Cumulative risk over the early life course and its relation to academic achievement in childhood and early adolescence

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ABSTRACT

Early-life risk factors, such as family disruption, maltreatment, and poverty, can negatively impact children's scholastic abilities; however, most previous studies have relied on cross-sectional designs and retrospective measurement. This study investigated the relation between cumulative risk factors during the early life course and subsequent academic achievement in a cohort of children and adolescents. Data for this study were based on registry-data material from the LIFECOURSE study of 1151 children from the 2000 birth cohort in Reykjavik, Iceland, assembled in 2014–2016. Multiple lifetime risk factors, including maternal smoking during pregnancy, parent's disability status, being born to a young mother, number of children in the household, family income, number of visits to school nurses, and reports of maltreatment, were assessed. Latent class analysis and Analysis of Covariance (ANCOVA) were used to predict academic achievement in the 4th and 7th grades. Individuals with no risk factors reported the highest average academic achievement in the 4th (M = 66 points, SD = 17) and 7th grades (M = 67 points, SD = 15). There was a significant main effect for 4th-grade risk factors and academic achievement ($F[7, 1146] = 12.06$, $p < 0.001$) and a similar relationship between the risk factor profile and achievement scores in 7th grade ($F[7, 1146] = 15.08$, $p < 0.001$). Each additional risk factor was associated with a drop in academic achievement at both grade levels. We conclude that academic achievement declines in proportion to the number of risk factors in early life.

1. Introduction

During the last three decades studies have consistently shown that exposure to early-life risk factors, such as family disruption, maltreatment, and poverty, can negatively impact children's scholastic abilities and academic achievement (Gutman et al., 2002; Prelow and Loukas, 2003; Fantuzzo et al., 2010). Poor academic achievement can lead both parents and teachers to lower expectations of students' academic performance, which in turn can discourage children's further academic success (Entwisle, 1995). Moreover, poor academic performance during childhood and adolescence can increase the risks of a life course trajectory that can lead to antisocial behaviors, health-compromising behaviors, and greater odds of incarceration (Hirschi, 1969; Yoshikawa, 1995; McKinsey and Company, 2009).

There is growing evidence that the accumulation of only a few risk factors can contribute to poor adolescent outcomes. For example, a study of psychiatric disorders in children 10 years of age in the United Kingdom found that a single risk factor did not significantly increase the overall risk of developing a psychiatric disorder, but that two or more risk factors increased the risk for a psychiatric disorder fourfold (Rutter, 1979). Similarly, the Rochester Longitudinal Study revealed that the number of risk factors was related to concurrent behavior problems in school (Sameroff et al., 1987a), as well as mental health problems and lower academic outcomes (Sameroff et al., 1998). More recent studies have replicated the effect of multiple risk factors on various outcomes such as delinquency (Lanza et al., 2014), maltreatment (MacKenzie et al., 2011), and juvenile court petitions (Smokowski et al., 2004). Generally, these studies support the notion that the effects of the accumulation of risk factors exceed the effects of any single factor.

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Several studies have focused specifically on the impact of multiple risk factors on academic achievement. In a study among 7th-grade African American students, a high number of risk factors was associated with school absenteeism, lower mathematics test scores, and lower Grade Point Average (GPA) (Gutman et al., 2002) Similarly, another study showed that living in a single-parent household, maternal psychological distress, maternal education level, perceived financial strain, and neighborhood problems, were predictive of lower mathematics achievement scores as well as behavioral problems in a group of 10–14 year old economically disadvantaged Latino youth (Prelow and Loukas, 2003). A particularly noteworthy finding was that worse outcomes were associated with five risk factors and not with four or less risk factors.

While these findings highlight the cumulative impact of multiple risk factors on academic achievement and related outcomes, much of the research on multiple risk factors across the early life course and academic achievement has relied on cross-sectional designs with retrospective measurement and limited causal inference. Our study extends previous work in three major ways. First, we utilized comprehensive data from national government registry sources. Second, we employed a cohort design that allowed us to look at risk in relation to outcomes longitudinally, from pre-birth through the age of 13. Third, we employ a person-centered analytic approach to the data (Lanza et al., 2011) instead of the more commonly employed variable-centered methods that have been used to investigate the relationship between variables and to examine processes mutual to a group of people (Laursen and Hoff, 2006). Thus, the overarching goal of the present study was to address two questions: 1) Does increased number of risk factors across the early life course lead to lower academic achievement in 4th and 7th grade?; and 2) Does the risk-factor profile produce distinct underlying classes of participants that reveal different academic outcomes?

2. Method

This report is based on registry data from a 5-year cohort study being conducted by the Icelandic Center for Social Research and Analysis at Reykjavik University. Registry data were assembled in years 2014–2016. The data registries from which the data are derived include the Icelandic Primary Health Care Clinics, the Reykjavik Child Protection Agency (CPA), the Icelandic Directorate for Health (equivalent to the Surgeon General in the US and which oversees the entire health registry system in Iceland), the Statistical Bureau of Iceland, and the Educational Testing Institute of Iceland. The study was approved by the National Bioethics Committee of Iceland.

2.1. Sample and procedure

The sample comprised all 1151 adolescents (49% female) that were born and residing in the City of Reykjavik, the capital of Iceland, in the year 2000, and is derived from registry data that were made available for the study. Thus, for purposes of the present analysis, the study design is a registry-based, retrospective cohort study with children born and residing in Reykjavik in the year 2000. No prospective data were collected. The analyses examined all available data that had been collected over the period from the pregnancy of each participant's mother, through to the 7th grade (13 years) of the study participants.

2.2. Measures

Risk-factor variables and criteria of risk and non-risk were selected to be comparable to those used in other similar studies (Gutman et al., 2002; Prelow and Loukas, 2003; Fantuzzo et al., 2010; Entwisle, 1995; Hirschi, 1969; Yoshikawa, 1995; McKinsey and Company, 2009; Rutter, 1979; Sameroff et al., 1987a).

2.2.1. Prenatal information
The Primary Health Care Clinics of Iceland provided data with prenatal information. In Iceland, each expectant mother visits a national healthcare center for regular examinations where data on various mental and physical health and behaviors are collected. The following measures were abstracted for use in the current analyses:

Smoking status during pregnancy. During the first trimester mothers are screened for smoking status. Assigned codes were 1 = yes, smoker, and 0 = no, previous, or never smoker at the time of birth.

Mother's age. Participants of young mothers at the time of birth (age < 19) were identified in the risk category.

Number of children in the household. Participants of families with three or more children at the time of birth were identified in the risk category.

2.2.2. School health information
For health and well-being of school children, data were abstracted from the Primary Health Care Clinics, which oversee the work of school nurses in Iceland who routinely conduct health examinations on children at the age of six, nine, and 12 years, in addition to being available to children in case of need.

Visits to school nurses. Participants that scored in the top 85th percentile in number of visits were defined as belonging in the risk category (13 visits + for 4th-grade students, 17 + visits for 7th-grade students).

Emotional well-being in school. During visits to school nurses in 4th grade children are screened for their emotional well-being at school for the current year (i.e., "How do you generally feel at school?"). Feeling bad at school were classified in the risk category.

2.2.3. Child maltreatment
Maltreatment data were abstracted from the records of the Reykjavik Child Protection Agency (CPA). Given that initial reporting of children to the CPA does usually not entail a need for intervention and that most case files are closed after a brief inspection, we defined maltreatment as 2 + reports in the CPA database from the age of 0–13 years.

2.2.4. Statistical bureau data
The Statistical Bureau of Iceland is the center for official statistics in Iceland. For the current analysis, the databank provided the following information:

Income. Income in the bottom 15th percentile (in Icelandic Kronur) when each participant was born and/or when he/she was 10 and 13 years of age was defined as a risk factor (14% at birth, at 10 and 13 years old).

Marital status. If parents were not married or in registered domestic partnership at the time of each participant's birth and/or when he/she was 10 and 13 years old it was coded as a risk factor.

Disability status. If either parent were registered as disabled at time of each participant's birth and/or when he/she was 10 and 13 years old it was defined as a risk factor.

2.2.5. Academic achievement
Data were assembled from the Educational Testing Institute, which oversees the universal standardized comparison exams for the national school system in Iceland. Every student in Iceland sits through