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Impact of socio-economic conditions and perinatal factors on risk of becoming a child looked after: a whole population cohort study using routinely collected data in Wales

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ABSTRACT

Objectives: Between 1997 and 2021, the number of children looked after (CLA) in Wales, UK, increased steadily, with stark inequalities. We aimed to assess how deprivation and maternal and child perinatal characteristics influence the risk of becoming CLA in Wales.
Study design: We constructed a prospective longitudinal cohort of children born in Wales between April 2006 and March 2021 (n = 395,610) using linked administrative records.
Methods: Survival models examined the risk of CLA from birth by small-area deprivation and maternal and child perinatal characteristics. Population attributable fractions quantify the potential impact of action on modifiable risk factors.
Results: Children from the most deprived fifth of the population were 3.4 times more likely to enter care than those in the least deprived (demographic adjusted hazard ratios [aHRs] 3.40, 95% confidence interval [CI] 3.08, 3.74). Maternal mental health problems in pregnancy (fully aHR, 2.03, 95% CI 1.88, 2.19) and behavioural factors, such as smoking (aHR 2.46, 95% CI 2.34–2.60), alcohol problems (aHR 2.35, 95% CI 1.70–3.23) and substance use in pregnancy (aHR 5.72, 95% CI 5.03–6.51), as well as child congenital anomalies (aHR 1.46, 95% CI 1.16–1.84), low birth weight (aHR 1.28, 95% CI 1.17, 1.39) and preterm birth (aHR 1.16, 95% CI 1.06, 1.26), were associated with higher risk of CLA status. The risk of CLA in the population may be reduced by 35% (95% CI 0.33, 0.38) if children in the two most deprived fifths of the population experienced the conditions of those in the least deprived.
Conclusions: Deprivation and perinatal maternal health are important modifiable risk factors for children becoming CLA. Our analysis provides insight into the mechanisms of intergenerational transfer of disadvantage in a vulnerable section of the child population and identifies targets for public health action.

Introduction

In England and Wales, the number of children looked after (CLA), defined as those in care by order of the State or in care placements (e.g. living with relatives), has risen dramatically over recent years.[1,2] The rates of CLA have increased more in Wales than in England. Between 1997 and 2018, the rates in Wales increased from 49 to 90 per 10,000 children, against a rise of 43–62 per 10,000 in England.[3] There are also stark and rising inequalities in rates of CLA in the United Kingdom. In England, between 2007 and 2019, the greatest increases in CLA rates and CLA entry rates occurred in the most disadvantaged areas.[1,4,5] In Wales, in 2018, 76% of mothers involved in care proceedings lived in the two most deprived fifths.[6]

Reducing the number of children in care is a focus of UK government and policy due to concerns for children's well-being and the high societal costs associated with care entry across the life

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course.[7,8] CLA experience worse educational and employment outcomes, higher mortality rates and higher rates of hospital admissions and criminal justice system involvement.[9,10] Supporting children in receipt of social service intervention and their carers represents a major, long-lasting expenditure at local authority level, and financial pressures are acute in many local authorities in the United Kingdom, hampering investment in the preventative and early years services that may support children at risk of care entry.[11]

Understanding the main drivers of social service intervention across the life course is key to developing strategies to reduce inequalities in CLA rates. Socio-economic disadvantage and family adversity in early childhood are recognised as important risk factors for families' involvement with social care services.[4,6,12–16] The risk factors in the perinatal period, such as young maternal age, lone parenthood, maternal mental health problems, learning difficulty and disability, smoking during pregnancy, and pre- and post-natal substance use, have also been implicated.[17–19] Some studies have shown that individual child perinatal health factors, such as congenital anomalies, low birth weight, and gestational age, are associated with the risk of being taken into care.[20,21] Child's sex was found to be associated with care entry, with males marginally more likely than females to enter care, whilst the impact of ethnicity varies across contexts, with higher rates reported for some ethnic minority groups.[14,22] Family composition, in terms of number of adults and children present in a household, as well as age of children, have also been found to influence the risk of CLA.[13,20,21]

Few studies have assessed the impact of deprivation and a range of maternal and child perinatal factors on risk of CLA in a whole population cohort,[13,15,16,18–21,23,24] none using UK data. In light of this, our study assessed the association between characteristics measured in routine data over the perinatal period until birth, focusing on area-level deprivation, maternal health, and early indicators of child health, and the risk of becoming CLA over a 15-year timespan in Wales. Fig. 1 shows our theoretical model, with the solid-line paths showing the main associations of interest.

Methods

Data sources and study design

We undertook a prospective, observational cohort study of children born in Wales between April 2006 and March 2021, drawing on anonymised, individual-level, population-scale, linked data sources available in the Secure Anonymised Information Linkage (SAIL) databank.[25] Data sources included administrative records from children's social care services, national birth records, population demographics, including residence history, and contact with primary and secondary healthcare services (see Supplementary Material (SM), Table SM2). We report in line with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (see Supplementary Material (SM), Table SM1).

Because of the overall poor performance of the standard matching process specific to the education and children's social care data sources, additional linkage processing was performed by generating an anonymised version of a child's Unique Pupil Number (UPN).[26] However, only children of school age have a UPN; younger children are typically unlinked. To overcome this limitation, we post-hoc triangulated events in the social care data with corresponding events in other data sources for children with the same week of birth and sex (see Supplementary Material (SM), Section SM2 Record linkage boosting).

Births in Welsh hospitals are comprehensively recorded across three data sources, which we combined to produce a single national birth cohort. We then applied several selection criteria to obtain our analysis sample (Fig. 2). Records were selected if (1) both mother and child had an anonymised linkage field; (2) the birth was recorded as a Welsh live birth with week of birth, sex, gestational age and birth weight recorded; (3) both mother and baby were registered with a SAIL general practice (GP) and recorded as living in Wales; and (4) the mother was aged $\geq$16 years at birth. Finally, children were excluded from the cohort if they were ever CLA under agreed short-term placements with a local authority, that is,

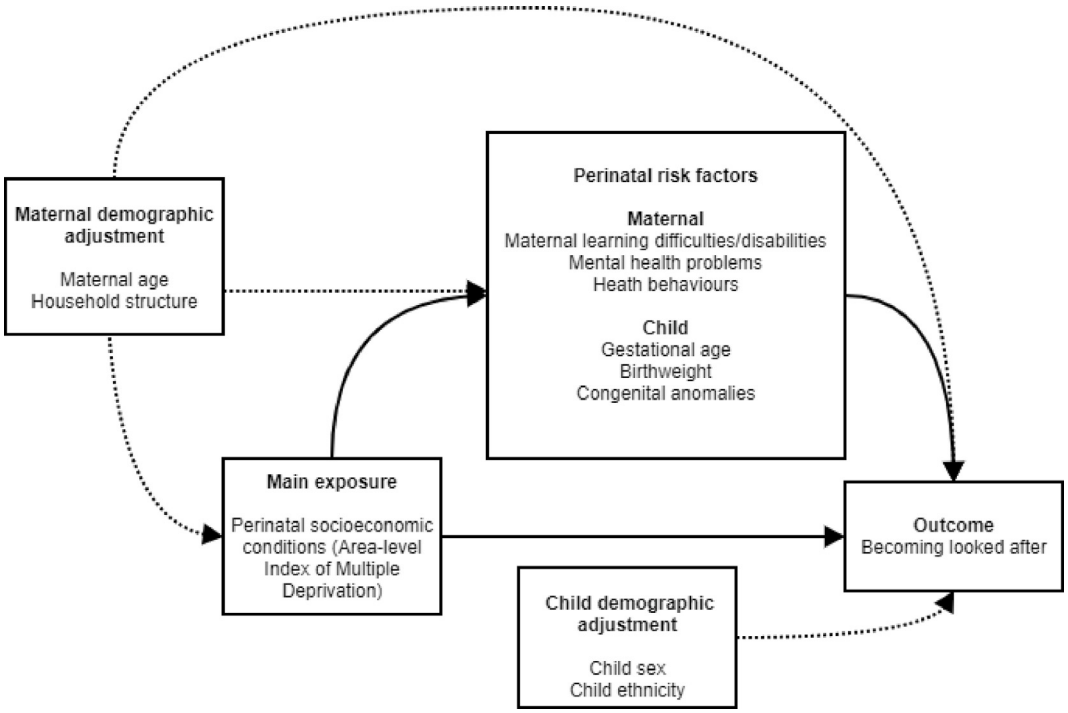

Fig. 1. Diagram of our theoretical model. Plain paths represent the main associations of interest and dotted paths represent adjustment.

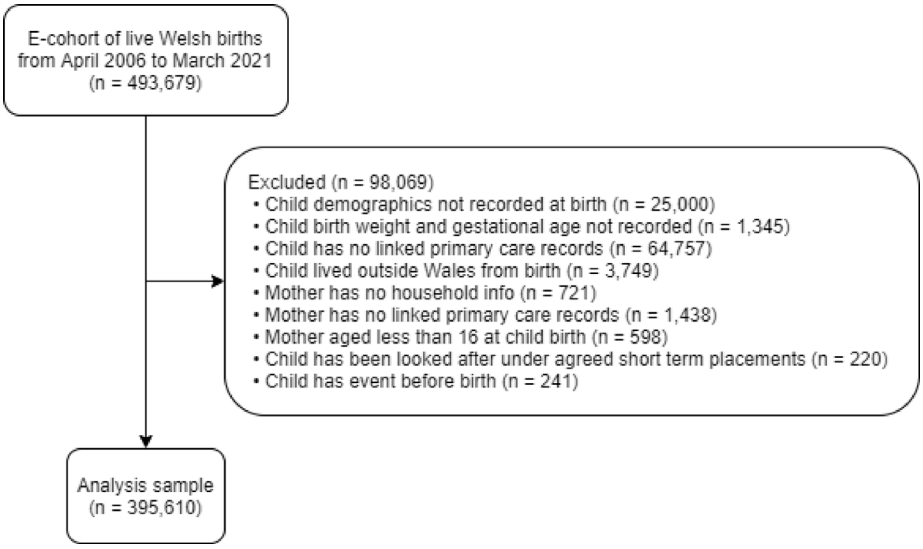

Fig. 2. Sample selection flowchart.

children were excluded from the cohort if they were ever looked after under agreed short-term placements with a local authority. These placements are merely temporary, offering brief respite to parents. Children who had an episode beginning before and spanning birth were included but with the outcome set to occur at birth.

Outcome, exposure and covariates

The main outcome of interest was the risk of becoming a child looked after, measured as the time from birth until the first recorded episode of being looked after. Children who had one episode beginning before and spanning birth were included but with the outcome set to occur at birth. Covariates of interest spanned three categories: maternal demographics, maternal perinatal risk factors and child characteristics (see Table 1).

Maternal demographic covariates consisted of area-level deprivation, the main exposure of interest; cohort period; household composition; and age of mother at child's birth. We allocated each live birth to a quintile of the Welsh Index of Multiple Deprivation (WIMD), a small-area measure of deprivation based on the residing Lower layer Super Output Area. We used five 3-year cohort intervals, assigning each birth to a cohort. Based on the residential anonymised linkage field available in SAIL,[27] we derived the number of children and adults living at the mother's residence in the week of birth.

Maternal perinatal risk factors included mental health problems and several behavioural factors derived from attendances at primary and secondary care services up to 5 years before birth, namely, alcohol problems, substance use, and smoking status. The presence of mental health problems was detected via primary care records only, using clinical codes covering anxiety, depression and treatments for common mental health problems.[28] Alcohol problems covered diagnosis of alcoholism, alcohol-related behaviour or illness in either primary or secondary care records.[29] Substance use was defined either explicitly as "substance use" in primary or secondary care records or as having any problematic behaviour or symptoms related to psychoactive substance use.[29] For mental health, alcohol problems and substance use, we used the date of the latest GP event or hospital admission before birth and categorised it as having occurred either during pregnancy or prepregnancy. We also identified the presence of maternal learning difficulties and disabilities by detecting diagnoses in primary care records for dyslexia or reading, spelling, speech, or arithmetic developmental disorders at any time before child's birth. Smoking status was coded from a self-reported measure at child's birth, which, when missing, was supplemented with primary care records up to 5 years before birth.

Child characteristics included those derived from birth records: sex, ethnic group, congenital anomalies; gestational age; and birth weight. Congenital anomalies were detected through clinical coding of hospital admissions up to 28 days after birth.

Statistical analysis

First, we described the birth cohort in terms of the prevalence of characteristics of interest and the crude event rate at which children became looked after. Second, we used Cox proportional hazard models to analyse the relative risks associated with our measures of interest, with the baseline stratified by the cohort interval in which the mother gave birth, and the main effects included for each covariate. No longer living in Wales and death were treated as competing outcomes, as we censored only if someone does not have either of those or the main outcome by the end of their follow-up. Due to non-proportionality, the number of children living with mother was included with time-varying coefficients; 0–5, 6–11, and $\geq$12 months from the start of the follow-up.

Our models were informed by our a priori directed acyclic graph[30] in Fig. 1. We present three sets of estimates in the tables: unadjusted, adjusted for maternal demographic covariates (WIMD, maternal age, household composition) and fully adjusted for all child and maternal risk factors and demographics. In the narrative description of the results, we highlight the estimates of particular interest, based on Fig. 1, that is, we report demographic-adjusted estimates for the area-level predictor WIMD and mother's demographics and fully adjusted estimates for the risk factors. Finally, we calculated attributable fractions for the main contrasts for each of the covariates at 1-, 5- and 10-year survival time. We did several sensitivity analyses using alternative measures of small-area deprivation and more restrictive sample selection criteria (see Supplementary Material (SM), SM4 Sensitivity analyses). Data preparation and analyses were performed in SQL and R v4.1.

Results

Cumulative incidence of becoming looked after

We identified a cohort of 395,610 children born between 1 April 2006 and 31 March 2021, who were followed up from birth to when

Table 1
Birth cohort's (April 2006 - March 2021) characteristics and event rates of becoming looked after per 1000 person-years.

Characteristic	*n* (%)	Events (rate)
Total	395,610 (100.0%)	7971 (2.7)
Maternal demographics		
Welsh Index of Multiple Deprivation		
1 – Most deprived	108,213 (27.4%)	3702 (4.7)
2	86,722 (21.9%)	1913 (3.0)
3	75,878 (19.2%)	1179 (2.1)
4	61,514 (15.5%)	698 (1.6)
5 – Least deprived	63,283 (16.0%)	479 (1.0)
Age		
16–17	5926 (1.5%)	386 (7.9)
18–19	18,480 (4.7%)	916 (6.1)
20–24	84,337 (21.3%)	2576 (4.0)
25–29	115,584 (29.2%)	2060 (2.5)
≥30	171,283 (43.3%)	2033 (1.6)
Household no. of children		
0 children	149,561 (37.8%)	2770 (2.5)
≥1 children	246,049 (62.2%)	5201 (2.9)
Household no. of adults		
1 adult	89,477 (22.6%)	2268 (3.5)
2 adults	182,459 (46.1%)	3019 (2.2)
≥3 adults	123,674 (31.3%)	2684 (3.0)
Maternal perinatal risk factors		
Learning difficulty/disability		
No	394,452 (99.7%)	7855 (2.7)
Yes	1158 (0.3%)	116 (17.1)
Smoking status		
Non-smoker	240,452 (60.8%)	2592 (1.5)
Ex-smoker	42,849 (10.8%)	678 (2.2)
Smoker	91,995 (23.3%)	4260 (6.1)
Unknown	20,314 (5.1%)	441 (3.1)
Alcohol problems		
Never	393,349 (99.4%)	7650 (2.6)
Prepregnancy	2058 (0.5%)	282 (20.3)
Pregnancy	203 (0.1%)	39 (29.0)
Substance use		
Never	390,540 (98.7%)	7119 (2.5)
Prepregnancy	3906 (1.0%)	585 (22.9)
Pregnancy	1164 (0.3%)	267 (37.2)
Mental health issues		
Never	289,898 (73.3%)	4329 (2.0)
Prepregnancy	87,316 (22.1%)	2822 (4.7)
Pregnancy	18,396 (4.7%)	820 (7.0)
Child characteristics		
Sex		
Male	202,439 (51.2%)	4199 (2.8)
Female	193,171 (48.8%)	3772 (2.7)
Ethnicity		
White	330,429 (83.5%)	7074 (2.8)
Asian	11,989 (3.0%)	135 (1.7)
Black	3757 (0.9%)	59 (2.6)
Mixed	10,236 (2.6%)	229 (3.3)
Other	5435 (1.4%)	72 (1.8)
Unknown	33,764 (8.5%)	402 (3.0)
Congenital anomalies		
No	393,421 (99.4%)	7897 (2.7)
Yes	2189 (0.6%)	74 (4.9)
Preterm birth		
No	367,027 (92.8%)	7105 (2.6)
Yes	28,583 (7.2%)	866 (4.3)
Birth weight		
Low	27,292 (6.9%)	970 (4.9)
Normal	321,798 (81.3%)	6448 (2.7)
Heavy	46,520 (11.8%)	553 (1.6)
Cohort period		
2006/07–2008/09	86,919 (22.0%)	2124 (2.0)
2009/10–2011/12	88,718 (22.4%)	2079 (2.5)
2012/13–2014/15	84,594 (21.4%)	1824 (3.1)
2015/16–2017/18	76,773 (19.4%)	1324 (4.1)
2018/19–2020/21	58,606 (14.8%)	620 (6.6)

they either became looked after, moved out of Wales, died, or reached the end of the study window (Fig. 2).

Table SM6 provides more detail of each step in applying our selection criteria to produce the final analysis dataset. As presented in Table 1, of the 395,610 children in the final data set, 7971 became looked after, at a rate of 2.7 per 1000 person-years. The overall rate of cumulative incidence of becoming CLA from birth is shown in Fig. 3, stratified by birth cohort, deprivation and maternal age. Cumulative incidence curves by each covariate are reported in Supplementary material, Figures SM2-SM5. The rates of CLA increased in more recent birth cohorts and with increasing area deprivation and maternal age.

Perinatal exposures and risk of becoming a child looked after

Fig. 4 shows the hazard ratios (HRs) for the risk of becoming looked after for each of the characteristics that we considered, and Table SM7 in the Supplementary Material reports exact estimates and 95% confidence intervals.

For maternal demographic factors, we found that the greater the area deprivation of the mother's residence, the greater the risk of the child becoming looked after. Children born to mothers living in the most deprived fifth of the population were 3.4 times more likely to enter care compared to those living in the least deprived fifth (demographic adjusted HR [aHR] 3.40, 95% CI 3.08, 3.74). Lower maternal age was strongly associated with the risk of CLA, with maternal age 16–17 years associated with a 3.81 times hazard in the demographic-adjusted estimate, relative to mothers aged ≥30 years (demographic aHR 3.81, 95% CI 3.41, 4.26). With respect to household composition, and relative to households with two adults, mothers living alone had the greatest risk of child removal (demographic aHR 1.28, 95% CI 1.21, 1.135). The presence of other children in the household is associated with lower risk of the relevant child's removal in the first 5 months from birth (demographic aHR 0.58, 95% CI 0.53, 0.62) but increased risk after 12 months (demographic aHR 1.51, 95% CI 1.42, 1.61).

For maternal perinatal risk factors, in the fully adjusted model, maternal mental health problems were associated with an increased risk of their child becoming looked after (fully aHR 2.03, 95% CI 1.88, 2.19). Maternal learning difficulties/disabilities (aHR 3.50, 95% CI 2.91–4.21), current history of smoking (aHR 2.46, 95% CI 2.34–2.60), prior alcohol-related admissions before and during pregnancy (aHR 2, 95% CI 1.76–2.27; aHR 2.35, 95% CI 1.70–3.23, respectively), prior substance use admissions (aHR 3.39, 95% CI 3.09–3.72; aHR 5.72, 95% CI 5.03–6.51 respectively) and history of mental health issues (aHR 1.63, 95% CI 1.55–1.71; aHR 2.03, 95% CI 1.88–2.19, respectively) were all strongly associated with the risk of their child becoming looked after.

With respect to child characteristics, beginning with child-level perinatal risk factors, also in the fully adjusted model, greater risk of care entry was associated with children who were recorded as having congenital anomalies (aHR 1.46, 95% CI 1.16–1.84), of low birth weight (aHR 1.28, 95% CI 1.17–1.39), born preterm (aHR 1.16, 95% CI 1.06–1.26). For child demographic factors, female sex was associated with a lower hazard (aHR 0.93, 95% CI 0.89–0.97) as was unknown ethnicity in the fully adjusted estimates (aHR 0.76, 95% CI 0.68–0.84).

Population attributable fraction

Fig. 5 show the population attributable fraction (PAFs). Considering only potentially modifiable factors and demographic-adjusted estimate, if all children in the two most deprived fifths had the same level of deprivation as those in the least deprived fifth, the risk of CLA would be reduced in the overall population by

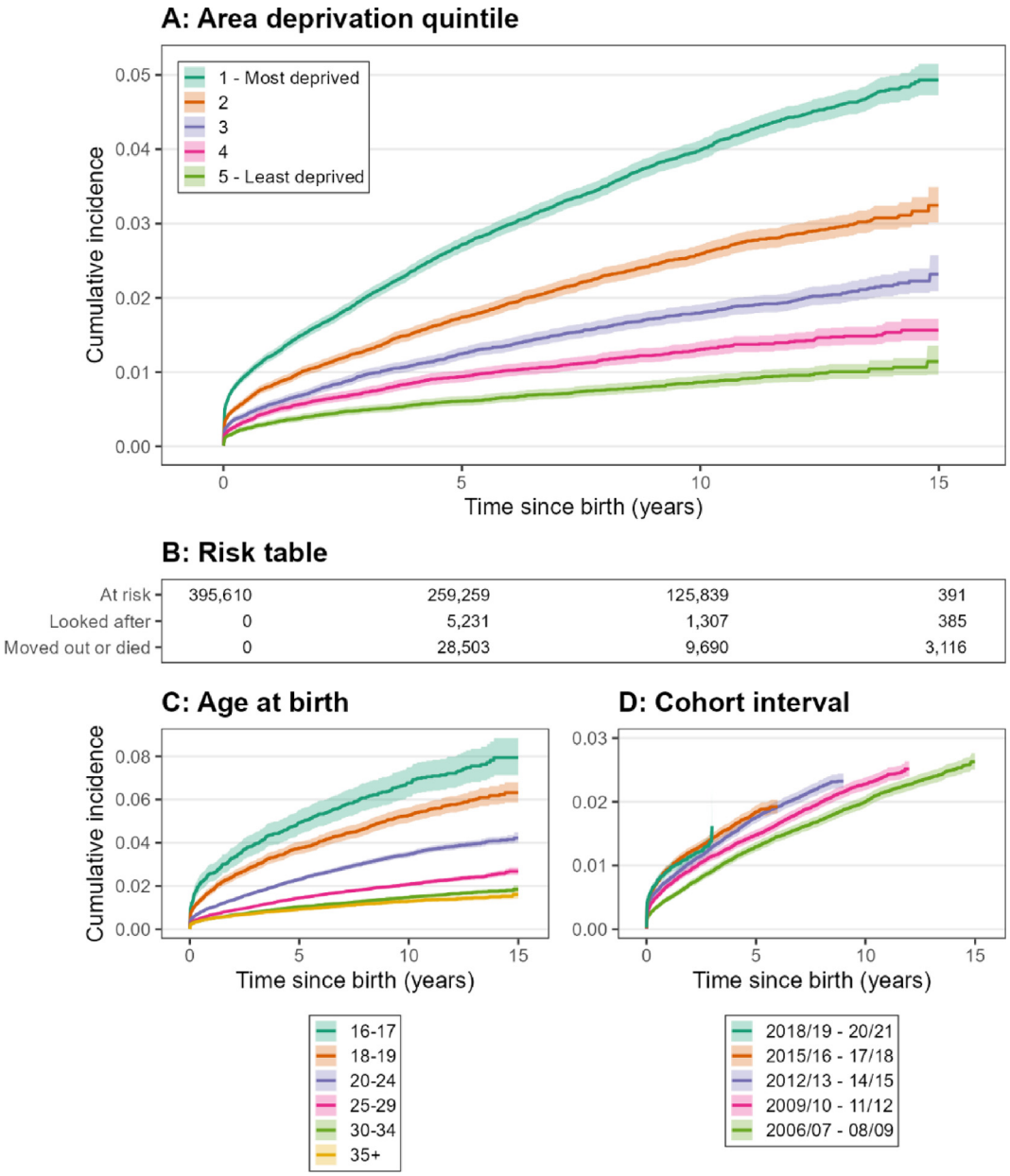

Fig. 3. Overall empirical cumulative incidence of becoming a child looked after, from time since birth, with 95% confidence intervals around the curve. Number at risk and number having had either event is shown below.

around 35% (demographic-adjusted 95% CI 0.33, 0.38). If children in the most deprived fifth had the same level of deprivation as those in the least deprived fifth, the percentage of CLA would be reduced by 22% (demographic-adjusted 95% CI 0.20, 0.24). For the fully adjusted estimates, eliminating maternal mental health issues would potentially reduce the risk of CLA by 20% (fully adjusted 95% CI 0.18, 0.21). Although part of a wider mechanism generating harmful health behaviours, eliminating maternal smoking habits and substance use might reduce the burden of CLA by 27% (fully adjusted 95% CI 0.26–0.29) and 7% (fully adjusted 95% CI 0.07–0.08) respectively.

Robustness checks and additional analyses

Our sensitivity analyses found that Townsend Index in place of WIMD as a measure of area deprivation produced similar results. Our findings did not change when using the more restrictive sample selection criteria, and slight increases were found for the effects of area deprivation when considering only outcomes captured using the routinely generated linkage keys, although the trend across the categories was the same as our main analysis (see Supplementary Material (SM), SM4. Sensitivity analyses).

Discussion

In a whole population sample of around 400,000 children born in Wales, we used linked, routinely collected data to assess demographic, maternal and child-level risk factors for children becoming looked after, measured in the perinatal period. Our findings are consistent with a limited UK literature on individual-level risk factors for becoming looked after which nevertheless highlights the powerful role of adverse socio-economic conditions

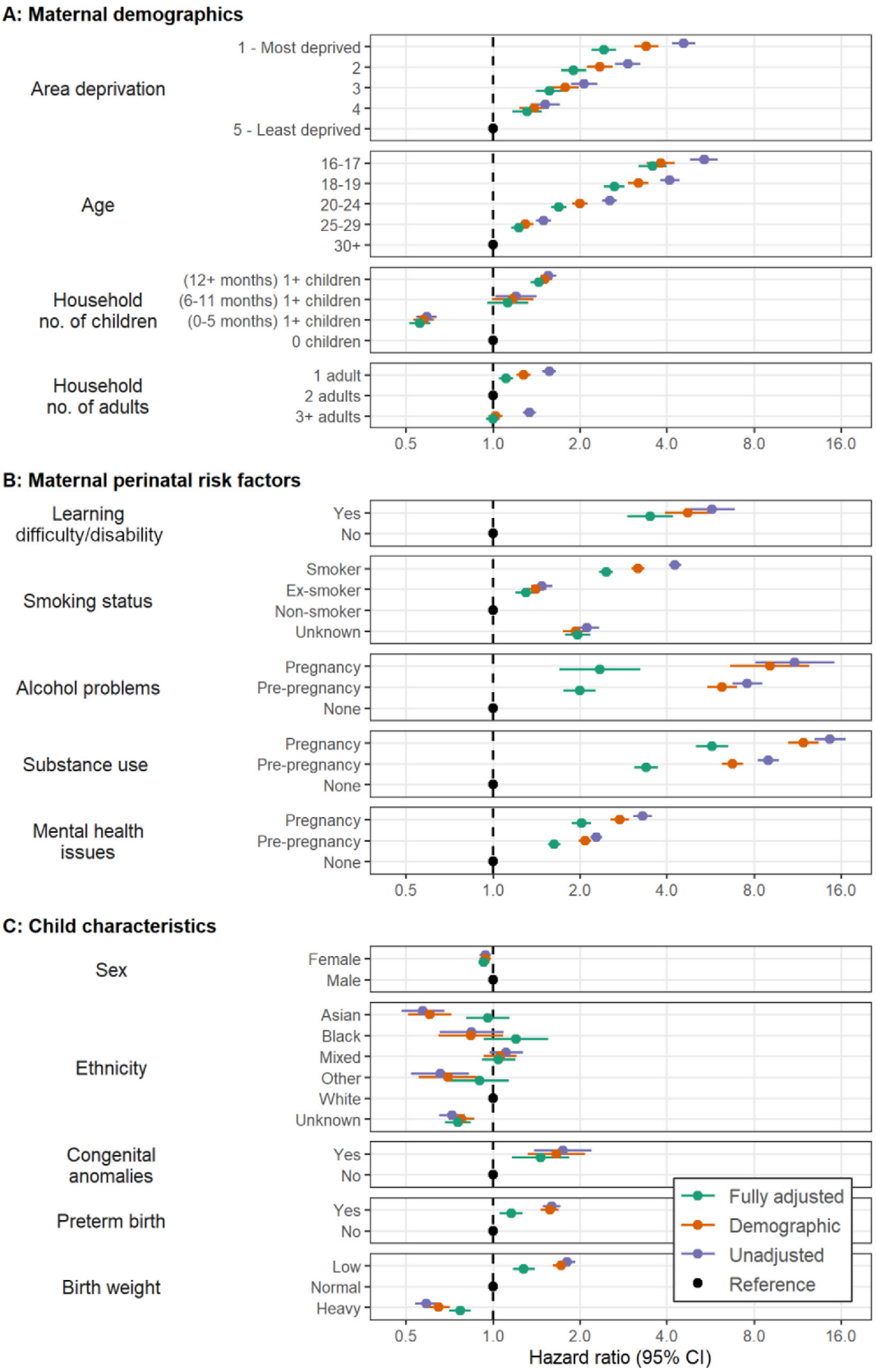

Fig. 4. Unadjusted, demographic-adjusted and fully adjusted hazard ratios for the risk of becoming looked after, with 95% confidence intervals.

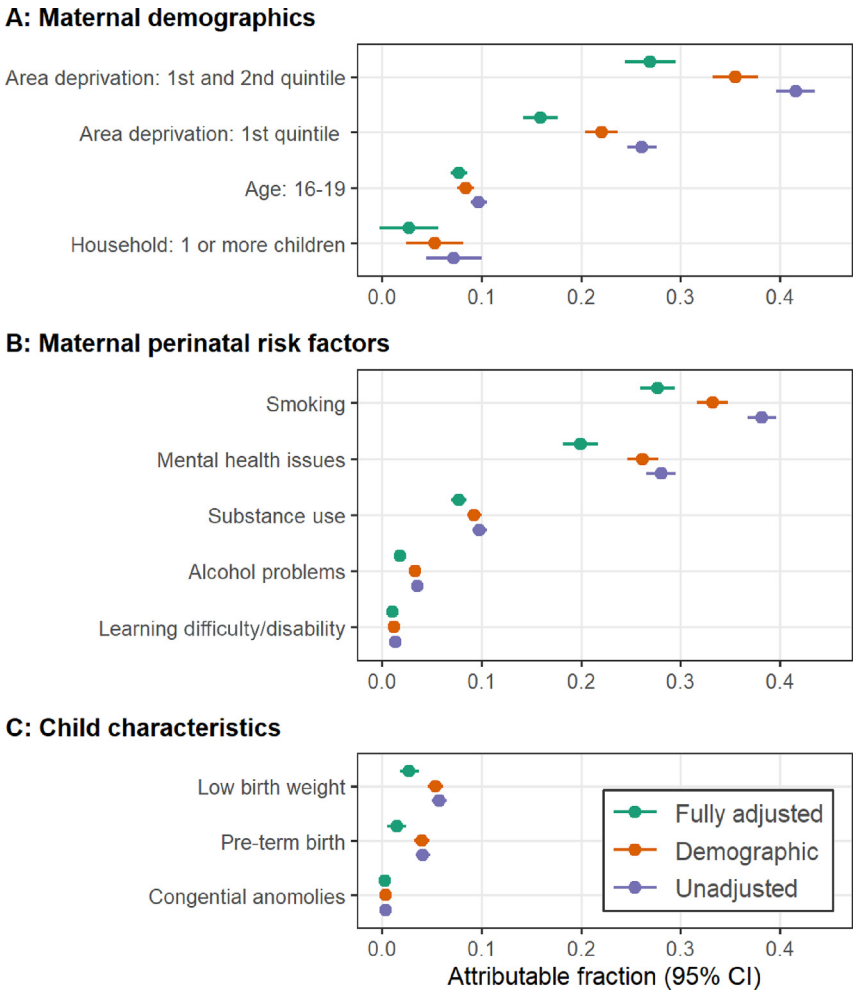

Fig. 5. Unadjusted population attributable fractions for key mother and child indicators after 1, 5 and 10 years of survival time, with 95% confidence intervals.

in the perinatal period in structuring the risk of care entry. We demonstrate stark inequalities in rates of children entering care and strong associations with a range of maternal demographic and perinatal factors and child characteristics. Mothers living in the most deprived fifth of WIMD were almost three and a half times more likely to have their children taken into care than those living in the least deprived fifth of the population. Mothers of children taken into care were more likely to be younger, to live in a household with no other adults, or more than two adults, and to live with other children during the new-born's first year of life; they were also more likely to experience mental health problems and learning difficulties and disabilities and were more likely to have alcohol problems, smoke and use substances. Children taken into care were more likely to be born male, preterm, with low birth weight, and have recorded congenital anomalies.

Regarding our estimates of the burden of CLA attributable to modifiable exposures, they align with the literature pointing to a contributory direct causal effect on care entry of adverse socio-economic conditions.[14–16,24,31] An evidence review[31] outlines two theoretical models for the relationship between poverty and child maltreatment – the family stress model, whereby poverty clusters with the adversities it produces, contributing to poor outcomes; and the investment model, whereby families lack the material and social to invest in children, leading to increased risk of neglect and care entry. These conditions contribute to poor child health and well-being also via their adverse impact on maternal mental health, itself an important risk factor for care entry.[15,16,18,19,24] Policies that directly address the socio-economic conditions in which expectant mothers live, and into which children are born, are likely to have a meaningful impact on the population-level risk of CLA. If children in the most deprived areas of Wales were to experience the same conditions as those in the least deprived, the population-level risk of CLA could be reduced by more than a third.

Based on our results, in an alternative policy scenario, successfully tackling maternal mental health issues might reduce the risk of CLA, and within an ideal scenario, our study estimates that eliminating maternal mental health problems would reduce the risk by as much as 20%. Poor maternal mental health as assessed during, or in the several years before pregnancy, was consistently associated with higher risk of children entering care in the literature.[16,19] Our finding that parents with learning difficulties and disabilities were more likely to have a child taken into care aligns with a study exploring the overrepresentation of parents with intellectual and development disabilities in the US child protection system.[18]

Of other perinatal maternal risk factors identified in our study, smoking before birth and substance use also appeared in the literature, as did alcohol use.[16,23] Reflecting socio-economic disadvantage and health behaviour associated with allostatic load, where allostatic load is defined as the cumulative burden of chronic stress and adverse life events,[32] the large PAF for maternal smoking may be attributable to a range of unmeasured social support and mental health–related factors associated with both

smoking habits and care entry.[16] The same may be true of the smaller PAF for substance use and alcohol abuse in pregnancy.[13,15,23] Policies that support women to tackle addiction or harmful health behaviours, family planning strategies targeting young people, and additional support for young expectant mothers, may have positive impacts on the risk of care entry.

With respect to child-level characteristics, our results parallel those from other studies identifying an increased risk of care entry for children with birth anomalies, born preterm, and of low birthweight.[6,21] Unsurprisingly, due to the ethnic composition of the Welsh population (around 95% White), and the ascertainment of the measure used in this study, our results do not shed further light on ethnicity and CLA.

Socio-economic conditions appear to offer a consistent frame within which to understand the role of other major risk factors. Further research should aim to use causal mediation methods to understand causal pathways in deprivation, adversity and risk of being looked after to disentangle processes and identify policy entry points.

Strengths and limitations

The key strength of this study is its use of one of the UK's largest linked administrative data sets, newly encompassing longer-term children's social care data, to identify individual-level risk factors for becoming looked after, with longitudinal data linkage over a 15-year period. Using this data set, we developed improved methods for identifying children who became looked after, so reducing bias. These data also allow for improved temporal modelling of exposures and outcomes while controlling for death and emigration as competing risks, improving the certainty of our findings.

Our application of restrictions to the denominator population, based on the availability of complete data on linkage fields and relevant indicators, constitutes a limitation. We also excluded from our analysis individuals from primary care practices that do not share their data with SAIL. Moreover, and despite improved linkage, complete ascertainment of the outcome was not possible, and we were unable to observe the entire CLA population between 2006 and 2021. As a result, we expect our estimates to be conservative and to potentially understate the impact of deprivation and other factors on the risk of CLA.

With respect to the covariates considered in this analysis, we were unable to measure other potential indicators of risk, such as involvement with the criminal justice system. Nor did we take into account child developmental and learning difficulties and disabilities, as these are only reliably measured postnatally. Children's learning difficulties and disabilities are a major risk factor for care entry in developed countries[14] and should be considered in future studies. Finally, the validity of PAFs rests on the assumption that the relationship between exposure and outcome approximates a true causal effect. They should therefore be interpreted with caution.

Implications for policy and practice

Rising deprivation and poverty appear to be major drivers of care entry. Given the wider context of ongoing austerity, rising poverty and cuts to preventative services for children in the United Kingdom, our findings are concerning. The vicious cycle of rising poverty, ever-increasing social spending on children who have been removed from their family and cuts to prevention services is magnified and perpetuated by the long-term poor health, social and educational outcomes of the increasing care experienced by population.[10] In both Wales and England, cuts to preventative children's services have occurred at the same time as rising spend on CLA.[7,8] Our analysis supports the view that approaches such as raising thresholds for care are unlikely to be effective without sustained attention to the wider determinants of child health.

We argue for the need to consider the compound effect of poverty and maternal health conditions on the risk of CLA, as a social policy and public health priority. At national level, increasing household income for families with children through the welfare benefits system is likely to be an effective strategy. Increasing funding to local authorities responsible for delivering preventative services proportional to need[11] may help strengthen the fragile child protection system. At local level, services offering benefits and debt advice, free childcare and respite may help mitigate the impact of disadvantaged socio-economic conditions on care entry. Within social services, effective interventions should occur as early as possible in pregnancy, particularly among disadvantaged mothers. These might include preventive maternal support services, including financial, mental health and community support. This should take precedence over child removal whenever possible.

Preventing CLA status through family-support measures, we believe, could play a prominent role in reducing the growing expenditure on escalating life course disadvantage, counteracting the lower educational outcomes, higher mortality rates and higher rates of hospital admissions and criminal justice system involvement experienced by the CLA population.

Author statements

Ethical approval

Ethical approval was sought and obtained by the authors to access pseudonymised and deidentified data from administrative sources and health records through the ethical approval committee of the SAIL Databank.

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Competing interests

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2023.09.001.

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