [-.027, -.011]	.044* [.030, .062]
CCR→ Learning Difficulties → Early-Onset Substance Use	–	–	–	.000 [-.001, .001]	-.001 [-.003, .001]
CCR→ Conduct Problems → Early-Onset Substance Use	–	–	–	-.005* [-.008, -.003]	.011* [.007, .016]

Note. Standardized coefficients in parentheses; CCR = cumulative contextual risk.

* Parameter estimates with confidence intervals that do not contain zero are statistically significant at $p < .05$.

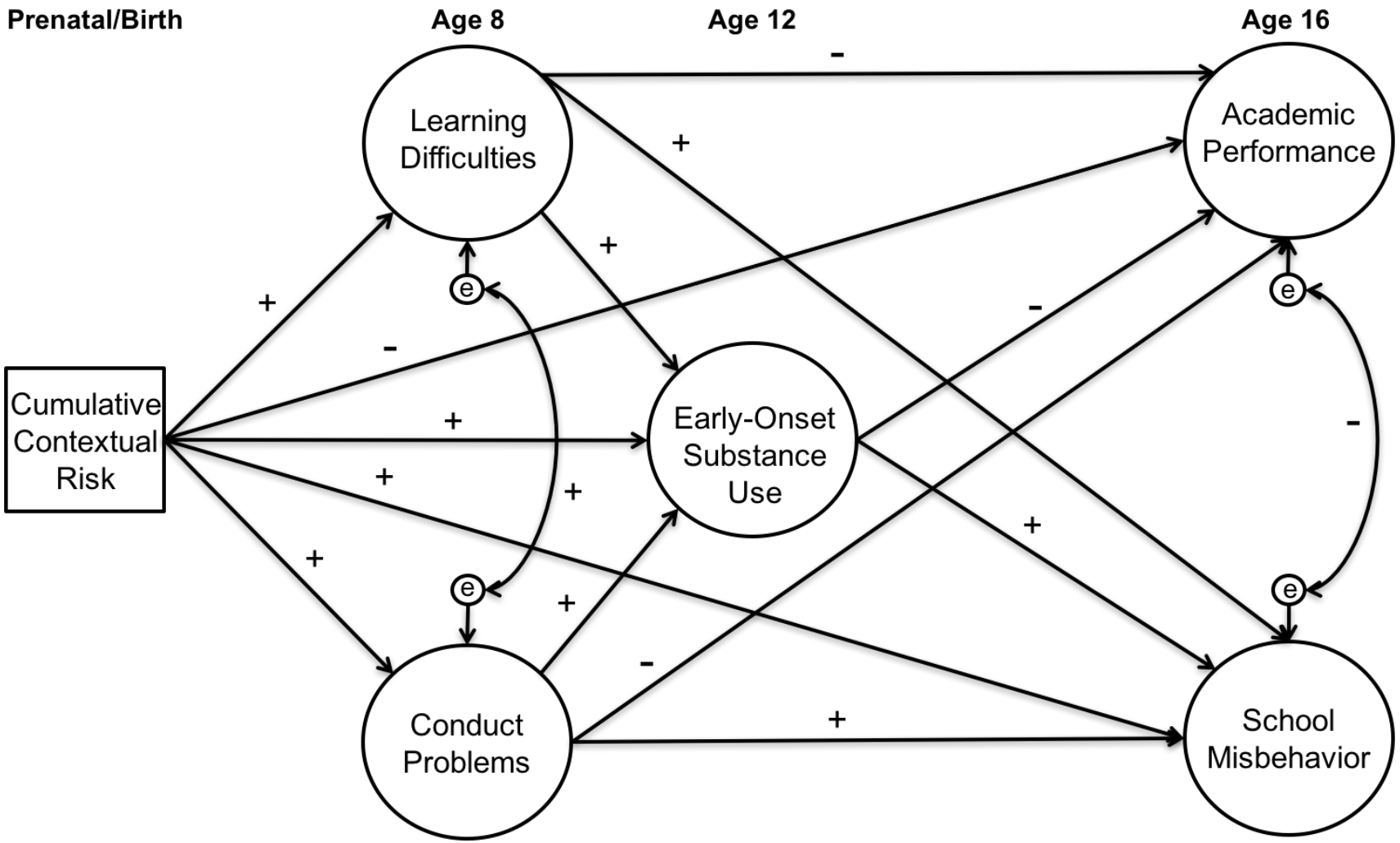

Figure 1. Conceptual model representing the hypothesized associations. Note that youth gender is included as a moderator.

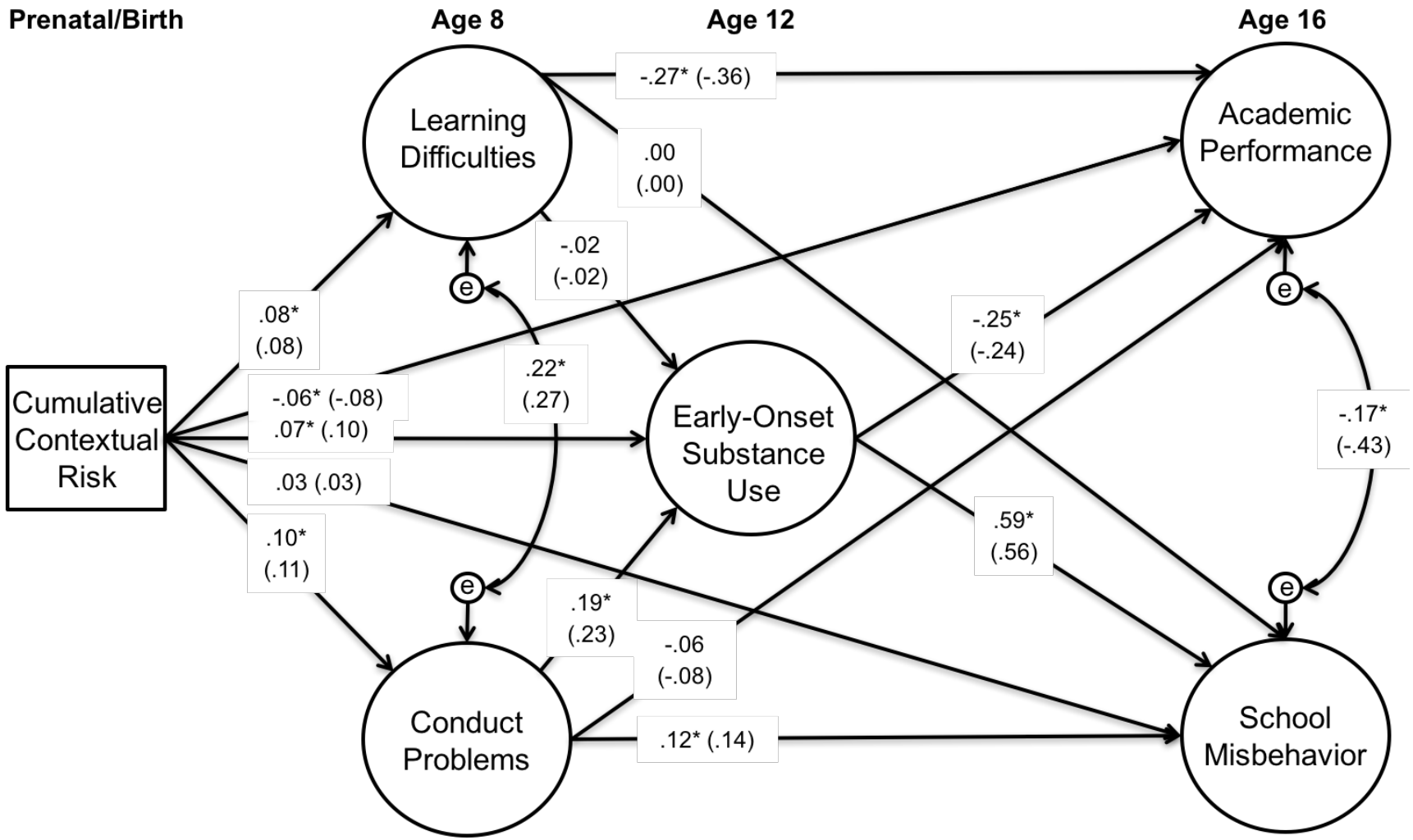

Figure 2. Structural Equation Model with unstandardized path coefficients and standardized path coefficients in parentheses. Note that youth gender is included as a covariate in all paths.
*$p < .05$

Stacy-Ann A. January is an Assistant Professor in the Department of Psychology at the University of South Carolina. She earned her Ph.D. in School Psychology at the University of Georgia and completed a 2-year postdoctoral research fellowship at the University of Nebraska–Lincoln. Her research interests include the prevention of academic and behavioral difficulties in youth.

W. Alex Mason is Director of Research at the Boys Town National Research Institute for Child and Family Studies. He received his Ph.D. in Social Psychology from the University of Nevada–Reno. His major research interests include the developmental etiology and family-based prevention of adolescent and young adult substance misuse and co-occurring problems. He also has interests in longitudinal and intervention-related methods and analytic techniques.

Jukka Savolainen is Research Professor at the Institute for Social Research, University of Michigan, where he serves as the Director of the National Archive of Criminal Justice, a topical data archive within the Inter-university Consortium for Political and Social Research. Dr. Savolainen's research is focused on etiological investigations of crime, delinquency, and adolescent problem behavior.

Starr Solomon is a doctoral student at the University of Nebraska–Omaha. Her research interests include the role of social networks in criminal offending and victimization.

Mary B. Chmelka is Director of Data Support at the Boys Town National Research Institute for Child and Family Studies. She has over 20 years of data collection and data management experience at Boys Town, implementing a variety of methods with a range of participants (e.g., youth, caregivers, agency staff). Her research interests focus on problem and positive development of at-risk youth in residential treatment and general population youth. She also has interests in longitudinal data analytic techniques.

Jouko Miettunen is Professor of clinical epidemiology at the Center for Life Course Health Research, University of Oulu, Oulu, Finland. He is also working as an Academy Research Fellow on risk factors for schizophrenia. He earned a M.Sc. in statistics from the University of Oulu, Finland in 1998, a M.Phil. in epidemiology from the University of Cambridge, UK in 2003, and a Ph.D. in psychiatry from the

University of Oulu, Finland in 2004. He has over 190 publications, primarily focused on schizophrenia, temperament, and medical statistics.

Juha Veijola is Professor in Psychiatry at the University of Oulu, Finland. His main research interests have been in psychotic disorders. In recent years, he has studied the neuroscience of mental health.

Irma Moilanen, MD, PhD, is Senior Professor of Child Psychiatry at the University of Oulu, Finland. She received her doctorate in 1979 on the development of twins from the Medical Faculty of the University of Oulu. Her major research interests include longitudinal studies of children and adolescents up to adulthood, especially concerning development, health and mental well-being.

Anja Taanila, PhD, is Professor Emerita of Public Health Science, Center for Life Course Health Research, University of Oulu. Her research lines have included: social exclusion and well-being resources in Northern Finland, epidemiological studies of social marginalization and regional inequality in health and social services among two birth cohorts (1966 and 1986), and intellectual disability and neurological disorders.

Marjo-Riitta Järvelin, MD, PhD, is Professor and Chair in Life Course Epidemiology at Imperial College London, UK, is Professor at the University of Oulu, and Consultant at the University Hospital Oulu. She earned her MD from the University of Oulu with a specialization in pediatrics, a MSc in Environmental Epidemiology and Policy from the University of London, and a PhD in Epidemiology in Medical Science from the University of Oulu. Dr. Järvelin has been managing large-scale population based studies for over 25 years and is director of the Northern Finland Birth Cohort research program. Her research interests include the genetic and early life environmental origins of multi-factorial disease and disorders.