



## Chains of risk for alcohol use disorder: Mediators of exposure to neighborhood deprivation in early and middle childhood



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### ABSTRACT

Our goal was to test a cascade model to identify developmental pathways, or chains of risk, from neighborhood deprivation in childhood to alcohol use disorder (AUD) in young adulthood. Using Swedish general population data, we examined whether exposure to neighborhood deprivation during early and middle childhood was associated with indicators of social functioning in adolescence and emerging adulthood, and whether these were predictive of AUD. Structural equation models showed exposure to neighborhood deprivation was associated with lower school achievement during adolescence, poor social functioning during emerging adulthood, and the development of AUD for both males and females. Understanding longitudinal pathways from early exposure to adverse environments to later AUD can inform prevention and intervention efforts.

### 1. Introduction

Excessive alcohol use is one of the leading causes of preventable death in the United States (US) (Mokdad et al., 2004). Alcohol use disorders (AUD) are debilitating, multi-faceted, recurrent conditions that impose a significant burden on the global population every year (Odling et al., 2016; Rehm and Imtiaz, 2016; Rehm et al., 2006; Whiteford et al., 2013). Alcohol-attributed productivity losses, disability and premature death are profound, especially among younger adults with AUD (Rehm et al., 2014). Although AUD is serious and prevalent, it also is preventable. Even in countries with strong social welfare systems, such as Sweden, supportive early neighborhood and family contexts can have a positive influence on later health outcomes, including AUD and other substance use disorders (Gauffin et al., 2013; Johansson et al., 2015; Kendler et al., 2014a; Sellstrom et al., 2011). There are many processes through which the neighborhood context may impact AUD, and understanding the longitudinal pathways from early exposure to adverse environments to later AUD can inform prevention and intervention. Given the intensive nature of the data required, this type of longitudinal study is relatively rare, however.

Developmental cascade theories suggest that successful completion of salient developmental tasks, or important accomplishments specific to a given developmental period, are interrelated over long periods,

with earlier success (or difficulty) affecting later development through various pathways (Obradović et al., 2010; Roisman et al., 2004). Thus, disruptions in salient domains at each stage of development prospectively predict adverse outcomes at the next developmental stage (Eiden et al., 2016), thereby mediating the impact of the immediately preceding domain on later outcomes (Dodge et al., 2009). These cascading influences may then extend into adulthood, with early antisocial and high-risk behaviors being associated with adverse adult outcomes (Dodge et al., 2009).

Cascade models of adolescent substance use, more specifically, have explored how exposure to early-childhood risk factors leads to other risk factors later in childhood such as academic problems, with both early and later childhood risk factors linked in turn to adolescent (and later) substance use and associated problems (Sitnick et al., 2014). These “chains of risk” are important to identify as they offer insight into possible time points and strategies for intervention. By identifying early developmental correlates of AUD, targeted interventions may be directed at individuals when alcohol use is less entrenched and more malleable (Sitnick et al., 2014). Environmental interventions also can help prevent onset of alcohol use, as well as reducing heavy use and stopping progression to AUD (Ahern et al., 2015). In the current paper, we use population registry data from Sweden to examine pathways from exposure to neighborhood deprivation during early and middle

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childhood, focusing on school achievement during adolescence and social functioning during emerging adulthood as mediators of neighborhood effects on AUD.

### 1.1. Chains of risk: beginning with neighborhood deprivation

Neighborhood deprivation poses many risks for child and adolescent development (Drukker et al., 2003; Kalf et al., 2001; Kohen et al., 2008; Leventhal and Brooks-Gunn, 2000; Schneiders et al., 2003). Deprived neighborhoods have fewer educational and employment opportunities (Williams and Collins, 2001), poor-quality physical, social and service environments (Macintyre et al., 1993), and weaker informal social control over deviant health-related behaviors, including substance use (Drukker et al., 2003; Karriker-Jaffe, 2011; Sampson et al., 1997). Although all of these represent possible pathways from neighborhood deprivation to adverse health outcomes, the ways in which neighborhood deprivation influences AUD through these chains of risk remains relatively understudied.

Two possible mediators are school achievement during adolescence and social functioning during emerging adulthood, including attainment of higher education and employment (Masten et al., 2008). Neighborhood deprivation in childhood may result in lower school achievement due to exposure to poorer quality schools and fewer other educational resources, as well as due to exposure to stressors including crime and violence. Repeated or continual environmental stress can impair cognitive and social development (Shonkoff et al., 2009; Shonkoff and Garner, 2012) and reduce the likelihood of educational success. The influence of neighborhood deprivation on educational outcomes has been heavily investigated, with established links to lower scholastic performance (Ainsworth, 2002), increased school dropout (Harding, 2003; Rendón, 2014), and decreased likelihood of high school graduation (Crowder and South, 2011; Wodtke et al., 2016) and of obtaining a college degree (Owens, 2010). Adolescents who do poorly in school are at higher risk for substance use, and school performance and academic achievement are predictors of AUD and alcohol-related mortality in adulthood (Budhiraja and Landberg, 2016; Crum et al., 2006; Gauffin et al., 2015). However, little research has reported on school achievement as a mediator of the relationship between neighborhood deprivation and AUD in young adulthood. Research on social functioning that includes successful accomplishment of other developmentally-appropriate tasks during emerging adulthood—such as being gainfully employed or otherwise integrated as a productive and functioning member of society—as a mediator of this relationship is even rarer. A Danish study used population registry data to compare employment in early adulthood (ages 21–27) for people who had lived in deprived neighborhoods in childhood (ages 8–9) with a control group matched on gender and age but who had lived in a relatively affluent neighboring area (Lander et al., 2012); rates of unemployment were significantly higher for the people who had lived in the deprived area as children. Our study aims to build on this research by explicitly emphasizing educational attainment and employment as intermediate outcomes on the pathway from early neighborhood deprivation to young adult AUD.

### 1.2. Sensitive periods of exposure to neighborhood deprivation

In addition to identifying pathways from early risk factors to later outcomes, developmental theories suggest that timing and chronicity of exposure to adversity differentially influence many long-term health outcomes (Slopen et al., 2014). In terms of timing, exposure to risk factors and stressors during sensitive developmental periods may be particularly damaging (McCutcheon et al., 2010; Olf et al., 2007). Sensitive developmental periods refer to life phases such as childhood and adolescence during which exposures to risk factors such as neighborhood deprivation may be more strongly associated with long-term AUD risk. When considering school achievement, exposure

to neighborhood deprivation during early childhood may be markedly detrimental from a basic developmental perspective (Heckman, 2006; Knudsen et al., 2006), however school quality during middle childhood may be essential during this early period of mastery of fundamental skills necessary for academic success later in adolescence.

In terms of chronicity, sustained exposure to neighborhood deprivation over time and across developmental periods may be more damaging than exposure of a shorter duration (Crowder and South, 2011; Wodtke et al., 2016, 2011). Despite recommendations that neighborhood effects should be studied within a longitudinal and developmental framework (Ferraro and Shippee, 2009; Wodtke et al., 2011), few prior studies have examined how the effects of neighborhood deprivation vary across different developmental periods (but see, for example, Wodtke et al., 2016), or how neighborhood effects may be strengthened with longer duration of exposure (as exceptions, see Cerdá et al., 2010; Clarke et al., 2014), particularly on AUD.

### 1.3. Current study

The goal of this study is to test a cascade model to identify developmental pathways, or chains of risk, from neighborhood deprivation in early childhood to AUD in young adulthood. We use data from the Swedish general population to examine whether exposure to neighborhood deprivation during two key developmental periods (early and middle childhood) is associated with school achievement in adolescence and later difficulties with social functioning in emerging adulthood, and whether these, in turn, are predictive of onset of AUD in adolescence and emerging adulthood. Our hypothesis is that, after accounting for parental SES and parent externalizing behavior, another key predictor of child academic problems (Berg et al., 2016; Gifford et al., 2015) and substance use (Chassin et al., 1999; Kendler et al., 2013, 2016c), exposure to neighborhood deprivation during early and middle childhood will be associated with lower school achievement in adolescence, as well as reduced social functioning in young adulthood, leading to subsequent development of AUD. We use stratified models to assess these pathways separately for men and women, as some research suggests sex differences in the effects of early adversity on later outcomes (Johansson et al., 2015; Kroneman et al., 2004).

## 2. Methods

### 2.1. Data sources

We linked Swedish National Registers by the unique identification number assigned at birth or upon immigration to all Swedish inhabitants. The identification number was replaced by a serial number to assure anonymity. Ethical approval for this study was secured from the Regional Ethical Review Board of Lund University.

The following national data sources were used to construct our analysis dataset: The Multi-Generation Register, linking individuals born after 1932 to their parents (Ekblom, 2011); the Swedish Census, containing information on household income and education every five years from 1960 to 1990; the Total Population Register, containing annual data on family structure from 1990 to 2013; the Longitudinal Integration Database for Health Insurance and Labor Market Studies, including annual information on income, unemployment, social welfare recipients, and education from 1990 to 2012; the Swedish Hospital Discharge Register, containing hospitalizations for Swedish inhabitants from 1964 to 2012; the Swedish Outpatient Register, covering medical diagnosis in open care clinics from 2001 to 2012; the Swedish Prescribed Drug Register for prescriptions picked up at pharmacies by patients from July 2005 to March 2014; the Swedish Crime Register, covering all convictions in lower court from 1973 to 2012; the Suspicion register, identifying individuals strongly suspected of a crime from 1995 to 2012; the Swedish Mortality Register from 1973 to April 2014, containing causes and timing of death; and the National School

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