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Socioeconomic deprivation, health and healthcare utilisation among millennials

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ABSTRACT

This study estimates and decomposes components of different measures of inequality in health and healthcare use among millennial adolescents, a sizeable cohort of individuals at a critical stage of life. Administrative data from the UK Hospital Episode Statistics are linked to Next Steps, a survey collecting information about millennials born between 1989 and 1990, providing a uniquely comprehensive source of health and socioeconomic variables. Socioeconomic inequalities in psychological distress, long-term illness and the use of emergency and outpatient hospital care are measured using a corrected concentration index. Shapley-Shorrocks decomposition techniques are employed to measure the relative contributions of childhood socioeconomic circumstances to adolescents' health and healthcare inequality of opportunity. Results show that income-related deprivation contributes to significant inequalities in mental and physical health among adolescents aged between 15 and 17 years old. There are also pro-rich inequalities in the use of specific outpatient hospital services (e.g., orthodontic and mental healthcare), while pro-poor disparities are found in the use of emergency care services. Regional and parental circumstances are leading factors in influencing inequality of opportunity in the use of hospital care among adolescents. These findings shed light on the main drivers of health inequalities during an important stage of human development and have potentially important implications on human capital formation across the life-cycle.

1. Introduction

Adolescence is a critical stage in human development regarding health and human capital formation (Heckman et al., 2014). Fundamental aspects of an individual's health are developed during childhood and are likely to persist throughout life, alongside any initial impacts of socioeconomic inequalities (Currie et al., 2016). Although adolescence is a crucial period for ensuring healthy and productive lives, there is limited understanding of the factors that contribute to socioeconomic inequalities in health for the millennial generation, who comprise a large part of the workforce. This study aims to measure socioeconomic disparities in health and healthcare use among millennial adolescents, using comprehensive data covering childhood circumstances, health status and hospital healthcare utilisation, including mental care services.

Evidence has shown that health disparities arise and are strengthened during adolescence (Currie et al., 2009). These disparities continue into adulthood and have long-term effects on an individual's health, particularly on chronic physical illness and mental health (Reiss, 2013). In the United States (US), 49.5% of adolescents are estimated to have a mental health disorder (U.S. Department of Health and Human Services, 2021), while in the UK, mental disorder rates have risen from 10.1% in 2017 to 25.7% for children aged between 17 and 19 in 2022 (Newlove-Delgado et al., 2022). Measuring health inequalities among adolescents can be challenging due to the lack of relevant information on their socioeconomic status (Hanson et al., 2007), as well as the absence of comprehensive large-scale data including childhood characteristics, together with measures of health and healthcare utilisation (Molcho

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et al., 2007). This study overcomes these issues by linking survey data from Next Steps' participants, covering socioeconomic information about adolescents and their families, with hospital records from the UK Hospital Episodes Statistics (HES). This paper measures income-related deprivation inequalities in adolescents' mental and physical health at ages 14–15 (middle adolescence) and 16–17 (late adolescence/young adulthood), two different stages of adolescence in terms of psychosocial development (Sawyer et al., 2018). This study focuses on England not just for the availability of high-quality data but also because English adolescents reported a 60% increase in the prevalence of mental health issues in recent years (Office for National Statistics, 2020).

Few studies have examined how socioeconomic factors impact adolescent's health and healthcare use in the UK. Rougeaux et al. (2017) use data from the Millennium Cohort Study to investigate health inequality during childhood, finding an increase in the socioeconomic gradient for overweight children over time. Zilanawala et al. (2019) show that ethnic minority adolescents in the UK have lower cognitive development and experience higher levels of adverse socio-emotional health. Previous studies using survey data have found evidence of pro-rich inequity in the self-reported use of medical specialist visits among older populations (Devaux, 2015; Cookson et al., 2016). This is the first study to combine cohort survey data with hospital administrative records to measure income deprivation inequalities in the use of hospital care among millennial adolescents in England. Our paper measures inequalities in the use of emergency hospital care and specific outpatient care services through the lens of the inequality of opportunity framework. We select a set of circumstances that are considered beyond an individual's control (e.g., parental education), as well as factors that might be controlled (e.g., behaviours such as smoking) and quantify their relative roles in affecting inequality of opportunity in health and healthcare use. The inequality of opportunity framework features the role of fairness in determining equal opportunities to maximise social welfare (Roemer et al., 2016).

Corrected Concentration Indices (CCIs) are employed to estimate income-related inequalities in (mental and physical) health and in the use of (emergency and outpatient) healthcare services. Regression-based Shapley-Shorrocks decomposition analyses are then implemented to measure the contribution of a set of childhood socioeconomic circumstances to the total inequality of opportunity. Findings suggest that income-related deprivation yields inequalities in health among adolescents, favouring the better-off. There are also pro-rich inequalities in the use of specific outpatient hospital services (e.g., mental health services), while pro-poor disparities are found in the use of emergency services. Our decomposition analysis measures the role of different childhood circumstances and their contributions to inequality of opportunity in health and healthcare utilisation. Specifically, we find that adolescents' lifestyle, school experiences (e.g., attitude toward school), health behaviours (e.g., practising sports, drinking alcohol), and parental homeownership are among the most relevant contributors to inequality of opportunity in adolescents' health status. Our findings show that regional and parental factors have the largest impact on inequality of opportunity in the use of hospital services.

This study provides several contributions to the literature. First, this is the first study systematically exploring the relationship between socioeconomic deprivation and healthcare utilisation among millennial adolescents using uniquely suited linked data from England, combining survey data with administrative hospital records. Second, this paper identifies key factors driving current trends of inequality of opportunity in mental and physical health among millennials, currently the largest living adult generation. Third, this research explores the extent to which differences in the use of healthcare are attributable to childhood socioeconomic characteristics (e.g., adolescent lifestyle and behaviour) by quantifying their relative contributions to total inequality of opportunity. Our findings contribute to more targeted and effective policies aimed at reducing health disparities during adolescence, a critical stage of an individual's life cycle.

2. Background

2.1. Previous literature

Adolescent health inequalities are often overlooked as the literature has traditionally focused on either newborns or adults (Currie et al., 2009). Previous research indicates that health disparities based on socioeconomic status often emerge during early childhood, might decrease during adolescence, and resurface in adulthood (West et al., 2004; Noonan, 2019). Education systems and welfare policies may play a significant role in reducing health inequalities during late childhood (Reiss, 2013). Another strand of research has found a consistent socioeconomic gradient in health throughout an individual's lifespan, including adolescence (Starfield et al., 2002; Rod et al., 2023).

There is growing interest in adolescent mental health, especially after the COVID-19 pandemic and the resulting lockdowns (UNESCO, 2020). Although mental health is a leading cause of illness among children, there is still a lack of evidence about the childhood circumstances that contribute to it (WHO, 2021). Previous studies suggest that childhood socioeconomic status is a significant predictor of mental health issues among young people worldwide (Ravens-Sieberer et al., 2008). In the US, McLaughlin et al. (2011) show a positive correlation between childhood financial hardship and mental disorders. Similarly, Davis et al. (2010) find that low family income is strongly correlated with worse children's mental health in Australia. This paper focuses on England as evidence shows that mental health disparities among children are increasing (Elgar et al., 2015), with one of the highest rates of mental health problems among children compared to their peers in Europe (Jessiman et al., 2021).

Equality of opportunity has emerged as an important framework for distributive justice (Donni et al., 2014). As part of this approach, inequalities related to factors that are beyond an individual's control, such as place of birth, are often considered unfair (Fleurbaey et al., 2013). Previous studies have used this framework to examine the ex-ante inequality of opportunity in health. For instance, Davillas et al. (2020) find that inequality of opportunity depends on factors such as parental education and occupational status. This paper builds on and contributes to this previous literature by identifying childhood socioeconomic circumstances that explain inequalities of opportunity in health and healthcare utilisation among millennial adolescents. This framework helps us emphasise the role of individual responsibility in determining the 'fair' distribution of health (and healthcare) outcomes (Ramos et al., 2016).

2.2. Social determinants of adolescents' health and healthcare utilisation

Young people experience substantial physical, psychological, and behavioural changes from adolescence into adulthood (Casey et al., 2010). During this transition, key socioeconomic circumstances may uniquely affect their health trajectories with long-term consequences on health and health inequalities (Gilman et al., 2002). Adolescents learn social and emotional behaviours during this stage of life, helping to shape good physical and mental health, problem-solving and interpersonal skills. Childhood circumstances can also affect health and healthcare inequalities among adolescents (Bartley, 2016). For instance, exposure to material risk factors, such as poor housing, inadequate diet, harsh parenting, and financial hardship, could exacerbate inequalities in health (Gibson et al., 2011). Psychosocial factors may also contribute to adolescents' health, including exposure to peer pressure and self-discovery. Social and economic factors also play an important role in creating health disparities among young people (Reiss, 2013). However, young individuals normally have less economic power as they are still in education and generally out of the labour market. Therefore, family socioeconomic status is often used as an indicator of adolescents' socioeconomic status (Currie et al., 2009).

In England, all residents are eligible for free healthcare in public

hospitals funded by the National Health Service (NHS). Primary care services serve as the first point of access to most healthcare and are provided by general practitioners. Healthcare utilisation is primarily determined by the need for services, availability of services, and resource provision. Despite being generally free at the point of use for most services, disparities in the use of certain hospital services may still arise due to socioeconomic status (Rod et al., 2023; Propper, 2022). For instance, unplanned A&E visits for patients aged 15–18 have increased significantly from 610,983 in 2020–2021 to 986,680 in 2022–2023. This increase is primarily driven by those at the lower end of the income distribution, according to the Emergency Care Dataset report (NHS England, 2023). Disparities in unplanned healthcare services in a universal healthcare system may suggest that outpatient services might not fully meet the population's healthcare needs, potentially leading to an increase in emergency visits (Cecil et al., 2016). This paper aims to measure and decompose income-related inequalities in health and healthcare utilisation among millennials using novel cohort data in two stages of adolescence and state-of-the-art methods in the health inequality literature.

3. Data

Data from the cohort study Next Steps are used in this paper (Calderwood et al., 2016). Next Steps follows the lives of a group of around 16,000 individuals born in England between 1989 and 1990. The study began in 2004, and annual interviews were conducted between 2004 and 2010 with participants (aged between 14 and 20 at the time) and their parents. The study re-started in 2015 when participants turned 25 years old, including the linkage to their hospital administrative records. This survey also involves questions answered directly by the participant's parents, allowing us to observe a rich set of parental and household characteristics. This paper uses two repeated cross-section waves (waves 2 and 4), one when the participants were aged between 14 and 15 in 2005 and a second wave when they were aged between 16 and 17 in 2007, including a total of 13,539 and 11,801 individuals, respectively. We exploit these two waves to obtain information about millennial adolescents' psychosocial development at two different stages of adolescence: 14–15 (middle adolescence) and 16–17 (late adolescence).

We also use administrative hospital records for Next Steps participants provided by the UK Hospital Episode Statistics (HES) (Kerry-Barnard et al., 2020). Specifically, 4895 of the 7707 people who were included in Next Steps in 2015 (wave 8) agreed to retrospectively link their hospital records, with a consent rate of 63.5%. A total of 4679 participants were successfully matched with their hospital records, corresponding to a 93.5% success rate. Appendix AA1 provides further details on the linkage process using information available from Kerry-Barnard et al. (2020). While the HES database contains information about all hospital admissions in England, this paper examines two types of hospital care: accident and emergency (A&E) and outpatient (OP) services. The data supplied by NHS Digital comprises the earliest years for which information was accessible and includes variables such as the number of diagnoses, types of treatments, treatment length, waiting times and geographical location. In this paper, we use hospital records of Next Steps' participants at ages 16–17 (i.e., from the fiscal year 2007–2008). The number of observations varies depending on the utilisation of the specific healthcare services. Appendix AA2 includes specific information on the distribution of waiting times as well as HES raw data for the general population.

Since attrition can still be a concern even when using cohort data as cross-sections, for instance when there are changes between cross-sections in time-invariant factors (e.g. ethnicity, biological sex, birth weight, mother's circumstances around birth) potentially affecting sample composition, we used two types of weights provided by Next Steps. More specifically, Next Steps provides composite weights combining both design and attrition weights to balance sample composition, considering oversampling and the characteristics of the boosted sample (included in wave 4 of Next Steps). Design weights are developed to balance the sample composition, while attrition weights are created using logistic models that predict the probability of responses in waves 2 and 4 as compared to wave 1. These models control for several covariates from wave 1 (e.g., socioeconomic characteristics of parents and respondents) and respondents' circumstances in the wave of analysis (such as young people's plans for education). The binary dependent variable in these models takes a value of one if a participant responds and zero if they do not (i.e., they drop from the survey). In addition, Multiple Imputation models were employed to handle missing values caused by non-monotone non-response or item nonresponse. The predicted linear values were then transformed into probabilities using an inverse logit transformation, following Jones et al. (2006); Wooldridge (2007). As a result, each Next Steps' wave (w) contains a final weight that takes the following form:

$$Final\ weight_w = Design\ weight_w * Attrition\ weight_w$$

Following Calderwood et al. (2021) and Department for Education (2011), our analyses use final weights to make them representative of the national population. In addition to using these weights provided by Next Steps, we have also estimated logit response/linkage models for waves 2, 4 and 8, and corresponding results can be found in Appendix AA3 (Tables AA3.1 and AA3.2), along with further details on how these final weights are created. We note that the attrition weights' effectiveness depends on including the most relevant covariates associated with non-response and the plausibility of the missing at random assumption during the multiple imputation process.

3.1. Health and healthcare measures

A General Health Questionnaire (GHQ-12) index and a variable capturing living with disability or long-term illness (classified according to the Disability Classification Equality Act, 2010) are used to capture adolescent health status at ages 14–15 and 16–17.

The GHQ-12 Likert scale is used as a continuous index ranging from 0 (lowest psychological distress) to 12 (highest psychological distress). A binary variable based on the GHQ score with a cut-off of 4 and higher is also defined as taking values of one, reflecting a clinically significant level of distress (Imo, 2017), and zero otherwise. The twelve GHQ components are used as different binary dependent variables (see Appendix B). For these twelve variables, two categories representing higher levels of depression are coded as one, while other two categories representing better mental health are coded as zero. Second, a binary variable capturing long-standing illness or disability is used. This variable takes a value of 1 when respondent report having any long-standing physical or mental impairment, illness or disability that troubles them for at least 12 months and 0 otherwise.

The following outcome variables for the emergency hospital services are created. First, the number of visits per patient and year; the duration (in minutes) between the patient's arrival and the start of their treatment; the duration (in minutes) between the patient's arrival and conclusion of their visit or treatment (whichever is later); the duration (in minutes) between the patient's arrival and the time the A&E visit has concluded, and the department is no longer responsible for the care of the patient. For outpatient hospital care, the following outcome variables are built: number of appointments per patient and fiscal year and a binary variable indicating whether or not a patient attended an appointment. The utilisation of the following specific outpatient hospital services are included in the analysis: mental health care; obstetrics, sexual and reproductive care; and orthodontic health care (see Appendix C for further details). These specific outpatient services are analysed as they are in higher demand among young and often healthier patients (Sawyer et al., 2012; Rolland et al., 2016).

3.2. Deprivation and background variables

An area-based measure of income deprivation is used as a ranking variable in the analyses. In particular, this paper uses the IDACI (Income Deprivation Affecting Children Index), an index measuring the proportion of children aged 0 to 15 living in income-deprived families by Lower-Layer Super Output Area (LSOA) – including parents of these children who are out of work and with low income (Gill, 2015). The LSOAs are one of the smallest geographical areas in the UK used for census statistics, covering between 400 and 1200 households. The IDACI score is ordered from the least to the most income-deprived areas, and it is observed across time for each individual.

Our decomposition analysis uses information regarding household, parental, and individual characteristics. Following the recent literature (Carrieri et al., 2020; Davillas et al., 2020), factors related to physical and mental well-being at individual, household, and regional levels are included. These factors cover aspects of adolescents' lifestyles, health behaviours, parental socioeconomic status, household characteristics and regional differences. The analysis includes a broad range of pre-existing circumstances to understand the factors that influence adolescents' health inequalities. These circumstances are recorded between birth and adolescence and provide insights into the policy debate around socioeconomic inequalities. Previous literature and data availability are used to choose the circumstances used in our analysis, though it should be noted that there is no universal agreement on these (Carrieri et al., 2020; Davillas et al., 2020).

We use a set of individual-level covariates, such as biological sex, ethnicity (non-white vs white), and young carer (defined as whether the participant ever reports regularly providing unpaid care to a family member). Individual-level pre-existing circumstances include nursery school (whether the participant attended a nursery school/pre-school class), birth weight, pre-term birth, and whether the mother returns to work shortly after delivery. For health-related lifestyle, the following covariates are included: a social life indicator (whether the participant has been to any social event during the last 4-weeks), attitude towards school, a bullying indicator (whether the participant experienced bullying at school), playing any instrument, reading (whether the participant has mentioned reading for pleasure at least once per week), TV hours (hours that participants spend watching TV), sport (whether the participant practices any sport at least once a week), cannabis (whether the participant ever tried cannabis), alcohol (whether the participant has ever had an alcoholic drink), and cigarettes (whether the participant has ever smoked cigarettes).

Parental socioeconomic status is defined using parental social class. This is measured using the National Statistics Socio-Economic Classification (NS-SEC), which is based on types of occupations (Rose et al., 2005). Our analysis includes parental education (educational attainment of the main parent); the age of the main parent; cohabitation status (whether the main parent's cohabitation status is single, separated, divorced, or widowed); and parental disability indicator (whether the participants' main parent has any disability limiting work). Following the previous literature on the association between living standards and children's health, the following household characteristics are included: single household (whether a participant has lived in a single-parent family at least once during their childhood), household income (as a total annual amount of benefits plus gross annual salaries of both parents), the number of siblings, housing tenure (whether the participants' house is owned outright or via a mortgage/bank loan), having internet access, and living in a non-English speaking household.

Nine dummies corresponding to the Government Office Regions (GORs) for England are included to explore regional mental and physical health differences. The GOR is the highest regional classification level in the UK and is used to examine regional differences in health status at an aggregate level. A rural indicator variable defined as living in a non-urban area is included ($\leq$10,000 population and less sparse). More information about these variables can be found in Appendix AA.4, Table AA4.1.

4. Methods

4.1. Concentration index

Concentration indices (CI) measure inequality in one dependent variable relative to the distribution of another ranking variable (Kakwani, 1977) and are commonly used to measure socioeconomic-related health inequality. They can also be illustrated graphically using concentration curves showing differences in the proportional share of, for example, healthcare utilisation across socioeconomic groups (see Appendix AD.1).

A CI uses a dependent variable (y, health status or healthcare utilisation variables) and a ranking (R) variable (IDACI). Therefore, when calculating the concentration index, the rank variable orders people by an area-based measure of income deprivation (IDACI), placing the poorest (highest index score) individuals at the top of the rank distribution. The index defines levels of inequality based on the proportion of people in ill-health within the distribution of the ranking variable (IDACI). For instance, if the highest proportion of psychological distress is concentrated among the poorest individuals, a positive value is calculated, indicating "pro-poor" inequality. Conversely, if the wealthiest adolescents present the largest proportion of psychological distress, a negative value is computed, indicating "pro-rich" inequality. The CI ranges from -1 (perfect pro-rich inequality) to $+1$ (perfect pro-poor inequality).

Following previous studies (Van Doorslaer et al., 1999), the CI can be shown as:

$$CI = \frac{2}{N\bar{y}} \sum_{i=1}^{N} y_i R_i - 1 \tag{1}$$

where y_i indicates the dependent variable of interest (e.g., psychological distress); $\bar{y}$ represents its means and R_i refers to the fractional rank of each individual across the income deprivation index distribution. Here, $i = 1$ for the individual at the bottom of the distribution (the richest in the sample) and $i = N$ for the individual at the top (the poorest in the sample).

It is important to consider the bounds of the dependent variables to accurately assess their values and attributes (Erreygers, 2009). Since most of the dependent variables in this paper are dichotomous, we normalise these variables on a scale between -1 and 1. Here, we prefer using Erreygers' normalisation rather than Wagstaff's, as the latter may lead to greater socioeconomic disparities when the relative differences between individuals' health are low. The Erreygers (2009) corrected concentration index (CCI) is computed as:

$$CCI_n = \frac{CI}{1 - \bar{y}} \tag{2}$$

Note that some of the healthcare use variables (and the GHQ-12 Likert) are measured on a continuous scale, and thus a Generalized Concentration (GC) index (Wagstaff et al., 1991) is implemented and can be expressed as:

$$GC\,(h|y) = \frac{1}{n} \sum_{i=n}^{n} \{h_i(2R_i - 1)\} \tag{3}$$

where $(2R_i - 1)$ represents the fractional rank that varies between $\overline{h}\{(1-n)/n\}$ (maximal pro-poor) and $\overline{h}\{(1-n)/n\}$ (maximal pro-rich). It is important to note that while the GCI is a measure of absolute inequality, the CCI is a measure of relative inequality. Results are stratified by biological sex, following previous studies finding sex disparities in health inequalities (Zhang et al., 2004). We also measure unmet healthcare needs using administrative health records for emergency and outpatient hospital services among this cohort of individuals

aged 16–17. Although the concept of healthcare needs is complex and subject to different interpretations, our study defines unmet needs as the presence of socioeconomic inequalities in healthcare utilisation among individuals with a perceived need for these services. We do so by restricting our sample to adolescents who report a long-standing health condition, following the strategy proposed by Davillas et al. (2021).

4.2. Decomposition analyses

The Shapley decomposition approach is used to determine the factors that are most strongly linked to overall inequality of opportunity in health. To compute the Shapley value, the first step is to estimate a value for inequality of opportunity (De Barros et al., 2009). In this case, an ex-ante inequality of opportunity approach is adopted, as suggested by Fleurbaey et al. (2013). This approach measures the overall inequality of opportunity as a proportion of total inequality and focuses on inequality in the distribution of average outcomes based on observed circumstances.

The regression-based approach measures *ex-ante inequality of opportunity* based on $E(y_i|C_i)$, where y_i is the health outcome for individual (i), C_i is a vector of circumstances, and it is estimated by ordinary least-squares (OLS). A probit model estimates the conditional probability function and produces counterfactual predictions conditional to a series of factors (as defined in Section 3.2.). Then, inequality of opportunity (IOp) is measured using a dissimilarity index, previously used to analyse inequalities when dependent variables are binary (Juárez et al., 2014):

$$IOp(.) = \frac{2}{n\bar{y}} \sum_{i=1}^{n} |\tilde{y}_i - \bar{y}| \tag{4}$$

Here, a probit model produces the predicted sample proportions $\tilde{y}_i$. The Shapley-Shorrocks decomposition (Shorrocks, 2013) is implemented by using the estimated inequality dissimilarity index and averaging the marginal contribution of each circumstance. Shapley decomposition satisfies two important properties: it is order-independent and each circumstance contributes equally to inequality of opportunity. Given that $D(n)$ is the dissimilarity index for the set of n circumstances, the role of circumstances n to $D(n)$ is:

$$S_c = \frac{\Delta D_c}{D(n)} \tag{5}$$

Where $\sum_{i \in C} S_i = 1$ and D_c is the dissimilarity index for a circumstance (c). This results in an additive decomposition of the dissimilarity index that measures the contribution of each circumstance (Fajardo-Gonzalez, 2016). The dissimilarity index ranges from 0 to 1, where 0 indicates the presence of equal opportunity. To make sure the sample is representative of the UK population, all regressions are weighted using survey weights, addressing non-response and dropout (attrition bias). As a robustness check, we used different covariates in various specifications. Specification 1 solely includes individual and regional inequalities, while Specification 2 further augments the model with lifestyle and health behaviour indicators. A set of household, parental and regional indicators are included in Specification 3. We do this as lifestyle, school experiences, and health behaviour may be endogenous with respect to the dependent variable. Results can be found in Appendix AD.2.

5. Results

5.1. Descriptive analysis

Table 1 displays descriptive statistics for background, health status, and healthcare variables by age group, covering two stages of adolescence: 14–15 (middle) and 16–17 (late). Although there are limited differences between the two age groups, 16-17-year-old adolescents tend to report worse mental health. As for the use of healthcare, we

Table 1
Summary statistics for background variables.

	Age 14–15 (2005)		Age 16–17 (2007)	
	Mean	Std. dev.	Mean	Std. dev.
Adolescent-level and pre-circumstances characteristics				
Non-white[a]	0.133	0.340	0.128	0.334
Female[a]	0.491	0.499	0.491	0.499
Young carer[a]	0.051	0.221	0.044	0.205
Born outside the UK[a]	0.048	0.215	0.045	0.209
No attend a nursery or pre-school[a]	0.165	0.371	0.161	0.367
Mother age at birth[a]				
Under 20	0.066	0.248	0.064	0.246
20-24	0.243	0.429	0.244	0.429
25-29	0.353	0.429	0.352	0.477
30-34	0.238	0.426	0.237	0.425
35+	0.098	0.297	0.099	0.299
Birth weight in kilos [0.33–6.12]	3.323	0.595	3.326	0.592
Number of weeks birth was early [0–17]	0.755	1.695	0.756	1.696
Any disability or long-standing illness[a]	0.148	0.356	0.145	0.279
Mental (ill-) health index (GHQ12) [0–12]	1.717	2.555	2.018	2.708
Mother return to work after birth[a]				
No	0.172	0.378	0.172	0.377
Mother returned to work full-time	0.348	0.476	0.343	0.474
Mother returned to work part-time	0.479	0.499	0.483	0.499
Total time main parent has been unemployed and seeking work since birth (in months)	1.311	10.266	1.300	10.306
Lifestyle and (health) behaviours				
Social life (amusement arcade; pub/bar; dance/party; cinema)[a]	0.758	0.428	0.865	0.341
Risk factors [0–12]	1.318	1.724	1.491	1.763
Positive attitude toward school[a]	0.641	0.479	0.652	0.476
Experience bullying[a]	0.388	0.487	0.493	0.499
Play an instrument[a]	0.203	0.402	0.189	0.391
Reading for pleasure at least once per week	0.714	0.451	0.713	0.452
TV[a]				
None or less than an hour	0.205	0.404	0.202	0.402
1–3 h	0.633	0.481	0.636	0.481
4–6 h	0.144	0.351	0.145	0.352
7 h or more	0.014	0.121	0.015	0.123
Number of hours playing computer games[a]	1.767	1.309	1.772	1.307
Sports at least once per week[a]	0.772	0.419	0.555	0.496
Whether ever tried cannabis[a]	0.207	0.405	0.380	0.485
Whether ever had proper alcohol drink[a]	0.674	0.468	0.849	0.357
Whether ever smoke cigarettes[a]	0.217	0.412	0.274	0.446
Parental-level characteristics				
Parental Education[a]				
Degree or Higher Education	0.343	0.474	0.343	0.474
A-level	0.248	0.431	0.244	0.429
GCSE	0.410	0.491	0.404	0.490
Low or no education	0.411	0.499	0.394	0.488
Parental occupational status[a]				
Managerial	0.481	0.499	0.455	0.498
Intermediate or technical	0.438	0.496	0.407	0.491
Routine occupation or not currently working	0.491	0.499	0.565	0.495
Age main parent	43.194	5.984	45.26	6.075
Non-cohabiting main parent[a]	0.275	0.446	0.318	0.465

(*continued on next page*)

Table 1 (*continued*)

	Age 14–15 (2005)		Age 16–17 (2007)	
	Mean	Std. dev.	Mean	Std. dev.
Not good general health main parent[a]	0.128	0.335	0.126	0.332
Any disability limiting work main parent[a]	0.135	0.342	0.135	0.342
Household-level characteristics				
Single family for at least one month[a]	0.416	0.493	0.408	0.491
Household income per capita	7276.205	35,960.34	7767.779	39,127.77
Number of siblings[a]	1.455	1.109	1.423	1.150
Owned outright or mortgage[a]	0.717	0.449	0.721	0.448
Motor vehicle[a]	0.858	0.348	0.858	0.348
Mobile telephone[a]	0.776	0.416	0.851	0.356
Computer[a]	0.913	0.280	0.895	0.305
Access internet from home[a]	0.811	0.390	0.765	0.423
English not spoken at home[a]	0.049	0.216	0.049	0.217
Number of dependent children in household	2.169	1.100	1.782	1.155
Regional differences				
Index of income-deprivation (IDACI)[a]				
IDACI income 1st quintile (most deprived)	0.198	0.399	0.195	0.396
IDACI income 2nd quintile	0.198	0.399	0.192	0.394
IDACI income 3rd quintile	0.205	0.404	0.205	0.404
IDACI income 4th quintile	0.191	0.393	0.195	0.396
IDACI income 5th quintile (least deprived)	0.209	0.407	0.210	0.407
London[a]	0.131	0.338	0.121	0.326
Non-urban area ($\geq$ 10k – less sparse)[a]	0.196	0.397	0.199	0.399
Health measures				
Mental health				
GHQ-12 Likert	1.717	2.555	2.018	2.702
GHQ-12 Caseness $\geq$ 4[a]	0.183	0.386	0.219	0.413
Physical health				
Disability/long-term illness[a]	0.148	0.355	0.085	0.355
Health care measures				
Accident & Emergency (A&E)				
Number of visits per year/ person			1.970	1.493
Duration to treatment (minutes)			91.114	171.093
Duration to conclusion (minutes)			113.483	77.567
Duration to departure (minutes)			116.088	80.345
Outpatient care (OP)				
Number of appointments per year/person	6.907	8.181	7.549	0.192
Not attended nor seen[a]	0.167	0.373	0.192	0.394
Treatment speciality: Mental Healthcare	0.057	0.232	0.041	0.199
Treatment speciality: Orthodontic	0.263	0.440	0.209	0.407
Treatment speciality: Obstetrics, Sexual and Reproductive Health	0.028	0.165	0.116	0.321

Notes: All descriptive statistics are weighted using Wave 2 or 4 final weights (including sample design and attrition weights). The analytical sample in Table 1 consists of 13,539 (at age 14-15, 2005), while the number of observations for health outcomes at age 16–17 (2007) is 11,449. For healthcare records, we have 1072 observations for A&E hospital services in fiscal year 2007–2008. For outpatient care, 3630 observations were recorded in fiscal year 2004–2005 and 3803 observations in fiscal year 2007–2008. For the A&E service, NHS Digital starts collecting data from 2007 to 2008 onwards. *Source:* University College London (2022). SN8681 Next Steps: Linked Health Administrative Datasets (Hospital Episode Statistics), England, 1997–2017: Secure Access, http://doi.org/10.5255/UKDA-SN-8681-1.

[a] Dummy indicators.

http://doi.org/10.5255/UKDA-SN-8681-1

observed an increase in the number of appointments to outpatient hospital care during adolescence. Specifically, the number of appointments to obstetrics, sexual and reproductive healthcare increased from 2.8% at ages 14–15 to 11.6% at 16–17, while mental healthcare and orthodontic care services remained unchanged.

Fig. 1 shows the distribution of key socioeconomic variables by region. Panel A shows that, on average, those with higher total household income in this sample live in the South-East of England. Similarly, Panel B shows that, on average, low social class families live mainly in North England and London. Higher income-related deprivation indices are concentrated in the North-West, Yorkshire and London, as shown in Panel C of Fig. 1. This paper uses an area-based measure of income deprivation to capture adolescents' socioeconomic deprivation since family income, parental education and occupation are affected by missing observations and self-reporting bias.

5.2. Socioeconomic inequality in health

Table 2 presents socioeconomic inequality estimates for mental and physical health measures among millennial adolescents aged 14–15 by biological sex. Statistically significant inequalities are found for long-term illness, especially among males living in an income-deprived area. Koolman et al. (2004) offer a straightforward interpretation of concentration index values. For instance, a concentration index value of 0.10 means that transferring 10% of the ill-health from the poorest half of the population to the richest half would improve overall health. Results from Table 2, Panel B, suggest that approximately 3.7% of the disability rate would need to be redistributed from the poorest half to the richest half of the income-related index distribution to obtain absolute equality in the incidence of disability among millennial adolescents.

Unlike males, income-related deprivation inequality in long-term illness is not statistically significant for females. These differences in income-related inequalities in health across biological sexes are in line with those results found in previous studies (Zhang et al., 2004; Costa-Font et al., 2014). Different patterns are observed for the mental ill-health measures. Results suggest the absence of a deprivation gradient in the distribution of mental ill-health among adolescents aged 14–15. However, one can observe a significant concentration of several components of the mental ill-health index among the better-off (i.e., sleep, strain and overcoming difficulties), while other components seem to be concentrated among the worse-off (i.e., role, decisions and face-up problems).

Table 3 presents the income-related deprivation inequality estimates for adolescents' health at 16–17 years old. Similar patterns for the socioeconomic inequalities in long-term illness among adolescents aged 16–17 are found, i.e., physical health disparities are concentrated among adolescents living in income-deprived areas. We also find statistically significant socioeconomic inequalities in mental ill-health, especially among female adolescents living in less income-deprived areas. Therefore, those female adolescents living in areas with higher income distribution have more psychological distress, including several components of the mental ill-health index such as concentration, sleep, decision-making, strain and overcoming difficulties.

5.3. Socioeconomic inequality in healthcare utilisation

Table 4 presents socioeconomic inequality estimates for measures of healthcare use by biological sex. We find pro-poor inequalities in the number of visits to emergency hospital departments among female adolescents. Similarly, higher waiting times (defined as the waiting time between arrival at the A&E and receiving treatment) are concentrated among male adolescents living in areas where more income-deprived families reside. This result remains statistically significant after replacing the lowest and highest 10% waiting time with their corresponding 10th and 90th percentile values using winsorising method for extreme values (Yale et al., 1976).

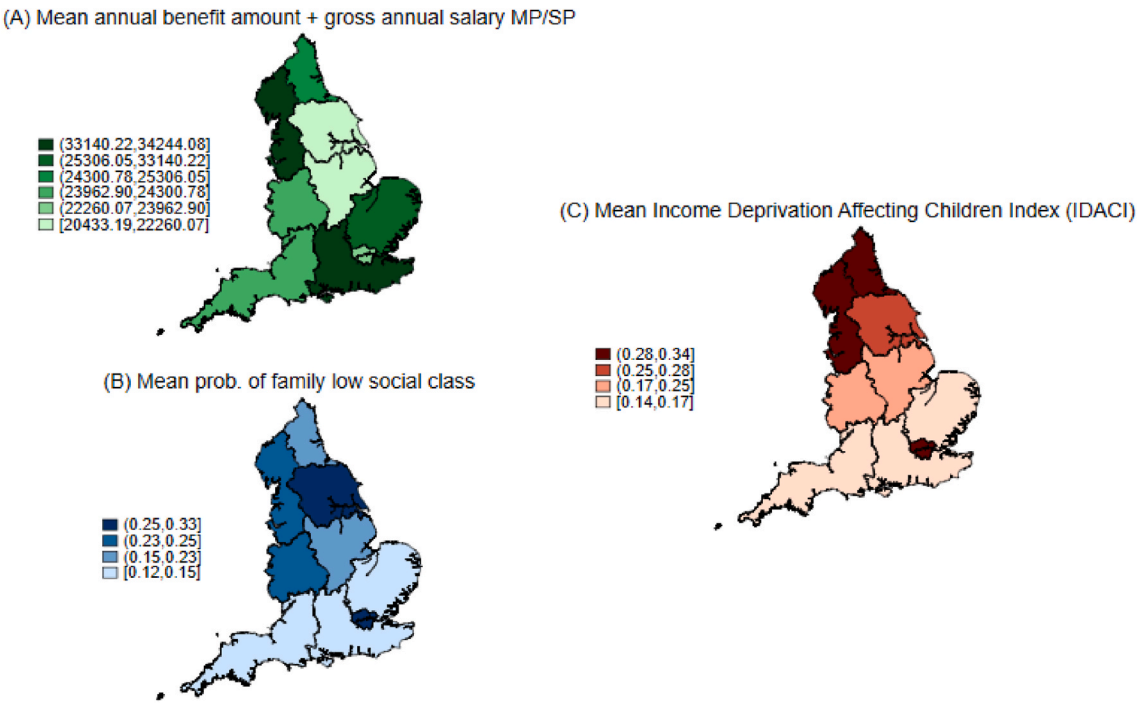


Fig. 1. Socioeconomic key variables by Government Office Regions (GOR)
Notes: Panel (A) shows the mean of the total annual benefit amount plus gross annual salary of MP/SP. Panel (B) shows the mean probability of family NS-SEC social class is defined as routine occupations or never worked/long term unemployed. Panel (C) shows the 2004 IDACI (Income Deprivation Affecting Children Index) score, where higher score means more deprivation (from 0 to 1). The LSOAs comprise between 1000 and 3000 persons and they are one of the lowest regional classification available in the UK.

Table 2
Income deprivation inequalities in health status at age 14-15.

	Males		Females	
	CCI/ GCI[r]	*Standard error*	*CCI/ GCI*	*Standard error*
Panel A. Psychological distress				
GHQ-12 elements				
Concentration	−0.007	0.010	−0.014	0.013
Sleep	−0.021[b]	0.011	−0.007	0.014
Role	0.026[a]	0.008	0.013	0.011
Decisions	0.028[a]	0.007	−0.008	0.009
Strain	−0.070[a]	0.014	−0.103[a]	0.016
Overcoming difficulties	0.008	0.013	−0.024[c]	0.014
Enjoy activities	0.003	0.009	0.005	0.011
Face up problems	0.014[b]	0.008	−0.003	0.011
Depressed	−0.012	0.023	−0.006	0.017
Confidence	−0.016	0.010	−0.001	0.014
Worthlessness	−0.013	0.008	0.021	0.013
Happiness	0.008	0.009	−0.007	0.012
GHQ-12 Likert[e]	−0.019	0.018	−0.048[c]	0.025
GHQ-12 Caseness ≥ 4	−0.002	0.011	−0.017	0.014
Panel B. Disability/long-term illness				
Disability/long-term illness	0.037[a]	0.012	0.006	0.011
Number of observations	6789		6609	

Notes: Robust standard errors clustered by sampling schools. Weighted using final Wave 2 weights.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.10$.
[e] GCI is calculated, a measure of absolute inequality.

Table 3
Income deprivation inequalities in health status at age 16-17.

	Males		Females	
	CCI// GCI	*Standard errors*	*CCI// GCI*	*Standard errors*
Panel A. Psychological distress				
GHQ-12 elements				
Concentration	−0.024[b]	0.011	−0.059[a]	0.014
Sleep	−0.006	0.014	−0.040[a]	0.015
Role	0.029[b]	0.011	0.007	0.012
Decisions	0.017[b]	0.007	−0.030[a]	0.010
Strain	−0.088[a]	0.015	−0.115[a]	0.017
Overcoming difficulties	0.010	0.013	−0.055[a]	0.014
Enjoy activities	0.015	0.012	−0.001	0.013
Face up problems	0.011	0.009	−0.016	0.012
Depressed	0.008	0.023	−0.002	0.018
Confidence	−0.001	0.011	−0.011	0.015
Worthlessness	0.012[c]	0.010	0.016	0.012
Happiness	0.003	0.010	−0.006	0.013
GHQ-12 Likert[f]	−0.001	0.021	−0.083[a]	0.026
GHQ-12 Caseness ≥ 4	−0.001	0.013	−0.041[a]	0.015
Panel B. Disability/long-term illness				
Disability/long-term illness	0.029[a]	0.011	−0.004	0.009
Number of observations	5772		5627	

Notes: Robust standard errors clustered by sampling schools. Weighted using final Wave 4 weights.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.10$.
[f] GCI is calculated, a measure of absolute inequality.

For outpatient care, Table 4 (Panel B) shows systematic pro-rich inequalities in the number of appointments to outpatient hospital care among female adolescents. Similar results are found for the number of appointments to mental health hospital services, where utilisation is concentrated among female adolescents living in areas with the highest income. In the case of orthodontic services, pro-rich inequalities are found among both biological sexes. In contrast, pro-poor inequalities are found in the use of sexual and reproductive hospital services. Results

Table 4
Income deprivation inequalities in healthcare use and waiting times at age 16-17.

	Males		Females	
	CCI/GCI	*Standard errors*	*CCI/GCI*	*Standard errors*
Panel A. Accident & Emergency (A&E)				
Number of visits per year[e]	0.007	0.024	0.134[a]	0.035
Duration to treatment (in minutes)[b]	9.395[b]	3.965	3.962	4.793
Duration to conclusion (in minutes)[e]	2.132	2.622	0.658	1.930
Duration to departure (in minutes)[e]	2.153	2.529	0.969	1.875
Number of observations	528		541	
Panel B. Outpatient care (OP)				
Number of appointments per patient and year[e]	0.369	0.064	−0.665[c]	0.109
Not attended nor seen[d]	0.073[c]	0.024	0.032	0.020
Treatment speciality: Mental Healthcare[d]	0.001	0.010	−0.013[c]	0.013
Treatment speciality: Orthodontic[d]	−0.076[c]	0.023	−0.061[c]	0.019
Treatment speciality: Obstetrics, Sexual and Reproductive Health[a]	0.002	0.002	0.275[c]	0.019
Number of observations	1560		2128	

Notes: The number of individuals who their health records were linked are 3746 and 4099 for A&E and outpatient hospital care, respectively. Robust standard errors in parentheses. *Source:* University College London, UCL (2020). SN8681 Next Steps: Linked Health Administrative Datasets (Hospital Episode Statistics), England, 1997–2017: Secure access. [data collection]. UK Data Service. SN:8681, http://doi.org/10.5255/UKDA-SN-8681-1.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
[d] Dummy indicators. Erreygers' CCI is used for binary outcomes variables.
[e] GCI, a measure of absolute inequality, is computed.

Table 5
Income deprivation inequities in healthcare use and waiting times at age 16-17.

	Males		Females	
	CCI/GCI	*Standard errors*	*CCI/GCI*	*Standard errors*
Panel A: Accident & Emergency (A&E)				
Number of visits per year[a]	−0.054	0.051	0.013	0.055
Duration to treatment (in minutes)[a]	15.491[d]	6.580	11.258[d]	4.648
Duration to conclusion (in minutes)[a]	3.404	2.251	0.378	2.663
Duration to departure (in minutes)[a]	2.002	2.138	2.054	2.470
Number of observations	271		279	
Panel B: Outpatient care (OP)				
Number of appointments per patient and year[a]	0.001	0.090	0.129	0.097
Not attended nor seen[b]	0.005	0.024	0.031	0.023
Treatment speciality: Mental Healthcare[b]	0.026[c]	0.006	0.051[c]	0.011
Treatment speciality: Orthodontic[b]	−0.046[d]	0.023	−0.085[c]	0.019[e]
Treatment speciality: Obstetrics, Sexual and Reproductive Health[b]	0.043[c]	0.010	0.099[c]	0.016
Number of observations	1440		1580	

Notes: Sample of adolescents reporting long-standing health conditions. Robust standard errors in parentheses. *Source*: University College London, UCL Institute of Education, Centre for Longitudinal Studies, NHS Digital. (2020). SN8681 Next Steps: Linked Health Administrative Datasets (Hospital Episode Statistics), England, 1997–2017: Secure access. [data collection]. UK Data Service. SN:8681, http://doi.org/10.5255/UKDA-SN-8681-1.
[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
[d] GCI is calculated, a measure of absolute inequality.
[e] Dummy indicators. Erreygers' CCI is used for binary outcomes variables.

also show pro-poor inequalities in the probability of not attending outpatient hospital appointments, suggesting that adolescents living in income-deprived areas are more likely to cancel or not attend their medical appointments.

Table 5 shows findings after adjusting for healthcare needs by restricting our sample to adolescents reporting long-standing health conditions. Here, we find that socioeconomic inequities in emergency and outpatient hospital visits are no longer significantly different from zero. This implies that conditional on healthcare needs, inequities in the use of emergency and outpatient hospital care seem to disappear. However, systematic pro-poor inequities are found in waiting times to treatment for both sexes. Moreover, pro-rich inequities are found in the use of orthodontic care, while pro-poor inequities are present in the use of mental and sexual/reproductive healthcare services among millennial adolescents aged 16–17.

5.4. Decomposing inequalities of opportunity in health and healthcare utilisation

Table 6 presents the results for the Shapley-Shorrocks decomposition of inequality of opportunity in health and healthcare use. The dissimilarity indices presented in Table 6 Column (1) are about 9% for long-standing illness among male adolescents and 23% for mental ill-health among female adolescents. Dissimilarity indexes are presented and defined as the percentage of overall opportunities that need to be redistributed from the healthiest to the least healthy to achieve perfect equality of opportunity. Panel B shows the Shapley-Shorrocks decomposition of the modified dissimilarity index. The decomposition results for long-standing illness among male adolescents reveal that lifestyle, school experiences, health behaviours, and parental ownership present the largest contributions to the dissimilarity index (22.44%, 24.48% and 11.90%, respectively). Likewise, the decomposition results for mental ill-health among female adolescents show that lifestyle, school experiences, health behaviours and parental socioeconomic status are the largest contributors to the dissimilarity index (37.14%, 25.81% and 10.34%, respectively).

Table 6 Column (2) reports dissimilarity indices of 32.1% for visiting more than once per year A&E hospital services and 23.5% for more than three appointments to the outpatient hospital services when the complete set of circumstances is included. In other words, 32.1% (23.5%) of total opportunities would need to be reallocated from those who use more emergency (outpatient) hospital services to those who use these services less frequently to attain equality of opportunity. The index decomposition results show that regional differences (19.26% and 28.58%) and parental SES (23.48% and 16.43%) are the leading circumstances influencing the value of the inequality of opportunity in the use of healthcare (emergency and outpatient hospital services, respectively) among adolescents in England. Fig. 2 visually shows the Shapley-Shorrocks decomposition values.

As a robustness check, we provide an additional set of results that includes these circumstances in different specifications. Specification 1 only includes individual and regional circumstances, while Specification 2 further augments the model with lifestyle and health behaviours' indicators for each outcome variable. We can see that lifestyle, school experience, and health behaviours are important factors in understanding inequality of opportunity in health, but they do not contribute substantially to healthcare utilisation equality. Tables AD2.1 and AD2.2 in Appendix AD.2 present the additional sets of results. We also report the statistical significance of each circumstance by outcomes and

Table 6
Dissimilarity indices and decomposition of inequality of opportunity in health and healthcare use at age 16-17.

	Health status (1)				Healthcare utilisation (2)			
	Long-standing illness or disability in *males*		Mental ill-health in *females*		A&E: More than one visit per year		OP: More than three appointments per year	
Panel (A). Inequality of Opportunity								
	Absolute inequality							
Dissimilarity Index	0.275 (0.009)		0.201 (0.012)		0.160 (0.030)		0.088 (0.015)	
Modified dissimilarity index	0.090 (0.022)		0.230 (0.010)		0.321 (0.016)		0.235 (0.006)	
Panel (B). Shapley-Sharrock decomposition of circumstances to IOp								
	Shapley value	*%*	*Shapley value*	*%*	*Shapley value*	*%*	*Shapley value*	*%*
Demographics (non-white ethnicity; young carer)	0.002	1.74	0.007	3.35	0.016	5.02	0.015	6.41
Regional dummies (GOR) and rural indicator	0.009	9.86	0.029	12.46	0.061	19.26	0.067	28.58
Pre-circumstances between birth and nursery age	0.007	8.53	0.005	2.38	0.024	7.54	0.028	12.24
Individual-level characteristics								
Lifestyle and school experiences	0.020	22.44	0.085	37.14	0.028	8.71	0.023	9.95
Health behaviour-related	0.022	24.48	0.059	25.81	0.043	13.41	0.008	3.36
Parental-level characteristics								
SES – educational and occupational status	0.005	5.91	0.023	10.34	0.075	23.48	0.039	16.43
Demographic characteristics	0.006	6.64	0.012	5.24	0.025	7.96	0.015	6.69
Ownerships	0.011	11.90	0.002	0.80	0.019	5.92	0.005	2.39
Household-level characteristics								
Household income	0.001	0.73	0.001	0.36	0.012	3.97	0.001	0.27
Type of family and number of siblings	0.007	7.76	0.004	2.09	0.015	4.73	0.030	13.66
Number of observations	4704		4286		697		2515	

Notes: Bootstrapped standard errors in parenthesis (500 replications). Weights are used to correct for any potential attrition and design bias. *Source:* University College London, UCL (2020). SN8681 Next Steps: Linked Health Administrative Datasets (Hospital Episode Statistics), England, 1997–2017: Secure access. [data collection]. UK Data Service. SN:8681, http://doi.org/10.5255/UKDA-SN-8681-1.

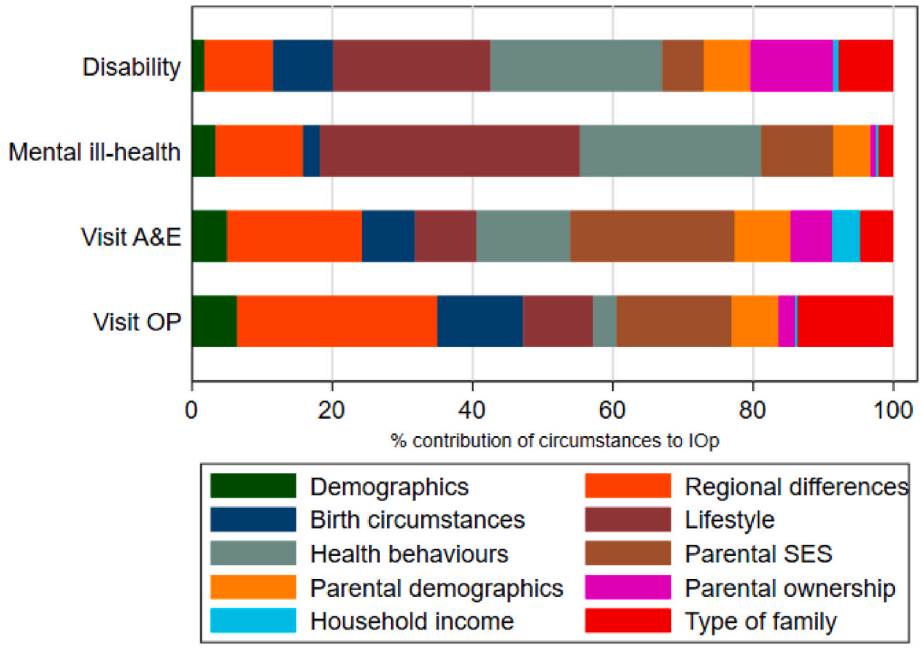


Fig. 2. Shapley-Shorrocks decomposition of circumstances to inequality of opportunity.
Source: SN8681 Next Steps: Linked Health Administrative Datasets (Hospital Episode Statistics), England, 1997–2017: Secure access. [data collection]. UK Data Service. SN:8681, http://doi.org/10.5255/UKDA-SN-8681-1.

specifications. Tables AD2.3 and AD2.4 present the estimated parameters of the inequality of opportunity regressions. Here, one can see the most relevant contributing variables – lifestyle, school experiences, health behaviours and parental SES for health outcomes and regional differences and parental SES for healthcare utilisation– are statistically significant. This indicates that addressing these adolescent circumstances may help to reduce inequality of opportunity in health and healthcare use. Finally, we estimate socioeconomic inequalities in waiting times for emergency departments using winsorising methods to reduce the number of outliers in our sample (see Appendix AD3).

6. Discussion & conclusions

This study uses administrative hospital records from the UK Hospital Episode Statistics linked with childhood socioeconomic information from the Next Steps study to quantify and decompose various measures of inequality in health and healthcare utilisation among millennial adolescents. We use corrected concentration index and Shapley-Shorrocks decomposition techniques to estimate income-related inequalities in health and healthcare use at two different stages of adolescence. We also measure the relative contribution of childhood circumstances to

inequality of opportunity in adolescents' health and healthcare use.

This study finds that income-related deprivation inequalities in long-term illness are concentrated among males aged 14–15 and 16–17 at the bottom of the income distribution. However, statistically significant inequalities for adolescents' mental-ill health only emerge among female adolescents aged 16–17 living in the most affluent areas. We also find socioeconomic inequalities in the use of healthcare, revealing a higher number of visits to emergency departments concentrated among adolescents living in income-deprived areas. In contrast, outpatient medical services are used mainly by adolescents living in less income-deprived areas. Concentration indices for emergency and outpatient hospital visits are no longer statistically different from zero after adjusting for healthcare needs, implying equity between adolescents with similar needs. There are still inequities favouring the wealthy when it comes to waiting times for emergency care and some outpatient specialties, such as mental health and orthodontic hospital care. This suggests that the principle of providing equal healthcare services to all citizens, based on their level of healthcare needs (as defined by Cookson et al., 2016), may not be upheld in the context of these specific outpatient hospital care services.

The decomposition analysis stresses the role of different childhood socioeconomic circumstances and their contributions to inequality of opportunity in health and healthcare utilisation. The most relevant contributors to inequality of opportunity in adolescents' health are their lifestyle, school experiences (e.g., attitude toward school, playing an instrument), health behaviours (e.g., practising sports, consuming alcohol), and parental home ownership. In contrast, regional and parental socioeconomic characteristics are the leading factors influencing the inequality of opportunity in the use of healthcare.

This study has some limitations. Firstly, it does not aim to establish a causal link between childhood socioeconomic circumstances and health and healthcare use. However, the results quantify the relative importance of childhood circumstances affecting inequality of opportunity in health and healthcare use among millennial adolescents (Ferreira and Gignoux, 2014). Secondly, whereas we accounted for potential selection and attrition in our data using appropriate weights, there may still be concerns regarding the external validity of findings when using administrative hospital records linked to survey data, as they only include healthcare users. Thirdly, although our measure of deprivation is based on an area-based index of income deprivation capturing the proportion of all children aged 0 to 15 living in income-deprived families, there might still be wealthy households residing in economically disadvantaged neighbourhoods, or relatively poor households residing in affluent areas, and so caution may be needed when interpreting the results. Finally, whereas there is no consensus on the social determinants driving children's health, this analysis employs observable circumstances previously identified in the literature as important drivers of health inequalities. We are aware that, depending on the specification, some of the variables used to define circumstances might be considered endogenous with respect to the dependent variable. Still, our inequality of opportunity approach satisfies important properties in the light of providing robust estimates, including order independence, and that each circumstance contributes equally to inequality of opportunity.

Adolescents and young people are among the most vulnerable population sub-groups. Addressing socioeconomic inequalities during adolescence can significantly improve long-term health status and reduce individual and societal costs. Our findings may help policymakers create targeted policies by providing new evidence on key socioeconomic factors contributing to socioeconomic inequalities in health and in the use of healthcare among millennial adolescents.

CRediT authorship contribution statement

Mario Martínez-Jiménez: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Bruce Hollingsworth:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Eugenio Zucchelli:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.116961.

Ethics approval not required.

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