UNOBSERVED CONFOUNDING IN ASSOCIATIONS BETWEEN CHILDHOOD HOUSEHOLD DYSFUNCTION AND HEALTH AND SOCIAL OUTCOMES IN YOUNG ADULTHOOD

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Introduction

A large body of literature has documented associations between experiences of childhood household dysfunction and several health (1–5), behavioural (5,6) and socioeconomic (7,8) outcomes. These experiences include a diverse range of events occurring in the family environment, such as substance use and mental health problems of a family member, parental conflict and union dissolution, witnessing domestic violence and having an incarcerated parent (1). In addition, experiences of familial death and economic disadvantage have been used as measures of household dysfunction (e.g., 6). These experiences are often studied within the wider conceptual framework of childhood adversity and adverse childhood experiences, a field which has garnered a lot of interest during the last decades (for reviews, see e.g., 1–3).

Studies on adverse childhood experiences and household dysfunction often rely on composite measures of different experiences (e.g., a sum score), which is then used to predict the outcomes in question. Commonly, a dose-response relationship between these indicators and the studied outcomes is found, and these associations usually attenuate to some extent after accounting for observed confounding (1). Explanations for the observed associations often revolve around the negative effects of stress (3,5). Moreover, there is often an intergenerational component between one of the indicators included in the household dysfunction composite score and the chosen outcome, e.g., parental psychiatric diagnosis is included as an adverse experience and offspring psychiatric diagnoses used as an outcome (5,6). However, a central methodological limitation in current literature about childhood household dysfunction and different health and social outcomes is that the research is has mostly not taken into account the problem of unobserved confounding, i.e., that a third unmeasured factor explains the association between childhood household dysfunction and the outcome. These factors might include, among others, genetic vulnerabilities and unobserved environmental factors, such as parenting (9).

A common way of adjusting for such unobserved confounders is to use family fixed effects models, such as sibling-comparisons, which account for an average of 50% of co-segregating genes and the shared environment (10). A small number of studies has used this approach to study the associations between adverse childhood experiences and subsequent outcomes, including violent victimization and antisocial behaviour (11,12), ADHD and autism (13), and physical health problems, problematic alcohol use, depressive symptoms, and attained education and income (12). The findings from these studies suggest that the association between household dysfunction or ACE and the outcomes observed at the population level is largely or totally attenuated in sibling-comparisons, which indicates the presence of unobserved confounding.

However, an important limitation of the sibling-design is that the results derived are based on information only from siblings who are differentially exposed to the exposure of interest (10). In the case of many of the indicators of household dysfunction this is often not a plausible assumption since many of the studied factors are very often shared by the siblings, especially full siblings. In the ACE indices used by previous research, the indicators included into the index often have both experiences that can be assumed to be more realistically discordantly experienced (e.g., physical abuse) and experiences where this assumption might not hold (e.g., parental death or psychiatric disorders). For the latter types of experiences, sibling-design might be more suitable if the age of exposure is limited to a short time frame (13) or if the studied experiences are limited to exposures happening in households (11,12), instead of measuring the indicators from biological parents. An additional option to study unobserved confounding between these type of experiences and subsequent outcomes is to use cousin-comparisons, which relax some of the assumptions

of the sibling-design, albeit with the cost of only accounting for 12.5% of genes and the environmental factors shared by the cousins (14). To date, cousin-comparisons have not been widely used in the field of ACE and household dysfunction research, but a Swedish study (13) has showed that the associations between childhood adversity and ADHD and autism attenuate in differentially exposed cousins when compared to associations observed at the population level.

In this study, we aim to contribute to this gap in research by studying multiple indicators of childhood household dysfunction and their association with multiple health and social outcomes in adolescence and young adulthood. We use cousin-comparisons to account for unobserved confounding in these associations and examine both the associations between single experiences and the outcomes and the dose-response relationship.

Data

The study is based on administrative register data on all individuals born in Finland between 1987 and 2000 and residing in Finland at age 15. From these individuals, we excluded those without any information on biological parents, and those who died or emigrated before age 15. We also excluded those individuals whose parents were not in the data at time of birth. The final analytical sample size was 835,448. Annually updated information on sociodemographic variables, living arrangements, police-reported crime and criminal convictions were obtained from Statistics Finland for all the study participants and their biological parents (permission number TK/3763/07.03.00/2021). These data were linked with annual records on inpatient and outpatient hospital episodes and purchases of prescription medication from Finnish Institute for Health and Welfare and the Social Insurance Institution of Finland (THL/2180/14.02.00/2020).

Methods

Household dysfunction

We included parental hospital-presenting substance use and psychiatric disorders, parental prison sentences, parental death, parental social assistance receipt and parental union dissolution as indicators of household dysfunction. Parental psychiatric disorders were identified from inpatient hospital data using ICD-codes for schizophrenia, mood disorders and anxiety disorders. Substance use was defined using the same data and ICD-codes for alcohol use and drug use disorders.

Parental prison sentences and parental deaths were identified from data on criminal sentences and data on causes of death obtained from Statistics Finland. Parental social assistance was defined as receiving more than 1 euro of social assistance during a year, measured from Statistics Finland's annually updated data. Finally, parental union dissolution was defined based on Statistics Finland's data on household unions. Both dissolutions of marriages and household unions were included.

All these experiences were measured from both biological mothers and fathers and combined into a single measure. If the other parent was missing or had exited the population, information on the available parent was used. All the indicators were measured as ever experienced during childhood (ages 0–14).

Outcomes

We examined the associations between household dysfunction and six different outcomes in adolescence and young adulthood: psychiatric hospitalizations, substance-attributable hospitalizations, psychotropic medication purchases, violent crime, property crime and being not in education, employment or training (NEET). Psychiatric hospitalizations and substance-attributable hospitalizations were defined using data on inpatient admissions and visits to specialized outpatient health care and the same ICD-codes as with the respective parental indicators. Psychotropic medication purchases were identified from the prescription

medication purchases using ATC-codes N05–N06. Violent and property crime were defined from data on police-reported crime (suspected crimes), obtained from Statistics Finland. NEET was defined from annual labour market indicators of Statistics Finland.

We followed the children for these outcomes from age 15 onwards. The start date of the follow-up period was January 1st of the year the children turned 15 years old. Measurement of household dysfunction stopped the last day of the preceding year. Exact event dates were available for all the outcomes except NEET, for which the last day of the year was used as the event date. The follow-up for outcomes lasted until the date of the outcome, death, emigration or end of 2020. The follow-up times were set separately for each outcome.

Covariates

Statistics Finland's data on parental education (basic, secondary, lower tertiary, higher tertiary), region of residence (large NUTS2 areas), birth order, mother's age at childbirth, indicator for a two-parent family, child's sex and birth year (1987–1991/1992–1996/1997–2000) were included as covariates to adjusted models. The covariates were measured at age 0.

Models

We used Cox regression to model the associations between the indicators of household dysfunction and the different outcomes. We first fitted a crude population-level model, which included all the individuals in the data. We clustered standard errors by biological mother's identification number. Second, we fitted a model adjusted for the covariates reported above.

We then estimated stratified Cox models to conduct cousin comparisons. In the cousin models, only first-born index individuals were included, and the cousins were defined as having the same grandmother but a different mother. Around 1/3 of the first-borns had a maternal cousin within the studied birth cohorts (N=92,992). The cousin models were adjusted for the same covariates as the population models, except for birth order.

Besides the associations between single experiences and the outcomes, we also examined accumulation of household dysfunction with a simple sum score ranging from 0 to 4 or more experiences. The sum score was used as a categorical covariate in the models and the models were adjusted for the observed covariates.

Preliminary results

All the studied indicators increased the risk of all the studied outcomes in the population-level models, with hazard ratios ranging from 1.3 to 4.5. After adjusting for observed confounders, the associations attenuated and ranged between 1.2 and 2.5. Furthermore, in the cousin-comparisons, most of the associations attenuated further, but the decreases were mostly relatively modest and there were clear differences in the amount of unobserved confounding accounted by the cousin-comparison by the outcomes. For hospital-presenting psychiatric disorders and medication purchases and not being in education, employment or training, the attenuation was smaller than for the other three outcomes (violent and property crime and substance use). The largest percentages attenuated were in the associations between parental imprisonment and substance-attributable hospitalizations and property crime, over 30%.

There was a clear dose-response relationship between the categorical sum score variable and all the outcomes, with HRs of one experience ranging from 1.3 to 1.6 and HRs of four or more experiences ranging from 1.8 to 4.3. These were further attenuated in the cousin comparisons, but there were again clear differences by outcome. There seemed to be more unobserved confounding between the sum score and

violent and property crime and substance-attributable hospitalizations than between the sum score and the other outcomes.

Discussion

The results from this study demonstrate that unobserved confounding may create upward bias in the associations between household dysfunction and health and social outcomes in adolescence and young adulthood, but the amount of this confounding depends on the outcome and the specific indicators under examination. Moreover, the associations between childhood dysfunction and health and social outcomes remains robust in the cousin-comparisons. The findings from this study indicate that the mechanisms in these associations are complex and the shared factors within families might have an important role, in addition to the toxic stress associated with experiences of childhood household dysfunction.

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