Exploring the effects of socioeconomic inequalities on health and disability in Northern Irish adolescents: Evidence from a nationally representative longitudinal study

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Abstract

Although a negative association between socioeconomic inequalities and health has been established, there is a dearth of robust longitudinal studies examining this relationship in adolescents. This study used a large, nationally representative longitudinal dataset to investigate the association between socioeconomic inequality, subjective health status, and disabilities among young people in Northern Ireland over a 10-year period. Data were from the Northern Ireland Longitudinal Study, a Census-based record linkage study (N=46,535). Logistic regression models were estimated in which health and disability variables from the 2011 Census were predicted by household deprivation in education, housing quality, housing tenure and employment from the 2001 Census. Models were adjusted for health and disability status in 2001. Deprivation in employment, housing tenure and coming from a single parent household in 2001 independently predicted poorer subjective health and disability status 10 years later [ORs = 1.28-1.93]. Deprivation in education in 2001 was also associated with increased risk of disability in 2011 [OR = 1.15; 95% CI = 1.06-1.25]. These results show that there is a need to dedicate more resources and support for economically disadvantaged children and young people in Northern Ireland, where child health outcomes are poorer than in the rest of the UK.

Keywords Socioeconomic status, health, disability, adolescents, inequalities, prospective data analysis

Introduction

There has been much attention given to the relationship between early life socioeconomic disadvantage and poorer health outcomes and disability in population health research. This association has been demonstrated across various objective and subjective measures, in both adults and children (Darin-Mattsson et al., 2017, Kivimäki et al., 2020, Nobles et al., 2013, Béatrice et al., 2012, Doebler and Glasgow, 2017). It is only recently that researchers have begun to focus on the impact on adolescent health, recognising the long-term implications of health inequality during this critical phase (Currie and Alemán-Díaz, 2015, Quon and McGrath, 2014, Hagell et al., 2018).

The majority of studies have considered this association using cross-sectional data (Cundiff and Matthews, 2017, Spencer et al., 2015). In a systematic review and meta-analysis of studies exploring the link between socioeconomic disadvantage and childhood disabling chronic conditions in high-income countries, 90 out of 160 identified studies were cross-sectional while only 25 were cohort studies (Spencer et al., 2015). The remainder were based on routine data (Aittomäki et al., 2012), or were case–control (Ahlborg et al., 2017) or register-based studies (Hagell et al., 2018). While findings suggested an association between disabling chronic conditions and social disadvantage, the authors pointed to a need for quality longitudinal studies to address questions of causality and mechanism. In addition, few studies employing longitudinal data have taken health or disability status at baseline into account (Blackburn et al., 2013), meaning it is difficult to rule out reverse causality; i.e. chronic health conditions/disability leading to poorer socioeconomic status (SES).

In order to investigate the association between socioeconomic inequality, subjective health status, and disability in Northern Irish adolescents, the present study used data from a nationally representative longitudinal study. We investigated the association between four indicators of household-level socioeconomic deprivation in a sample of children aged 9 years or less included in the 2001 Census and their health and disability outcomes ten years later. We included Census indicators of health and disability from 2001 as covariates in our analyses, allowing us to control for baseline health and disability status.

Methods

Data

The Northern Ireland Longitudinal Study (NILS) is proportionally the largest longitudinal cohort study in the UK, covering 28% of individuals enumerated in the NI Census (O'Reilly et al., 2012). The NILS draws on data from a range of linked administrative data sources, including Census returns since 1981 onwards, the NI Health Card Registration System and General Register Office; consequently, it is a strong research resource for exploring socio-demographic and health characteristics of the population. The 2001 and 2011 Censuses were the prime data source for the purpose of this study. Our analysed sample were NILS members enumerated at the 2001 Census and also returned in the 2011 School Census, with a maximum age of 19 in 2011, and who had valid responses on all study variables (N=46,535).

Measures

Self-reported health and disability

The outcome variables were questions related to general health and disability in the 2011 Census. Respondents were asked to rate the general level of health of each household occupant on a 5-point scale (1 = Very good health; 2 = Good health; 3 = Fair health; 4 = Bad health; 5 = Very bad health), and reported whether their day-to-day activities were limited by a disability on a 3-point scale (1 = Day-to-day activities limited a lot; 2 = Day-to-day activities limited a little; 3 = Day-to-day activities not limited). Health and disability variables from 2001 were included as covariates to control for baseline health and disability status. In 2001, responses to the general health question were recorded on a 3-point scale (1= Good; 2 = Fairly good; 3 = Not good), and the disability variable had two categories (0 = no limiting long-term illness or disability; 1= limiting long-term illness or disability). As the response scales of the variables differed across the two waves, we created harmonised binary variables for health (coded as 0 = very good/good/fair; 1= bad/very bad) and disability (coded as 0 = activities not limited; 1= activities limited a little/a lot), and these were used in all subsequent analyses.

Socioeconomic inequalities

Binary categorical indicators of household-level socio-economic deprivation across four dimensions were available from the 2001 Census. A household was defined as deprived in the employment dimension if any person in the household aged 16-74 who was not a full-time student was either unemployed or permanently sick. Houses were deprived in education if no person aged 19 to pensionable age had level 2 education and no person aged 16-18 was in full-time education or had level-2 education. A household was defined as deprived in the housing dimension if it was either overcrowded / was a shared dwelling / did not have sole use of bath, shower, or toilet / did not have central heating. A household was defined as deprived in the tenure dimension if it was social housing. All four variables were scored 0 (not deprived) or 1 (deprived).

Additional individual-level correlates

Additional correlates included sex (male; female), ethnicity (white; other), household composition (2-parent household; 1-parent household; other), age (centred at 2011 Census), religion (Catholic, Protestant/Presbyterian, other, no religion), and country of birth (Northern Ireland, Republic of Ireland, other UK, other EU, other).

Analysis

Logistic regression models were estimated in which health and disability variables in 2011 were predicted by household-level socioeconomic inequalities in 2001, controlling for health and disability status at the 2001 assessment. Correlates from the 2001 sweep were also included in the models. To account for the nested structure of the data, individuals were nested within geographical Super Output Areas (SOA), two-level mixed effects models were used. All analyses were conducted in a secure room at the Northern Ireland Statistics and Research Agency (NISRA) headquarters. All models were estimated using Stata v14.0. The results from these analyses were graphically illustrated as odds ratio plots using the R package ggplot2 (Wickham, 2011).

Results

Prevalence of socio economic inequalities, health and disability variables, and additional correlates

Frequencies and percentages of the study variables are presented in Table 1. The mean age of the children in our sample in 2011 was 13.75 years (SD = 2.42; range = 10-19). Levels of household deprivation in 2001 varied by indicator, ranging from 11.28% of participants deprived in the housing domain, to 36.11% deprived in education. It was reported that 1.58% of children had bad/very bad health in 2001, decreasing to 0.53% in 2011. In terms of disability, 5.02% of children had their activities limited in 2001, which rose to 6.34% in 2011.

<Table 1 around here>

Associations between individual characteristics, socio economic inequalities, and health

The associations between socio-economic and key individual indicators in 2001 and self-reported health in 2011 are presented in Figure 1. Full results from these models are available in table format in the online supplement (Table S1). The Intraclass Correlation Coefficient (ICC) for this model was 0.007, suggesting minimal differences in associations within geographical SOA.

<Figure 1 around here>

Controlling for health status in 2001, household deprivation in employment (OR = 1.93; 95% CI = 1.44-2.58), and coming from a single parent household (OR = 1.66; 95% CI = 1.21-2.26) were both associated with poorer Census reported health a decade later.

Associations between individual characteristics, socio economic inequalities, and disability

Similarly, controlling for disability status in the 2001 Census, those deprived in household employment (OR = 1.52; 95% CI = 1.38-1.68); living in social housing (OR = 1.34; 95% CI = 1.20-1.49); and deprived in household education (OR = 1.15; 95% CI = 1.06-1.25) were more likely to report a limiting disability in 2011 (Figure 2; full model results in Table S2). Children from single-parent households (OR = 1.28; 95% CI = 1.15-1.41) were also at increased risk of later disability, whereas males were 1.5 times more likely to have a disability in 2011 (OR=1.49; 95% CI=1.39-1.61). The ICC for this model was 0.1, again suggesting minimal variation within SOA.

<Figure 2 around here>

Discussion

Our findings highlight the considerable long-term effects of inequalities on the health and disability status of children and young people in Northern Ireland. Controlling for health status in 2001, household-level deprivation in employment and education, along with living in social housing, independently predicted poorer health status in 2011. Deprivation in employment and education, living in social housing, living in a single parent household and being male were associated with increased risk of disability a decade later, even after statistically controlling for disability status in 2001.

While much research has explored the relationship between SES and health, findings in relation to adolescent health have been somewhat inconsistent. For instance, a systematic review of the effect of poverty on child outcomes found that low SES was indeed linked with worse outcomes in domains such as cognitive development and school achievement (Cooper and Stewart, 2013). However, evidence regarding physical health was scarce and more mixed. Of the eight studies that linked financial resources to physical health, five found a positive relationship between resources and health and three found no effect (Cooper and Stewart, 2013). Furthermore, it is recognised that only through the use of quality longitudinal data that causal relationships between measures of SES and health can be established (Blackburn et al., 2013, Organization, 2011). Such longitudinal studies have been relatively scarce. Thus, the current study adds robust evidence on the relationship between adolescent health relative to SES by employing data from a large and representative longitudinal study of young people in Northern Ireland. The availability of information on health and disability in two waves of Census data, ten years apart, has allowed us to demonstrate the negative association between socioeconomic disadvantage in earlier childhood and health and disability outcomes in adolescence while controlling for baseline health and disability status. The potential clustering of inequalities within certain geographic areas of Northern Ireland have also been taken into account in our models. In addition, this association was observed across multiple indicators of SES.

These findings have important implications for adolescent health policies given that almost one quarter of children in Northern Ireland were living in poverty in 2017/2018 (Royal College of Paediatrics and Child Health, 2020). A 2018 report has shown that healthy life expectancy is lower in Northern Ireland than elsewhere in the UK, with a sizeable gap between those living in the least and most deprived areas (Barnard, 2018). Furthermore, child health in Northern Ireland is among the poorest in Western Europe and Northern Ireland has higher child mortality rates than the rest of the UK (Royal College of Paediatrics and Child Health, 2017). Therefore, this study further highlights the importance of tackling child poverty in Northern Ireland, where there are significant challenges facing the health and social care system (Royal College of Paediatrics and Child Health, 2017).

Limitations of this study

A limited number of variables were available from the 2001 sweep of NILS data. For instance, this data set does not contain information on household or individual income. More comprehensive indicators across both years would have allowed us to examine associations across further dimensions of deprivation, health and disability. The measures of health and disability used in the present study were questions from the 2001 and 2011 Censuses, meaning there may have been inconsistencies with regards to who completed the questions (e.g. parent, other guardian, self-report). Furthermore, the questions used to report health and disability varied across the 2001 and 2011 Census sweeps and thus harmonisation was needed to create comparable measures. Our analyses lack specificity in relation to health/disability therefore we could not determine what forms of ill-health disability were negatively affected by inequality/deprivation. Census 2021 however will introduce much more detailed information on these constructs, meaning future research may be able to explore this specificity. In the current study, SES is measured at one point in time and as such does not take into account the effect of changes in socioeconomic status or poverty dynamics during childhood as considered in some other recent studies (Levesque et al., 2021, Lai et al., 2019). Considering the effect of changes in SES is a worthwhile area for future research, which may be possible when 2021 Census data becomes available.

Conclusions

Our findings, using a robust and representative longitudinal dataset, are consistent with previous research showing a negative relationship between SES and health. Evidence linking socioeconomic disadvantage in childhood and poorer adolescent health and disability has important policy implications within the Northern Irish context, where child mortality is higher and life expectancy is lower than the rest of the UK and the healthcare system is under pressure. They provide further rationale for dedicating more resources and support for economically disadvantaged children and young people.

Further research is necessary to provide a better understanding of the pathways and mechanisms through which SES influences health in order to identify modifiable factors in this relationship. Future waves of NILS data may also provide the opportunity to take changes in SES into account and make available a richer variety of health and socioeconomic variables in order to gain more nuanced insights.

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The Administrative Data Research Network takes privacy protection very seriously. All information that directly identifies individuals will be removed from the datasets by trusted third parties, before researchers get to see it. All researchers using the Network are trained and accredited to use sensitive date safely and ethically, they will only access the data via a secure environment, and all of their findings will be vetted to ensure they adhere to the strictest confidentiality standards.

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Data Availability

The data that support the findings of this study are available from ADRC-NI, but restrictions apply to the availability of these data, which were used with appropriate permissions for the current study, and so are not publicly available. Data are not available from the authors because they are administrative data (i.e. Census) records, and the authors do not have permission to share these data.

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Conflict of interest

The authors declare that there is no conflict of interest.

Tables

Table 1. Frequencies and percentages of study variables			
Health indicators		**N**	**%**
General health 2001	Very good/good/fair	45,802	98.42%
	Bad/very bad	733	1.58%
General health 2011	Very good/good/fair	46,289	99.47%
	Bad/very bad	246	0.53%
Disability (daily activities limited) 2001	Activities not limited	44,200	94.98%
	Activities limited a little/a lot	2,335	5.02%
Disability (daily activities limited) 2011	Activities not limited	43,586	93.66%
	Activities limited a little/a lot	2,949	6.34%
Socioeconomic Disadvantage			
Employment deprivation	Not deprived	39,733	85.38%
	Deprived	6,802	14.62%
Social housing	Not in social housing	38,305	82.31%
	Living in social housing	8,230	17.69%
Education deprivation	Not deprived	29,733	63.89%
	Deprived	16,802	36.11%
Housing deprivation	Not deprived	41,284	88.72%
	Deprived	5,251	11.28%
Demographics			
Sex	Male	23,450	50.39%
	Female	23,085	49.61%
Ethnicity	White	46,050	98.96%
	Other	485	1.04%

Household composition	Two-parent household	36,652	78.76%
	Lone-parent	9,478	20.37%
	Other	405	0.87%
Country of birth	Northern Ireland	45,330	97.41%
	Republic of Ireland	177	0.38%
	Other UK	746	1.60%
	Other EU	75	0.16%
	Other	207	0.44%
Religion	Catholic	21,292	45.75%
	Protestant/Presbyterian	14,939	32.10%
	Other	2,432	5.23%
	No religion	7,872	16.92%

Figures legends

Figure 1. Odds ratios and 95% confidence intervals from mixed effects logistic regression model with Census-reported health (bad/very bad) in 2011 as the outcome. Predictors are presented on the Y-axis (all based on 2001 data, with the exception of age). Model controls for Census-reported health at 2001 sweep (OR = 21.32; 95% CI = 15.74-28.90), omitted for clarity of presentation. Ethnicity and country of birth also omitted for clarity of presentation (wide 95% CIs), see Table S1 for full details.

Figure 2. Odds ratios and 95% confidence intervals from mixed effects logistic regression model with Census-reported disability (day-to-day activities limited) in 2011 as the outcome. Predictors are presented on the Y-axis (all based on 2001 data, with the exception of age). Model controls for Census-reported disability at 2001 sweep (OR = 9.96; 95% CI = 9.02-11.01), omitted for clarity of presentation. Ethnicity and country of birth also omitted for clarity of presentation (wide 95% CIs), see Table S2 for full details.

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