SSM - Population Health 9 (2019) 100506

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: http://www.elsevier.com/locate/ssmph

Article

Troubled childhoods cast long shadows: Childhood adversity and premature all-cause mortality in a Swedish cohort

Josephine Jackisch [a,*], Lars Brännström [b], Ylva B. Almquist [a]

[a] Centre for Health Equity Studies (CHESS), Department of Public Health Sciences, Stockholm University, SE-106 91, Stockholm, Sweden
[b] Department of Social Work, Stockholm University, SE-106 91, Stockholm, Sweden

ARTICLE INFO

Keywords:
Sweden
Premature mortality
Cohort study
Adverse childhood experiences
Childhood social conditions
Longitudinal
Child welfare

ABSTRACT

Experiences of childhood adversity are common and have profound health impacts over the life course. Yet, studying health outcomes associated with childhood adversity is challenging due to a lack of conceptual clarity of childhood adversity, scarce prospective data, and selection bias. Using a 65-year follow-up of a Swedish cohort born in 1953 (n = 14,004), this study examined the relationship between childhood adversity (ages 0–18) and premature all-cause mortality (ages 19–65). Childhood adversity was operationalized as involvement with child welfare services, household dysfunction, and disadvantageous family socioeconomic conditions. Survival models were used to estimate how much of the association between child welfare service involvement and mortality could be explained by household dysfunction and socioeconomic conditions. Results show that individuals who were involved with child welfare services had higher hazards of dying prematurely than their majority population peers. These risks followed a gradient, ranging from a hazard ratio of 3.08 (95% CI: 2.68–3.53) among those placed in out-of-home care, followed by individuals subjected to in-home services who demonstrated a hazard ratio of 2.53 (95% CI: 1.93–3.32), to a hazard ratio of 1.81 among those investigated and not substantiated (95% CI: 1.55–2.12). Associations between involvement with child welfare services and premature all-cause mortality were robust to adjustment for household dysfunction and disadvantageous family socioeconomic conditions. Neither household dysfunction nor socioeconomic conditions were related with mortality independent of child welfare services involvement. This study suggests that involvement with child welfare services is a viable proxy for exposure to childhood adversity and avoids pitfalls of self-reported or retrospective measures.

Introduction

The World Health Organization has posited that childhood adversity is a leading cause of inequity in health (Sethi et al., 2013). Moreover, childhood adversity has high societal costs (Caspi et al., 2016; Gilbert et al., 2009b), which are considered largely avoidable (World Health Organization, 2018). A systematic review of community surveys suggested that adverse childhood experiences (ACE) are common; the prevalence of at least one ACE ranged from 33% to 88% (Hughes et al., 2017). Adversity during childhood and adolescence can be detrimental to health as it may lead to stress and physiological changes in the nervous, endocrine, and immune systems (e.g. Miller, Chen, & Parker, 2011). Individuals exposed to childhood adversity might not be able to reach their full intrinsic capacity of cognitive, social, and emotional functioning and become more susceptible to disease development or adoption of harmful health behaviours (Dong et al., 2004; Kelly-Irving, Mabile, Grosclaude, Lang, & Delpierre, 2013b). A continuously growing number of investigations into childhood adversity have, indeed, confirmed that such experiences are related to higher risks of morbidity and mortality (Hughes et al., 2017; Kelly-Irving et al., 2013a). However, the rapid expansion of this multidisciplinary research field has also led to some conceptual ambiguity. Empirical studies in this field have been largely based on relatively short-term follow-ups or research designs sensitive to bias, such as self-reported measures, retrospective data, and non-population based, cross-sectional, or selected samples (Holman et al., 2016; Hughes et al., 2017; Kalmakis & Chandler, 2015; Putnam-Hornstein, Needell, & Rhodes, 2013; Reuben et al., 2016). Against this background, the current study will use prospective, large-scale data from a Swedish birth cohort followed for 65 years to examine the association between childhood adversity (ages 0–18) and premature

* Corresponding author.
E-mail addresses: josephine.jackisch@su.se (J. Jackisch), lars.brannstrom@socarb.su.se (L. Brännström), ylva.almquist@su.se (Y.B. Almquist).

https://doi.org/10.1016/j.ssmph.2019.100506
Received 19 August 2019; Received in revised form 16 October 2019; Accepted 23 October 2019
Available online 28 October 2019

mortality (ages 19–65). Aiming to improve conceptual clarity, as well as exploring avenues for measuring childhood adversity with register-based information, we will operationalize childhood adversity into three components: involvement with child welfare services, household dysfunction, and family socioeconomic conditions. Our choice of health outcome is based on the international recognition and use of premature mortality as an indicator to monitor health and health inequalities (WHO, 2018).

Past research has clearly demonstrated that involvement with child welfare services (CWS), household dysfunction, and disadvantageous family socioeconomic conditions are linked to health development across the life course. Studies concerned with previous child welfare clients have reported alarming negative social and health outcomes (Gypen, Vanderfaeillie, De Maeyer, Belenger, & Van Holen, 2017; Kääriälä & Hiilamo, 2017), including suicide attempts and severe psychiatric morbidity (Egelund & Lausten, 2009; Vinnerljung, Hjern, & Lindblad, 2006), injury-related deaths, as well as teenage pregnancy, substance abuse, involvement in crime, and low educational attainment (Gypen et al., 2017). Associations with mortality have been confirmed in childhood, early adulthood, and midlife (Gao, Brännström, & Almquist, 2017; Kalland, Pensola, Meriläinen, & Sinkkonen, 2001; Thompson & Newman, 1995). It has been suggested that these negative outcomes might not be the result of the CWS per se, but rather are attributable to these children's disadvantageous family socioeconomic conditions (Almquist et al., 2018). Although studies in child welfare research typically account for socioeconomic conditions, child welfare populations are also likely to be more exposed to household dysfunction and other types of ACE, creating selection bias (Maclean, Sims, O'Donnell, & Gilbert, 2016).

The evidence is strong regarding the association between ACE and increased risk of premature mortality (e.g., Bellis et al., 2015; Felitti et al., 1998; Gilbert et al., 2009b) and other health problems, including ischemic heart disease (Dong et al., 2004), cancer (Felitti et al., 1998), mental health problems (Anda et al., 2006), and health risk behaviours (Bellis et al., 2015; Hughes et al., 2017). Childhood adversity is strongly socially patterned. Having younger parents, parents with low educational attainment, or parents with a history of child abuse are aspects associated both with higher risks of receiving CWS (Sidebotham & Heron, 2006) and ACE (Walsh, McCartney, Smith, & Armour, 2019).

Conceptualizing childhood adversity

There is no consensus regarding how to measure childhood adversity and there has been a lack of population-based prospective data (Putnam-Hornstein et al., 2013). While community-based ACE surveys are appropriate to investigate the prevalence of childhood adversities at the national level (Meinck et al., 2016), prospective longitudinal cohort studies are key for assessing long-term outcomes (Spatz Widom, Raphael, & DuMont, 2004). Self-reports and non-selective attrition of ACE surveys cause serious bias when assessing relationships between childhood adversities and subsequent outcomes (Bellis et al., 2015). The current study explores an alternative way of using information from administrative data. We combine data from child welfare registers with linked register data indicating events of household dysfunction during childhood as well as information about disadvantageous family socioeconomic conditions measured at birth. While child welfare records might have imperfect coverage of child maltreatment (Gilbert et al., 2009a; 2009b), supplementing these with other types of register data broadens the scope to include children who experienced adversity but did not come to the attention of the child welfare authorities. Previous studies using register data to measure childhood adversity have created different cumulative indices including indicators of involvement with CWS, household dysfunction, and disadvantageous family socioeconomic conditions (Björkenstam, Kosidou, & Björkenstam, 2016, 2017; Gauffin, Hjern, Vinnerljung, & Björkenstam, 2016; Kelly-Irving et al., 2013a). These studies have shown a graded association with health outcomes similar to the gradient found in retrospective ACE studies (Hughes et al., 2017). Some researchers, however, have warned that expanding the ACE concept too far may lead to an "unhelpful conflation of directly harmful risk factors, such as abuse, and measures of family structure and childhood socioeconomic conditions" (Allen & Abresch, 2018; Kelly-Irving et al., 2013b; Taylor-Robinson, Straatmann, & Whitehead, 2018, p. e262).

The concept of childhood adversity lacks a consistent definition (Mclaughlin, 2016). Hence, our conceptual framework of childhood adversity and premature mortality draws on different bodies of research from the fields of social work and public health. Public health research tends to frame childhood adversity in terms of early social determinants of health (Marmot, 2014) which are related to an array of socioeconomic and contextual factors in the child's environment. Since the 1990s, the ACE framework has gained prominence, conceptualizing ACE in terms of child maltreatment and household dysfunction. We propose that child welfare research can add to this framework as it specializes in the assessment, prevention, and treatment of child abuse and neglect and has a long tradition of focussing on child welfare clients as one of the most vulnerable populations. Child welfare entails the state's involvement in assisting children and families in cases where the legal caregiver cannot ensure that children's needs are met; sometimes this is also called family services (Khoo, Hyvonen, & Nygren, 2002). Child welfare has developed a range of services including investigations into family situation, issuing warnings and instructions, as well as conducting in-home supervision. In the most severe cases, child welfare agencies have legislative powers to remove a child from their family and place it into out-of-home care (OHC), in the form of family foster care or institutional care. In Sweden, reasons for child welfare involvement can be related to family circumstances or to the child's behaviours (the latter does not apply to all contexts; in some countries cases of juvenile delinquency and behavioural problems are referred to the criminal justice system). Dysfunctional family environments are among the most frequently mentioned causes for investigation by child welfare agencies in early childhood. Household dysfunction is thus both a risk factor for involvement with CWS and an aspect of ACE.

This study uses administrative national and local registers to identify those who experienced household dysfunction and disadvantageous family socioeconomic conditions in childhood without having come to the attention of CWS. The list of household dysfunctions was modelled after the list proposed in the series of seminal studies in San Diego that coined the term ACE (e.g. Felitti et al., 1998). Household dysfunction is one part of ACE; the other part includes experiences of child maltreatment (physical, psychological and sexual, witnessing domestic violence) and neglect, which are not detectable in the administrative register data available for research. We abstain from merging experiences of child welfare into the list of ACE, as this risks muddling different concepts (Taylor-Robinson et al., 2018). Disadvantageous family socioeconomic conditions are examined as separate covariates rather than included among the indicators of household dysfunction. It is established that premature mortality differs for men and women; therefore all results are gender adjusted. Since welfare services in different countries have different traditions of dealing with behavioural problems, we also will present results for the relationship between involvement with child welfare and premature mortality as stratified by the reason for involvement; family circumstances versus behavioural problems.

The aim of this study

Based on data from a 1953 Stockholm birth cohort (n = 14,004), this study aims to tease apart indicators of childhood adversity (ages 0–18) and explore their associations with premature all-cause mortality (ages 19–65). We operationalize childhood adversity into three components: involvement with CWS (out-of-home care, in-home services, and not substantiated investigation), household dysfunction (alcohol problems, divorces, mental illness, incarceration, and death), and family

socioeconomic conditions (occupational class, marital status, and maternal age). We will specifically investigate to what extent household dysfunction and socioeconomic conditions confound the association between involvement with CWS and mortality. Moreover, we will examine whether the association between child welfare and mortality is contingent on the reason for involvement with CWS.

This study attempts to fill four gaps in previous research. First, it contributes to sharpening the concept of childhood adversity by disentangling household dysfunction and disadvantageous family socioeconomic conditions from involvement with CWS. Second, this study uses prospective population-based data to identify exposure to events of household dysfunction. Third, it expands our knowledge about long-term outcomes after childhood adversity by studying premature mortality up to retirement age. Fourth, selection bias into CWS is addressed by supplementing records from social services with other registers, and by separating several groups within the child welfare population based on the degree of decision severity.

Methods

Data material

This study used data from the Stockholm Birth Cohort Multigenerational Study (SBC Multigen) (Almquist, Grotta, Vågerö, Stenberg, & Modin, 2019). The SBC Multigen (n = 14,608) is based on the Stockholm Metropolitan Study (SMS), which includes everyone born in 1953 and living in the greater municipal area of Stockholm, Sweden in 1963 (n = 15,117) (Stenberg et al., 2007). The SMS was anonymized in 1986. Follow up after this point was made possible by a probability matching between the SMS cohort with register data from RELINK53 (resulting in the SBC Multigen). The Regional Ethical Review Board in Stockholm approved the probability matching (no. 2017/34–31/5; 2017/684–32). From the full SMS cohort of 15,117 individuals, 509 could not be matched with certainty to the follow-up data, resulting in a sample of 14,608 individuals to be included in the SBC Multigen. The outcome in this study was defined as adult premature mortality between ages 19–65, resulting in left truncation of 106 individuals, since 47 individuals had died and another 59 had emigrated before the age of 19. The final sample included 14,004 complete cases (see Table 1 for information on the distribution of missing values).

Variables used in this study were based on prospective register data derived from multiple sources: the cause of death register, delivery records, occupational and income registers, censuses, the social register, the register of population, occupation and income, and the crime register. A particular strength of the SBC Multigen is that data on child welfare were manually collected from social registers that existed locally in all municipalities in the Stockholm region. This resulted in earlier and more detailed information (e.g. the reason for involvement with CWS) compared to what have been used in other Swedish register-based studies. Sweden has a mandatory reporting law, meaning that professionals (e.g. police, doctors, nurses, social workers) are required to inform the local child welfare boards whenever they suspect child maltreatment (Gilbert, 2012). The Swedish child welfare system in the 1950s and 1960s was characterized by a strong belief in the legitimacy of state interventions in families, resulting in a high prevalence of child welfare investigations and services (Sundell, Vinnerljung, Andrée Löfholm, & Humlesjö, 2007).

Table 1
Descriptive statistics for the study variables (n = 14,004).

	Total study sample	Sample stratified by: Involvement with child welfare services (ages 0–18)				Sample stratified by: Household dysfunction (ages 0–18)					Prevalence of deaths (row %)
		Majority population	Not substantiated investigation	In-home services	Placement in OHC	Alcohol problems	Divorce	Mental illness	Incarceration	Death	
	n = 14,004	n = 11,100	n = 1354	n = 284	n = 1266	n = 608	n = 1514	n = 881	n = 255	n = 886	n = 1354
	%	%	%	%	%	%	%	%	%	%	
Premature all-cause mortality (ages 19–65)	9.7	7.4	14.5	19.7	21.7	16.4	12.0	14.5	16.9	12.2	
Gender: Female	49.0	52.9	25.8	24.6	45.6	50.5	50.4	46.5	51.4	48.9	7.4
Occupational class (age 0)											
Upper (middle) class	13.9	16.0	8.1	6.0	3.6	3.6	9.6	4.5	3.9	14.3	7.6
Lower middle class	38.3	40.1	32.2	29.2	30.6	28.6	35.6	33.4	28.2	37.8	9.1
Working class	47.8	43.9	59.7	64.8	65.8	67.8	54.8	62.1	67.8	47.9	10.7
Missing information[a]	n = 494	n = 377	n = 46	n = 12	n = 59	n = 25	n = 47	n = 32	n = 11	n = 34	
Marital status (age 0): Unmarried	6.2	4.1	7.8	13.7	21.1	16.6	9.3	14.5	18.4	5.9	14.1
Maternal age (age 0)											
<20 years	4.2	3.5	5.0	5.6	9.5	8.2	8.0	7.9	10.6	2.7	12.9
20–34 years	80.1	80.6	79.5	80.3	76.0	76.5	81.7	76.5	80.8	65.3	9.6
≥35 years	15.7	15.9	15.5	14.1	14.5	15.3	10.3	15.6	8.6	31.9	9.2
Missing information[a]	n = 15	n = 10	n = 2	n = 1	n = 2	n = 0	n = 0	n = 0	n = 0	n = 0	
Household dysfunction (ages 0–18)											
Alcohol problems	4.3	2.4	7.7	16.9	14.8						
Divorce	10.8	8.1	14.0	27.5	27.5						
Mental illness	6.3	2.9	11.7	18.0	27.7						
Incarceration	1.8	1.1	3.0	4.9	6.5						
Death	6.3	5.5	7.8	10.6	11.1						

[a] Not included in the Cox regression models.

Variables

Premature all-cause mortality was defined as deaths from all causes between the ages 19 and 65, derived from death records. Follow-up started in January 1972 and ended in January 2018. By observing mortality from age 19, i.e. subsequent to the measurement of childhood adversity, we did not include mortality that happened simultaneously with household dysfunction or child welfare.

The measure of *involvement with child welfare services* was coded using dummy variables based on the different forms of decisions and measures taken by the child welfare committee between birth and age 19 (1953–1972). Mutually exclusive groups were coded according to the highest order of decision severity: (1) 'Placement in OHC', i.e. children who were placed in family foster care or institutional care; (2) 'In-home services', i.e. children from families receiving in-home assistance, instructions, warnings, or in-home supervision by CWS; and (3) 'Not substantiated investigation', i.e. children whose cases were investigated by the child welfare committee but were not further substantiated. The reference group was (4) 'Majority population', i.e. children who were not included in the child welfare register.

Household dysfunction is a set of family risk factors in childhood, which gained prominence through the San Diego ACE studies (e.g. see Felitti et al., 1998). Our definition of household dysfunction was inspired by the original ACE list, and includes incarceration, alcohol abuse, mental health problems, and parental divorce (Felitti et al., 1998). Following Kelly-Irving and colleagues (Kelly-Irving et al., 2013b), who noted that household dysfunction relates to a 'disruption amid the child's important relationships,' we added parental death to the original list. We thus use five indicators for household dysfunction. *Alcohol problems* were indicated if one of the parents was registered in either the criminal register as having been convicted for drunkenness or drunk driving more than once, or the social register (including actions by the temperance committee). In Sweden, physicians, police officers, and public prosecutors had to report cases of disorderliness or offenses under the influence of alcohol to local temperance committees. *Divorce* refers to any registered divorces between 1953 and 1970 as recorded retrospectively in the 1960 and 1970 censuses. In contrast with today, marriage was the norm for parents at the time when cohort members grew up and divorce was less common. *Mental illness* was indicated if at least one parent was recorded in the social register for suffering symptoms of mental illness or having psychiatric treatment. *Incarceration* was derived from any registration of incarceration in the national crime register between 1953 and the first half of 1972. Data were only available for father's criminality. Information about *death* was derived from the multigenerational data linkages and the cause of death register, indicating whether one parent had died between 1953 and 1972.

Family socioeconomic conditions were included as covariates rather than as part of household dysfunction. Occupational class (typically of the father) at the time of the cohort member's birth was classified into three categories: upper (middle) class, lower middle class, and working class. Other included covariates were maternal marital status at birth of the child and maternal age at delivery.

We additionally analysed whether the relationship between involvement with CWS and premature all-cause mortality differed according to the reason for involvement: family circumstances or the child's own behaviour. The first subsample analysis excluded contacts with child welfare that were only due to behavioural reasons whereas the second subsample excluded exclusively family-related child welfare contacts.

Statistical analysis

The multivariable analysis was based on Cox proportional hazards models to estimate person-years at risk for premature all-cause mortality. The models were specified in three stages (all adjusted for gender): Model 1 examines involvement with CWS, family socioeconomic conditions (mother's age at delivery, maternal marital status at birth and parental occupational class at birth), and household dysfunction (alcohol problems, mental health problems, divorce, incarceration, death) separately. In Model 2, involvement with CWS and the indicators of family socioeconomic conditions are entered into the analysis simultaneously. Model 3 builds on Model 2 but additionally includes the indicators of household dysfunction. Hazard ratios are presented with 95% confidence intervals (CI). Schoenfeld residuals were calculated to check the proportional hazards assumption. While gender contributed to non-proportionality in Model 1, the overall Schoenfeld residual test for the fully adjusted model was not statistically significant ($p > 0.05$). We tested for interactions between gender and the predictors, but none of the interaction terms were statistically significant and the model fit was not improved by inclusion of these interaction terms.

As an additional robustness check for the results of the group exposed to OHC, propensity score matching was performed using *psmatch2* in Stata (Leuven & Sianesi, 2018). A synthetic control group was matched to individuals who were placed in OHC during childhood ($n = 1266$) using family and environmental background variables that existed prior to the child welfare investigation. All covariates and household dysfunction measures were included in the matching, as well as additional measures for municipality, tenure status, housing quality, overcrowding, household size, and number of children in the household (age 7). Balance checks showed that bias in the background variables could be successfully reduced. Cox models were run to estimate the remaining association with premature mortality on two reduced samples comparing the individuals placed in OHC to controls with and without replacement.

Descriptive statistics

Table 1 shows that 9.0% ($n = 1266$) of the cohort was placed in OHC at some point in childhood (ages 0–18). Another 9.7% ($n = 1354$) were assessed by the child welfare committee but remained in their families without further intervention, whereas 2.0% ($n = 284$) received in-home services such as instructions, warnings, or supervision. The majority population reference group contains 79.3% ($n = 11{,}100$) of the sample, who were not involved with CWS in childhood or adolescence. Among the cases of involvement with CWS, 2150 individuals were involved due to the cohort member's behavioural problems, 1290 were involved because of family circumstances, whereas 480 individuals were involved due to both reasons.

Regarding household dysfunction, 22.86% experienced at least one indicator throughout their childhood (Supplementary material, Table 1). Parental divorce was the most prevalent and experienced by almost 11% of the sample. More than 6% experienced parental death or had at least one parent with mental illness. Around 4% had parents reported for alcohol problems, and nearly 2% experienced paternal incarceration. Boys were more likely to be involved with CWS than girls. In contrast, girls and boys did not differ in their exposure to household dysfunction. The more socioeconomically disadvantaged the family was at birth, the more common were experiences of child welfare and household dysfunction. Furthermore, household dysfunction, particularly mental illness, was positively associated with placement in OHC.

As also shown in Table 1, compared to majority population peers, children who were involved with CWS, exposed to household dysfunction, or experiencing disadvantageous family socioeconomic conditions had a higher prevalence of premature mortality during adulthood.

Results

Table 2 reports hazard ratios (HR) and 95% CI for premature all-cause mortality across the groups being involved with CWS relative to their majority population peers. When estimated separately in Model 1, all indicators of CWS, household dysfunction and disadvantageous family socioeconomic conditions were associated with increased risks of

Table 2
Associations between involvement with child welfare services, household dysfunction (ages 0–18), and premature all-cause mortality (ages 19–65). Results from multivariable Cox regression models (n = 14,004).

	Premature all-cause mortality					
	Model 1[a]		Model 2[b]		Model 3[c]	
	HR	95% CI	HR	95% CI	HR	95% CI
Involvement with child welfare services						
Majority population (ref.)	1.00		1.00		1.00	
Not substantiated investigation	**1.81**	1.55, 2.12	**1.78**	1.52, 2.09	**1.76**	1.50, 2.07
In-home services	**2.53**	1.93, 3.32	**2.47**	1.88, 3.25	**2.41**	1.82, 3.18
Placement in OHC	**3.08**	2.68, 3.53	**2.97**	2.57, 3.43	**2.91**	2.49, 3.39
Household dysfunction						
Alcohol problems	**1.81**	1.48, 2.22			1.23	0.99, 1.53
Divorce	**1.30**	1.11, 1.51			0.98	0.83, 1.15
Mental illness	**1.55**	1.29, 1.86			0.93	0.77, 1.14
Incarceration	**1.77**	1.31, 2.40			1.17	0.85, 1.61
Death	1.29	1.06, 1.57			1.15	0.95, 1.41
Family socioeconomic conditions						
Occupational class						
Upper (middle) class	0.83	0.69, 1.00	0.94	0.78, 1.13	0.94	0.78, 1.13
Lower middle class (ref.)	1.00		1.00		1.00	
Working class	1.17	1.04, 1.31	1.03	0.92, 1.16	1.03	0.92, 1.16
Marital status (ref. = unmarried)						
Married	**0.66**	0.55, 0.79	0.92	0.76, 1.12	0.93	0.77, 1.13
Maternal age (ref. = 20–34years)						
<20 years	1.40	1.12, 1.75	1.10	0.87, 1.40	1.11	0.87, 1.41
≥35 years	0.94	0.81, 1,10	0.95	0.82, 1.11	0.94	0.81, 1.10

HR=Hazard ratios; CI=Confidence interval.
Bold face = $p < 0.001$.
[a] Adjusted for gender. Each independent variable entered in a separate model.
[b] Adjusted for gender. Child welfare services and family socioeconomic conditions entered simultaneously (mutually adjusted).
[c] Adjusted for gender. Child welfare services, household dysfunction and family socioeconomic conditions entered simultaneously (mutually adjusted).

mortality. The hazard ratios for CWS involvement were graded along the severity of the child welfare decisions taken, with those investigated without being substantiated showing the lowest (HR = 1.81), followed by those with in-home services (HR = 2.53), and highest for those placed in OHC (HR = 3.08), versus majority population peers. The association between involvement with CWS and mortality was adjusted for indicators of family socioeconomic conditions in Model 2. This led to a small reduction in the size of the CWS estimates (HRs = 1.78/2.47/2.97) and attenuation of family socioeconomic condition indicators. Model 3 adds household dysfunction to the mutual adjusted model, which also leads to attenuation of household dysfunction indicators, while the patterning of premature mortality across the categories of CWS involvement remained largely intact (HRs = 1.76/2.41/2.91).

Subsample analysis by reasons for child welfare contact

As demonstrated in Table 3, we further explored whether the association between CWS and premature mortality was contingent on the reason for involvement with CWS (family circumstances versus behavioural problems). First, we created a subsample for those child welfare

Table 3
Associations between involvement with child welfare services (ages 0–18) and premature all-cause mortality (ages 19–65). Stratified by reason for involvement with child welfare services. Results from multivariable Cox regression models (subsamples for family circumstances, n = 12,314; behavioural problems, n = 12,714).

	Premature all-cause mortality					
	Model 1[a]		Model 2[b]		Model 3[c]	
	HR	95% CI	HR	95% CI	HR	95% CI
Involvement with child welfare services because of family circumstances						
Majority population (ref.)	1.00		1.00		1.00	
Not substantiated investigation	**1.75**	1.21, 2.54	**1.66**	1.14, 2.42	1.53	1.03, 2.26
In-home services	**2.98**	1.84, 4.81	**2.65**	1.61, 4.35	**2.40**	1.43, 4.02
Placement in OHC	**2.29**	1.94, 2.71	**2.17**	1.82, 2.59	**2.07**	1.71, 2.51
	Model 1[a]		Model 2[b]		Model 3[c]	
	HR	95% CI	HR	95% CI	HR	95% CI
Involvement with child welfare services because of behavioural problems						
Majority population (ref.)	1.00		1.00		1.00	
Not substantiated investigation	**2.01**	1.70, 2.37	**1.81**	1.52, 2.14	**1.79**	1.51, 2.13
In-home services	**2.90**	2.14, 3.94	**2.40**	1.74, 3.31	**2.35**	1.70, 3.25
Placement in OHC	**6.56**	5.41, 7.97	**6.21**	5.07, 7.61	**6.04**	4.89, 7.46

HR=Hazard ratios; CI=Confidence interval.
Bold face = $p < 0.001$.
[a] Adjusted for gender.
[b] Adjusted for gender and family socioeconomic conditions (occupational class, marital status, and maternal age).
[c] Adjusted for gender and household dysfunction (alcohol problems, divorce, mental illness, incarceration, death) and family socioeconomic conditions (occupational class, marital status, and maternal age).

contacts due to family circumstances, excluding 1767 individuals that were reported for behavioural reasons only. All child welfare groups with family reasons had significantly increased HRs compared to the majority population. However, the estimates did no longer follow a gradient by decision severity. Confidence intervals are large in the estimates for in-home services. Household dysfunction and disadvantageous family socioeconomic conditions did not explain the associations found.

Second, we excluded 1353 individuals who were involved with CWS exclusively due to family circumstances, resulting in a subsample of behaviour-related child welfare. All child welfare groups with behavioural reasons had highly increased HRs compared to the majority population. Effect sizes were similar as in the full sample for those investigated but not substantiated as well as for those who received other in-home CWS. Yet, individuals placed in OHC due to behavioural problems had a much higher HR for premature mortality (HR = 6.2, 95% CI 5.1–7.6) compared to OHC placements due to any reason. Associations were robust to adjustment for household dysfunction and disadvantageous family socioeconomic conditions.

Robustness check

Selection processes systematically influence who is registered with CWS. As the effect sizes were most severe for those placed in OHC, we performed an additional robustness check for this group applying a counterfactual approach. For each individual placed in OHC, nearest neighbour matching selected a matched control from the rest of the population based on propensity scores. Matching variables included all covariates used in the regression adjustment plus a number of

environmental characteristics including quality of the dwelling, overcrowding, and household size. First, we used the closest match, even if this meant that a control could be used more than once (referred to as 'with replacement'); second, we restricted each control to be used only once ('without replacement'). The matching achieved a balance on all observed background factors. Cox regression models based on the reduced samples, comparing those placed in OHC to their control groups, produced results comparable to those from regression adjustment (see Table 4).

Discussion

Based on a cohort of approximately 14,000 individuals born in 1953 in Stockholm, Sweden, this study investigated premature all-cause mortality after childhood adversity, which was operationalized as involvement with CWS, household dysfunction, and disadvantageous family socioeconomic conditions.

Involvement with child welfare services

The results show that children who were involved with CWS have a higher probability of dying prematurely versus their majority population peers. This is in line with earlier studies, which have reported mortality disadvantages in childhood (Jonson-Reid, Chance, & Drake, 2007), in the period after leaving care (Barth, Blackwell, & Patterson, 1998), and in midlife (Almquist et al., 2018; Gao et al., 2017). Our study advances this knowledge by extending the follow up of mortality until retirement age and by further distinguishing different groups within the child welfare population based on CWS decision severity.

The decision severity (placement in OHC, in-home services, and not substantiated investigation) is congruent with the strength of the association with premature mortality. Comparing different groups within the child welfare population might remedy some selection as they are more similar on observable and unobservable factors influencing the reporting to CWS. The graded association might reflect the distribution of unobserved adversity, as it seems reasonable to assume that the more severe consequences decided upon by the child welfare committee are based on exposure to e.g. neglect or violence. Consequently, we suggest that child welfare registrations can be understood as a proxy either for the unobserved more severe ACE (such as neglect or abuse), or for the level of severity in the exposure to adverse family backgrounds, in a way that is associated with worse long-term health development.

The results derived from the analyses stratified by reason for placement show that mortality risks are exacerbated among those who are placed in OHC due to behavioural problems. This is in line with previous studies that found worse outcomes after behavioural placements, often appearing during teenage years, versus other reasons (Vinnerljung & Sallnäs, 2008). An earlier study based on the Stockholm Birth Cohort suggested that life courses of individuals placed due to behavioural reasons might have changed, as their placement in the given historical period may have kindled adult involvement in criminal activities (Lindquist & Santavirta, 2014). Research into reasons for placement is, however, relatively rare. When restricting the analysis to include involvement with CWS due to family circumstances, our study found an interesting reversal of the gradient between in-home services and placement in OHC. This finding calls the hypothesis of OHC being an adverse exposure further into question.

Family socioeconomic conditions

Adversity in childhood is a product of social, cultural, economic and biological factors. Children in socioeconomically disadvantaged families are at higher risks of being involved with CWS and experiencing household dysfunction. We therefore examined whether the association between CWS involvement and premature all-cause mortality might be due to selection on family socioeconomic conditions. Our results suggest that this is not the case. Moreover, in line with a previous study (Sheikh, 2018), we found that disadvantageous family socioeconomic conditions were not significantly related to mortality net of other indicators of childhood adversity.

Household dysfunction

A common explanation for the association between involvement with CWS and premature mortality is that the problems in the family of origin deprive a child from reaching their full developmental potential. Greater exposure to household dysfunction is related to registration with child welfare and to having been the victim of maltreatment (Ohashi et al., 2018). Nonetheless, relatively few studies have examined the differential relationships between household dysfunction and CWS involvement explicitly. We show that the increased risks of premature mortality among individuals who were involved with CWS remain robust net of household dysfunction in the family of origin. Moreover, in line with findings from a cross-sectional study (Clemens et al., 2019), the relationship between household dysfunction and mortality is fully explained by CWS involvement.

Previous studies have found evidence for associations with premature mortality only for the highest number of accumulated ACE (Bellis et al., 2015; Brown et al., 2009; Kelly-Irving et al., 2013a). Although the data material used in these studies does not allow us to analyze the contributing factors in depth, we may hypothesize that household dysfunction becomes relevant once it is paired with other adversities such as neglect or violence. This would be in line with our understanding that CWS could indicate other unobserved ACE or a certain level of severity with regard to household dysfunction and disadvantageous family socioeconomic conditions. We provide additional material of a robustness check where we modify our analysis to adjust for a count of the number of household dysfunction types rather than for specific events (Supplementary material, Table 2). The results do not provide much evidence that cumulative household dysfunction explains more than the specific events. Differences in methods and the nature of ACE counts make it, however, difficult to compare effect sizes of premature mortality risks. In addition, our results are influenced by the selection into CWS due to behavioural problems in adolescence, which might explain why there is a larger proportion of the population affected and a larger effect size in our study in comparison to ACE studies.

Table 4
Associations between placement in OHC (ages 0–18) and premature all-cause mortality (ages 19–65), before and after propensity score matching.

	HR (95% CI)	n	Person-years	Number of events (deaths)
Before matching, crude model[a]	**2.71** (2.38–3.09)	14,502	639,348	1403
Before matching, adjusted model[a c]	**2.32** (1.99–2.70)	14,004	618,400	1354
After matching, with replacement[b d]	**2.43** (1.89–3.13)	2075	89,532	352
After matching, without replacement[b d]	**1.95** (1.39–2.73)	1468	64,223	207

HR=Hazard ratios; CI=Confidence interval.
Bold face = $p < 0.001$.
[a] Comparing individuals placed in OHC to the rest of the population.
[b] Compared to control group. Matching variables include gender, household dysfunction, family socioeconomic conditions, and environmental factors prior to placement.
[c] Model adjusted for same variables as matching variables.
[d] Nearest neighbour matching in which each OHC placed individual is matched to a control from the rest of the population that is nearest in terms of propensity scores. With replacement means that always the closest match will be used where a control can be used more than once, whereas in procedures without replacement each control can be used only once.

Alternatively, some authors have argued that associations between involvement with CWS and health outcomes might be due to the services themselves. The experience of being removed from the family might be a traumatizing or stigmatizing life event, which can affect normal social and biological development, explaining effects extending into adulthood (Browne, Hamilton-Giachritsis, Johnson, & Ostergren, 2006; Sethi et al., 2013). Yet, our analysis of decision severity shows that not only those who are placed in OHC but also those receiving in-home services, and even cases *ad acta* (not substantiated investigation) have increased hazards of premature mortality.

While each single event of household dysfunction challenges supportive and nurturing environments when growing up, if managed well, they might not create a trauma to the child's long-term health. If there is indeed a threshold of severity of exposure to underlying adversity, CWS might indicate that it has been passed. Results from the additional robustness check based on propensity score matching were consistent with the regression adjustment, suggesting that family background and household dysfunction or environmental factors cannot explain the excess mortality. This is in contrast with a previous study of negative adolescent outcomes, where the association with placement in OHC did not remain statistically significant after comparison to matched controls (Averdijk, Ribeaud, & Eisner, 2018).

Limitations and strengths of this study

Strengths of this study include the population-based approach and the possibility of prospectively following a cohort from birth up until retirement age. The findings broaden our understanding by ascertaining the robustness of mortality risks following involvement with CWS. In contrast to retrospective ACE surveys, this study used prospective birth cohort data to identify experiences of household dysfunction. Cost-effectiveness and potential harm of ACE screenings in community settings have been debated (Allen & Abresch, 2018), particularly because the next steps following ACE surveys are uncertain and adequate resources for equitable response when children are found at risk are often absent. Our alternative strategy to assessing childhood adversity does not have such side effects. While ACE surveys have important merits, prospective population-based data are needed to examine the association between adversity in childhood and health outcomes throughout the life course (Gilbert et al., 2009b). Deriving indicators from population-based registers bears the advantage of not being affected by recall bias and systematic non-random attrition. As mortality follow-up is register-based, attrition is nearly non-existent. Our specific study is nevertheless limited by the focus on the capital region of Stockholm, which affects the generalizability of results; children who were send to foster families residing outside this region before the age of ten are missing in the sample. Some missing cases of CWS might have occurred in children who were born outside Stockholm and exposed to child welfare measures before they moved to Stockholm.

This study shows how indicators of childhood adversity can be derived from child welfare administrative data and linkages with other registers. In contrast to other studies using administrative data to study childhood adversity, we disentangle aspects of household dysfunction and disadvantageous family socioeconomic conditions from child welfare experiences. While we are unable to assess all ACE because data are not available for experiences of childhood neglect, abuse and violence, our approach focuses specifically on household dysfunction. Bringing household dysfunction together with child welfare registrations adds an important layer of information, as child welfare registers have been criticized for only covering the 'tip of the iceberg'. Data used in this study are likely to be reproducible in other contexts and cohorts.

The associations found should not be interpreted as causal links. We were unable to adjust for baseline health status and development of the children before being involved with CWS. Nevertheless, we examined health selection in sensitivity analyses. First, we excluded individuals with congenital malformations, psychiatric care during childhood and special school attendance from the sample. Second, additional covariates such as birth weight were included as this might indicate prenatal disadvantage (Barker, Osmond, Simmonds, & Wield, 1993; Kuh and Ben Shlomo, 2004). None of these procedures lead to a noteworthy change of the results. Another challenge to our study is measurement error in the household dysfunction variables. Parental death and divorce can be assessed with high level of certainty through census data. Yet, incarceration data was only available for the fathers and parental alcohol abuse and mental health might have been underreported for those never involved with social services. Finally, several indicators of family socioeconomic position are used in the literature (Manor, Matthews, & Power, 1997). We chose occupational class, material status, and maternal age because these were the only ones measured at birth and thus preceding the other two indicators of childhood adversity.

Implications for practice

While child welfare data have been criticized for covering only the tip of the iceberg of childhood adversity, our study suggests that this tip might deserve some special attention. The findings of this study raise hope that not every event of household dysfunction or type of disadvantageous family socioeconomic condition is correlated with premature mortality. Nevertheless, our results highlight the importance of prevention of behavioural problems in youth. Youth with behavioural problems have particularly high levels of premature mortality and it cannot be dismissed that such problems might be a result of earlier, more hidden, levels of adversity. We also observe that a substantial part of those portraying behavioural problems in teenage years have been reported for family circumstances earlier. Our study shows that socioeconomic factors, family functioning, and social policy are intricately linked in shaping experiences in childhood. Influencing any of these levels can affect health across the life course. While this study identified involvement with CWS as a viable proxy for a level of childhood adversity that is likely to impact health negatively, the factors that lead to involvement are key. It is therefore crucial to work across agencies to prevent childhood adversity.

It is important to consider the specific historical context of CWS. Practices, visions and institutions have changed since the 1950s and 1960. The welfare optimism declined after 1980 and, with it, the tendency of taking children out of the family. Family preservation and family foster care placement have attained a stronger focus. Future research is needed to examine whether our findings also hold for younger cohorts and other contexts. In comparison to the 1953 cohort, children involved with child welfare today would be expected to be an even more selected group and more diverse in terms of cultural or migration backgrounds. Possibly, the discriminatory power of CWS involvement decreased with a less invasive child welfare system.

Conclusions

This study contributes to sharpening the concept of childhood adversity. Routinely collected child welfare data can be used as a proxy for childhood adversity and provides a rich source of information when linked to other population-based prospective data. There is nonetheless a need for more specific theories and empirical studies that explain the life-course trajectories and mechanisms behind the excess risk of premature mortality among individuals who experienced childhood adversity.

Ethics approval

This study has been approved by the Regional Ethical Review Board in Stockholm (no. 2017/34–31/5; 2017/684–32; 2016/481–31/5).

Declaration of competing interest

None.

Acknowledgements

This research was partially funded by the Swedish Research Council for Health, Working Life and Welfare (Grant No. 2016-07148).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100506.

References

Allen, D., & Abresch, C. (2018). Confronting adversity: MCH responds to ACEs. *Maternal and Child Health Journal, 22*, 283–287. https://doi.org/10.1007/s10995-018-2455-8.

Almquist, Y. B., Grotta, A., Vågerö, D., Stenberg, S.-Å., & Modin, B. (2019). Cohort profile update: The Stockholm birth cohort study. *International Journal of Epidemiology, 63*, 1273–1274. https://doi.org/10.1093/ije/dyz185.

Almquist, Y. B., Jackisch, J., Forsman, H., Gauffin, K., Vinnerljung, B., Hjern, A., et al. (2018). A decade lost: Does educational success mitigate the increased risks of premature death among children with experience of out-of-home care? *Journal of Epidemiology & Community Health, 72*, 997–1002. https://doi.org/10.1136/jech-2018-210487.

Anda, R. F., Felitti, V. J., Bremner, J. D., Walker, J. D., Whitfield, C., Perry, B. D., et al. (2006). The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neuroscience, 256*, 174–186. https://doi.org/10.1007/s00406-005-0624-4.

Averdijk, M., Ribeaud, D., & Eisner, M. (2018). The long-term effects of out-of-home placement in late adolescence: A propensity score matching analysis among Swiss youths. *Longitudinal and Life Course Studies, 9*, 30–57. https://doi.org/10.14301/llcs.v9i1.450.

Barker, D. J., Osmond, C., Simmonds, S. J., & Wield, G. A. (1993). The relation of small head circumference and thinness at birth to death from cardiovascular disease in adult life. *BMJ, 306*, 422–426. https://doi.org/10.1136/bmj.306.6875.422.

Barth, R. P., Blackwell, D. L., & Patterson, H. (1998). Death rates among California's foster care and former foster care populations. *Children and Youth Services Review, 20*, 577–604. https://doi.org/10.1016/S0190-7409(98)00027-9.

Bellis, M. A., Hughes, K., Leckenby, N., Hardcastle, K. A., Perkins, C., & Lowey, H. (2015). Measuring mortality and the burden of adult disease associated with adverse childhood experiences in England: A national survey. *Journal of Public Health, 37*, 445–454. https://doi.org/10.1093/pubmed/fdu065 (United Kingdom).

Björkenstam, E., Ekselius, L., Burström, B., Kosidou, K., & Björkenstam, C. (2017). Association between childhood adversity and a diagnosis of personality disorder in young adulthood: A cohort study of 107,287 individuals in Stockholm county. *European Journal of Epidemiology, 32*, 721–731. https://doi.org/10.1007/s10654-017-0264-9.

Björkenstam, E., Kosidou, K., & Björkenstam, C. (2016). Childhood household dysfunction and risk of self-harm: A cohort study of 107 518 young adults in Stockholm county. *International Journal of Epidemiology, 45*, 501–511. https://doi.org/10.1093/ije/dyw012.

Brown, D. W., Anda, R. F., Tiemeier, H., Felitti, V. J., Edwards, V. J., Croft, J. B., et al. (2009). Adverse childhood experiences and the risk of premature mortality. *American Journal of Preventive Medicine, 37*, 389–396. https://doi.org/10.1016/j.amepre.2009.06.021.

Browne, K., Hamilton-Giachritsis, C., Johnson, R., & Ostergren, M. (2006). Overuse of institutional care for children in Europe. *BMJ British Medical Journal, 332*, 485–487. https://doi.org/10.1136/bmj.332.7539.485.

Caspi, A., Houts, R. M., Belsky, D. W., Harrington, H., Hogan, S., Ramrakha, S., et al. (2016). Childhood forecasting of a small segment of the population with large economic burden. *Nat. Hum. Behav., 1*, 1–10. https://doi.org/10.1038/s41562-016-0005.

Clemens, V., Berthold, O., Witt, A., Sachser, C., Brähler, E., Plener, P. L., et al. (2019). Child maltreatment is mediating long-term consequences of household dysfunction in a population representative sample. *European Psychiatry, 58*, 10–18. https://doi.org/10.1016/j.eurpsy.2019.01.018.

Dong, M., Giles, W. H., Felitti, V. J., Dube, S. R., Williams, J. E., Chapman, D. P., et al. (2004). Insights into causal pathways for ischemic heart disease. *Circulation, 110*, 1761–1766. https://doi.org/10.1161/01.cir.0000143074.54995.7f.

Egelund, T., & Lausten, M. (2009). Prevalence of mental health problems among children placed in out-of-home care in Denmark. *Child & Family Social Work, 14*, 156–165. https://doi.org/10.1111/j.1365-2206.2009.00620.x.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine, 14*, 245–258. https://doi.org/10.1016/S0749-3797(98)00017-8.

Gao, M., Brännström, L., & Almquist, Y. B. (2017). Exposure to out-of-home care in childhood and adult all-cause mortality: A cohort study. *International Journal of Epidemiology, 46*, 1010–1017. https://doi.org/10.1093/ije/dyw295.

Gauffin, K., Hjern, A., Vinnerljung, B., & Björkenstam, E. (2016). Childhood household dysfunction, social inequality and alcohol related illness in young adulthood. A Swedish national cohort study. *PLoS One, 11*, 1–13. https://doi.org/10.1371/journal.pone.0151755.

Gilbert, N. (2012). A comparative study of child welfare systems: Abstract orientations and concrete results. *Children and Youth Services Review, 34*, 532–536. https://doi.org/10.1016/j.childyouth.2011.10.014.

Gilbert, R., Kemp, A., Thoburn, J., Sidebotham, P., Radford, L., Glaser, D., et al. (2009). Recognising and responding to child maltreatment. *Lancet, 373*, 167–180. https://doi.org/10.1016/S0140-6736(08)61707-9.

Gilbert, R., Widom, C. S., Browne, K., Fergusson, D. M., Webb, E., & Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *Lancet, 373*, 68–81. https://doi.org/10.1016/S0140-6736(08)61706-7.

Gypen, L., Vanderfaeillie, J., De Maeyer, S., Belenger, L., & Van Holen, F. (2017). Outcomes of children who grew up in foster care: Systematic-review. *Children and Youth Services Review, 76*, 74–83. https://doi.org/10.1016/j.childyouth.2017.02.035.

Holman, D. M., Ports, K. A., Buchanan, N. D., Hawkins, N. A., Merrick, M. T., Metzler, M., et al. (2016). The association between adverse childhood experiences and risk of cancer in adulthood: A systematic review of the literature. *Pediatrics, 138*, S81–S91. https://doi.org/10.1542/peds.2015-4268L.

Hughes, K., Bellis, M. A., Hardcastle, K. A., Sethi, D., Butchart, A., Mikton, C., et al. (2017). The effect of multiple adverse childhood experiences on health: A systematic review and meta-analysis. *The Lancet Public Health, 2*, e356–e366. https://doi.org/10.1016/S2468-2667(17)30118-4.

Jonson-Reid, M., Chance, T., & Drake, B. (2007). Risk of death among children reported for nonfatal maltreatment. *Child Maltreatment, 12*, 86–95. https://doi.org/10.1177/1077559506296722.

Kääriälä, A., & Hiilamo, H. (2017). Children in out-of-home care as young adults: A systematic review of outcomes in the nordic countries. *Children and Youth Services Review, 79*, 107–114. https://doi.org/10.1016/j.childyouth.2017.05.030.

Kalland, M., Pensola, T. H., Meriläinen, J., & Sinkkonen, J. (2001). Mortality in children registered in the Finnish child welfare registry: Population based study. *BMJ, 323*, 207–208. https://doi.org/10.1136/bmj.323.7306.207.

Kalmakis, K. A., & Chandler, G. E. (2015). Health consequences of adverse childhood experiences: A systematic review. *Journal of the American Association of Nurse Practitioners, 27*, 457–465. https://doi.org/10.1002/2327-6924.12215.

Kelly-Irving, M., Lepage, B., Dedieu, D., Bartley, M., Blane, D., Grosclaude, P., et al. (2013). Adverse childhood experiences and premature all-cause mortality. *European Journal of Epidemiology, 28*, 721–734. https://doi.org/10.1007/s10654-013-9832-9.

Kelly-Irving, M., Mabile, L., Grosclaude, P., Lang, T., & Delpierre, C. (2013). The embodiment of adverse childhood experiences and cancer development: Potential biological mechanisms and pathways across the life course. *International Journal of Public Health, 58*, 3–11. https://doi.org/10.1007/s00038-012-0370-0.

Khoo, E., Hyvonen, U., & Nygren, L. (2002). Child welfare or child protection. *Qualitative Social Work, 1*, 451–471.

Kuh, D., & Ben Shlomo, Y. (Eds.). (2004). *A life course approach to chronic disease epidemiology*. Oxford University Press.

Leuven, E., & Sianesi, B. (2018). *PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*.

Lindquist, M. J., & Santavirta, T. (2014). Does placing children in foster care increase their adult criminality? *Labour Economics, 31*, 72–83. https://doi.org/10.1016/j.labeco.2014.10.001.

Maclean, M. J., Sims, S., O'Donnell, M., & Gilbert, R. (2016). Out-of-Home care versus in-home care for children who have been maltreated: A systematic review of health and wellbeing outcomes. *Child Abuse Review, 25*, 251–272. https://doi.org/10.1002/car.2437.

Manor, O., Matthews, S., & Power, C. (1997). Comparing measures of health inequality. *Social Science & Medicine, 45*, 761–771. https://doi.org/10.1016/S0277-9536(96)00412-1.

Marmot, M. (Ed.). (2014). *Review of social determinants and the health divide in the WHO European Region*. Copenhagen: World Health Organization Regional Office for Europe.

Mclaughlin, K. A. (2016). Future directions in childhood adversity and youth psychopathology. *Journal of Clinical Child and Adolescent Psychology, 45*, 361–382. https://doi.org/10.1080/15374416.2015.1110823.

Meinck, F., Steinert, J. I., Sethi, D., Gilbert, R., Bellis, M. A., Mikton, C., et al. (2016). *Measuring and monitoring national prevalence of child maltreatment: A practical handbook*. Copenhagen: World Health Organization Regional Office for Europe.

Miller, G. E., Chen, E., & Parker, K. J. (2011). Psychological stress in childhood and susceptibility to the chronic diseases of aging: Moving toward a model of behavioral and biological mechanisms. *Psychological Bulletin, 137*, 959–997. https://doi.org/10.1037/a0024768.

Ohashi, H., Wada, I., Yamaoka, Y., Nakajima-Yamaguchi, R., Ogai, Y., & Morita, N. (2018). Cumulative risk effect of household dysfunction for child maltreatment after intensive intervention of the child protection system in Japan: A longitudinal analysis. *Environmental Health and Preventive Medicine, 23*, 14. https://doi.org/10.1186/s12199-018-0703-6.

Putnam-Hornstein, E., Needell, B., & Rhodes, A. E. (2013). Understanding risk and protective factors for child maltreatment: The value of integrated, population-based data. *Child Abuse & Neglect, 37*, 116–119. https://doi.org/10.1016/j.chiabu.2012.08.006.

Reuben, A., Moffitt, T. E., Caspi, A., Belsky, D. W., Harrington, H., Schroeder, F., et al. (2016). Lest we forget: Comparing retrospective and prospective assessments of adverse childhood experiences in the prediction of adult health. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 57*, 1103–1112. https://doi.org/10.1111/jcpp.12621.

Sethi, D., Bellis, M. A., Hughes, K., Gilbert, R., Mitis, F., & Galea, G. (Eds.). (2013). *European report on preventing child maltreatment*. Copenhagen: World Health Organization Regional Office for Europe.

Sheikh, M. A. (2018). Childhood adversities and chronic conditions: Examination of mediators, recall bias and age at diagnosis. *International Journal of Public Health, 63*, 181–192. https://doi.org/10.1007/s00038-017-1021-2.

Sidebotham, P., & Heron, J. (2006). Child maltreatment in the "children of the nineties": A cohort study of risk factors. *Child Abuse & Neglect, 30*, 497–522. https://doi.org/10.1016/j.chiabu.2005.11.005.

Spatz Widom, C., Raphael, K. G., & DuMont, K. A. (2004). The case for prospective longitudinal studies in child maltreatment research: Commentary on Dube, Williamson, Thompson, Felitti, and Anda (2004). *Child Abuse & Neglect, 28*, 715–722. https://doi.org/10.1016/j.chiabu.2004.03.009.

Stenberg, S.-Å., Vågerö, D., Österman, R., Arvidsson, E., von Otter, C., & Janson, C.-G. (2007). Stockholm birth cohort study 1953-2003: A new tool for life-course studies. *Scandinavian Journal of Public Health, 35*, 104–110. https://doi.org/10.1080/14034940600777385.

Sundell, K., Vinnerljung, B., Andrée Löfholm, C., & Humlesjö, E. (2007). Child protection in Stockholm: A local cohort study on childhood prevalence of investigations and service delivery. *Children and Youth Services Review, 29*, 180–192. https://doi.org/10.1016/j.childyouth.2006.07.001.

Taylor-Robinson, D. C., Straatmann, V. S., & Whitehead, M. (2018). Adverse childhood experiences or adverse childhood socioeconomic conditions? *The Lancet Public Health, 3*, e262–e263. https://doi.org/10.1016/s2468-2667(18)30094-x.

Thompson, A. H., & Newman, S. C. (1995). Mortality in a child-welfare population - implications for policy. *Child Welfare, 74*, 843–857.

Vinnerljung, B., Hjern, A., & Lindblad, F. (2006). Suicide attempts and severe psychiatric morbidity among former child welfare clients - a national cohort study. *Journal of Child Psychology and Psychiatry, 47*, 723–733. https://doi.org/10.1111/j.1469-7610.2005.01530.x.

Vinnerljung, B., & Sallnäs, M. (2008). Into adulthood: A follow-up study of 718 young people who were placed in out-of-home care during their teens. *Child & Family Social Work, 13*, 144–155. https://doi.org/10.1111/j.1365-2206.2007.00527.x.

Walsh, D., McCartney, G., Smith, M., & Armour, G. (2019). Relationship between childhood socioeconomic position and adverse childhood experiences (ACEs): A systematic review. *Journal of Epidemiology & Community Health*. https://doi.org/10.1136/JECH-2019-212738. jech-2019-212738.

WHO. (2018). *European health report 2018: More than numbers - evidence for all*. Copenhagen: World Health Organization Regional Office for Europe.

World Health Organization. (2018). *European status report on preventing child maltreatment*. Copenhagen: World Health Organization Regional Office for Europe.