Association between childhood adversity and use of the health, social, and justice systems in Denmark (DANLIFE): a nationwide cohort study

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Summary

Background Childhood adversities can negatively affect health and social outcomes. We aimed to assess the association between adversity in childhood and use of public services in early adulthood across three systems: health, social welfare, and justice.

Methods We used Danish nationwide registry data on individuals born between 1980 and 1991 and followed up between 1998 and 2021. We evaluated annual exposure to adversity during childhood (age 0–16 years) across three dimensions—material deprivation, loss or threat of loss within the family, and family dynamics—and used this to divide individuals into five trajectory groups: low adversity, early-life material deprivation, persistent material deprivation, loss or threat of loss, and high adversity. We defined high-intensity users of each public service system as those above the 90th percentile in terms of hospital visits (health system) and weeks of social welfare use (social welfare system), and whether or not they were convicted for a crime (justice system) during early adulthood (age 18–40 years). We analysed the proportion of high-intensity users of each public service system across the childhood adversity trajectory groups. Logistic regression was used to assess whether the risk of becoming a high-intensity user differed by trajectory group relative to the low-adversity group, with adjustment for sex, parental education, parental origin, and maternal age at time of birth.

Findings Of the 567 035 individuals in the cohort, 273 616 (48·3%) were in the low-adversity group, 128 238 (22·6%) were in the early-life material deprivation group, 100 959 (17·8%) were in the persistent material deprivation group, 43 826 (7·7%) were in the loss or threat of loss group, and 20 396 (3·6%) were in the high-adversity group. Childhood adversity was associated with a markedly higher risk of belonging to the high-intensity user group across all three public service systems. Specifically, low proportions of the low-adversity group became high-intensity users of the health system (19 675 [7·2%]), social welfare system (13 681 [5·0%]), and justice system (38 198 [14·0%]). By comparison, those in the high-adversity group were significantly more likely to become high-intensity users of the health system (4685 [23·0%]; adjusted odds ratio 2·81 [95% CI 2·71–2·93]), social welfare system (8158 [40·0%]; 8·88 [8·50–9·27]), and justice system (8681 [42·6%]; 3·62 [3·50–3·75]).

Interpretation There were long-term effects of childhood adversities across three public service systems, with an association of high-intensity users among individuals who experienced childhood adversity. Systemic inequalities already present in childhood need to be addressed, with prioritisation of equitable resource allocation for those most in need of assistance.

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Introduction

Addressing childhood health inequalities is a major public health priority, and populations at risk for poor developmental outcomes continue to require attention. For many children and adolescents, the experience of social and family-related adversities during these formative years can have detrimental effects on their life-course development.[1] Studies have shown that childhood and early-life adversity can have long-term effects on physical and mental health[2–5] and risk of premature death,[6] and can lead to economic hardships and a greater need for social assistance.[7] These effects can also be associated with increased risk of being prosecuted for a crime.[8]

The unequal distribution of childhood adversities between socioeconomic groups[9] has given rise to disparities in the use of public service systems, and this can exacerbate the challenge of maintaining and providing the support needed to all citizens, regardless of their socioeconomic backgrounds. The negative effect of childhood adversities on health and social outcomes has been shown to have substantial economic implications across 28 European countries.[10] Unequal public service use can directly affect expenditure on social services,

Research in context

Evidence before this study
We conducted an exhaustive literature review using PubMed, without language restrictions, from inception to Nov 15, 2022. Our search strategy used the following terms: "(adverse childhood experiences" OR "childhood adversity" OR "poverty" OR "family disruption" OR "parental loss") AND ("high service utilization" OR "welfare dependence" OR "healthcare use" OR "social services" OR "criminal justice system") to identify studies examining the relationship between childhood adversities and subsequent high use of public service systems in adulthood. Previous research has identified associations between early-life adversities and increased risks of adverse health outcomes, socioeconomic challenges, and interactions with the justice system. However, these investigations frequently focused on individual systems, offering a fragmented perspective on the effect of childhood adversities. Furthermore, there is a recognised need for more comprehensive, life-course approaches to understand how early adversities contribute to multisystem high-use patterns in adulthood.

Added value of this study
This study extends the existing body of research by employing a comprehensive, life-course approach, using

large-scale Danish registry data to examine the effects of childhood adversity on high use of public services across health, social welfare, and justice systems in young adulthood. This study shows the interconnected nature of different childhood adversities and high use of multiple public service systems, and offers a deeper and more nuanced understanding of how childhood adversities are persistently associated with disadvantage in adult life.

Implications of all the available evidence
The findings of this study have important implications for policy and practice. They underscore the need for early, integrated interventions that address not just individual aspects of adversity but the broader, interconnected challenges that individuals with early-life adversities face in young adulthood. This could involve coordinated efforts across health care, social services, and justice systems to provide targeted support. Furthermore, these results highlight the importance of preventive measures in early childhood to mitigate the long-term, multisystem consequences of adversities.

health care, and support programmes, thereby placing considerable strain on public resources overall. Subsequent broader societal implications can include reduced workforce productivity, increased unemployment rates, and intergenerational cycles of poverty and disadvantage.[11–13] However, the relationships between childhood adversities and long-term outcomes such as health-care service use, use of social benefits, and criminal offences have not been sufficiently documented in the scientific literature. Identifying potential populations at risk is crucial for developing targeted interventions that can mitigate the long-term negative effects of childhood adversity, as well as reduce the economic burden on public service systems, and promote social and economic stability.

A retrospective study of 1307 children in New Zealand previously showed positive associations between individual childhood risk factors and costly adult outcomes in areas such as health care, criminal justice, and social welfare.[14] However, this previous study focused on childhood maltreatment alone and thus had low coverage of childhood risk factors. Another study using large-scale data from Denmark and New Zealand showed that some groups of the working-age population had a disproportionately higher use of services from hospital, justice, and social service systems.[15] This previous study provides important information on multidimensional marginalisation in some subgroups of the population, and it highlights a pressing need for identifying and intervening on early drivers of such marginalisation.

Leveraging nationwide data from Danish individuals tracked from birth to 40 years of age, our objective was to explore the prospective life-course relationship between childhood adversity across material, health, and family dimensions and the risk of belonging to a high-intensity user group in young adulthood across three central public service systems: health, social welfare, and justice.

Methods

Study design and population
This population-based cohort study uses register data from the Danish life course (DANLIFE) cohort, which tracks 2223927 children born in Denmark between 1980 and 2015.[9] The cohort includes continuously updated and comprehensive information on multiple childhood adversities, morbidity, mortality, and socio-demographic information. Since the focus of this study is public service system use in young adults aged 18–40 years, we restricted the study population to individuals born between 1980 and 1991, and followed up between 1998 and 2021. Individuals who emigrated or died during follow-up were excluded from the study. Access to Danish registers is granted by Statistics Denmark and the Danish Health Data Authorities in a pseudonymised and secure form. Each Danish citizen is assigned a unique personal identification number at birth, enabling individual-level linkage across national registries.[16] The DANLIFE study has received approval by the Danish Data Protection Agency through the joint notification of The Faculty of Health and Medical Sciences at the University of Copenhagen (record

number 514-0641/21-3000). Studies based on Danish registers do not require informed consent or ethical approval by the Danish National Committee on Health Research Ethics.

Trajectories of childhood adversities

Childhood adversities were operationalised using predefined trajectory groups based on a multitrajectory model.[6] These groups were identified by counting annual adversity exposure from birth to age 16 years across three dimensions (appendix p 2): material deprivation (ie, family poverty and parental long-term unemployment), loss or threat of loss within the family (ie, parental somatic illness, sibling somatic illness, and death of a parent or a sibling), and family dynamics (ie, parental separation, being placed in foster care, parental psychiatric illness, sibling psychiatric illness, and parental alcohol or drug abuse). Further details on these dimensions and metrics are provided in the appendix (pp 5–6). The current study population is a subsample of the original population from which the trajectory groups were derived: a low-adversity group, characterised by a low rate of adversities across all dimensions; an early-life material deprivation trajectory group, characterised by a high annual rate of material deprivation during the first 4–5 years of life, after which the rate became low; a persistent material deprivation trajectory group, characterised by a high annual rate of material deprivation during the entirety of childhood, but with a low rate of adversities in the other two dimensions; a loss or threat of loss trajectory group, characterised by a high and increasing annual rate of loss or threat of loss during childhood; and a high-adversity trajectory group, characterised by a high and increasing annual rate of adversities in all three dimensions. We included both two-parent and single-parent families; detailed data on the number of children per family (one child *vs* multiple children) by childhood trajectory are available in the appendix (p 7).

Health, social welfare, and justice system use

We gathered data from Danish registries covering health, social welfare, and justice systems. Health data were obtained from the National Patient Registry, which includes mandatory reporting from all Danish hospitals detailing various aspects, such as type of encounter, admission and discharge dates, and diagnosis.[17] Social welfare information was retrieved from the DREAM database, covering all social benefits and transfer income since July, 1991.[18] People not included in this register are assumed not to have received transfer income. The type of transfer payment is recorded on a weekly basis. Lastly, information on the justice system was available from the Danish System of Criminal Statistics.[19] The System of Criminal Statistics, KRAF, includes data on criminal cases from the reported offences and charges to the convictions plus arrests and imprisonments. In this study, we considered only confirmed adult criminal convictions. Detailed codes for welfare benefits, hospital admissions, and criminal convictions are listed in the appendix (pp 7–8).

High-intensity user groups across health, social welfare, and justice systems

To assess marginalisation within the health and social welfare systems in our study population, we identified high-intensity users through a three-step process. First, we calculated annual hospital contacts (inpatient, outpatient, and emergency) and weeks of social benefits per individual. Second, we divided the counts of hospital contacts and the number of weeks of social benefits by the number of years that an individual was followed up in the study, to adjust for varying follow-up durations. Lastly, we defined high-intensity users within the health and social welfare systems as those with use above the 90th percentile within that service. In the justice system, high-intensity users were defined as individuals with at least one conviction during the follow-up period.

Statistical analysis

We analysed the proportion of high-intensity users in three public service systems by plotting their distribution across childhood adversity trajectory groups. To test whether individuals belonging to different trajectories of childhood adversities had different risks of becoming high-intensity users across the different systems, we used logistic regression models to estimate odds ratios (ORs) with 95% CIs. The low-adversity group was used as the reference category in all models. Adjusted models considered the following confounders: sex (male or female), parental education (low [<10 years], middle [10–12 years], or high [>12 years]), parental origin (Western [defined as both parents being from Europe, North America, Australia, or New Zealand] or non-Western [at least one parent with a non-Western nationality]), maternal age at time of birth (<20 years, 20–30 years, or >30 years). Each covariate was chosen for its potential to both affect childhood adversities and adult outcomes. In selecting covariates for our models, we considered factors present at birth that have been consistently highlighted in the literature as influencing long-term outcomes related to health and social welfare. We have included a breakdown of missing values in all tables (appendix pp 9, 11), which were found to be negligible for our total population.

Data management and analysis were done with SAS (version 9.4M8) and Python (version 3.12.1).

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. Although author SHA is affiliated with the Rockwool Foundation, her contribution was solely in her capacity as a research professor.

	Low adversity (n=273 616)	Early-life material deprivation (n=128 238)	Persistent material deprivation (n=100 959)	Loss or threat of loss (n=43 826)	High adversity (n=20 396)
Sex					
Male	52%	51%	51%	51%	54%
Female	48%	49%	49%	49%	46%
Highest household education at time of birth					
Low (≤9 years)	11%	24%	37%	24%	57%
Medium (10–12 years)	49%	56%	48%	49%	34%
High (>12 years)	39%	19%	14%	26%	8%
Missing data	≤1%	≤1%	≤1%	≤1%	≤1%
Parental origin					
Western*	99%	98%	96%	99%	99%
Non-Western†	<1%	1%	4%	1%	<1%
Missing data	≤1%	≤1%	≤1%	≤1%	≤1%
Maternal age at time of birth					
<20 years	1%	4%	8%	4%	12%
20–30 years	71%	78%	74%	69%	71%
>30 years	27%	18%	18%	27%	17%
Missing data	≤1%	≤1%	≤1%	≤1%	≤1%

*Includes Europe, North America, Australia, and New Zealand. †Includes those with at least one parent with a non-Western nationality.

Table: **Background characteristics at time of birth for 567 035 Danish children by the five estimated trajectory groups**
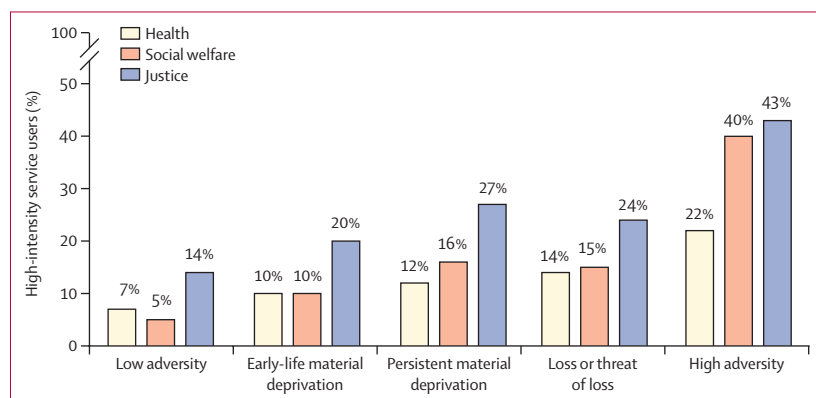

Figure 1: **Proportions of high-intensity users within the health, social welfare, and justice systems by childhood adversity trajectory group**

Results

Of the 647 509 individuals born between 1980 and 1991 and followed up between 1998 and 2021, we excluded 75 959 who emigrated and 4515 who died during follow-up, resulting in a final cohort of 567 035 individuals (415 576 families; appendix p 2). Among them, 273 616 (48·3%) were in the low-adversity group, 128 238 (22·6%) were in the early-life material deprivation group, 100 959 (17·8%) were in the persistent material deprivation group, 43 826 (7·7%) were in the loss or threat of loss group, and 20 396 (3·6%) were in the high-adversity group. The background characteristics at time of birth are presented in the table.

Figure 1 shows the proportions of high-intensity users across the health, social welfare, and justice systems by

childhood adversity group. In general, in the low-adversity group, low proportions of individuals became high-intensity users before 40 years of age across each of the three systems, whereas the high-adversity group had notably higher proportions of high-intensity users. The appendix (pp 9–10) provides further details on these outcomes. In an additional analysis, we identified 4821 individuals as high-intensity users of all three systems, with the high-adversity group having an adjusted OR (aOR) of 13·50 (95% CI 12·20–14·94) for high-intensity usage of all three systems (appendix p 11). Stratifying by number of children per family revealed no major differences as compared with our main statistical model (appendix p 12). The results of a sensitivity analysis with a fixed 30-year follow-up did not differ from our main findings.

By definition, 10% of the population fell into the high-intensity user group of secondary health services, with only 19 675 (7·2%) of 273 616 individuals in the low-adversity group being categorised as high-intensity users. By contrast, the proportion of high-intensity users was higher across all other childhood adversity groups, particularly in the high-adversity group, in which 4685 (23·0%) of 20 396 individuals were high-intensity users (aOR 2·81 [95% CI 2·71–2·93] vs the low-adversity group; figure 2). Non-high-intensity users had an average of 13 visits, whereas high-intensity users had a markedly higher average of 54 visits. Crude estimates are provided in the appendix (p 13) for comparison with adjusted models. The associations were slightly stronger for mental health diagnoses than for somatic health (appendix p 13). Stratification by sex showed no major

differences (appendix p 14), while stratification by parental origin indicated weaker associations among those with non-Western parents (appendix p 15).

By definition, 10% of the population belonged to the high-intensity user group of social welfare services, but this proportion varied by childhood adversity group. Only 13 681 (5·0%) of 273 616 in the low-adversity group were high-intensity users, compared with 16 153 (16·0%) of 100 959 in the persistent material deprivation group and 6574 (15·0%) of 43 826 in the loss or threat of loss group. The highest proportion was in the high-adversity group, with 8158 (40·0%) of 20 396 classified as high-intensity users (aOR 8·88 [95% CI 8·50–9·27] *vs* the low-adversity group). A progressive increase in welfare service use was observed with higher adversity levels; non-high-intensity users averaged 3·8 weeks of welfare benefits, while high-intensity users averaged 42·6 weeks. Adjusting for parental mental health status before birth did not substantially alter these findings (appendix p 16).

During the study period, 299 394 convicted crimes were recorded in the study population, and childhood adversity was strongly associated with these convictions. 456 944 individuals had no recorded convictions while the 110 091 individuals who committed crimes had an average of 2·7 convictions. Most groups had less than one conviction per person, except the high-adversity group, with 1·9 convictions per person. Within the low-adversity group, 38 198 (14·0%) of 273 616 were convicted of a crime, while the proportion was higher in the other childhood adversity groups (figure 1). The high-adversity group had the highest prevalence, where 8681 (42·6%) of 20 396 individuals were convicted before age 40 years, reflecting a four-fold higher risk of conviction compared with the low-adversity group (aOR 3·62 [95% CI 3·50–3·75]); figure 2.

Discussion

Leveraging large-scale, high-resolution life-course data, we documented a marked clustering of high-intensity users of several public service systems associated with childhood adversity. All four of the adversity groups, characterised by various types and degrees of childhood adversity, were associated with a higher risk of becoming high-intensity users of public service systems before the age of 40 years compared with the low-adversity group. In particular, the group that experienced high levels of childhood adversity had a very high proportion of individuals who were high-intensity users of health services and social welfare benefits or were convicted of a crime in young adulthood. This finding indicates that some young individuals and families are trapped in cycles of ill health, social adversity, and crime, perpetuating inequality across generations.

Previous studies have shown a dose–response relationship between adversities and individual public service systems. Our study builds on this by focusing on individuals with disproportionately high use of
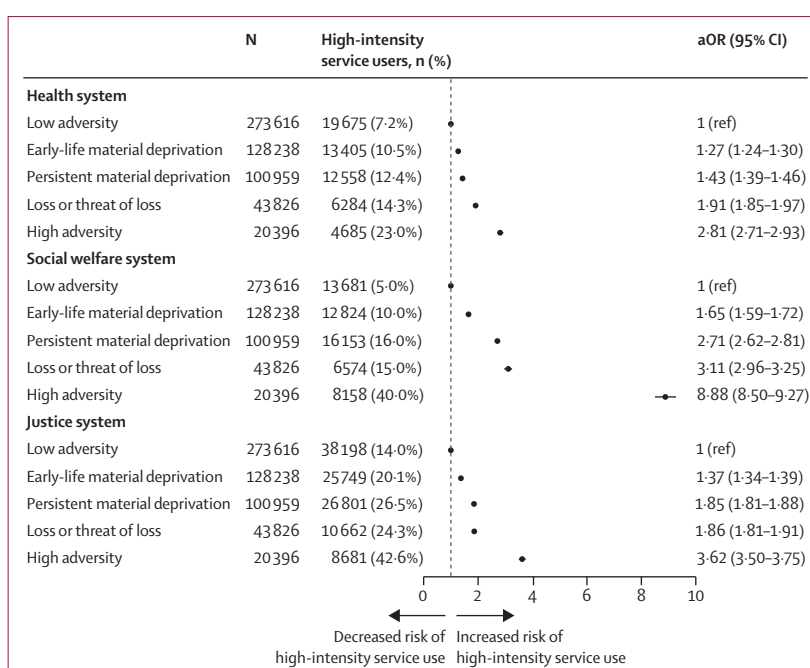

	N	High-intensity service users, n (%)		aOR (95% CI)
Health system				
Low adversity	273 616	19 675 (7·2%)		1 (ref)
Early-life material deprivation	128 238	13 405 (10·5%)		1·27 (1·24–1·30)
Persistent material deprivation	100 959	12 558 (12·4%)		1·43 (1·39–1·46)
Loss or threat of loss	43 826	6284 (14·3%)		1·91 (1·85–1·97)
High adversity	20 396	4685 (23·0%)		2·81 (2·71–2·93)
Social welfare system				
Low adversity	273 616	13 681 (5·0%)		1 (ref)
Early-life material deprivation	128 238	12 824 (10·0%)		1·65 (1·59–1·72)
Persistent material deprivation	100 959	16 153 (16·0%)		2·71 (2·62–2·81)
Loss or threat of loss	43 826	6574 (15·0%)		3·11 (2·96–3·25)
High adversity	20 396	8158 (40·0%)		8·88 (8·50–9·27)
Justice system				
Low adversity	273 616	38 198 (14·0%)		1 (ref)
Early-life material deprivation	128 238	25 749 (20·1%)		1·37 (1·34–1·39)
Persistent material deprivation	100 959	26 801 (26·5%)		1·85 (1·81–1·88)
Loss or threat of loss	43 826	10 662 (24·3%)		1·86 (1·81–1·91)
High adversity	20 396	8681 (42·6%)		3·62 (3·50–3·75)

Decreased risk of high-intensity service use ← → Increased risk of high-intensity service use

Figure 2: aOR for being in the high-intensity user group for each public service system, categorised by childhood adversity trajectory
The low-adversity group was used as the reference group in the model. aOR=adjusted odds ratio.

three critical public service systems concurrently. We found that the most intensive public service use is skewed towards those with substantial childhood adversities, highlighting the need for integrated interventions that address multiple aspects of an individual's life. While not all young adults with a history of childhood adversity will face negative transitions or require social welfare assistance, our findings show that a considerable proportion do. High-intensity use of one public service system might increase the use of other systems; for instance, a criminal conviction can lead to stigma, hindering employment opportunities[20] and leading to increased reliance on social welfare, as affected individuals seek support to mitigate their economic hardships.[21] Similarly, chronic health conditions necessitate frequent health-care service use and often result in greater social system dependency because of disabilities or reduced work capacity.[22]

Our results strengthen and expand the findings from Caspi and colleagues, who tracked 1037 children in New Zealand and identified a group with childhood risk factors burdened by substantial economic challenges.[14] Similarly, Richmond-Rakerd and colleagues explored a segment of the adult working population characterised by high needs and high-cost use of multiple public service systems.[15] Our results contribute valuable new insights by showing that the heightened risk of becoming a high-intensity user of public services is not limited to those experiencing high adversities; it also includes individuals facing early-life or persistent material deprivation, and those who

have experienced loss or threat of loss during their childhood. Adverse health and social outcomes are more prevalent following economic hardship or the death of a parent during childhood.[23,24] Economic instability in an individual's formative years can hinder educational attainment and labour market integration, increasing the likelihood of reliance on economic and social assistance in adulthood. Our findings showed similar effects of early-life and persistent material deprivation on public service use. These findings highlight the profound influence of material deprivation during early childhood, which is a particularly sensitive period for cognitive, emotional, and social development, and the effect of cumulative exposure to material deprivation throughout childhood. Similarly, experiencing the death of a parent during childhood or growing up in an economically unstable household is linked to adverse health, social, and educational outcomes later in life.[25,26]

This study emphasises the need for a multisectoral approach to public policy that addresses not just the symptoms but also the root causes of high service use. Early interventions are crucial and often more cost-effective in preventing the escalation of adverse outcomes. Heckman argued that the highest return on investment in education comes from nurturing disadvantaged young children.[27] Programmes that enhance early-life environments such as free access to community programmes, nutritional programmes, and family support services can yield substantial long-term benefits in reducing a person's need for social welfare services and interactions with the justice system. Our findings advocate for policy frameworks that prioritise early childhood as a key intervention point to improve long-term social, health, and justice-related outcomes. Neglecting to prevent the occurrence of adversity can lead to a perpetuation of health and economic disparities across families and generations, undermining the effectiveness of state welfare policies for the most vulnerable.

This life-course study leverages high-resolution data from nationwide registers, providing annual occurrences of childhood adversity and the public service system use of young adults. This extensive dataset enabled a comprehensive measure of childhood adversity from different domains of life and the identification of high-intensity users across three public service systems in early adulthood. Relying on registry-linkage data also ensured almost complete long-term prospective follow-up and prevented problems with selective inclusion. However, it is essential to acknowledge the limitations of the childhood adversity measure, as it does not include direct measures of maltreatment (ie, family violence, child abuse, and neglect), which cannot be fully retrieved from registry data. Nevertheless, we specifically included measures on foster care, which are likely to capture the most severe cases of maltreatment in the family. Adversities also tend to cluster, and by

including a wide range of adversity measures we expect to have been able to capture at least the most severe cases of childhood adversity. However, some cases might still have been overlooked, potentially resulting in an underestimation of the associations. Although we addressed the potential effect of family clustering in this paper by conducting sensitivity analyses and found no significant differences in results when accounting for the number of children per family, it is important to acknowledge that the original study from which the childhood adversity trajectories were derived did not account for clustering. Additionally, our insight into health-care service use is confined to the secondary hospital sector, excluding interactions with general practitioners and other medical specialists in primary care. Furthermore, our study exclusively focuses on individuals born in Denmark, relying on national registry data that do not account for non-registered, potentially vulnerable segments of the population. These individuals, who might include undocumented immigrants and others who are not officially registered, remain beyond the scope of routinely collected data, thereby restricting our ability to track and analyse their experiences and interactions with the social, health, and justice systems, which might differ from those of registered residents. In addition, it is important to recognise that there might be groups who are marginalised to such a large extent that they abstain from using the public service system, despite their need for these services (eg, those who are homeless). Additionally, while we were able to stratify by Western and non-Western parental origin, we could not separate the data by race or ethnicity, which might have provided more specific insights into the effect of childhood adversity across different demographic groups.

Denmark has a strong social security system with, for example, free and universal health care, so it is likely that the findings from this study cannot directly be transferred to other sociopolitical settings. However, these results can still help increase the awareness of the childhood origins of many health and social problems and underscore the need for upstream structural interventions to prevent childhood adversity and the associated disease and social burden across countries.

This study contributes to our understanding of the complex relationship between childhood adversities and public service use in young adulthood. Our findings highlight the need for longitudinal research designs, which are essential for elucidating the temporal patterns and dynamics of how early adversities affect later life outcomes. Our results also underline the need for targeted interventions and policies that address the complex social and health needs of individuals who have experienced adversities during their childhood. A comprehensive, multisectoral approach is crucial in providing the necessary support and resources to help break the cycle of childhood adversity, ill health, and early dependency on

public services, promoting better outcomes for individuals and society as a whole.

References
1 Hughes K, Bellis MA, Hardcastle KA, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health* 2017; **2**: e356–66.

2 Elsenburg LK, Bengtsson J, Rieckmann A, Rod NH. Childhood adversity and risk of type 2 diabetes in early adulthood: results from a population-wide cohort study of 1.2 million individuals. *Diabetologia* 2023; **66**: 1218–22.

3 Rod NH, Bengtsson J, Elsenburg LK, et al. Cancer burden among adolescents and young adults in relation to childhood adversity: a nationwide life-course cohort study of 1.2 million individuals. *Lancet Reg Health Eur* 2023; **27**: 100588.

4 Bengtsson J, Elsenburg LK, Andersen GS, Larsen ML, Rieckmann A, Rod NH. Childhood adversity and cardiovascular disease in early adulthood: a Danish cohort study. *Eur Heart J* 2023; **44**: 586–93.

5 Juwariah T, Suhariadi F, Soedirham O, et al. Childhood adversities and mental health problems: a systematic review. *J Public Health Res* 2022; **11**: 22799036221106613.

6 Rod NH, Bengtsson J, Budtz-Jørgensen E, et al. Trajectories of childhood adversity and mortality in early adulthood: a population-based cohort study. *Lancet* 2020; **396**: 489–97.

7 Fridell Lif E, Brännström L, Vinnerljung B, Hjern A. Childhood adversities and later economic hardship among Swedish child welfare clients: cumulative disadvantage or disadvantage saturation? *Br J Soc Work* 2017; **47**: 2137–56.

8 Fox BH, Perez N, Cass E, Baglivio MT, Epps N. Trauma changes everything: examining the relationship between adverse childhood experiences and serious, violent and chronic juvenile offenders. *Child Abuse Negl* 2015; **46**: 163–73.

9 Bengtsson J, Dich N, Rieckmann A, Hulvej Rod N. Cohort profile: the DANish LIFE course (DANLIFE) cohort, a prospective register-based cohort of all children born in Denmark since 1980. *BMJ Open* 2019; **9**: e027217.

10 Hughes K, Ford K, Bellis MA, Glendinning F, Harrison E, Passmore J. Health and financial costs of adverse childhood experiences in 28 European countries: a systematic review and meta-analysis. *Lancet Public Health* 2021; **6**: e848–57.

11 Björkenstam E, Helgesson M, Mittendorfer-Rutz E. Childhood adversity and risk of later labor market marginalization in young employees in Sweden. *Eur J Public Health* 2023; **33**: 264–71.

12 Hansen CD, Kirkeby MJ, Kjelmann KG, Andersen JH, Møberg RJ. The importance of adverse childhood experiences for labour market trajectories over the life course: a longitudinal study. *BMC Public Health* 2021; **21**: 2044.

13 Najman JM, Bor W, Ahmadabadi Z, et al. The inter- and intra-generational transmission of family poverty and hardship (adversity): a prospective 30 year study. *PLoS One* 2018; **13**: e0190504.

14 Caspi A, Houts RM, Belsky DW, et al. Childhood forecasting of a small segment of the population with large economic burden. *Nat Hum Behav* 2016; **1**: 0005.

15 Richmond-Rakerd LS, D'Souza S, Andersen SH, et al. Clustering of health, crime and social-welfare inequality in 4 million citizens from two nations. *Nat Hum Behav* 2020; **4**: 255–64.

16 Schmidt M, Pedersen L, Sørensen HT. The Danish Civil Registration System as a tool in epidemiology. *Eur J Epidemiol* 2014; **29**: 541–49.

17 Rod NH, Bengtsson J, Elsenburg LK, Taylor-Robinson D, Rieckmann A. Hospitalisation patterns among children exposed to childhood adversity: a population-based cohort study of half a million children. *Lancet Public Health* 2021; **6**: e826–35.

18 Hjollund NH, Larsen FB, Andersen JH. Register-based follow-up of social benefits and other transfer payments: accuracy and degree of completeness in a Danish interdepartmental administrative database compared with a population-based survey. *Scand J Public Health* 2007; **35**: 497–502.

19 Statistics Denmark. Criminal offences. https://www.dst.dk/en/Statistik/emner/sociale-forhold/kriminalitet (accessed Aug 28, 2024).

20 Visher CA, Debus-Sherrill SA, Yahner J. Employment after prison: a longitudinal study of former prisoners. *Justice Q* 2011; **28**: 698–718.

21 Sugie NF. Punishment and welfare: paternal incarceration and families' receipt of public assistance. *Soc Forces* 2012; **90**: 10.1093/sf/sos055.

22 International Labour Office. World social protection report 2020–22: social protection at the crossroads—in pursuit of a better future. 2021. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_protect/%40soc_sec/documents/publication/wcms_817572.pdf (accessed Aug 8, 2024).

23 Smith C, Smith-Carrier T, Gazso A, Baker Collins S, Saxby C. The relationship between child maltreatment and social assistance use: a chain of adversities and transitions from a life course perspective. *J Public Child Welf* 2019; **13**: 556–77.

24 Berg L, Rostila M, Arat A, Hjern A. Parental death during childhood and violent crime in late adolescence to early adulthood: a Swedish national cohort study. *Palgrave Commun* 2019; **5**: 74.

25 Appel CW, Johansen C, Deltour I, et al. Early parental death and risk of hospitalization for affective disorder in adulthood. *Epidemiology* 2013; **24**: 608–15.

26 Fergusson D, Swain-Campbell N, Horwood J. How does childhood economic disadvantage lead to crime? *J Child Psychol Psychiatry* 2004; **45**: 956–66.

27 Heckman JJ. Skill formation and the economics of investing in disadvantaged children. *Science* 2006; **312**: 1900–02.