

The Economic Costs of Child Maltreatment in UK

Abstract

Child maltreatment is a major public health problem with significant consequences for individual victims and for society. In this paper we quantify for the first time the economic costs of fatal and non-fatal child maltreatment in the UK in relation to several short-, medium- and long-term outcomes ranging from physical and mental health problems, to labour market outcomes and welfare use. We combine novel regression analysis of rich data from the National Child Development Study and the English Longitudinal Study of Ageing with secondary evidence to produce an incidence-based estimate of the lifetime costs of child maltreatment from a societal perspective. The discounted average lifetime incidence cost of non-fatal child maltreatment by a primary caregiver is estimated at £89,390 (95% uncertainty interval £44,896 to £145,508); the largest contributors to this are costs from social care, short-term health and long-term labour market outcomes. The discounted lifetime cost per death from child maltreatment is estimated at £940,758, comprising health care and lost productivity costs. Our estimates provide the first comprehensive benchmark to quantify the costs of child maltreatment in the UK and the benefits of interventions aimed at reducing or preventing it.

Keywords: child maltreatment, incidence-based approach, lifetime costs, health care costs, productivity losses, sensitivity analysis.

1. Introduction

Child maltreatment has increased in developed nations since the 1970s, despite varied policy initiatives aimed at preventing or reducing it (Gilbert et al., 2011). In England and Wales, in the last twenty years there has been a steep rise in the incidence of crimes against children, of child protection registrations, and of children entering care during 2000–16 (Degli Esposti et al., 2019). In particular, over the last decade, in England there has been a substantial increase in the number of children becoming involved in the child protection system, with those subject to child protection investigations rising from 87,700 in 2009/10 to 179,160 in 2018/2019 (Department for Education, 2010 and 2019). More recently, a substantial increase in child maltreatment is feared to be one of the consequences of the ongoing covid-19 pandemic and the associated lockdown policies (Conti, 2020). The total number of serious incident notifications where a child had died or been seriously harmed reported to the Department for Education in England during the first half of 2020-21 increasing by 27% on the same period in 2019-20.¹

The NSPCC describes child maltreatment as “all forms of physical and/or emotional ill-treatment, sexual abuse, neglect or negligent treatment or commercial or other exploitation, resulting in actual or potential harm to the child’s health, survival, development or dignity in the context of a relationship of responsibility, trust or power”. Child maltreatment has long-lasting effects on mental health, drug and alcohol use, risky sexual behaviour, obesity and crime, with high costs for both the individual and the society (Norman et al., 2012). While there are estimates of the costs of child maltreatment for different countries, such as US (Fang et al., 2012; Peterson et al., 2018) and Australia (McCarthy et al., 2016), scarce is the evidence for the United Kingdom.

The aim of this study is to calculate the first estimates of the lifetime costs per victim of nonfatal and fatal child maltreatment by primary caregivers from a societal perspective in the UK using an incidence-based approach. While previous studies have used only secondary evidence to quantify the costs of child maltreatment (as for example in Fang et al., 2012), we develop a novel approach by combining new estimates from two British cohorts on the medium- and long-term consequences of child maltreatment with secondary evidence from the literature; in this way, our cost estimates are based on a more coherent set of results than those produced in previous studies. More specifically, we assess the costs of child maltreatment in two steps. In a first step, we estimate robust associations of child maltreatment with medium-

¹ <https://explore-education-statistics.service.gov.uk/find-statistics/serious-incident-notifications>

and long-term outcomes by means of regression analysis, and we address selection issues by controlling for an extensive set of background and socioeconomic conditions; additionally, we perform a formal test for omitted variable bias developed by Oster (2019). For associations with short-term outcomes, we use recent results from the literature, given the lack of primary data. In a second step, we compute the costs over a lifetime horizon, including those related to short- and long-term health, crime, social care, special education, and productivity losses; additionally, we provide extensive sensitivity analyses.

The discounted average lifetime incidence cost of non-fatal child maltreatment by a primary caregiver is estimated at £89,390 (95% uncertainty interval £44,896 to £145,508); the largest contributors to this are costs from social care, short-term health and long-term labour market outcomes. The discounted lifetime cost per death from child maltreatment is estimated at £940,758, comprising health care and lost productivity costs. Our estimates provide the first comprehensive benchmark to quantify the costs of child maltreatment in the UK and the benefits of interventions aimed at reducing or preventing it.

2. Literature Review

Our work relates to three different strands of literatures: papers which have studied determinants and consequences of child maltreatment using data from the UK, economic papers on child maltreatment, and papers which have tried to assess its costs. Hence, before conducting our analysis, we performed three literature reviews: the first one of work based on UK data, the second one of papers published in economic journals, and the third one of cost-focused studies. The full list of papers for each of the three reviews performed is presented in Appendix 1.

The first literature review showed that both survey/cohort and administrative data have been used to date for UK studies. The UK survey/cohort data used in the published literature are: the National Child Development Study (NCDS), the Avon Longitudinal Study of Parents and Children (ALSPAC), the Environmental Risk Longitudinal Twin Study (E-Risk), and more recently the UK Biobank study (UKB). For what concerns the use of administrative data: two studies (Woodman et al., 2012, and Chandan et al., 2019) have used primary care records, two studies (González-Izquierdo et al., 2010 and 2014) have used data from the Hospital Episode Statistics, two studies (Mc Grath-Lone et al., 2016 and 2017) have used administrative records on Children Looked After and two very recent studies (Murray et al., 2020a and 2020b) have used data from the Longitudinal Study; additionally, another recent study (Baldwin et al., 2020) has used the Born in Bradford cohort linked with data from the Child Protection System. This

review also showed that using directly results from this literature as basis for our cost estimates was problematic, since different definitions of child maltreatment have been adopted (even in studies based on the same data, see Table A1 of the Supplementary Material), and different methodologies and control variables have been used in the various studies. The majority of the studies documented associations between child maltreatment and a variety of outcomes across the lifecycle, ranging from greater prevalence of cardiovascular diseases, multi-morbidities, mental health illness, higher BMI and (premature) mortality, and worse socioeconomic outcomes among children maltreated or placed in out-of-home care (e.g. Chandan et al., 2019; Fahy et al., 2017; Geoffroy et al., 2016; Hanlon et al., 2020; Ho et al., 2020; Soares et al., 2020; Murray et al., 2020, 2021; Power et al., 2015). Other studies examined the determinants of child maltreatment, and noted that individual-, family-, environment-, community-level and also genetic-level factors are all relevant in understanding its aetiology (e.g. Sidebotham et al., 2001, 2002, 2003, 2006; Jaffee et al., 2004; Baldwin et al., 2020) Few other studies (e.g. Collishaw et al., 2007) investigated the intergenerational consequences of childhood abuse, trends in child maltreatment over time (Gonzalez-Izquierdo et al., 2010, 2014), and the patterns of entry and exit from out-of-home care (McGrath-Lone et al., 2015, 2017).

The second literature review showed that few papers have been published in economic journals on the causes and consequences of child maltreatment (see Doyle and Aizer, 2018, for a recent review), with only one paper (Schurer et al., 2019) based on UK data from the 1958 birth cohort. Among the studies with the more robust design, Currie and Tekin (2012) use a siblings and twins fixed effects strategy based on data from the National Longitudinal Study of Adolescent Health (Add Health) to find that maltreatment greatly increases the probability of engaging in crime and that the probability increases with the experience of multiple forms of maltreatment; and Doyle (2007 and 2008) uses the placement tendency of child protection investigators as an instrumental variable to identify causal effects of foster care on long-term outcomes, and finds that children on the margin of placement tend to have better outcomes when remain at home.²

The third and last literature review identified 29 cost studies, none of which, however, estimated lifetime costs for UK using an incidence-based approach. The most common objective of the included studies was to estimate the cost of child maltreatment (in general across all types of abuse combined, or for some specific form of abuse); the majority of the

² Bald et al. (2019) and Gross and Baron (2021) use the same instrument and find that removal, instead, significantly increases test scores, improves children's safety and educational outcomes and reduces grade repetition for girls.

studies adopted the health care provider perspective, the hospital perspective or the societal perspective. There are several incidence-based studies from the USA (Fang et al., 2012; Peterson et al., 2018), Europe (Sethi et al., 2013), Germany (Habetha et al., 2012), Australia (McCarthy et al., 2016) and Asia (Fang et al., 2015), but epidemiological data, socioeconomic conditions and costs structure are very different from the UK. Among the few UK studies, one conducted in the UK Royal Liverpool Children's Hospital (Summers and Molyneaux, 1992) estimates the financial implications of child maltreatment from the hospital perspective; however, the study refers to children hospitalised in 1990, therefore the results are out of date and take a narrow cost perspective. Another UK study has estimated the cost of sexual abuse in the UK using a prevalence approach (Saied-Tessier, 2014). Hence, to date, no comprehensive cost analysis of child maltreatment for UK exists, despite the high and increasing prevalence of this phenomenon. Our study fills this significant gap in the literature.

3. Data and Methods

As mentioned in the introduction, we conduct our analysis in two steps: in a first step, we obtain the association between child maltreatment and a variety of short-, medium- and long-term outcomes; in a second step, we compute the costs. In the following we describe the data and the methods used in each of these steps in turn.

3.1 Data and methods for the regression analysis

We use two datasets to estimate the medium- and long-term effects of child maltreatment:³ the National Child Development Study (NCDS), i.e. the 1958 British birth cohort, and the English Longitudinal Study of Ageing (ELSA). The NCDS (Power et al., 2005) follows the lives of over 17,000 people born in England, Scotland and Wales in a single week of 1958; it is the dataset which has been mostly used in the UK literature to examine the effects of child maltreatment. The ELSA (Steptoe et al., 2012) is a longitudinal survey of ageing and quality of life among people aged 50 and above, which began in 2002.

In the NCDS, both prospective and retrospective measures of child maltreatment are available, and both have been used in the past literature. Few papers (see for example Newbury et al., 2018 among the more recent) compare prospective and retrospective measures: in general, both have shortcomings and both should be used, since they are likely to capture non-overlapping groups of maltreated children. However, the prospective measures in the NCDS

³ Note that the datasets used in more recent papers, as noted in the first literature review, were not available to us when we started this project.

are only related to neglect, and consist in teachers assessments reported at three points in time (ages 7, 11 and 16 of the cohort member) on particular aspects of the child ('looks undernourished, scruffy or dirty'), on the parental level of interest and aspiration for the child's education, and on the amount of time the parents spends with the child; no prospective measures are collected in the NCDS on any form of abuse. The retrospective measures, instead, have been asked in the biomedical sweep to approximately 9,400 cohort members when they were 44/45 years of age, and they directly refer to both neglect and physical, emotional, and sexual abuse; the precise wording used is detailed in Appendix 2 of the Supplementary Material. After consultation with experts in the field, we opted for the retrospective measures because they were directly related to different types of child maltreatment, while the prospective ones were only indirectly related to neglect (as such also potentially subject to interpretational biases); and we constructed a 'global' measure, which includes any type of maltreatment by a primary caregiver by age 16 (reported retrospectively at age 44/45), to both overcome the lack of costing data disaggregated by the type of child maltreatment, and also to avoid potential double-counting. In the ELSA, only retrospective measures of neglect and physical abuse are available, which were asked in the life history module in the third wave (when the subjects were age 53 or above); to the best of our knowledge, they have not been used in any other published paper. Like for the NCDS, we combined them into a 'global' measure, indicating whether the individual reports to have been neglected or physically abused before age 16. The summary statistics (Appendix 2) show that 12.4% of the NCDS respondents report to have been neglected in childhood (the corresponding figure for ELSA is 3.6%, see Tables 2L and 2M in Appendix 2), another 12.4% report to have received a form of emotional abuse, 6% report to have experienced physical abuse (the corresponding figure for ELSA is 3.5%, see Table 2N), and 1.5% report to have experienced sexual abuse. Combining them all together into our 'global' measure, 20.6% of the NCDS respondents has been victim of some form of child maltreatment: this is very similar to the figure in Radford et al. (2013) for UK, who report that 24.5% of young adults have experienced a form of child maltreatment at least once during childhood, in a random representative sample interviewed in 2009.

To study the consequences of child maltreatment, we then selected the following medium- and long-term outcomes to be used in the regression analysis, on the basis of the literature review: obesity, hypertension, diabetes, cancer, any diagnosed mental health problem, anxiety, depression, heavy drinking (consuming two or more alcoholic drinks/day), smoking, heavy smoking (25 cigarettes or more/day), employment, net and gross earnings and disability

benefits. The vast majority of the outcomes was surveyed in both the NCDS and in the ELSA, and we put great care in making them comparable to the extent possible.

Clearly, the key challenge in the empirical analysis arises from the fact that parents maltreating their children are not a random sample of the population, hence the effect of maltreatment needs to be disentangled from that of other unobserved characteristics which are also correlated with the outcomes of interest. Given the unavailability of information on siblings or twins in our data, or of any credible instrument, our approach consists in estimating different specifications including incrementally more controls for background and socioeconomic conditions, pregnancy and birth circumstances, and other adverse early experiences, and to check the robustness of our results to the inclusion of such controls (a similar methodology has been used in Schurer et al., 2019); we also formally implement a test for omitted variable bias proposed by Oster (2019) which corroborates the robustness of our results. For the cost analysis, we use the estimates from the most conservative specifications.

We use linear probability models throughout for computational convenience; logistic regression models (available upon request) yielded qualitatively similar results. We estimate four different specifications, incrementally adding different sets of controls. The first specification only includes a basic set of demographic controls (binary indicators for gender, ethnicity and interview date); the second specification adds as controls an extended set of demographics recorded at birth (the social class of the husband and of the father of the mother, parity, birthweight, whether the mother stayed in school beyond the minimum school leaving age, marital status, smoking in pregnancy, mother's and father's age at the child's birth, working during pregnancy, weight before pregnancy, mother's height, whether the mother had any antenatal visit in the first trimester of pregnancy, and the number of people per room); the third specification controls for other early adverse childhood experiences, collected in the age 6 sweep (whether the child lived with both natural parents, whether there was any family contacts with the probation officer, whether the parents divorced, whether a parent was alcoholic, whether the death of the father or of the mother occurred, whether there was any domestic tension, whether there were financial or housing difficulties, and the number of times the family moved since the birth of the child); the fourth specification further controls for an extended set of early adverse childhood experiences, reported retrospectively in the biomedical sweep (whether the mother suffered from nervous or emotional trouble, whether the mother had trouble drinking, whether there was some or a lot of conflict and tension in the house, whether the child grew up in poverty or in financial hardship).

3.2 Data and methods for the cost analysis

In the second step of our approach, we use the results from the regression analysis carried out in the first step, supplemented with the best published evidence, to develop our cost estimates for the medium- and long-term outcomes: anxiety, depression, smoking, alcohol abuse, productivity losses, special educational and social care needs, and police, court and penal services. We prefer the NCDS results over the ELSA results (apart from heavy drinking), since the former incorporates more types of child maltreatment in the global measure; as mentioned, we use the estimates from the specification with the extended set of controls (including indicators for several other early adversities, such as parental separation or death), so that our results can be considered conservative. Then, we combine the medium- and long-term costs based on our novel NCDS and ELSA results with published UK figures for short-term costs caused by unplanned hospital admissions, maltreatment or violence-related injuries and emergency treatment of hyperkinetic, conduct or emotional disorders; we could not directly estimate from the data the association of child maltreatment with short-term outcomes because we did not have details on the exact age at which child maltreatment occurred (only that it occurred before age 16). The list of all the outcomes included in the computation of the costs is in Table 1. The analysis excludes costs associated with obesity, hypertension, type 2 diabetes, and cancer, as these were not significantly related to the global measure of child maltreatment in our regression results (see Table 2). We did, however, include costs of other conditions that are related to depression, anxiety, smoking and alcohol abuse where these are included in published cost estimates (e.g., the cost of developing lung cancer among smokers is included in the smoking-related costs). The analysis also excludes costs of days off work among those who are employed as direct consequence of child maltreatment, as this variable was not available in the datasets we used; however, these costs were included in the calculations of long-term health-related costs where they were included in published cost estimates (e.g., absenteeism due to depression). To avoid double counting, when productivity losses from long-term health-related problems were included, the productivity losses due to reduced employment associated with child maltreatment were removed. We also found that child maltreatment was not associated with lower wages among those who were employed, so we did not include this cost. Also, we did not evaluate the association of child maltreatment with education attainment directly, but we included special education costs associated with child maltreatment and accounted for education effects indirectly in the calculation of productivity losses.

[TABLE 1 ABOUT HERE]

All costs were measured in GBP and adjusted to 2015 prices. We assumed that the average age at which maltreatment starts is 6 years,⁴ and that incidents are assumed to occur up to age 18 (DfE, 2016). Costs are presented in present value terms: future costs for the ages 6-30 years, 31-74 years and over 75 years are discounted using annual rates of 3.5%, 3% and 2.5%, respectively. Costs related to productivity losses are assumed to end at 67 years.

As explained above, given that in both the NCDS and ELSA the exact age of maltreatment was not specified (only the fact that it happened before age 16), we based our calculations of short-term costs on published figures. Secondary evidence was identified via searches of several databases including PubMed, the NHS Economic Evaluations Database, EconLit, Google Scholar and Google. For each cost category, we used published estimates from previous cost of illness studies where possible. We used data that were specific to the UK as opposed to countries outside of the UK because health care, social care, education and criminal justice systems vary between countries and costs in other countries are unlikely to apply to the UK. The only exception to this was in sensitivity analyses, where we applied costs of child maltreatment calculated for the USA to the UK to compare differences between the two studies. Costs vary over time and we used recent data whenever possible, though as noted below several of the data sources are dated.

We did not evaluate costs by type and severity of child maltreatment and instead opted for an overall maltreatment estimate. One reason is that many of the studies used to provide inputs into the calculations did not distinguish by type of maltreatment, so disaggregating costs would be difficult. In the econometric analysis, it was not possible to analyse the impact of different types of maltreatment on long-term health outcomes and labour market outcomes, since small numbers of cases for some types of maltreatment meant the analysis was underpowered. Another issue is that there may be overlap between different types of maltreatment, making it difficult to attribute costs to individual types.

Although our aim was to estimate the lifetime cost per victim of child maltreatment, for several of the cost components data were only available at the aggregate level across all victims. Where costs were available at the aggregate level across all victims only, they were divided by an estimate of the number of new cases of maltreatment per year. Several of the cost components required longitudinal data on the number of events for new cases of child

⁴ This reflects the age children become subject to a child protection plan or come on to the child protection register in the UK, and it is likely an upper bound; we did not find any reliable data on the age at which maltreatment starts.

maltreatment in a single year in order to accurately calculate incidence-based costs. Where data was insufficient to calculate accurate incidence-based costs, proxies for event frequency were created under steady-state assumptions. Using this approach, the number of events in a single year across all victims of child maltreatment is a proxy for all events over time among new victims in that year. This assumption requires that the number of events remains fairly constant over time, which may be problematic for some of the cost components considered.

A summary of the cost components included in the analysis is presented in list form in Table 4.

We first estimated short-term health-related costs in the form of unplanned hospital admissions for maltreatment or violence-related injuries by using incidence rates as a proxy for total admissions (ordinary and day case) for new victims (González-Izquierdo et al., 2014): we applied the unplanned admission rate for (diagnosed) maltreatment or violence related injuries in England in 2011 by age group to the mid-year UK population estimates to assess the number of unplanned admissions in 2015 in UK. Combined with the national average unit cost of non-elective admissions for paediatric injuries (DoH, 2015) and divided by an estimate of maltreatment occurrence, those figures yielded average costs of £120 per victim. Additionally, we calculated the prevalence of mental health problems for children who were maltreated (Table A2, based on Meltzer et al., 2003). Combined with costs reported by Snell et al. (2013), multiplied by the probability of each disorder and summed across different disorder types, these figures yielded a discounted cost of £11,453 per victim. Supplemented by evidence on increased criminal justice costs associated with conduct disorders (Scott et al., 2001), those generated a total of £18,553 in short-term mental health costs per victim.

For long-term health-related costs, we firstly estimated the mean incremental lifetime costs of anxiety and depression as the product of their average costs per year as indicated by McCrone et al. (2008) and Fineberg et al. (2010) (Table 5) and the marginal effect of child maltreatment on the probability of the respective outcome at each year of age (linearly extrapolated where missing). Costs were estimated to be £954 per year per victim for anxiety and £5,145 for depression. Similarly, combining the NCDS results with estimated social annual costs and smoking population data by Action on Smoking and Health (ASH 2016), the discounted mean incremental lifetime cost of smoking was estimated at £528 per victim. Equally, the discounted lifetime cost of alcohol misuse associated with maltreatment (assumed to begin at age 50 and remain constant), calculated with cost figures by the Cabinet Office (2003) and ELSA estimates, was £537.

For criminal justice system costs, the proportion of sexual offence cases resulting in court proceedings and convictions — derived from police records — was applied to the total number of relevant criminal cases in 2015 and used as a proxy for the lifetime number of offences from new maltreatment cases. Multiplying resulting figures by the unit cost of court proceedings, convictions, and sex offender treatment programmes yielded an average cost of £4,316 per victim. Next, we estimated social care costs, multiplying the number of children entering child protection plans or registers in 2015 (minus the number of re-registrations, DfE 2015) by the fixed and ongoing costs of protection initiatives. We further estimated the cost of children in foster care or local authority homes using the English data for all newly looked after children (DfE, 2015). This was based on the proportion of looked after children due to maltreatment in England and Wales (61% and 66% respectively) in 2016 (NSPCC, 2016) and on the incidence of child maltreatment in 2015 (DfE, 2016). In absence of data, costs of being placed for adoption, parents or community placement, were not considered. The actual costs for child social care thus likely exceed the estimated total of £2,360,129,680 or £38,132 average cost per victim (Tables 4 and A3). We excluded costs from drug use, divorce and disability for lack of data, as well as intangible costs, such as emotional suffering, which are difficult to quantify.

For productivity costs due to educational losses, we used the incremental effect of child maltreatment on special education:⁵ the undiscounted cost per maltreated child in receipt of educational support from age 6 to 16 was calculated as £7,068 per victim, using the DCSF (2009) Schools Census. Lastly, productivity losses due to reduced employment were calculated as the product of earnings and the marginal effect of maltreatment on employment, assumed to be zero before 33 years and after 55 years, and linearly interpolated in between. Losses were valued by age-specific earnings before deduction of taxes in 2013-14 inflated to 2015 prices (ONS, 2014), yielding an average discounted lifetime productivity loss of £14,037. The central estimate of the mean total lifetime costs of non-fatal child maltreatment per victim was calculated by summing per-victim costs across all components.

We performed extensive sensitivity analyses to deal with the uncertainty in our estimates. Probabilistic sensitivity analysis (PSA) was used to calculate 95% uncertainty intervals at the 2.5th and 97.5th percentiles (Table A8). For each of the 1000 simulations, all parameters with assigned probability distributions were selected at random from beta distributions for uncertainty in the probabilities, and gamma or triangular distributions for

⁵ Private communication from H. Fisher, based on published data from the E-Risk Twins.

uncertainty in costs (Briggs et al., 2006). Univariate deterministic sensitivity analysis was used to explore the sensitivity of the central estimates to individual parameter values related to: the discount rate, unplanned injury-related admissions, health care and criminal justice system costs, the impacts of child maltreatment, the number of cases ending in court proceedings, the unit costs of child protection plans, monthly ongoing support, special education, and the wages. In Table 5 we summarise the assumptions of the univariate sensitivity analysis and we report the central values and the changed values for each parameter; for example we assumed a base case discount rate of 3.5% up to 30 years and varied it between 0 and 5%. For all outcomes, we further explored the impact of using US estimates (Fang et al., 2012). Changes producing total lifetime costs £10,000 higher or lower than the central estimate were judged substantive.

Lastly, the lifetime cost per victim of fatal child maltreatment was estimated in two components, following Fang et al. (2012). Firstly, health care costs from fatal injuries were calculated based on the mean cost of £13,863 per fatal blunt trauma and £5,408 per penetrating trauma injuries in the UK, including the costs of hospital transport, stays, and procedures (Christensen et al., 2008a and 2008b). The lower value was used for the central estimate, the higher for sensitivity analysis. Second, lifetime costs of lost productivity were calculated using the human capital approach combining mean annual earnings — discounted to present value terms and inflated assuming a 2% constant annual increase in earnings — and employment rates by age (ONS, 2016). Those were summed across the lifetime and assumed to represent mean lifetime productivity — lost with an early fatality. For these calculations, probabilistic sensitivity analysis was not possible because probability distributions could not be assigned to key parameters, so univariate deterministic sensitivity analysis was undertaken, varying the discount rate, health care costs, assumptions concerning the lost productivity and criminal justice costs.

4. Results

The main NCDS results on the associations between child maltreatment (our ‘global’ measure) and medium- and long-term outcomes are reported in Table 2;⁶ secondary results from the age 23 sweep of the NCDS and from the ELSA are reported in Tables A5, A6, A7 in the Supplementary Material. Our preferred results are those for the most controlled specification (column 4 in Table 2, and column 2 in Tables A6 and A7). They show that having experienced maltreatment in childhood is associated with worse mental health outcomes (in particular

⁶ The precise definitions of the outcome variables are reported in Table A8 of the Supplementary Material.

anxiety and depression, with increases ranging from 2.6 to 7.8 percentage points in the NCDS and from 1.0 to 6.9 p.p. in the ELSA), and with a higher probability of being a current smoker (3.2-3.4 p.p. increase in the NCDS) and a heavy drinker (2.9 p.p. increase in the ELSA) in adulthood. These results are present since early (30s) until late adulthood (mid 50s or 70s, depending on the data), are remarkably similar in the two cohorts, and are robust to the inclusion of an extended set of controls, including an extensive set of adverse early childhood experiences (to try and isolate the effect of being maltreated versus other early adversities). The strong results on mental health are in line with other studies, also based on administrative data: for example, Chandan et al. (2019) find that having been maltreated doubles the risk of developing mental ill health, using primary care electronic health records from the UK.

The NCDS results also show a 2.7 and 3.6 percentage point reduction in the probability of being in paid employment at ages 42 and 50, respectively, for victims of child maltreatment. The ELSA results further show an increase in weekly disability-related benefits receipt by £36 for the victims of abuse (Table A7); however, these were not included in the cost analysis, since they are transfer payments (Luce et al., 1996). On the other hand, we are unable to detect any robust associations with several physical health measures, such as obesity, hypertension, diabetes and cancer, and with earnings (conditional on employment). These results are not entirely consistent with some other studies based on UK data (even based on the same NCDS data we use), which instead detected significant associations with these outcomes, although comparisons are significantly hindered by differences in samples, methods and choice of control variables; for example, none of the previous studies controls for other forms of child adversity (like we do in our more controlled specification), which are likely to co-occur with child maltreatment and so potentially bias estimates of its impacts.

Despite controlling for an extensive set of covariates, there is still the possibility that our estimates might be biased by omitted variables. Two facts however reassure us against that. First, previous results on child maltreatment from studies using robust designs: Currie and Tekin (2012) notice (p.528) that the estimated effects from siblings fixed effects models are remarkably similar to the OLS results; in Doyle (2008) the 2SLS coefficients are much bigger than the OLS coefficients, which would suggest that – if anything - our estimates are very conservative and we are estimating a lower bound. Second, to formally assess the robustness of our results, we have performed the test developed by Oster (2019), to examine the extent to which omitted variables could bias the relationship between child maltreatment measures and our set of outcomes. This test uses movements in the coefficient of interest and in the R2 after

adding observable controls to learn about the likely impact of the unobservables. The results are shown in Table 3 for the NCDS results: the estimates of the coefficients of proportionality (Delta) in general are above one, suggesting that unobservables would have to be more important than observables for the coefficients to be zero – an unlikely occurrence, given the extensive set of results we include in our most controlled specification.

[TABLES 2 AND 3 ABOUT HERE]

Using the results of the regression analysis, the marginal effect of child maltreatment on the probability of experiencing an outcome (e.g. anxiety, depression, smoking, drinking alcohol etc) at each year of age are applied to the unit average cost associated to each outcome. For example, if child maltreatment increases by 5.3% the probability of experiencing depression at age 33 and 7.8% at age 42, assuming a linear relation between the marginal effects at different ages, we apply the unit cost per year to the increased probability to estimate the incremental cost to treat depression that is associated to child maltreatment. The same is done for all the statistically significant results.

Combining the regression results with secondary cost data, we calculate a discounted average lifetime cost of non-fatal child maltreatment per victim of £89,390 (95% uncertainty interval £44,896 to £145,508). The main contributors are social care, short-term health-related, and reduced employment costs (Table 4). In Figure 1a we summarise graphically the distribution of values and we calculate the probability that the total cost was greater than pre-specified values as the proportion of the simulations greater than values £0 to £200,000 (Figure 1a). The intervals are wide, reflecting uncertainty in the parameters: there is a 96% probability that the total cost is greater than £50,000, a 34% probability that is greater than £100,000, and a 3% probability that is greater than £150,000 (Figures 1a, 1b).

[TABLES 4 AND 5 ABOUT HERE]

Deterministic sensitivity analysis (Table 5) suggests that the central estimate is sensitive to: the discount rate (values recommended by HM Treasury were used for final results), the marginal effects of child maltreatment on mental health problems, and to changes in assumptions on social care and employment costs (Table 5); the central estimate remains stable in the other cases. The discounted lifetime cost of fatal child maltreatment is calculated as £940,758, comprising £5,408 health care costs and £935,350 lost productivity costs (Table 6). As for the cost of non-fatal child maltreatment, these results are sensitive to the discount rate and assumptions concerning productivity losses (Table 7). While there is no comparable study using UK data, direct comparisons with the Fang et al. (2012) approach based on US data are

complicated by systemic cross-country differences, as well as differences in methodology. Estimated lifetime costs per victim of non-fatal child maltreatment are thus noticeably different (£89,930 versus US\$210,012); estimated costs per death from child maltreatment however are broadly comparable (£940,758, versus US\$1,272,900). Differences are even more marked with Peterson et al. (2018), who estimate lifetime cost per victim of non-fatal maltreatment at \$830,928 (2015 USD) and per-victim cost of fatal child maltreatment at \$16.6 million. However, their calculations also incorporate victim and intangible community costs, suggesting that the UK costs we have calculated are likely a lower bound of the full costs of child maltreatment.

[TABLES 6 AND 7 ABOUT HERE]

5. Conclusions

This paper has provided the first estimate of the lifetime costs of child maltreatment in UK. We have combined novel regression analysis to estimate associations between child maltreatment and several medium- and long-term health and socioeconomic outcomes, using rich data from the National Child Development Study (the 1958 British birth cohort) and the English Longitudinal Study of Ageing, with published results on short-term outcomes and secondary sources for the costs. We have computed the discounted average lifetime incidence cost of non-fatal child maltreatment by a primary caregiver at £89,390 (95% uncertainty interval £44,896 to £145,508); the largest contributors to this are costs from social care, short-term health and long-term labour market outcomes. The discounted lifetime cost per death from child maltreatment is estimated at £940,758, comprising health care and lost productivity costs.

Our paper has some noticeable key strengths, such as the inclusion of a wide range of cost components (several based on novel regression analysis), and the extensive sensitivity analysis undertaken to evaluate the impact of uncertainty. However, while our estimates are conservative and based on the best possible evidence, they also have limitations. First, some outcomes found relevant in previous studies (such as drug use) were not available in our data; second, the retrospective measures of child maltreatment we used relied on respondent recall; third, our data did not allow us to use some designs such as sibling fixed effects or instrumental variables; fourth, data shortcomings caused uncertainty regarding specific costs and new cases of child maltreatment per year. The sensitivity analyses showed that the estimates for non-fatal child maltreatment are especially sensitive to its impacts on short-term health-related costs, for which there was substantial uncertainty. For all other outcomes, any parameter uncertainty did not affect lifetime costs or the central estimate appreciably.

Several extensions of this work are possible for future research: to include child maltreatment by non-primary caregivers, to calculate the costs of different types of child maltreatment and to use richer data and improved methodological approaches. For the time being, our figures provide the first important indication of how much money the British society is spending on any case of child maltreatment, and consequently, the amount saved if it were prevented. These figures can inform economic evaluations of child maltreatment intervention or prevention initiatives, as well as retrospective analysis of their cost-effectiveness; they can be included in estimates of the costs of the increase in cases of child maltreatment as result of the coronavirus pandemic and associated lockdown restrictions;⁷ and in general they can shape a wider narrative on the significant burden child maltreatment poses on society.

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⁷ For example, the 119 notified child deaths (as part of the serious incident notifications reported to the Department for Education in England during the first half of 2020-21) will cost £940,758*119=£105,364,896.

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Table 1: Outcomes included in the calculation of the costs of child maltreatment

Health
Short-term
Unplanned hospital admissions for injuries: MVR rate for different year groups and admission expenses Stress-induced disorders in children: Hyperkinetic, Conduct and Emotional
Long-term
Depression* Anxiety* Smoking* Alcohol (heavy drinking at age 50 or more)*
Criminal justice
Court proceeding and convictions expenses Sex offenders treatment programmes Proportion of cases ending in court Proportion of cases ending in convictions Proportion of cases of sexual abuse ending in sex offenders treatment programmes
Social care
Foster care expenses Local Authority care expenses Child Protection Plan involvement Monthly childcare support Proportion newly looked after children receiving intervention in foster care
Productivity
Special education Employment at different ages* Receipt of disability benefits*

Note: *The outcomes depression, anxiety, smoking, alcohol, employment and receipt of disability benefits are based on the regression analysis of NCDS and ELSA; we combine this regression analysis with costs taken from published source. For the remaining outcomes, the computation of the costs is entirely based on secondary evidence from the literature.

Table 2: NCDS Results of the Effects of the global measure of CM

	Physical Health Problem: Obesity				Physical Health Problem: Hypertension				Physical Health Problem: Diabetes				Physical Health Problem: Cancer			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Sweep 5 (33 y)	0.008 (0.009) <i>7,185</i>	0.001 (0.009) <i>7,185</i>	0.002 (0.010) <i>7,185</i>	0.005 (0.011) <i>7,184</i>	0.016** (0.007) <i>7,240</i>	0.014* (0.007) <i>7,240</i>	0.013* (0.007) <i>7,240</i>	0.006 (0.008) <i>7,239</i>	-0.001 (0.002) <i>7,240</i>	-0.002 (0.002) <i>7,240</i>	-0.002 (0.002) <i>7,240</i>	0.002 (0.003) <i>7,239</i>	0.010** (0.004) <i>7,196</i>	0.008* (0.004) <i>7,196</i>	0.008* (0.004) <i>7,196</i>	0.005 (0.005) <i>7,195</i>
Sweep 6 (42 y)	0.006 (0.010) <i>7,751</i>	-0.007 (0.010) <i>7,751</i>	-0.005 (0.010) <i>7,751</i>	-0.022 (0.012) <i>7,750</i>	0.005 (0.009) <i>7,877</i>	0.001 (0.009) <i>7,877</i>	0.003 (0.009) <i>7,877</i>	-0.005 (0.010) <i>7,876</i>	0.000 (0.004) <i>7,880</i>	-0.001 (0.004) <i>7,880</i>	-0.001 (0.004) <i>7,880</i>	0.003 (0.004) <i>7,879</i>	0.005 (0.004) <i>7,880</i>	0.004 (0.004) <i>7,880</i>	0.004 (0.004) <i>7,880</i>	0.000 (0.005) <i>7,879</i>
Sweep 8 (50 y)	0.030** (0.015) <i>6,034</i>	0.010 (0.015) <i>6,034</i>	0.009 (0.015) <i>6,034</i>	0.010 (0.016) <i>6,033</i>	0.032*** (0.011) <i>7,134</i>	0.024** (0.011) <i>7,134</i>	0.023** (0.011) <i>7,134</i>	0.018 (0.013) <i>7,133</i>	0.006 (0.006) <i>7,134</i>	0.004 (0.006) <i>7,134</i>	0.005 (0.006) <i>7,134</i>	0.003 (0.007) <i>7,133</i>	0.003 (0.003) <i>7,134</i>	0.003 (0.003) <i>7,134</i>	0.003 (0.003) <i>7,134</i>	0.005 (0.004) <i>7,133</i>
Sweep 9 (55 y)	0.025* (0.014) <i>6,302</i>	0.010 (0.014) <i>6,302</i>	0.010 (0.014) <i>6,302</i>	0.010 (0.016) <i>6,301</i>	0.035*** (0.013) <i>6,628</i>	0.026** (0.013) <i>6,628</i>	0.026* (0.014) <i>6,628</i>	0.016 (0.015) <i>6,627</i>	0.018** (0.008) <i>6,630</i>	0.014* (0.008) <i>6,630</i>	0.015* (0.008) <i>6,630</i>	0.012 (0.009) <i>6,629</i>	0.009 (0.006) <i>6,631</i>	0.008 (0.006) <i>6,631</i>	0.011* (0.006) <i>6,631</i>	0.012 (0.007) <i>6,630</i>
	Mental Health Problem: Any				Mental Health Problem: Anxiety (diagnosis)				Mental Health Problem: Depression				Healthy Behaviours: Drinking on Most Days			
Sweep 5 (33 y)	0.114*** (0.013) <i>7,241</i>	0.112*** (0.013) <i>7,241</i>	0.109*** (0.013) <i>7,241</i>	0.069*** (0.015) <i>7,240</i>	0.045*** (0.008) <i>7,243</i>	0.044*** (0.008) <i>7,243</i>	0.043*** (0.008) <i>7,243</i>	0.026*** (0.009) <i>7,242</i>	0.084*** (0.011) <i>7,246</i>	0.082*** (0.011) <i>7,246</i>	0.081*** (0.011) <i>7,246</i>	0.053*** (0.013) <i>7,245</i>	-0.001 (0.009) <i>7,265</i>	0.005 (0.009) <i>7,265</i>	0.003 (0.010) <i>7,265</i>	-0.007 (0.011) <i>7,264</i>
Sweep 6 (42 y)	0.144*** (0.013) <i>7,880</i>	0.140*** (0.013) <i>7,880</i>	0.139*** (0.013) <i>7,880</i>	0.085*** (0.015) <i>7,879</i>	0.071*** (0.009) <i>7,880</i>	0.071*** (0.010) <i>7,880</i>	0.070*** (0.010) <i>7,880</i>	0.042*** (0.010) <i>7,879</i>	0.133*** (0.012) <i>7,880</i>	0.127*** (0.013) <i>7,880</i>	0.127*** (0.013) <i>7,880</i>	0.078*** (0.014) <i>7,879</i>	-0.015 (0.011) <i>7,880</i>	0.001 (0.011) <i>7,880</i>	-0.001 (0.011) <i>7,880</i>	-0.017 (0.013) <i>7,879</i>
Sweep 8 (50 y)	0.068*** (0.012) <i>7,135</i>	0.064*** (0.012) <i>7,135</i>	0.066*** (0.012) <i>7,135</i>	0.022 (0.014) <i>7,134</i>	0.063*** (0.010) <i>7,135</i>	0.063*** (0.010) <i>7,135</i>	0.062*** (0.010) <i>7,135</i>	0.035*** (0.011) <i>7,134</i>	0.092*** (0.012) <i>7,135</i>	0.088*** (0.013) <i>7,135</i>	0.088*** (0.013) <i>7,135</i>	0.041*** (0.014) <i>7,134</i>	-0.016 (0.012) <i>7,136</i>	-0.001 (0.013) <i>7,136</i>	-0.000 (0.013) <i>7,136</i>	-0.024* (0.014) <i>7,135</i>
Sweep 9 (55 y)	0.094*** (0.013) <i>6,622</i>	0.092*** (0.013) <i>6,622</i>	0.091*** (0.013) <i>6,622</i>	0.049*** (0.014) <i>6,621</i>	0.065*** (0.010) <i>6,616</i>	0.063*** (0.010) <i>6,616</i>	0.062*** (0.011) <i>6,616</i>	0.034*** (0.011) <i>6,615</i>	0.093*** (0.012) <i>6,614</i>	0.091*** (0.012) <i>6,614</i>	0.090*** (0.012) <i>6,614</i>	0.052*** (0.014) <i>6,613</i>	-0.003 (0.012) <i>6,632</i>	0.011 (0.012) <i>6,632</i>	0.011 (0.012) <i>6,632</i>	0.001 (0.014) <i>6,631</i>
	Healthy Behaviours: Current Smoker				Healthy Behaviours: Heavy Smoker (25 Cigarettes/Day or More)				Labour Market Outcome: Employed				Labour Market Outcome: Net Weekly Earnings (if Employed)			
Sweep 5 (33 y)	0.086*** (0.014) <i>7,252</i>	0.058*** (0.014) <i>7,252</i>	0.051*** (0.014) <i>7,252</i>	0.034** (0.016) <i>7,251</i>	0.035* (0.019) <i>2,209</i>	0.032* (0.019) <i>2,209</i>	0.024 (0.019) <i>2,209</i>	0.007 (0.022) <i>2,208</i>	-0.023** (0.012) <i>7,219</i>	-0.016 (0.012) <i>7,219</i>	-0.016 (0.012) <i>7,219</i>	-0.019 (0.013) <i>7,218</i>	-24.76** (11.64) <i>4,760</i>	-15.05 (11.36) <i>4,760</i>	-12.54 (11.23) <i>4,760</i>	-10.57 (11.91) <i>4,759</i>
Sweep 6 (42 y)	0.088*** (0.013) <i>7,879</i>	0.059*** (0.013) <i>7,879</i>	0.051*** (0.013) <i>7,879</i>	0.034** (0.014) <i>7,878</i>	0.062*** (0.020) <i>1,886</i>	0.054*** (0.021) <i>1,886</i>	0.055** (0.022) <i>1,886</i>	0.046* (0.025) <i>1,885</i>	-0.049*** (0.010) <i>7,779</i>	-0.039*** (0.010) <i>7,779</i>	-0.036*** (0.010) <i>7,779</i>	-0.027** (0.011) <i>7,778</i>	-23.29 (38.59) <i>5,649</i>	-7.98 (42.37) <i>5,649</i>	-5.12 (43.03) <i>5,649</i>	-27.81 (43.76) <i>5,648</i>
Sweep 8 (50 y)	0.070*** (0.012) <i>7,136</i>	0.047*** (0.012) <i>7,136</i>	0.041*** (0.013) <i>7,136</i>	0.032** (0.014) <i>7,135</i>	0.058** (0.023) <i>1,292</i>	0.051** (0.023) <i>1,292</i>	0.039* (0.023) <i>1,292</i>	0.030 (0.026) <i>1,291</i>	-0.056*** (0.011) <i>7,043</i>	-0.047*** (0.011) <i>7,043</i>	-0.043*** (0.011) <i>7,043</i>	-0.036*** (0.012) <i>7,042</i>	-9.98 (10.96) <i>4,997</i>	-2.60 (10.91) <i>4,997</i>	-3.09 (10.92) <i>4,997</i>	-8.83 (11.32) <i>4,996</i>
Sweep 9 (55 y)	0.050*** (0.012) <i>6,629</i>	0.032*** (0.012) <i>6,629</i>	0.027** (0.012) <i>6,629</i>	0.019 (0.013) <i>6,628</i>	0.059** (0.024) <i>887</i>	0.046* (0.025) <i>887</i>	0.052** (0.024) <i>887</i>	0.042 (0.028) <i>886</i>	-0.041*** (0.013) <i>6,604</i>	-0.034*** (0.013) <i>6,604</i>	-0.031** (0.013) <i>6,604</i>	-0.009 (0.014) <i>6,603</i>	11.75 (30.82) <i>3,777</i>	14.46 (29.34) <i>3,777</i>	5.97 (20.66) <i>3,777</i>	20.83 (22.68) <i>3,776</i>

Note: The table contains estimates from linear regression models with robust standard errors. Each cell contains results from a different model. Within each cell, we first report the estimated coefficients; we then report in parentheses robust standard errors; we last report in italics the sample size. For each sweep, outcome and exposure, we report four different specifications, in the columns (1) to (4), respectively. Specification (1) only includes a basic set of demographic controls: dummies for gender, ethnicity and interview date (year, month and day). Specification (2) adds as controls an extended set of demographics recorded at birth: the social class of the husband and of the father of the mother, parity, birthweight, whether the mother

stayed in school beyond the minimum school leaving age, marital status, smoking in pregnancy, mother's and father's age at the child's birth, working during pregnancy, weight before pregnancy, mother's height, whether the mother had any antenatal visit in the first trimester of pregnancy, and the number of people per room. Specification (3) controls for other early adverse childhood experiences, as collected in the age 6 sweep: whether the child lived with both natural parents, whether there was any family contacts with the probation officer, whether the parents divorced, whether a parent was alcoholic, whether the death of the father or of the mother occurred, whether there was any domestic tension, whether there were financial or housing difficulties, and the number of times the family moved since the birth of the child. Specification (4) controls for an extended set of early adverse childhood experiences, reported retrospectively in the biomedical sweep: whether the mother suffered from nervous or emotional trouble, whether the mother had trouble drinking, whether there was some or a lot of conflict and tension in the house, whether the child grew up in poverty or in financial hardship. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Results of the Oster (2019) Test								
	Physical Health Problem: Obesity		Physical Health Problem: Hypertension		Physical Health Problem: Diabetes		Physical Health Problem: Cancer	
	Beta (Specific ation 4)	Delta	Beta (Specific ation 4)	Delta	Beta (Specific ation 4)	Delta	Beta (Specific ation 4)	Delta
Sweep 5 (33 y)	0.0005	0.153	0.006	1.122	0.002	-1.525	0.005	1.344
Sweep 6 (42 y)	-0.002	-0.698	-0.005	-1.260	0.003	-3.540	0.000	0.041
Sweep 8 (50 y)	0.010	1.025	0.018	2.071	0.003	1.910	0.005	-12.880
Sweep 9 (55 y)	0.010	1.335	0.016	1.384	0.012	2.855	0.012	-147.175
	Mental Health Problem: Any		Mental Health Problem: Anxiety (diagnosis)		Mental Health Problem: Depression		Healthy Behaviours: Drinking on Most Days	
Sweep 5 (33 y)	0.069	1.089	0.027	1.737	0.016	1.211	-0.007	-2.046
Sweep 6 (42 y)	0.085	1.131	0.042	1.590	0.078	1.143	-0.017	14.981
Sweep 8 (50 y)	0.022	0.628	0.035	1.517	0.041	0.896	-0.024	-24.064
Sweep 9 (55 y)	0.049	2.448	0.034	1.035	0.052	1.504	0.001	-0.348
	Healthy Behaviours: Current Smoker		Healthy Behaviours: Heavy Smoker (25 Cigarettes/Day or More)		Labour Market Outcome: Employed		Labour Market Outcome: Net Weekly Earnings (if Employed)	
Sweep 5 (33 y)	0.034	1.238	0.007	0.455	-0.019	1.041	-10.569	1.135
Sweep 6 (42 y)	0.034	1.196	0.046	2.041	-0.027	1.053	-27.812	16.497
Sweep 8 (50 y)	0.032	1.560	0.030	1.322	-0.036	1.656	-12.502	2.545
Sweep 9 (55 y)	0.019	1.036	0.042	2.127	-0.009	0.422	20.830	-10.163

Note: the table presents the results of the Oster (2019) test for the results reported in Table 2. For each outcome and sweep, the first column reports the estimated coefficient from the most controlled specification, and the second column reports the coefficient of proportionality delta computed following Oster (2019).

Table 4: Discounted lifetime costs per victim of non-fatal child maltreatment

	Value (£)	95% Uncertainty Interval	% Total
Unplanned hospital admissions for injuries	120	(83, 141)	<1
Short-term mental health problems	18,553	(9,758, 29,833)	21
Short-term health-related costs	18,673	(9,841, 29,974)	21
Anxiety	954	(311, 2,094)	1
Depression	5,145	(1,782, 10,740)	6
Smoking	528	(100, 1,461)	1
Alcohol abuse	537	(148, 1,262)	1
Long-term health-related costs	7,164	(2,341, 15,558)	8
Criminal justice system costs	4,316	(2,509, 6,165)	5
Social care costs	38,132	(22,679, 53,346)	43
Special education costs	7,068	(2,162, 14,455)	8
Reduced employment	14,037	(5,364, 26,010)	16
Total	89,390	(44,896, 145,508)	100

Note: All costs are discounted and in 2015 UK£. The outcomes anxiety, depression, smoking, alcohol abuse, and employment, are based on the regression analysis of NCDS and ELSA.

Table 5: Discounted lifetime costs per victim of non-fatal child maltreatment: univariate deterministic sensitivity analysis

		Value (£)
Central estimate		89,390
Central estimate assumption	Changed to (all else equal)	
Discount rate		
Years 0 to 30 = 3.5% per annum; years 31 to 75 = 3% per annum; years 76 to 125 = 2.5% per annum	All years = 0% per annum	148,747
Years 0 to 30 = 3.5% per annum; years 31 to 75 = 3% per annum; years 76 to 125 = 2.5% per annum	All years = 5% per annum	75,884
Unplanned hospital admissions for injuries		
8,685 unplanned admissions across all victims	Each victim has one unplanned admission; 31.2% have a second admission	90,389
8,685 unplanned admissions across all victims	Each victim has one unplanned admission; 31.2% have a second admission; each admission is associated with 11.5 outpatient visits and 11.5 GP visits	92,758
Short-term mental health problems		
Annual cost per victim with mental health disorder = £1,351 to £3605 depending on disorder	Annual cost per victim with mental health disorder doubles	100,843
Marginal effect of child maltreatment on probability of mental health problems = +0.061 to +0.345 depending on age and type of disorder	Marginal effect of child maltreatment on probability of mental health problems = +0.05	75,657
Marginal effect of child maltreatment on probability of mental health problems = +0.061 to +0.345 depending on age and type of disorder	Marginal effect of child maltreatment on probability of mental health problems = +0.5	119,035
Annual criminal justice costs for children with conduct disorder = £3,436	Annual criminal justice costs for children with conduct disorder doubles	96,490
Short-term health-related costs		
Total short-term costs as in base case	Total short-term health care costs as in Fang et al., updated to 2014/15 UK£ (=£24,167)	94,884
Long-term health-related costs		
Marginal effect of child maltreatment on all types of long-term health care costs = +0.029 to +0.077 in effective age ranges depending on age and condition	Marginal effect of child maltreatment on all conditions and ages (maintaining original effective age ranges) = +0.1	97,571
Marginal effect of child maltreatment on all types of long-term health care costs = +0.029 to +0.077 in effective age ranges depending on age and condition	Marginal effect of child maltreatment on all conditions and ages (maintaining original effective age ranges) = +0.2	112,916
Marginal effect of child maltreatment on all types of long-term health care costs = +0.029 to +0.077 in effective age ranges depending on age and condition	Marginal effects of child maltreatment at youngest effective age extrapolated to 18, and at oldest effective age extrapolated to 100	93,469
Total long-term costs as in base case	Total long-term health care costs as in Fang et al., updated to 2014/15 UK£ (=£7,795)	90,021
Criminal justice system costs incurred by perpetrators		

17.6% cases end in court proceedings and 10.7% end in convictions	All cases end in court proceedings and convictions	115,045
Criminal justice costs as in base case	Criminal justice cost as in Fang et al., updated to 2014/15 UK£ (=£3,533)	88,607
Social care costs		
Unit cost of child protection plan = £5,321; monthly child care support cost = £328	Unit cost of child protection plans and monthly child care support costs double	96,900
Child social care costs as in base case	Child social care costs as in Fang et al., updated to 2014/15 UK£ (= £5,721)	56,979
Special education costs		
Unit cost of special educational support per victim = £3,740 per annum	Unit cost of special educational needs provision doubles	96,459
Marginal effect of child maltreatment on receipt of special education support = 0.22	Marginal effect of child maltreatment on receipt of special education support = 0.11	85,863
Marginal effect of child maltreatment on receipt of special education support = 0.22	Marginal effect of child maltreatment on receipt of special education support = 0.33	92,946
Reduced employment		
Earnings if employed = national average earnings by age group	Earnings if employed = 75% of the national average earnings by age group	85,881
Earnings if employed = national average earnings by age group	Earnings if employed = 50% of the national average earnings by age group	82,372
Annual increase in wages 2%	Annual increase in wages 1%	84,876
Annual increase in wages 2%	Annual increase in wages 3%	96,008
Marginal effect of child maltreatment on not being employed = 0 at age 33, -0.027 at age 42, -0.035 at age 50 and 0 at age 55, with linear interpolation	Marginal effect of child maltreatment on not being employed at ages 42 and 50 = -0.05, all else equal	98,349
Marginal effect of child maltreatment on not being employed = 0 at age 33, -0.027 at age 42, -0.035 at age 50 and 0 at age 55, with linear interpolation	Marginal effect of child maltreatment on not being employed at ages 42 and 50 = -0.1, all else equal	121,344
Marginal effect of child maltreatment on not being employed = 0 at age 33, -0.027 at age 42, -0.035 at age 50 and 0 at age 55, with linear interpolation	Marginal effect of child maltreatment on not being employed at ages 42 and 50 = -0.2, all else equal	167,334
Marginal effect of child maltreatment on not being employed = 0 at age 33, -0.027 at age 42, -0.035 at age 50 and 0 at age 55, with linear interpolation	Marginal effects of child maltreatment at age 42 (= -0.027) extended to age 18, and at age 50 (= -0.035) extended to age 67	113,515
Cost of reduced employment as in base case	Cost of reduced employed as in Fang et al., updated to 2014/15 UK£ (=£4,360 per annum from ages 18-64 inclusive, £0 otherwise)	150,001

Note: All costs are in 2015 UK£ and discounted unless indicated otherwise. GP = general practitioner.

Table 6: Discounted lifetime costs per death from child maltreatment

	Value (£)	% Total
Health care costs	5,408	1
Lost productivity	935,350	99
Total	940,758	100

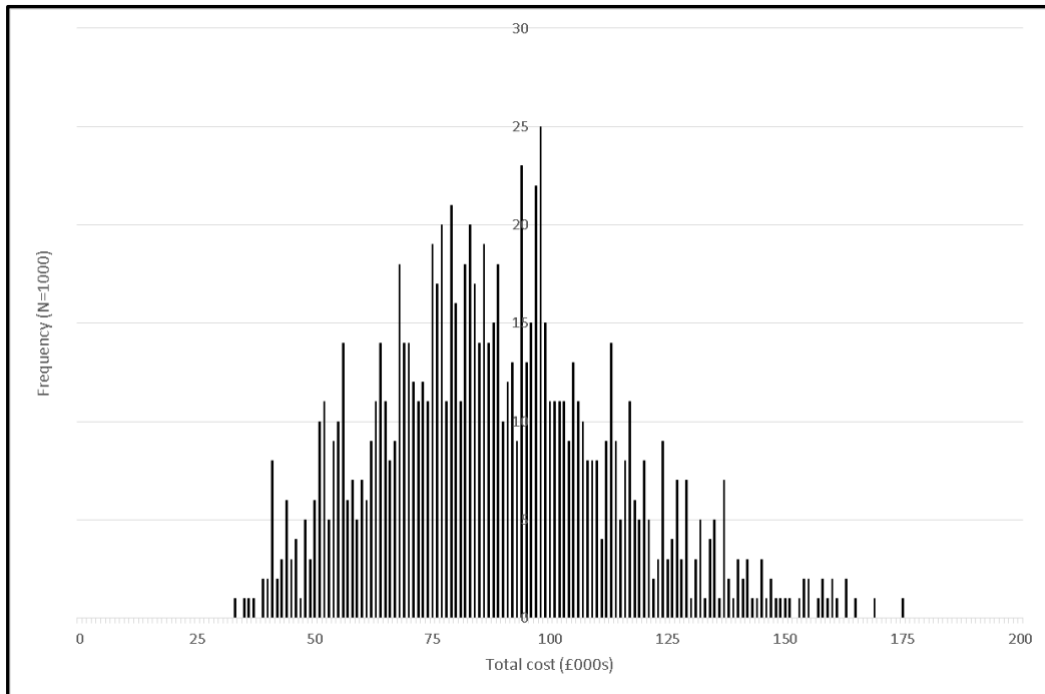
Note: All costs are discounted and in 2015 UK£.

Table 7: Discounted lifetime costs per death from child maltreatment: univariate deterministic sensitivity analysis

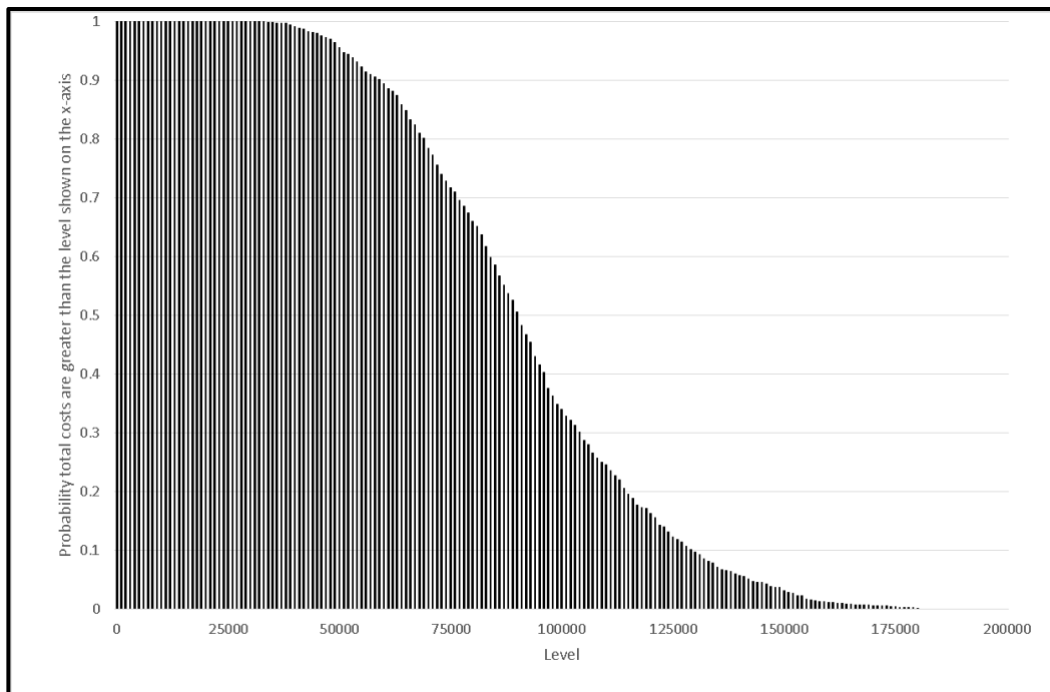
		Value (£)
Central estimate		940,758
Central estimate assumption	Changed to (all else equal)	
Discount rate		
Years 0 to 30 = 3.5% per annum; years 31 to 75 = 3% per annum; years 76 to 125 = 2.5% per annum	All years = 0% per annum	2,994,842
Years 0 to 30 = 3.5% per annum; years 31 to 75 = 3% per annum; years 76 to 125 = 2.5% per annum	All years = 5% per annum	504,483
Health care costs		
Health care costs associated with fatal injury = £5,408	Health care costs associated with fatal injury = £13,863	949,213
Lost productivity		
Earnings if employed = national average earnings by age group	Earnings if employed = 75% of the national average earnings by age group	706,921
Earnings if employed = national average earnings by age group	Earnings if employed = 50% of the national average earnings by age group	473,083
Employment rate = national average rates by age group	Employment rate = 75% of the national average rates by age group	706,921
Employment rate = national average rates by age group	Employment rate = 50% of the national average rates by age group	473,083
Annual increase in wages = 2%	Annual increase in wages = 1%	663,419
Annual increase in wages = 2%	Annual increase in wages = 3%	1,348,863
Criminal justice system costs		
Not included	Assume all cases result in a court proceedings and a conviction	972,867

Note: All costs are discounted and in 2015 UK£.

Figure 1. Discounted lifetime costs per victim of non-fatal child maltreatment: distribution of values from probabilistic sensitivity analysis.



(a) Frequency distribution



(b) Probability values are higher than level

