Does childhood adversity account for poorer mental and physical health in second generation Irish people? Birth cohort study

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Title: Does childhood adversity account for poorer mental and physical health in second generation Irish people living in Britain? Birth cohort study from Britain (NCDS)

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Objectives: Worldwide, the Irish diaspora experience elevated mortality and morbidity across generations, not accounted for through socioeconomic position. The main objective of the present study was to assess if childhood disadvantage accounts for poorer mental and physical health in adulthood, in second generation Irish people.

Design: Analysis of prospectively collected birth cohort data, with participants followed to mid-life.

Setting & participants: 17,000 babies born in a single week in 1958 in England, Scotland and Wales. 6% of the cohort were of second generation Irish descent.

Outcomes: Primary outcomes were common mental disorders assessed at age 44/ 45 and self-rated health at age 42. Secondary outcomes were these assessed at age 23 and 33.

Results: Relative to the rest of the cohort, second generation Irish children grew up in marked material and social disadvantage, which tracked into early adulthood. By mid-life, parity was reached between second generation Irish cohort members and the rest of the sample on most disadvantage indicators. At age 23 Irish cohort members were more likely to screen positive for common mental disorders (OR: 1.44; 95% CI: 1.06, 1.94). This had reduced slightly by mid-life (OR: 1.27; 95% CI: 0.96, 1.69). Whereas at age 23 second generation cohort members were just as likely to report poorer self-rated health (OR: 1.06; 95% CI: 0.79, 1.43), by mid-life this difference had increased (OR: 1.25; 95% CI: 0.98,1.60). Adjustment for childhood and early adulthood adversity fully attenuated differences in adult health disadvantages.

Conclusions: Social and material disadvantage experienced in childhood continues to have long-range adverse effects on physical and mental health at mid-life, in

second generation Irish cohort members. This suggests important mechanisms over the life-course, which may have important policy implications in the settlement of migrant families.

ARTICLE SUMMARY

Article focus

- In a nationally representative birth cohort from Britain, to assess the prevalence of mid-life common mental disorders and poorer self-rated health in second generation Irish respondents relative to the rest of the cohort.
- To assess the contribution of psychosocial and material disadvantage over the life-course (from childhood through to adulthood) in accounting for any observed health inequalities noted in Irish cohort members.

Key messages

- Second generation Irish children were more likely to grow up under circumstances of marked material and social adversity relative to the rest of the cohort. By mid-life, second generation Irish cohort members were no longer less disadvantaged than the rest of the cohort, suggesting a degree of differential upward social mobility.
- Yet, compared to the rest of the cohort, second generation Irish people experienced an elevated relative odds of common mental disorders and poorer self-rated health at mid-life. This disappeared after adjusting for childhood disadvantage.
- The findings imply that adult health disadvantages in migrant or ethnic minority groups may be 'transmitted' through exposure to childhood adversity, a factor which may be related to migrant settlement experiences.

Strengths and Limitations

- The study used mostly prospectively collected data from a nationally representative birth cohort from Britain.
- Detailed assessment of psychosocial and material circumstances in childhood and adulthood were obtained. Main outcomes were assessed using structured, validated scales (for mental health) or a standardised question around self-rated health.
- Limitations of the study include the use of parental country of birth to determine ethnicity and the lack of measures assessing the specific migration experiences of Irish cohort members, as this was a historical cohort study.

Introduction

Four decades of research has suggested that Irish people living in Britain experience elevated mortality[1-4] and morbidity[5, 6], relative to the rest of the population. A similar phenomena has been noted worldwide[7-9]. These inequalities persist into second[1, 5] and later generations[2, 10]. An elevated prevalence and incidence of depression and suicidality has also been noted in Irish-born and second or later generation Irish people[7, 11-14]. This is out of keeping with the assertion that over time and subsequent generations, the health of migrant groups should start to approximate to that of the receiving country[3].

There have been few longitudinal studies which have examined the health of Irish people or other migrant groups using a life-course informed approach. Longitudinal studies from North America have suggested disadvantage related to the processes of migration and settling into a new host country interact dynamically over the life course and lead to specific health effects in migrants which diverge from the host population[15]. The policy benefits of using a life course approach are obvious; by identifying structural factors that impact on the health of second generation Irish people from childhood through to adulthood, it may be possible to identify earlier 'intervention points', which could reduce later 'downstream' adverse health outcomes.

We analysed data from a nationally representative British birth cohort to establish if second generation Irish people were more likely to grow up under, and live in, circumstances of material and social disadvantage over their life-course, relative to people without a parental history of migration. Our second objective was to establish

if the prevalence of common mental disorders and self-rated health (a predictor for mortality[16]) would be elevated in second generation Irish cohort members relative to the rest of the cohort, at age 23, 33, and at mid-life (age 44/ 45). Finally, we sought to establish if disadvantage over the life-course mediated any health disparities observed at mid-life (age 44/ 45). In particular, we wished to assess the contribution of disadvantage broken down by *timing* of exposure (childhood, early adulthood, mid-life) and *type* of exposure (material disadvantage, social adversity, health-related behaviours and prior mental health/ self-rated health).

Methods

Study sample

The National Child Development Survey (NCDS) surveyed 17415 babies born during March 3-9 in 1958 (98% of live births), and followed respondents into adulthood. Parents, teachers and medical personnel were interviewed when children were 7, 11 and 16. At age 23, 33, 42 and 44/ 45 cohort members were interviewed. For the analysis, the 'target sample' was: children born in England, Scotland and Wales in the selected week, and children with both parents born in England, Scotland and Wales, or who had one or both parents born in Ireland or Northern Ireland.

Parental migration status

At sweeps two and three, parents reported their country of birth. Cohort members with one or both parents reporting that they were born in Ireland or Northern Ireland were classified as 'second generation Irish'. Excluding non-responders, kappa assessing reliability of parental responses to this question between the two sweeps was high (kappa=0.97).

MEASURES

CHILDHOOD

Material and social adversity measures

At 7, 11 and 16 parents of children were asked if they had experienced financial difficulties in the previous year, or lived in overcrowded housing (1+ persons/ room). Parents were asked if they had access to hot water, an indoor toilet and an indoor bathroom. At 11 and 16 parents reported if their child received free school meals. At age 7 health visitors assessed family difficulties, these were problems with: housing,

finances, physical or mental illness/ disability, learning disabilities, death, divorce, parental separation, domestic tensions, in-law conflicts, unemployment, alcoholism, or any other difficulties 'affecting child's development'.

Childhood psychological health

At 7 and 11, teachers rated children's emotional and behavioural health using the Bristol Social Adjustment Guide (BSAG)[17]. At age 16, the Rutter School Behavioural Scale (Rutter-B), was completed by teachers[18]. Scores on both scales were summed, square root transformed, with the top 13% indicating children who were a 'case'[19].

ADULTHOOD

Material and social adversity measures

Cohort members were asked if they lived in overcrowded housing (1+ persons/ room) (age 23, 33, 42), were unemployed (23, 33, 42), lived in council housing (23, 33, 42), had been homeless (23, 42), received benefits (23, 42), had access to an indoor toilet/ bathroom (23), had experienced difficulties paying bills (33, 45), had a telephone (33), had damp or lacked central heating in their house (33), had no car (42, 45), had experienced financial difficulties (42), or couldn't afford food or clothing (45).

At age 33 cohort members rated emotional and practical social support provided from four sources of support[20]. At age 42, cohort members reported if there was someone they could turn to for support. At 44/ 45, the Close Person's Questionnaire[21] assessed social support provided from the closest nominated

person.

Stressful life events within the previous six months were assessed at 44/ 45. These were: cohort member/ close relation suffering serious illnesses, injury/ assault, death of parent/ child/ partner or close friend/ relative, end of serious relationship, serious problems with a close friend/ neighbour/ relative, serious disappointments at work, cohort member/ partner fears losing their job, losing one's job, major financial crises, problems with the police, and theft. Responses were dichotomised into '*experienced no stressful life events'* versus '*experienced 1+ stressful life events'*. At age 44/ 45, cohort members' job security was also enquired after.

Health-related behaviours

At age 33, and 42, people responding in the affirmative to ≥1 items on the CAGE were classed as reporting hazardous alcohol use[22]. This questionnaire comprises four questions *("Have you wanted to **C**ut down your alcohol use lately?" "Do you get **A**ngry if other people suggest you should cut down your alcohol use?" "Do you feel **G**uilty about the amount of alcohol you consume?" "Have you ever needed an **E**ye-opener?"*)[22]. At age 44/ 45, people scoring ≥8 on the *Alcohol Use Disorders Identification Test* (AUDIT) were classed as reporting hazardous use[23]. Cohort members also reported if they were current or previous smokers at 23, 33 and 42.

ADULT HEALTH OUTCOMES

Mental Health

Malaise Inventory

At age 23 and 33 cohort members completed the Malaise Inventory, which is a

structured self-report tool which assesses recent psychiatric morbidity[24]. Questions asked include "*Do you often feel miserable or depressed?", "Do you wake unnecessarily early in the morning?"*[24]. Scores of ≥8 indicated depression[25].

Clinical Interview Schedule-Revised (CIS-R)

The CIS-R assessed mid-life common mental disorders at age 44/45 [26]. This is a structured validated instrument administered by trained lay interviewers, where scores of ≥12 indicate common mental disorders[26]. In the NCDS, a shortened form of the CIS-R was used, in which sections enquiring after worry, obsessions, somatic symptoms, compulsions and physical health worries were omitted[27], thus focusing on depressive and anxiety disorders. To ensure that the results of the present analysis would be comparable to previous surveys[28, 29], an equivalent cut-point on the abbreviated CIS-R scale was determined.

Data from the 2000 National Psychiatric Morbidity Survey (NPMS)[29] and from the 2000 Ethnic Minorities Psychiatric Illness Rates in the Community Survey (EMPIRIC) [28]were used to devise an abbreviated scale of symptoms on the CIS-R, with the same items which had been omitted in the 2000 sweep of the NCDS also omitted. To determine equivalent cut-points to conventional cut-points of 11/12 on the full-scale CIS-R, a linear regression of the full-scale CIS-R was performed against the abbreviated scale from the CIS-R using NPMS and EMPIRIC data. The resultant regression equation was used to predict the equivalent cut-point on the abbreviated CIS-R scale. Using this approach, a cut-point of ≥9 was equivalent to the conventional cut-point of ≥12. Kappa comparing the cut-point for 11/12 on the full-scale CIS-R to a cut-point of 8/9 on the abbreviated scale was 0.86 for the NPMS

and 0.85 for the EMPIRIC (both p<0.001).

Self-rated health

At age 23, 33 and 44/ 45 cohort members asked: *"How would you describe your health generally?"* Responses were dichotomised into 'excellent/ good' versus 'fair/ poor'.

Statistical analysis

STATA 10.1 was used for analyses[30]. The association of social and material adversity measures over the life course, from childhood to adulthood, was assessed in second generation Irish cohort members, relative to non-Irish cohort members. Next, the odds of screening positive for common mental disorders and poorer self-rated health, in second generation Irish cohort members, relative to non-Irish cohort members, was assessed at 23, 33, and 44/ 45, using multivariable logistic regression. Common mental disorders and poorer self-rated health at these time points was specified as the dependent variables.

The contribution of adversity variables over the life-course in mediating excess risks of common mental disorders and poorer self-rated health at mid-life was assessed[31]. To assess mediation, three criteria needed to be fulfilled[31]. First, the association of parental migration history with putative mediator was assessed using multivariable logistic regression[31]. Second, the association of the putative mediator with the outcome variable (poorer self-rated health and common mental disorders at mid-life) was assessed using multivariable logistic regression[31]. Finally the association of parental migration history with outcome- (either mid-life common

mental disorders or poorer self-rated health at mid-life) was assessed in the presence of the putative mediator[31]. If the coefficient for the association between parental migration history and outcome was reduced in the presence of the putative mediator, then it was presumed that the data were consistent with mediation[31].

Missing data

As with any prospective survey, missing data due to attrition was a concern. At age 7, 11 and 16 response rates were 89%, 88%, 84%, and at 23, 33, 42 response rates were 72%, 65% and 66%[32]. At age 44/ 45, complete data was available for the CIS-R for 9297 individuals (which was 99% of the biomedical sample), and complete data was available on self-rated health in 9115 individuals (97% of the biomedical sample).

As missing values were likely to be missing at random[33], missing values were imputed using the chained equations approach ('ICE') in STATA 10 [30, 34]. Imputations were conducted on all cohort members known to be alive at the time of the biomedical survey (age 44/45). 50 imputed datasets were created using proper imputation from an imputation model in which all covariates as well as variables known to predict attrition (mother's education, region of birth, employment at 33 and social class at all sweeps) were included[35, 36]. Analyses were performed on each imputed dataset using multivariable logistic regression, and estimates combined using Rubin's Rules[33]. Wald tests assessed strength of associations.

Results

Rates of attrition were similar in second generation Irish respondents compared to the rest of the sample (supplementary table 1). 9377 cohort members provided data at age 44/45. Excluding migrants and children with parents not born in England, Scotland, Wales, Ireland or Northern Ireland, analyses were performed on 8403 individuals providing complete information on the CIS-R, and on 8243 individuals providing a response to the self-rated health at mid-life question.

Experiences of social adversity over the life course

Figure 1 displays how social adversity differed for second generation Irish cohort members, compared to non-Irish counterparts, over the life-course. Irish cohort members experienced marked social adversity across all childhood sweeps, relative to the rest of the cohort. These inequalities tracked into early adulthood, with differences still apparent at age 23, and to an extent, at 33. By mid-life (42, 44/ 45) life-course social adversity measures were equivalent in second generation Irish cohort members relative to non-Irish cohort members.

[FIGURE 1 HERE]

Assessment of health over the life course

Table 1 displays differences in common mental disorders and self-rated assessments of health, assessed prospectively at age 23, 33, and 44/45. After adjusting for gender, second generation Irish cohort members were 1.44 times more likely to screen positive for depression at 23 (95% CI: 1.06, 1.94) (Table 1). Second generation Irish cohort members continued to carry this relative excess risk throughout their life course, although the magnitude of the difference had diminished by age 33. In contrast, second generation Irish cohort members were no more likely

to report fair or poorer self-rated health in early adulthood (age 23, 33), although by mid-life (age 44/45) there was a suggestion of widening inequalities affecting the Irish group with respect to this measure (Table 1).

[TABLE 1 HERE]

Mid-life health in second generation Irish cohort members

The association of being second generation Irish and screening positive for common mental disorders and poorer self-rated health at mid-life was assessed after taking into account exposures at earlier time points (tables 2 & 3). The largest attenuation for both common mental disorders as well as poorer self-rated health at mid-life was from material adversity assessed in childhood. A similar attenuation in the excess risk was seen when prospectively assessed family adversity (at age 7) was added into the models (tables 2& 3). Material adversity at age 23 attenuated the excess risk of being Irish with poorer health at mid-life, albeit to a lesser extent than childhood adversity variables. Health-related behaviours, prior mental health/ self-rated health, and covariates assessed from age 33 onwards, did not attenuate associations of being second generation Irish with poorer mid-life health. The tables in the online repository show full associations for tables 2 and 3.

[TABLE 2 HERE]

[TABLE 3 HERE]

Discussion

The findings suggest that second generation Irish children born in the late 1950s experienced greater levels of childhood adversity than those of English, Scottish or Welsh heritage, although social and economic inequalities diminished between the two groups as the cohort entered mid-life. Despite improvements in material and social conditions by adulthood, an inheritance of poorer health at mid-life for second generation Irish people was evident, relative to the rest of the cohort. Childhood material and social adversity as well as early adulthood material adversity accounted for these differences, whereas health-related behaviours and earlier psychological health/ self-rated health did not. These findings are potentially in keeping with a 'sensitive period' in childhood/ early adulthood which continues to adversely influence adult health many years later[37], and may be relevant in understanding previously reported adult health inequalities experienced by second generation Irish people, despite apparent improvements in socioeconomic position across generations [1, 12].

Second generation Irish cohort members had an elevated risk of common mental disorders in early adulthood (age 23) which had partially reduced by mid-life. In contrast, for poorer self-rated health, (also a predictor for mortality[16]), although there were no differences between second generation Irish cohort members and the rest of the cohort at earlier time-points, by mid-life differences had started to become apparent.

Strengths and limitations

The data derives from a nationally representative sample from England, Scotland

and Wales, therefore the findings are generalisable to second generation Irish people, now in mid-life. Most assessments were prospective, reducing the possibility of measurement bias. The possibility of reverse causality may have been an issue, as people who had poorer health at the earlier time-points may have been more likely to move into or stay in conditions of adversity. The isolated mediating effect of early life disadvantage is therefore striking, as one would have expected a larger contribution of adult social and material adversity in mediating differences.

We could not assess exposures which may have been important in understanding the specific settlement experiences of Irish people living in Britain, as these were unavailable. These might include factors relating to migration and settlement, such as the pre-migration health of parents, reasons and circumstances surrounding migration[11] experiences of discrimination[11] and residential or neighbourhood context[38]. Future research should endeavour to understand how these factors operate within a life-course framework.

There has been one other study from the 1970 British birth cohort which has also shown that second generation Irish children were more likely to be born into disadvantage, compared to the rest of the population[39]. This suggests a degree of consistency across periods and cohorts. However we cannot be sure if period-specific effects accounted for some of the findings. In 1958 it was common for Irish people to experience overt discrimination, for example signs reading "*No Irish Need Apply*"[40], would have been frequently encountered when applying for employment or accommodation. By the time cohort members were aged 23 (1981) the conflict in Northern Ireland had escalated such that anti-Irish discrimination and issues relating

to identity may have had a particular salience for second generation Irish people at that time[41]; this may have contributed to the mental health inequalities noted at this age, although it was not possible to discern this from the present analysis.

Relationship to historical context and policy implications

In 1958 Irish citizens would have been subject to the recently instated 'common travel area', which enabled relatively informal migration between Ireland to Britain. Irish-born people migrating to Britain at this time took up employment in industries in which post-war labour shortages in Britain were greatest, this included the construction industry, domestic and personal industry, and nursing[42]. Adverse health outcomes previously noted in Irish-born migrants to Britain have been suggested to have been due to a relative lack of barrier to migration[3], alongside post-migration settlement experiences where work in transient and poorly paid employment was more likely[11]. The present analysis suggests mechanisms by which such inequalities were then subsequently 'transmitted' to the next generation.

Although by mid-life, second generation Irish people enjoyed social circumstances at parity with the rest of the cohort, an inheritance of growing up in adversity as a result of parental migration and settlement experiences has continued to influence downstream health outcomes. The relative non-specificity of childhood disadvantage in being detrimental to later health suggests important priorities for future research on the health of migrant groups now settling in Britain. Although the process of migration and settlement may mean that the experiences of relative social deprivation are transient[15, 43], tackling health inequalities in second generation groups may mean directing concerted attention to childhood. The findings suggest

the importance of considering the life-course in its entirety, rather than taking 'snapshot' measures of socioeconomic position at single time-points[43], as it is clear that the experiences of adversity over the life-course have differed greatly for second generation Irish people, relative to their non-Irish counterparts.

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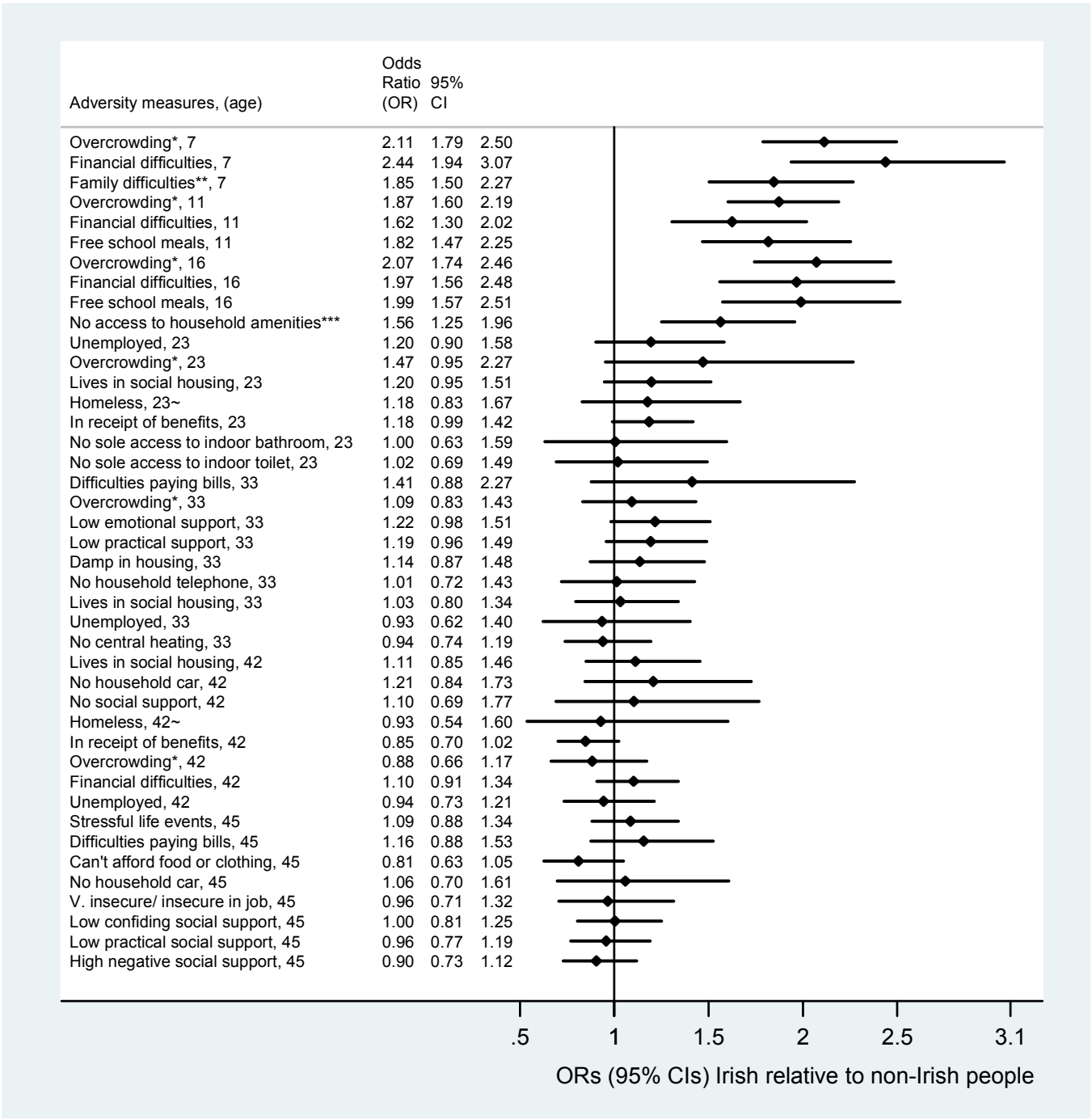
Figure 1: Odds ratios for social adversity across the life-course; Second generation Irish cohort members relative to non-Irish cohort members.

Estimates on the vertical line represent no difference between the two groups



Key: **more than one person/ room; **one or more family difficulties as prospectively rated by health visitor (difficulties with: housing, finances, physical illness/ disability, mental illness/ neurosis, mental sub-normality, death of child's mother or father, divorce/ separation/ desertion, domestic tension, "in-law" conflicts, unemployment, alcoholism, or any 'other serious family difficulties affecting child's development'); ***no access to at least one of: indoor bathroom, indoor toilet or hot water at either age 7, 11, or 16; ~periods of homelessness since last assessment*

Table 1: Common mental disorders and self-rated health in second generation Irish people across the life course

Common mental disorders				
Age		**Number of observations**	**OR**	**(95% CI)**
23†	All other	11036	1.00	(ref)
	Second generation Irish		1.44	1.06,1.94
33†	All other	9980	1.00	(ref)
	Second generation Irish		1.31	0.94,1.81
45‡	All other	8403	1.00	(ref)
	Second generation Irish		1.27	0.96,1.69
Poor self-rated health				
Age				
23	All other	11067	1.00	(ref)
	Second generation Irish		1.06	0.79,1.43
33	All other	10045	1.00	(ref)
	Second generation Irish		1.06	0.81,1.37
45	All other	8243	1.00	(ref)
	Second generation Irish		1.25	0.98,1.60

Key
† *Assessed with the Malaise Inventory*
‡ *Assessed with the CIS-R*
All models adjusted for gender

Table 2: Association of parental migration history (Irish vs non-Irish) with common mental disorders at mid-life (age 44/ 45)

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life common mental disorders, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.27	0.96,1.69
Models adjusting for gender + material adversity over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.28	0.95,1.72
42	Material adversity[2]	1.28	0.95,1.72
33	Material, adversity[3]	1.26	0.94,1.69
23	Material adversity[4]	1.18	0.88,1.57
7, 11, 16	Material adversity[5]	1.12	0.84,1.50
Models adjusting for gender + health-related behaviours over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.25	0.94,1.67
33, 42	Hazardous alcohol use[7]	1.23	0.92,1.64
Models adjusting for gender + previous mental health over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[8]	1.33	0.97,1.81
7, 11, 16	Childhood emotional or behavioural health problems[9]	1.21	0.91,1.62
Models adjusting for gender + social support over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[10]	1.30	0.97,1.73
42	Social support[11]	1.27	0.95,1.69
33	Social support[12]	1.25	0.94,1.67
Models adjusting for gender + stressful life events over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[13]	1.28	0.96,1.72
44/ 45	Stressful life events[14]	1.24	0.93,1.66
7	Family adversity[15]	1.19	0.89,1.58

Key:

1	*Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*
2	*Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*
3	*Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in house, shared household amenities*
4	*No access/ shared access to indoor toilet, none/ shared access to indoor bathroom, lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, unemployed*
5	*Household overcrowding, financial difficulties, qualifies for free school meals, no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16*

6	*Scored ≥8 on the AUDIT*
7	*Scored ≥1 on the CAGE*
8	*Scored ≥8 on the Malaise inventory at least once*
9	*Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)*
10	*Emotional & confiding, practical and negative social support (Close Person's Questionnaire)*
11	*Has someone they could turn to for support*
12	*Emotional and practical social support*
13	*Feel 'not very secure' or 'insecure' in current job (versus 'secure')*
14	*One or more stressful life events experienced in last six months*
15	*Prospectively assessed family adversities*

Table 3: Association of parental migration history (Irish vs non-Irish) with poorer self-rated health at age mid-life (age 44/ 45)

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life poorer self rated health, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.25	0.98,1.60
Models adjusting for gender + material adversity across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.27	0.99,1.64
42	Material adversity[2]	1.27	0.98,1.64
33	Material, adversity[3]	1.23	0.96,1.59
23	Material adversity[4]	1.16	0.91,1.49
7, 11, 16	Material adversity[5]	1.10	0.85,1.41
Models adjusting for gender + health-related behaviours across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.24	0.97,1.58
33, 42	Hazardous alcohol use[7]	1.22	0.95,1.55
23, 33, 42	Life-course tobacco use[8]	1.23	0.96,1.57
Models adjusting for gender + previous mental health across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[9]	1.20	0.94,1.55
7, 11, 16	Childhood emotional or behavioural health problems[10]	1.20	0.94,1.53
Models adjusting for gender + previous poorer self-rated health			
Age	**Adjustments**	**OR**	**95% CI**
23, 33, 42	Previous poorer self-rated health	1.35	1.03,1.77
Models adjusting for gender + social support across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[11]	1.27	0.99,1.62
42	Social support[12]	1.25	0.98,1.59
33	Social support[13]	1.24	0.97,1.58
Models adjusting for gender + stressful life events across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[14]	1.26	0.98,1.61
44/ 45	Stressful life events[15]	1.24	0.97,1.59
7	Family adversity[16]	1.17	0.92,1.50

Key to variables:

1 *Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*

2 *Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*

3	*Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in housing, shared household amenities (bathroom, shower/ wash facilities, toilet, kitchen)*
4	*No access or shared access to indoor toilet, none or shared access to indoor bathroom, lives in council housing, has been homeless, in receipt of benefits, household overcrowding, unemployed*
5	*Household overcrowding, financial difficulties, child qualifies for free school meals, and no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16*
6	*Scored ≥8 on the AUDIT*
7	*Scored ≥1 on the CAGE*
8	*Current or ex-smoker at least once*
9	*Scored ≥8 on the Malaise inventory at least once*
10	*Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)*
11	*Emotional & confiding, practical and negative social support (Close Person's Questionnaire)*
12	*Has someone they could turn to for support*
13	*Emotional and practical social support*
14	*Feels 'not very secure' or 'insecure' in current job (versus 'secure')*
15	*One or more stressful life events experienced in last six months*
16	*Prospectively assessed family adversities*

CONTRIBUTORSHIP STATEMENT

JD designed the study, analysed the data, and prepared the manuscript for publication. JD is guarantor of the data and for the analysis. CC advised on aspects of the analysis and assisted in part with the analysis. CC also helped to prepare the manuscript. MED advised on statistical aspects of the analysis and helped in the preparation of the manuscript. GL advised on the study design and assisted with the literature review. GL assisted in the interpretation of results and in the preparation of the manuscript. SAS advised on the study design, assisted in the interpretation of results and advised on analytic methods. SAS assisted in the preparation of the manuscript. MJP advised on the study design, the analytic methods and in the interpretation of the results. MJP advised and helped in the preparation of the manuscript, figures and tables.

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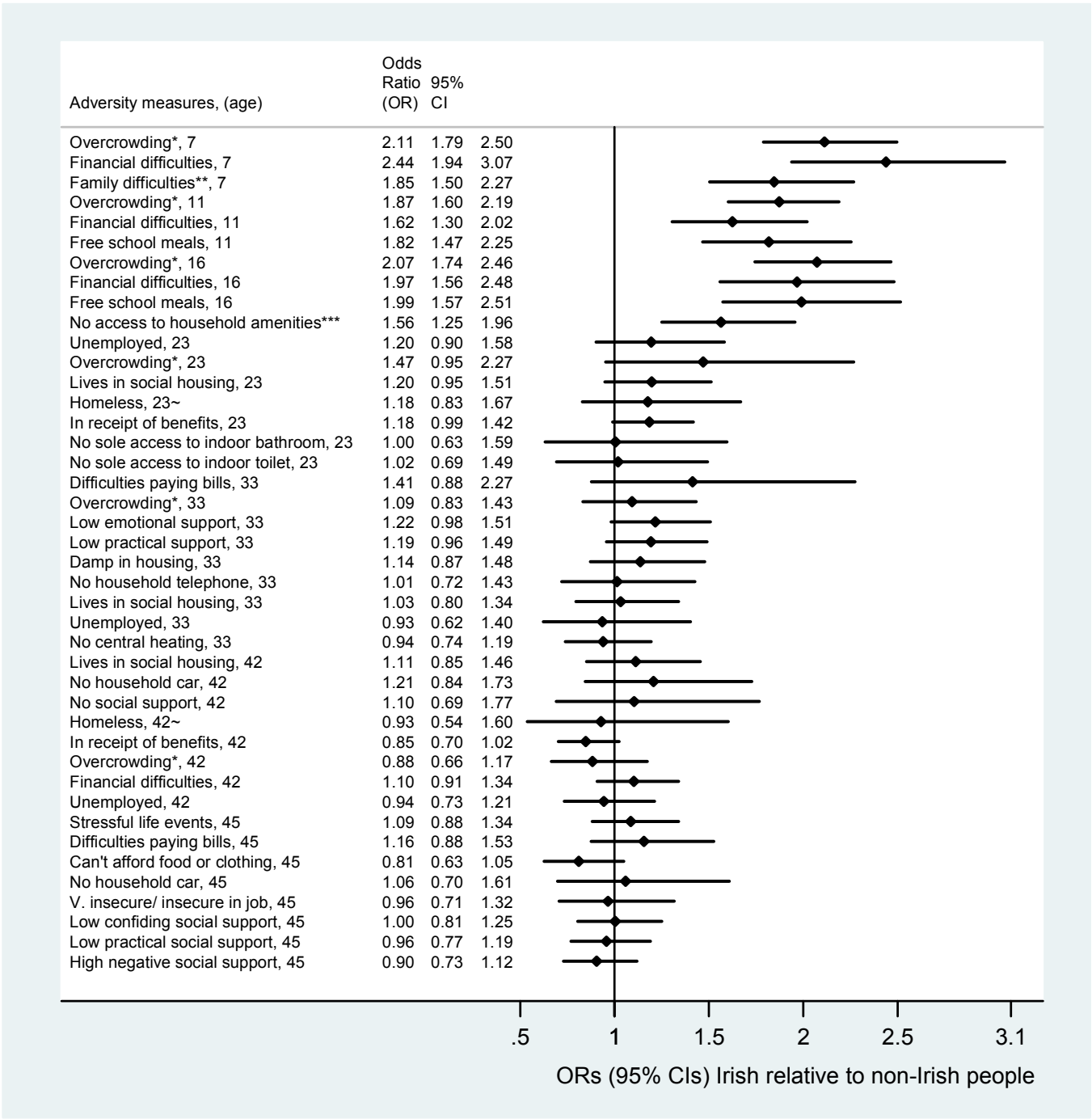
ETHICS

Access to the dataset for the purposes of secondary analysis was subject to the terms of an end user license agreement, and further ethical approval was not needed.

DATA SHARING:

The data used for the analysis is available from the Economic and Social Data Service at http://www.esds.ac.uk/. Access to all of the data, except for biomedical data, is through an end-user licence agreement. Access to biomedical data from NCDS is through a special license gained through application to ESDS.

Figure 1: Odds ratios for social adversity across the life-course; Second generation Irish cohort members relative to non-Irish cohort members.
Estimates on the vertical line represent no difference between the two groups



Key: **more than one person/ room; **one or more family difficulties as prospectively rated by health visitor (difficulties with: housing, finances, physical illness/ disability, mental illness/ neurosis, mental sub-normality, death of child's mother or father, divorce/ separation/ desertion, domestic tension, "in-law" conflicts, unemployment, alcoholism, or any 'other serious family difficulties affecting child's development'); ***no access to at least one of: indoor bathroom, indoor toilet or hot water at either age 7, 11, or 16; ~periods of homelessness since last assessment*

ONLINE REPOSITORY MATERIAL

Supplementary table 1: Response rates at each sweep of NCDS (un-imputed data)

NCDS								
Sweep (age- years)	**0 (0)**	**1 (7)**	**2 (11)**	**3 (16)**	**4 (23)**	**5 (33)**	**6 (42)**	**Biomedical sweep (44/45)**
Year	1958	1965	1969	1974	1981	1991	2000	2002
Number (% of total (n=16765*)) present in analysis sample at each sweep	16553 (99%)	14258 (85%)	13915 (83%)	13138 (78%)	11411 (68%)	10460 (62%)	10412 (62%)	8690 (52%)
	The above figures include Irish respondents in the totals							
Number (% of total (n=791)) of second generation Irish respondents in analysis sample**	782 (99%)	710 (90%)	761 (96%)	699 (88%)	544 (69%)	509 (64%)	505 (64%)	417 (53%)

***Key**:*Excludes children who migrated to Britain and were not born in England, Scotland or Wales in the index week, 1958 (n=920). Also excludes children who had one or both parents born outside England, Scotland, Wales, Ireland or Northern Ireland (n=1251); **After excluding migrant children, there were 791 children who were second generation Irish within NCDS*

ONLINE REPOSITORY MATERIAL

Supplementary table 2: Association of parental migration history (Irish-born versus non-Irish) with mid-life common mental disorders in cohort members, taking into account proximal and distal risk factors, across the life-course

All displayed covariates have been adjusted for each other in each model

MODEL 1: ADJUSTED FOR GENDER ONLY

Covariate	OR	95% CI	p value
Second generation Irish	1.27	0.96,1.69	0.10
Female gender	1.81	1.57,2.07	p<0.001

MODEL 2: ADJUSTING FOR MATERIAL ADVERSITY ACROSS THE LIFE-COURSE

Model 2a

Childhood material adversity (age 7, 11, 16)

Covariate	OR	95% CI	p value
Second generation Irish	1.12	0.84,1.50	0.44
Female gender	1.79	1.56,2.06	p<0.001
Household crowding once	1.05	0.84,1.31	0.67
Household crowding twice	1.15	0.92,1.44	0.23
Household crowding thrice	1.08	0.88,1.31	0.46
Financial difficulties once	1.52	1.20,1.92	p<0.001
Financial difficulties twice	1.88	1.31,2.69	p<0.001

Model 2b

Material adversity (age 23)

Covariate	OR	95% CI	p value
Second generation Irish	1.18	0.88,1.57	0.27
Female gender	1.71	1.49,1.97	p<0.001
No access/ shared access to indoor toilet	1.48	0.97,2.27	0.07
None/ shared access to indoor bathroom	0.76	0.43,1.32	0.33
Lives in council house	1.55	1.25,1.92	p<0.001
Has been homeless	1.72	1.33,2.23	p<0.001
Receiving benefits	1.46	1.23,1.74	p<0.001

Model 2c

Material adversity, (age 33)

Covariate	OR	95% CI	p value
Second generation Irish	1.26	0.94,1.69	0.12
Female gender	1.86	1.61,2.14	p<0.001
Unemployed	1.71	1.26,2.31	p<0.001
Household crowding	0.93	0.74,1.17	0.54
In arrears with bills	1.82	1.27,2.60	p<0.001
No access to phone	0.69	0.52,0.90	0.01
Damp in housing	1.31	1.06,1.61	0.01

Financial difficulties thrice	2.91	1.77,4.79	p<0.001	Household crowding	1.03	0.66,1.62	0.89	Lives in council house	2.12	1.74,2.58	p<0.001
Free school meals once	1.24	0.94,1.64	0.12	Unemployed	1.24	0.96,1.60	0.10	No central heating in house	0.92	0.76,1.12	0.41
Free school meals twice	1.43	1.01,2.04	0.04					Shared/ reduced access to amenities	1.59	0.86,2.92	0.14
No access to indoor toilet, bathroom or hot water at either 7, 11 or 16	1.22	1.00,1.50	0.05								

Model 2d

Material adversity, (age 42)

Covariate	OR	95% CI	p value
Second generation Irish	1.28	0.95,1.72	0.10
Female gender	1.68	1.45,1.94	p<0.001
In council housing	1.91	1.57,2.31	p<0.001
No access to car	1.04	0.77,1.42	0.80
Has been homeless	1.47	1.07,2.02	0.02
Receiving benefits	0.85	0.72,1.00	0.05
Overcrowding	0.90	0.71,1.15	0.41
Financial difficulties	1.92	1.65,2.23	p<0.001
Unemployed	2.00	1.68,2.38	p<0.001

Model 2e

Material adversity, (age 44/ 45)

Covariate	OR	95% CI	p value
Second generation Irish	1.28	0.95,1.72	0.10
Female gender	1.82	1.58,2.09	p<0.001
Difficulties paying bills	2.29	1.89,2.78	p<0.001
Sometimes/ often/ always can't afford food or clothing	1.92	1.61,2.29	p<0.001
Access to household car	1.51	1.18,1.93	p<0.001

MODEL 3: ADJUSTING FOR HEALTH-RELATED BEHAVIOURS ACROSS THE LIFE-COURSE

Model 3a

Model 3b

Hazardous alcohol use (1+ on CAGE) (age 33, 42)				*Harmful alcohol use (8+ on AUDIT) (age 44/ 45)*			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.23	0.92,1.64	0.16	Second generation Irish	1.25	0.94,1.67	0.12
Female gender	1.98	1.72,2.27	p<0.001	Female gender	2.05	1.77,2.37	p<0.001
Hazardous alcohol use on one occasion	1.47	1.24,1.74	p<0.001	Harmful alcohol use (8+ on AUDIT)	1.65	1.41,1.94	p<0.001
Hazardous alcohol use on two occasions	1.61	1.35,1.93	p<0.001				

MODEL 4: ADJUSTING FOR PREVIOUS MENTAL HEALTH ACROSS THE LIFE COURSE

Model 4a *Childhood psychological health (age 7, 11, 16)*				**Model 4b** *Previous depression (age 23, 33)*			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.21	0.91,1.62	0.19	Second generation Irish	1.33	0.97,1.81	0.08
Female gender	1.99	1.73,2.29	p<0.001	Female gender	1.42	1.23,1.65	p<0.001
Case once	1.70	1.42,2.05	p<0.001	Depressed on at least one occasion, age 23, 33	7.86	6.76,9.13	p<0.001
case twice	2.43	1.84,3.21	p<0.001				
Case thrice	3.63	2.27,5.80	p<0.001				

MODEL 5: ADJUSTING FOR SOCIAL SUPPORT ACROSS THE LIFE COURSE

Model 5a **Social support*** (age 33)**				**Model 5b** **Social support** (age 42)**				**Model 5c** **Social support* (age 44/ 45)**			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.25	0.94,1.67	0.12	Second generation Irish	1.27	0.95,1.69	0.10	Second generation Irish	1.30	0.97,1.73	0.07
Female gender	1.93	1.67,2.22	p<0.001	Female gender	1.86	1.62,2.13	p<0.001	Female gender	1.83	1.59,2.10	p<0.001
Emotional support	0.79	0.61,1.01	0.06	Social support	1.94	1.39,2.70	p<0.001	Confiding emotional support	0.92	0.78,1.08	0.29

Practical support	0.75	0.59,0.97	0.03						Practical support	0.98	0.84,1.14	0.76
									Negative support	0.50	0.43,0.58	p<0.001
MODEL 6: ADJUSTING FOR STRESSFUL LIFE EVENTS ACROSS THE LIFE COURSE												
Model 6a				**Model 6b**					**Model 6c**			
Prospectively assessed family adversity (age 7)				***One or more stressful life events in preceding six months (age 44/ 45)***					***Job insecurity (age 44, 45)***			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**		**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.19	0.89,1.58	0.25	Second generation Irish	1.24	0.93,1.66	0.14		Second generation Irish	1.28	0.96,1.72	0.09
Female gender	1.80	1.57,2.06	p<0.001	Female gender	1.80	1.57,2.07	p<0.001		Female gender	1.99	1.73,2.30	p<0.001
One or more family difficulties, age 7	1.73	1.45,2.07	p<0.001	One or stressful life events (vs. none)	2.51	2.15,2.93	p<0.001		Not v. secure/ insecure in current job (vs. secure)	2.62	2.15,3.18	p<0.001

ONLINE REPOSITORY

Supplementary table 3: Association of parental migration history (Irish-born versus non-Irish) with poorer self-rated health at mid-life (age 44/ 45), in cohort members, taking into account proximal and distal risk factors, across the life-course

All displayed covariates have been adjusted for each other in each model

MODEL 1: ADJUSTED FOR GENDER ONLY

Covariate	OR	95% CI	p value
Second generation Irish	1.25	0.98,1.60	0.07
Female gender	1.02	0.91,1.14	0.77

MODEL 2: ADJUSTING FOR MATERIAL ADVERSITY ACROSS THE LIFE-COURSE

Model 2a

Childhood material adversity (age 7, 11, 16)

Covariate	OR	95% CI	p value
Second generation Irish	1.10	0.85,1.41	0.46
Female gender	1.00	0.89,1.12	0.99
Household crowding once	1.22	1.01,1.47	0.03
Household crowding twice	1.25	1.04,1.50	0.02
Household crowding thrice	1.27	1.08,1.50	p<0.001
Financial difficulties once	1.41	1.17,1.71	p<0.001

Model 2b

Material adversity (age 23)

Covariate	OR	95% CI	p value
Second generation Irish	1.16	0.91,1.49	0.24
Female gender	0.94	0.84,1.06	0.32
No access/ shared access to indoor toilet	1.10	0.76,1.60	0.62
None/ share access to indoor bathroom	1.22	0.78,1.93	0.38
Lives in council house	1.57	1.32,1.86	p<0.001
Has been homeless	1.23	0.95,1.59	0.11

Model 2c

Material adversity, (age 33)

Covariate	OR	95% CI	p value
Second generation Irish	1.23	0.96,1.59	0.11
Female gender	1.03	0.92,1.16	0.59
Unemployed	2.09	1.63,2.68	p<0.001
Household crowding	1.25	1.04,1.49	0.02
In arrears with bills	1.82	1.32,2.51	p<0.001
No access to phone	0.66	0.53,0.84	p<0.001

Financial difficulties twice	1.82	1.34,2.49	p<0.001	Receiving benefits	1.59	1.37,1.83	p<0.001	Damp in housing	1.29	1.08,1.55	p<0.001
Financial difficulties thrice	1.58	0.96,2.61	0.07	Household crowding	1.56	1.12,2.19	0.01	Lives in council house	2.03	1.71,2.41	p<0.001
Free school meals once	1.09	0.86,1.38	0.45	Unemployed	1.19	0.97,1.47	0.10	No central heating in house	0.73	0.63,0.86	p<0.001
Free school meals twice	1.16	0.85,1.59	0.35					Shared/ reduced access to amenities	1.47	0.86,2.50	0.16
No access to indoor toilet, bathroom or hot water at either 7, 11 or 16	1.29	1.07,1.54	0.01								

Model 2d

Material adversity, (age 42)

Covariate	**OR**	**95% CI**	**p value**
Second generation Irish	1.27	0.98,1.64	0.07
Female gender	0.91	0.81,1.02	0.11
In council housing	2.43	2.05,2.88	p<0.001
No household car	1.04	0.80,1.34	0.77
Has been homeless	1.01	0.72,1.42	0.94
Receiving benefits	0.81	0.70,0.93	p<0.001

Model 2e

Material adversity, (age 44/ 45)

Covariate	**OR**	**95% CI**	**p value**
Second generation Irish	1.27	0.99,1.64	0.06
Female gender	1.00	0.89,1.12	0.94
Difficulties paying bills	1.94	1.64,2.30	p<0.001
Sometimes/ often/ always can't afford food or clothing	1.86	1.61,2.16	p<0.001
No household car	1.86	1.51,2.29	p<0.001

Overcrowding	0.8	0.66,0.98	0.03
Financial difficulties	1.96	1.72,2.22	p<0.001
Unemployed	2.18	1.86,2.55	p<0.001

MODEL 3: ADJUSTED FOR HEALTH-RELATED BEHAVIOURS ACROSS THE ADULT LIFE COURSE

Model 3a ***Hazardous alcohol use (1+ on CAGE) (age 33, 42)***	**OR**	**95% CI**	**p value**	***Model 3b*** ***Harmful alcohol use (8+ on AUDIT) (age 44/ 45)***	**OR**	**95% CI**	**p value**	**Model 3c** ***Life-course tobacco use (age 23, 33, 42)***	**OR**	**95% CI**	**p value**
Second generation Irish	1.22	0.95,1.55	0.11	Second generation Irish	1.24	0.97,1.58	0.09	Second generation Irish	1.23	0.96,1.57	0.10
Female gender	1.10	0.98,1.23	0.11	Female gender	1.11	0.99,1.24	0.09	Female gender	1.04	0.93,1.16	0.53
Hazardous alcohol use on at least one occasion	1.31	1.13,1.51	p<0.001	Harmful alcohol use	1.43	1.26,1.64	p<0.001	Current or ex-smoker on at least one occasion	1.55	1.36,1.78	p<0.001
Hazardous alcohol use on two occasions	1.56	1.34,1.81	p<0.001								

MODEL 4: ADJUSTING FOR PREVIOUS MENTAL HEALTH ACROSS THE LIFECOURSE

Model 4a **Childhood mental health (age 7, 11, 16)**	**OR**	**95% CI**	**p value**	***Model 4b*** **Adult depression (age 23, 33)**	**OR**	**95% CI**	**p value**
Second generation Irish	1.20	0.94,1.53	0.15	Second generation Irish	1.20	0.94,1.55	0.15
Female gender	1.09	0.98,1.22	0.13	Female gender	0.86	0.77,0.97	0.01
Childhood psychological disturbance†	1.94	1.70,2.21	p<0.001	Adult depression at least once	4.04	3.44,4.74	p<0.001

MODEL 5: ADJUSTING FOR PREVIOUS POORER SELF RATED HEALTH

Model 5a

Previous poor self-rated health (age 23, 33, or 42)

	OR	95% CI	p value
Second generation Irish	1.35	1.03,1.77	0.03
Female gender	0.98	0.87,1.11	0.80
Previous poorer self-rated health‡	8.93	7.88,10.13	p<0.001

MODEL 6: ADJUSTING FOR SOCIAL SUPPORT ACROSS THE LIFE COURSE

Model 6a

Social support at age 33***

	OR	95% CI	p value
Second generation Irish	1.24	0.97,1.58	0.09
Female gender	1.07	0.95,1.19	0.27
Emotional support	0.85	0.70,1.03	0.09
Practical support	0.78	0.64,0.95	0.01

Model 6b

Social support** at age 42

	OR	95% CI	p value
Second generation Irish	1.25	0.98,1.59	0.07
Female gender	1.04	0.93,1.16	0.54
Social support	1.65	1.24,2.20	p<0.001

Model 6c

Social support* at age 44/ 45

	OR	95% CI	p value
Second generation Irish	1.27	0.99,1.62	0.06
Female gender	1.05	0.94,1.17	0.40
Confiding emotional support	0.66	0.58,0.76	p<0.001
Practical support	1.12	0.99,1.28	0.08
Negative support	0.74	0.66,0.84	p<0.001

MODEL 7: ADJUSTING FOR STRESSFUL LIFE EVENTS ACROSS THE LIFE COURSE

Model 7a

Adjusting for prospectively assessed family adversity, age 7

	OR	95% CI	p value
Second generation Irish	1.17	0.92,1.50	0.21
Female gender	1.01	0.90,1.13	0.88

Model 7b

Stressful life events in the previous six months (age 44/ 45)

	OR	95% CI	p value
Second generation Irish	1.24	0.97,1.59	0.08
Female gender	1.01	0.91,1.13	0.84

Model 7c

Adjusting for job security, age 44/ 45

	OR	95% CI	p value
Second generation Irish	1.26	0.98,1.61	0.07
Female gender	1.07	0.95,1.19	0.26

One or more family difficulties, age 7	1.64	1.40,1.91	p<0.001	One or more stressful life events in the previous six months	1.48	1.31,1.66	p<0.001	Feels not v.secure/ insecure (vs secure) in current job	1.80	1.51,2.16	p<0.001

***Key to OR table 1 & 2**: † screened positive as a 'case' on the Bristol Social Adjustment Guide or Rutter-B at age 7, 11 or 16; ‡ Rated health as 'fair' or 'poor' at least once, at age 23, 33, or 42; *social support assessed on the Close Person's Questionnaire- intermediate to high levels of confiding emotional and practical social support versus low levels, and low levels negative social support versus intermediate to high levels; **cohort member has someone they could turn to for advice and support (versus none); ***medium to high (versus low) levels of emotional and practical social support*

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract The study design is a historical cohort study; 'birth cohort study' has been indicated in the title
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found The main findings relating to differential experiences of disadvantage in childhood and in early adulthood amongst UK-born Irish people relative to the rest of the cohort, and its role in accounting for observed differences at mid-life for common mental disorders and self-rated health has been described in the abstract.
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Four decades of research has continued to show that second generation Irish people living in Britain experience excess mortality and psychological morbidity, however these differences are not accounted for through socioeconomic position. This is a concern as Irish people living in Britain constitute one of the largest ethnic minority groups however their health needs have been neglected until fairly recently. There have been no studies using prospective cohort data to examine potential life-course antecedents of poorer health in this group of people.
Objectives	3	State specific objectives, including any prespecified hypotheses Main objectives: 1. To establish if second generation Irish people are more likely to grow up under, and live in, circumstances of material and social disadvantage over their life-course, relative to people without a parental history of migration; 2. To establish if the prevalence of common mental disorders and self-rated health (a predictor for mortality) is elevated in second generation Irish cohort members relative to the rest of the cohort, in early adulthood (at age 23, 33), and in mid-life (age 44/ 45); 3. To establish if disadvantage over the life-course mediates any health disparities observed at mid-life (age 44/ 45) in second generation Irish people.
Methods		
Study design	4	Present key elements of study design early in the paper This has been done.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection This has been done.
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Data from all eligible participants (children born in England, Scotland or Wales in the selected week who had one or both parents reporting that they were born in England, Scotland, Wales, Ireland or Northern Ireland) was used. Participants were followed up at age 7, 11, 16, 23, 33, 42, 45/ 46.
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed Not applicable

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Main outcomes: common mental disorders assessed at age 23, 33, 44/ 45, self-rated health assessed at 23, 33, 42. Main exposure: parental migration history. Effect modifier: gender- which was adjusted for as no interactions with gender were found. Other exposures/ covariates were social and adversity indicators assessed over the life-course which were analysed in models as putative mediators for the association between parental migration history and mid-life common mental disorders and poorer self rated health.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group This has been done.
Bias	9	Describe any efforts to address potential sources of bias Bias due to missing data/ attrition was handled using multiple imputation under assumptions of Missing At Random (MAR)
Study size	10	Explain how the study size was arrived at This was a secondary analysis of an existing dataset.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Not applicable
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding This has been done- see 'statistical analysis' section in manuscript
		(*b*) Describe any methods used to examine subgroups and interactions Only gender interactions with ethnicity for mid-life common mental disorders and poorer self rated health were assessed. These were specified in the imputation regression and then assessed in the analysis using standard multivariate techniques. No interactions with gender were found, so models have been adjusted for gender.
		(*c*) Explain how missing data were addressed This has been explained in the text, under section entitled 'Missing Data'. Multiple Imputation using the chained equations approach in STATA 10 was the main method used, followed by analysis using MIM in STATA 10.
		(*d*) If applicable, explain how loss to follow-up was addressed As above- assumed that data was missing at random. Predictors for attrition were entered into the imputation regression. Estimates derived through multiple imputation and through complete case analysis were compared as a sensitivity analysis and very little differences were found.
		(*e*) Describe any sensitivity analyses Estimates derived through multiple imputation were compared to estimates derived through complete case analysis and very little differences were found.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the

		study, completing follow-up, and analysed This has been done
		(b) Give reasons for non-participation at each stage A supplementary table showing rates of attrition in the sample has been provided.
		(c) Consider use of a flow diagram A table has been provided instead.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders This has been done within the text.
		(b) Indicate number of participants with missing data for each variable of interest Overall proportions of missing data for the main dependent variables have been provided in the text. Table 1 shows the number of cohort members used for each part of the analysis for the main dependent variables, as analysis of imputed data was restricted to individuals with complete information on outcomes.
		(c) Summarise follow-up time (eg, average and total amount) Follow-up time was the same for all cohort members and is provided in the methods section
Outcome data	15*	Report numbers of outcome events or summary measures over time This has been done – see table 1 and figure 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included All models have been adjusted for gender. In addition the analysis examined a number of potential mediators over the life course in accounting for mid-life health inequalities in second generation Irish people in the cohort. The rationale for this approach is explained in the text.
		(*b*) Report category boundaries when continuous variables were categorized Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Not thought to be applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses See statistical methods section- interactions with gender were assessed
Discussion		
Key results	18	Summarise key results with reference to study objectives This has been done- first few paragraphs in the 'Discussion section' of the manuscript
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Limitations have been discussed under a separate heading in the 'Discussion' section.

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence This has been done- the findings are consistent with findings from a wider body of work which has examined childhood adversity or the role of 'sensitive periods' in increasing the risk of downstream adult health outcomes.
Generalisability	21	Discuss the generalisability (external validity) of the study results This has been done under the 'Strengths and limitations' in the Discussion section.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based This has been done- see 'Acknowledgements' section of the manuscript

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

PROTOCOL
SUBMITTED TO MRC PANEL OCTOBER 2007

Does childhood disadvantage lead to poorer health in second generation Irish people living in Britain?

BACKGROUND

Three decades of research[1-3] have indicated that Irish people living in Britain suffer elevated mortality and morbidity[3] compared with non-Irish White British people. These health effects persist into the second[1] and third generations[2] despite greater upward social mobility and improvements in socioeconomic circumstances. High rates of ischaemic heart disease[3], cerebrovascular disease[3], and hypertension[4] may partly account for elevated mortality in Irish people. Irish people also experience higher rates of common mental disorders[5] and suicide[6]. Putative factors which have been suggested to account for these health effects include 'selection effects', identity difficulties[6] and social deprivation[7]. Although controversial, alcohol misuse may be an additional aetiological factor[8].

There have, however, been very few longitudinal studies that have examined the health of Irish people or other migrant groups in Britain using a life-course approach. Longitudinal studies elsewhere have suggested that social class and the processes of migration and settling into a new host country interact dynamically over the life course and lead to specific health effects in migrants which diverge from the host population[9]. The policy benefits of using a life course approach are obvious; by identifying structural factors that impact on the health of second generation Irish people from childhood through to adulthood, (including later morbidity linked to elevated mortality risk), it may be possible to identify earlier 'intervention points', which could reduce later 'downstream' adverse health outcomes. This proposal will seek to explore the mechanisms through which morbidity may be 'transmitted' across generations, amongst Irish people living in Britain, by using data from two ongoing birth cohorts; the National Child Development Survey (NCDS), which first commenced in 1958, and the 1970 British Birth Cohort (BCS70). The findings will be compared with the Ethnicity Minority Psychiatric Illness Rates in the Community survey (EMPIRIC)[5], a cross-sectional survey.

In this proposal the shorthand '*poorer health outcomes'* refers to the following adult health outcomes: common mental disorders, hazardous alcohol use, suicidal ideation, self-reported longstanding illness, and hypertension. Gender will also be specifically examined in each of the models.

OBJECTIVES: 1) To determine the prevalence of poorer health outcomes in second generation Irish people in the most recent sweeps of the 1958 & 1970 British Birth Cohorts (age 34 in the BCS70 and age 46 in the NCDS) and to compare these with data from the EMPIRIC. **2)** Using a longitudinal approach, to determine those childhood and early adulthood factors which may predispose or protect against (downstream) poorer health outcomes in second generation Irish people, compared to non-Irish respondents in the 1970 and 1958 British birth surveys.

HYPOTHESES: 1) Early adverse experiences in childhood will predispose to childhood internalising and externalising disorders which will predispose to later life (adult/ downstream) poorer health outcomes and tobacco use in adulthood; this will be more evident in Irish-descended people, compared to the rest of the sample **2)** Amongst the sample as a whole, upwards social mobility will be more likely amongst Irish-descended cohort members compared to the rest of the sample. However, any protective effect of upward social mobility on adult health

will be less evident among Irish-descended cohort members **3)** Increased prevalence rates in adulthood of hazardous alcohol use and tobacco use, will be predicted by poorer psychological health across the life course in Irish-descended cohort members, compared to non-Irish cohort members.

METHODS 1) Datasets: NCDS & BCS70 The 1958 birth cohort included all children born in England, Scotland, and Wales during 3-9 March 1958. 98% of live births in this week were included in the survey, which totalled 17,414 live births. The 1970 birth cohort was similar, with over 17,000 births in Britain over the week of 5-11 April 1970. Data for both of the surveys were taken from parents, teachers, doctors, school records, as well as by interview of cohort members at ages 7, 11, 16, 23, 33, 42 (1958 cohort), and at ages 5,10,16,26, 30, 34 (1970 cohort). Parents of children in the cohort were asked to confirm their country of birth. Using this method there are 627 cohort members with one or both parents born in the Republic of Ireland or in Northern Ireland, in the 1958 cohort. In the 1970 cohort 847 children were similarly identified and followed up over the subsequent sweeps of the BCS70 survey, into adulthood. **EMPIRIC:** For the purposes of comparison, the Ethnicity Minority Psychiatric Illness Rates in the Community (EMPIRIC) survey[5] will be used. This was a follow-up of ethnic minority groups covered in the 1999 Health Survey for England (HSE) study along with the white English sample who had previously taken part in the 1998 HSE. There were 733 people describing their ethnicity as Irish.
2) MAIN MEASURES: (due to space limitations the following list is not exhaustive) Socioeconomic variables: (Birth): 1) Social class, occupation, employment status of cohort member's father at birth (1958 & 1970 cohorts) **(Adulthood):** Occupational social class at ages 42 (NCDS) & 34 (BCS70). '**Social mobility'** will be determined across the life course by taking father's occupation at birth and comparing with cohort member's occupation in adulthood (age 46 in NCDS and age 34 in BCS70) **Childhood variables:** 1) **Behaviour**- Parents completed the Rutter Home scale for behaviour at ages 7, 11, and 16 (NCDS) and age 10, 16 (BCS70)[12,13], to assess for emotional & conduct disorders in childhood. Examples of statements used to identify conduct disorders included: *Destroys own or others belongings;* whilst statements used to identify childhood emotional disturbances included *Is miserable or tearful*[12,13]. Items will be scored according to the scale[12,13]. 2) **Stressful events in childhood**: Parents were asked about; their child being bullied at school (NCDS only); number of family moves since birth; their child spending any time in care or experiencing any significant maternal separation; any outside agencies being involved with the child's care; domestic tension at home; financial & housing difficulties at home (age 5 BCS70; age 7 NCDS); death of mother or father; significant parental illnesses (mental health problems, alcoholism, chronic physical illnesses or disabilities) (age 7 NCDS; age 5 BCS70). **Outcomes *('poorer health outcomes'):* NCDS:** 9377 participants took part in the biomedical sweep of the NCDS at age 45, with a response rate of 78%[10]. Measures to be used from this phase: 1) **Blood pressure**- Hypertension will be treated as a categorical variable and considered present if blood pressure was greater than 140/90, or if cohort members report being prescribed antihypertensive medication. If numbers permit, Metabolic Syndrome[20] will also be examined as an outcome, using other relevant data from this sweep (ie. glucose, cholesterol & triglycerides, blood pressure, waist:hip measurements). 2)**Self-reported longstanding illness** 3)**Common mental disorders** & **suicidal ideation**- ICD10 diagnoses[15] determined through the *Clinical Interview Schedule-Revised* (CIS-R)[16] 5)**Hazardous alcohol use**- determined through the Alcohol Use Disorders Inventory Tool (AUDIT)[17]. Hazardous alcohol use will be defined as a score above 8[17]. **BCS70:** 9664 individuals in the 1970 cohort completed interviews at the age of 34 (2004). Outcome measures to be used from this phase; 1) **Self-reported longstanding illness**; 2) **Psychological malaise**- the malaise inventory was used to indicate

psychological morbidity. Cut-offs above 6/7 suggests caseness for depression, with sensitivity 0.64 and specificity of 0.88[14] 3)**Alcohol**- The CAGE questionnaire was used to enquire after drinking habits within the previous year (cut off>2 suggest harmful use), questions around heavy alcohol use were also asked: >50 units of alcohol/ week (men), >35 units of alcohol/ week (women) indicating hazardous use. **Tobacco**- 'Regular smoking', defined as ≥1+ cigarettes/ day for at least 12 months, measured in most recent sweeps, of both NCDS and BCS.

Selected health indicators in the 1958 and 1970 cohorts, recent sweeps (2000 survey)

	Cohort year	Irish CM	Non-Irish CM	N
One or more longstanding illnesses	1958	**34.1%***	**29.1%***	3327
	1970	26.7%	23.4%	2422
Psychological malaise†	1958	18.9%	17.8%	2004
	1970	**22.6%***	**16.9%***	1744
Harmful alcohol use¥	1958	16.7%	15.1%	1442
	1970	17.1%	14.2%	1452
Hypertension (self report)	1958	11.4%	11.4%	1300
	1970	**11.8%***	**7.8%***	797

**p≤0.05; †Scores of 7 or more on malaise inventory; ¥ Scores of 2 or more on CAGE questionnaire; 'CM': cohort members*

STATISTICAL ANALYSIS: STATA[18] will be used to generate prevalence figures of poorer health outcomes in adulthood in the NCDS & BCS70 and will be compared with age and gender adjusted prevalence from the EMPIRIC. Factors associated with these outcomes (social support, marital status, educational level, stressful life events, gender and social class) will be examined using multivariable logistic regression techniques. **Structural Equation Models:** Mplus[19] will be used to model complex interactions between downstream health effects & earlier exposures (eg. childhood internalising/ externalising disorders), with potential interactions such as the impact of social mobility on these effects. **Handling of sample attrition and missing data within the NCDS & BCS70:** As with any longitudinal survey both the NCDS and BCS70 suffered from loss to follow up over time. Overall, response rates/ attrition for second generation Irish people within the two cohorts did not differ significantly from overall response rates for the 1958 and 1970 cohorts. Attrition within this study will be handled using the techniques previously described by Clark *et al* (2007)[10], with weighting for missing data and missing data imputation, where appropriate. **Cohort, period and age effects:** Cohort, period and age effects potentially impacting on outcomes in the 1958 and 1970 cohorts will be examined in the first instance descriptively. If sample sizes permit then this will be subjected to more formal statistical analysis using the methods described by Sacker *et al* (2002)[11]. Age effects will be further compared using the EMPIRIC.

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22, 465 (1992) **17)** TF Babor et al, *AUDIT: Alcohol Use Disorders Identification Test: Guidelines for use in primary care, second edition* (WHO 1992) **18)** StataCorp. *Intercooled STATA, version 9.1 for Windows* (College Station, USA, 2005) **19)** LK Muthen, BO Muthen. *Mplus user's guide*. (Muthen & Muthen, USA, 1998) **20)** KGM Alberti et al, *The Lancet* **366,** 1059 (2005)

Does childhood adversity account for poorer mental and physical health in second generation Irish people? Birth cohort study

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Title: Does childhood adversity account for poorer mental and physical health in second generation Irish people living in Britain? Birth cohort study from Britain (NCDS)

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Objectives: Worldwide, the Irish diaspora experience elevated mortality and morbidity across generations, not accounted for through socioeconomic position. The main objective of the present study was to assess if childhood disadvantage accounts for poorer mental and physical health in adulthood, in second generation Irish people.

Design: Analysis of prospectively collected birth cohort data, with participants followed to mid-life.

Setting & participants: 17,000 babies born in a single week in 1958 in England, Scotland and Wales. 6% of the cohort were of second generation Irish descent.

Outcomes: Primary outcomes were common mental disorders assessed at age 44/ 45 and self-rated health at age 42. Secondary outcomes were these assessed at age 23 and 33.

Results: Relative to the rest of the cohort, second generation Irish children grew up in marked material and social disadvantage, which tracked into early adulthood. By mid-life, parity was reached between second generation Irish cohort members and the rest of the sample on most disadvantage indicators. At age 23 Irish cohort members were more likely to screen positive for common mental disorders (OR: 1.44; 95% CI: 1.06, 1.94). This had reduced slightly by mid-life (OR: 1.27; 95% CI: 0.96, 1.69). Whereas at age 23 second generation cohort members were just as likely to report poorer self-rated health (OR: 1.06; 95% CI: 0.79, 1.43), by mid-life this difference had increased (OR: 1.25; 95% CI: 0.98,1.60). Adjustment for childhood and early adulthood adversity fully attenuated differences in adult health disadvantages.

Conclusions: Social and material disadvantage experienced in childhood continues to have long-range adverse effects on physical and mental health at mid-life, in

second generation Irish cohort members. This suggests important mechanisms over the life-course, which may have important policy implications in the settlement of migrant families.

ARTICLE SUMMARY

Article focus

- In a nationally representative birth cohort from Britain, to assess the prevalence of mid-life common mental disorders and poorer self-rated health in second generation Irish respondents relative to the rest of the cohort.
- To assess the contribution of psychosocial and material disadvantage over the life-course (from childhood through to adulthood) in accounting for any observed health inequalities noted in Irish cohort members.

Key messages

- Second generation Irish children were more likely to grow up under circumstances of marked material and social adversity relative to the rest of the cohort. By mid-life, second generation Irish cohort members were no longer disadvantaged, relative to the rest of the cohort, suggesting a degree of differential upward social mobility.
- Yet, compared to the rest of the cohort, second generation Irish people experienced an elevated relative odds of common mental disorders and poorer self-rated health at mid-life. This disappeared after adjusting for childhood disadvantage.
- The findings imply that adult health disadvantages in migrant or ethnic minority groups may be 'transmitted' through exposure to childhood adversity, a factor which may be related to migrant settlement experiences.

Strengths and Limitations

- The study used mostly prospectively collected data from a nationally representative birth cohort from Britain.
- Detailed assessment of psychosocial and material circumstances in childhood and adulthood were obtained. Main outcomes were assessed using structured, validated scales (for mental health) or a standardised question around self-rated health.
- Limitations of the study include the use of parental country of birth to determine ethnicity and the lack of measures assessing the specific migration experiences of Irish cohort members, as this was a historical cohort study.

Introduction

Four decades of research has suggested that Irish people living in Britain experience elevated mortality[1-4] and morbidity[5, 6], relative to the rest of the population. A similar phenomena has been noted worldwide[7-9]. These inequalities persist into second[1, 5] and later generations[2, 10]. An elevated prevalence and incidence of depression and suicidality has also been noted in Irish-born and second or later generation Irish people[7, 11-14]. This is out of keeping with the assertion that over time and subsequent generations, the health of migrant groups should start to approximate to that of the receiving country[3].

There have been few longitudinal studies which have examined the health of Irish people or other migrant groups using a life-course informed approach. Longitudinal studies from North America have suggested disadvantage related to the processes of migration and settling into a new host country interact dynamically over the life course and lead to specific health effects in migrants which diverge from the host population[15]. The policy benefits of using a life course approach are obvious; by identifying structural factors that impact on the health of second generation Irish people from childhood through to adulthood, it may be possible to identify earlier 'intervention points', which could reduce later 'downstream' adverse health outcomes.

We analysed data from a nationally representative British birth cohort to establish if second generation Irish people were more likely to grow up under, and live in, circumstances of material and social disadvantage over their life-course, relative to people without a parental history of migration. Our second objective was to establish

if the prevalence of common mental disorders and self-rated health (a predictor for mortality[16]) would be elevated in second generation Irish cohort members relative to the rest of the cohort, at age 23, 33, and at mid-life (age 44/ 45). Finally, we sought to establish if disadvantage over the life-course mediated any health disparities observed at mid-life (age 44/ 45). In particular, we wished to assess the contribution of disadvantage broken down by *timing* of exposure (childhood, early adulthood, mid-life) and *type* of exposure (material disadvantage, social adversity, health-related behaviours and prior mental health/ self-rated health).

Methods

Study sample

The National Child Development Survey (NCDS) surveyed 17415 babies born during March 3-9 in 1958 (98% of live births), and followed respondents into adulthood. Parents, teachers and medical personnel were interviewed when children were 7, 11 and 16. At age 23, 33, 42 and 44/ 45 cohort members were interviewed. For the analysis, the 'target sample' was: children born in England, Scotland and Wales in the selected week, and children with both parents born in England, Scotland and Wales, or who had one or both parents born in Ireland or Northern Ireland.

Parental migration status

At sweeps two and three, parents reported their country of birth. Cohort members with one or both parents reporting that they were born in Ireland or Northern Ireland were classified as 'second generation Irish'. Excluding non-responders, kappa assessing reliability of parental responses to this question between the two sweeps was high (kappa=0.97).

MEASURES

CHILDHOOD

Material and social adversity measures

At 7, 11 and 16 parents of children were asked if they had experienced financial difficulties in the previous year, or lived in overcrowded housing (1+ persons/ room). Parents were asked if they had access to hot water, an indoor toilet and an indoor bathroom. At 11 and 16 parents reported if their child received free school meals. At age 7 health visitors assessed family difficulties, these were problems with: housing,

finances, physical or mental illness/ disability, learning disabilities, death, divorce, parental separation, domestic tensions, in-law conflicts, unemployment, alcoholism, or any other difficulties 'affecting child's development'.

Childhood psychological health

At 7 and 11, teachers rated children's emotional and behavioural health using the Bristol Social Adjustment Guide (BSAG)[17]. At age 16, the Rutter School Behavioural Scale (Rutter-B), was completed by teachers[18]. Scores on both scales were summed, square root transformed, with the top 13% indicating children who were a 'case'[19].

ADULTHOOD

Material and social adversity measures

Cohort members were asked if they lived in overcrowded housing (1+ persons/ room) (age 23, 33, 42), were unemployed (23, 33, 42), lived in council housing (23, 33, 42), had been homeless (23, 42), received benefits (23, 42), had access to an indoor toilet/ bathroom (23), had experienced difficulties paying bills (33, 45), had a telephone (33), had damp or lacked central heating in their house (33), had no car (42, 45), had experienced financial difficulties (42), or couldn't afford food or clothing (45).

At age 33 cohort members rated emotional and practical social support provided from four sources of support[20]. At age 42, cohort members reported if there was someone they could turn to for support. At 44/ 45, the Close Person's Questionnaire[21] assessed social support provided from the closest nominated

person.

Stressful life events within the previous six months were assessed at 44/ 45. These were: cohort member/ close relation suffering serious illnesses, injury/ assault, death of parent/ child/ partner or close friend/ relative, end of serious relationship, serious problems with a close friend/ neighbour/ relative, serious disappointments at work, cohort member/ partner fears losing their job, losing one's job, major financial crises, problems with the police, and theft. Responses were dichotomised into '*experienced no stressful life events'* versus '*experienced 1+ stressful life events'*. At age 44/ 45, cohort members' job security was also enquired after.

Health-related behaviours

At age 33, and 42, people responding in the affirmative to ≥1 items on the CAGE were classed as reporting hazardous alcohol use[22]. This questionnaire comprises four questions *("Have you wanted to **C**ut down your alcohol use lately?" "Do you get **A**ngry if other people suggest you should cut down your alcohol use?" "Do you feel **G**uilty about the amount of alcohol you consume?" "Have you ever needed an **E**ye-opener?"*)[22]. At age 44/ 45, people scoring ≥8 on the *Alcohol Use Disorders Identification Test* (AUDIT) were classed as reporting hazardous use[23]. Cohort members also reported if they were current or previous smokers at 23, 33 and 42.

ADULT HEALTH OUTCOMES

Mental Health

Malaise Inventory

At age 23 and 33 cohort members completed the Malaise Inventory, which is a

structured self-report tool which assesses recent psychiatric morbidity[24]. Questions asked include "*Do you often feel miserable or depressed?", "Do you wake unnecessarily early in the morning?"*[24]. Scores of ≥8 indicated depression[25].

Clinical Interview Schedule-Revised (CIS-R)

The CIS-R assessed mid-life common mental disorders at age 44/45 [26]. This is a structured validated instrument administered by trained lay interviewers, where scores of ≥12 indicate common mental disorders[26]. In the NCDS, a shortened form of the CIS-R was used, in which sections enquiring after worry, obsessions, somatic symptoms, compulsions and physical health worries were omitted[27], thus focusing on depressive and anxiety disorders. To ensure that the results of the present analysis would be comparable to previous surveys[28, 29], an equivalent cut-point on the abbreviated CIS-R scale was determined.

Data from the 2000 National Psychiatric Morbidity Survey (NPMS)[29] and from the 2000 Ethnic Minorities Psychiatric Illness Rates in the Community Survey (EMPIRIC) [28]were used to devise an abbreviated scale of symptoms on the CIS-R, with the same items which had been omitted in the 2000 sweep of the NCDS also omitted. To determine equivalent cut-points to conventional cut-points of 11/12 on the full-scale CIS-R, a linear regression of the full-scale CIS-R was performed against the abbreviated scale from the CIS-R using NPMS and EMPIRIC data. The resultant regression equation was used to predict the equivalent cut-point on the abbreviated CIS-R scale. Using this approach, a cut-point of ≥9 was equivalent to the conventional cut-point of ≥12. Kappa comparing the cut-point for 11/12 on the full-scale CIS-R to a cut-point of 8/9 on the abbreviated scale was 0.86 for the NPMS

and 0.85 for the EMPIRIC (both p<0.001).

Self-rated health

At age 23, 33 and 44/ 45 cohort members asked: *"How would you describe your health generally?"* Responses were dichotomised into 'excellent/ good' versus 'fair/ poor'.

Statistical analysis

STATA 10.1 was used for analyses[30]. The association of social and material adversity measures over the life course, from childhood to adulthood, was assessed in second generation Irish cohort members, relative to non-Irish cohort members. Next, the odds of screening positive for common mental disorders and poorer self-rated health, in second generation Irish cohort members, relative to non-Irish cohort members, was assessed at 23, 33, and 44/ 45, using multivariable logistic regression. Common mental disorders and poorer self-rated health at these time points was specified as the dependent variables.

The contribution of adversity variables over the life-course in mediating excess risks of common mental disorders and poorer self-rated health at mid-life was assessed[31]. To assess mediation, three criteria needed to be fulfilled[31]. First, the association of parental migration history with putative mediator was assessed using multivariable logistic regression[31]. Second, the association of the putative mediator with the outcome variable (poorer self-rated health and common mental disorders at mid-life) was assessed using multivariable logistic regression[31]. Finally the association of parental migration history with outcome- (either mid-life common

mental disorders or poorer self-rated health at mid-life) was assessed in the presence of the putative mediator[31]. If the coefficient for the association between parental migration history and outcome was reduced in the presence of the putative mediator, then it was presumed that the data were consistent with mediation[31].

Missing data

As with any prospective survey, missing data due to attrition was a concern. At age 7, 11 and 16 response rates were 89%, 88%, 84%, and at 23, 33, 42 response rates were 72%, 65% and 66%[32]. At age 44/ 45, complete data was available for the CIS-R for 9297 individuals (which was 99% of the biomedical sample), and complete data was available on self-rated health in 9115 individuals (97% of the biomedical sample).

As missing values were likely to be missing at random[33], missing values were imputed using the chained equations approach ('ICE') in STATA 10 [30, 34]. Imputations were conducted on all cohort members known to be alive at the time of the biomedical survey (age 44/45). 50 imputed datasets were created using proper imputation from an imputation model in which all covariates as well as variables known to predict attrition (mother's education, region of birth, employment at 33 and social class at all sweeps) were included[35, 36]. Analyses were performed on each imputed dataset using multivariable logistic regression, and estimates combined using Rubin's Rules[33]. Wald tests assessed strength of associations.

Results

Rates of attrition were similar in second generation Irish respondents compared to the rest of the sample (supplementary table 1). In un-imputed data 90% of Irish children had a father of a manual social class background, compared to 82% of non-Irish children, at age 7. This figure remained fairly similar at mid-life (age 42) (90% and 81% respectively), indicating that there had not been differential attrition by childhood social class over the course of follow-up. 9377 cohort members provided data at age 44/45. Excluding migrants and children with parents not born in England, Scotland, Wales, Ireland or Northern Ireland, analyses were performed on 8403 individuals providing complete information on the CIS-R, and on 8243 individuals providing a response to the self-rated health at mid-life question.

Experiences of social adversity over the life course

Figure 1 displays how social adversity differed for second generation Irish cohort members, compared to non-Irish counterparts, over the life-course. Irish cohort members experienced marked social adversity across all childhood sweeps, relative to the rest of the cohort. These inequalities tracked into early adulthood, with differences still apparent at age 23, and to an extent, at 33. By mid-life (42, 44/ 45) life-course social adversity measures were equivalent in second generation Irish cohort members relative to non-Irish cohort members.

[FIGURE 1 HERE]

Assessment of health over the life course

Table 1 displays differences in common mental disorders and self-rated assessments of health, assessed prospectively at age 23, 33, and 44/45. After adjusting for gender, second generation Irish cohort members were 1.44 times more

likely to screen positive for depression at 23 (95% CI: 1.06, 1.94) (Table 1). Second generation Irish cohort members continued to carry this relative excess risk throughout their life course, although the magnitude of the difference had diminished by age 33. In contrast, second generation Irish cohort members were no more likely to report fair or poorer self-rated health in early adulthood (age 23, 33), although by mid-life (age 44/45) there was a suggestion of widening inequalities affecting the Irish group with respect to this measure (Table 1).

[TABLE 1 HERE]

Mid-life health in second generation Irish cohort members

The association of being second generation Irish and screening positive for common mental disorders and poorer self-rated health at mid-life was assessed after taking into account exposures at earlier time points (tables 2 & 3). The largest attenuation for both common mental disorders as well as poorer self-rated health at mid-life was from material adversity assessed in childhood. A similar attenuation in the excess risk was seen when prospectively assessed family adversity (at age 7) was added into the models (tables 2& 3). Material adversity at age 23 attenuated the excess risk of being Irish with poorer health at mid-life, albeit to a lesser extent than childhood adversity variables. Health-related behaviours, prior mental health/ self-rated health, and covariates assessed from age 33 onwards, did not attenuate associations of being second generation Irish with poorer mid-life health. The tables in the online repository show full associations for tables 2 and 3.

[TABLE 2 HERE]

[TABLE 3 HERE]

Discussion

The findings suggest that second generation Irish children born in the late 1950s experienced greater levels of childhood adversity than those of English, Scottish or Welsh heritage, although social and economic inequalities diminished between the two groups as the cohort entered mid-life. Despite improvements in material and social conditions by adulthood, an inheritance of poorer health at mid-life for second generation Irish people was evident, relative to the rest of the cohort. Childhood material and social adversity as well as early adulthood material adversity accounted for these differences, whereas health-related behaviours and earlier psychological health/ self-rated health did not.

Second generation Irish cohort members had an elevated risk of common mental disorders in early adulthood (age 23) which had partially reduced by mid-life. In contrast, for poorer self-rated health, (also a predictor for mortality[16]), although there were no differences between second generation Irish cohort members and the rest of the cohort at earlier time-points, by mid-life differences had started to become apparent.

Our findings are consistent with a large body of evidence which has shown that childhood adversity exerts long range effects on a variety of adult health outcomes, including (but not limited to): mental health[37-39], self-rated health[40], mortality[41, 42], poorer cardiovascular health, dental health and substance abuse[43]. Studies using data from birth cohorts[43] (including those using data from the NCDS[38]) have shown that social class gradients in health do not emerge exclusively in adulthood but have origins in childhood, and social and material adversity may

accumulate in individuals both cross-sectionally and longitudinally, over time[38]. In the present study, there was evidence to suggest that Irish cohort members were more likely than the rest of the cohort to experience an accumulation of adversity in childhood and in early adulthood; and that this to a certain extent, accounted for a greater risk of mid-life common mental disorders and poorer self-rated health, compared to the rest of the cohort. The findings of the present study are therefore in keeping with a 'sensitive period' in childhood/ early adulthood which continues to adversely influence adult health many years later[44], and may be relevant in understanding previously reported adult health inequalities experienced by second generation Irish people, despite apparent improvements in socioeconomic position across generations [1, 12].

Strengths and limitations

The data derives from a nationally representative sample from England, Scotland and Wales, therefore the findings are generalisable to second generation Irish people, now in mid-life. Most assessments were prospective, reducing the possibility of measurement bias. The possibility of reverse causality may have been an issue, as people who had poorer health at the earlier time-points may have been more likely to move into or stay in conditions of adversity. The isolated mediating effect of early life disadvantage is therefore striking, as one would have expected a larger contribution of adult social and material adversity in mediating differences.

We could not assess exposures which may have been important in understanding the specific settlement experiences of Irish people living in Britain, as these were

unavailable. These might include factors relating to migration and settlement, such as the pre-migration health of parents, reasons and circumstances surrounding migration[11] experiences of discrimination[11] and residential or neighbourhood context[45]. Future research should endeavour to understand how these factors operate within a life-course framework.

There has been one other study from the 1970 British birth cohort which has also shown that second generation Irish children were more likely to be born into disadvantage, compared to the rest of the population[46]. This suggests a degree of consistency across periods and cohorts. However we cannot be sure if period-specific effects accounted for some of the findings. In 1958 it was common for Irish people to experience overt discrimination, for example signs reading "*No Irish Need Apply*"[47], would have been frequently encountered when applying for employment or accommodation. By the time cohort members were aged 23 (1981) the conflict in Northern Ireland had escalated such that anti-Irish discrimination and issues relating to identity may have had a particular salience for second generation Irish people at that time[48]; this may have contributed to the mental health inequalities noted at this age, although it was not possible to discern this from the present analysis.

Relationship to historical context and policy implications

In 1958 Irish citizens would have been subject to the recently instated 'common travel area', which enabled relatively informal migration between Ireland to Britain. Irish-born people migrating to Britain at this time took up employment in industries in which post-war labour shortages in Britain were greatest, this included the construction industry, domestic and personal industry, and nursing[49]. Adverse

health outcomes previously noted in Irish-born migrants to Britain have been suggested to have been due to a relative lack of barrier to migration[3], alongside post-migration settlement experiences where work in transient and poorly paid employment was more likely[11]. The present analysis suggests mechanisms by which such inequalities were then subsequently 'transmitted' to the next generation.

We did not have data to directly examine the childhood circumstances of Irish-born parents of cohort members. Irish-born migrants to Britain in the immediate post-war period were more likely to be shorter in height, and less well educated than both Irish people who stayed behind in Ireland, as well as English people living in England at this time[50]. This might support the assertion that Irish-born migrants to Britain in the 1950s were selectively of poorer health[3, 50]. This is also consistent with the assertion that parents of second generation Irish cohort members may have experienced material adversity in their own childhoods. Although this cannot be examined directly in this dataset, findings from other cohorts have indicated that material adversity[51], as well as other risk factors for poorer adult health, such as birth weight, may 'transmit' across generations[52]. It has been suggested that the economic and social resources of parents may impact on the adult health of their offspring, through the exposure of offspring to environmental factors in early life[51], or that early childhood adversity may impact not only on later adult health, but also on the birth-weight of future offspring[53] In addition, a study of first and second generation ethnic minority women in Britain (women of Indian, Pakistani, Bangladeshi, Black Caribbean and Black African origin) found that the mean birth weight of first and second generation ethnic minority women was lower than that of white British women, with no evidence of an increase in birth weight across

generations, despite it being known that these groups experience high levels of upward social mobility across generations[54]. Given the links between low birth weight and later poorer adult health, such an intergenerational 'lag' in low birth-weight may lead to persistent poorer health in ethnic minority groups, even if improved social circumstances had been experienced at later time points over the life-course, or across subsequent generations. Potentially, this has implications in the understanding of the 'transmission' of health inequalities in other migrant groups who may have experienced social deprivation in their childhoods, relative to people of the receiving country, and who may therefore continue to experience health inequalities in adulthood across subsequent generations, despite apparent improvement in their material circumstances.

Although by mid-life, second generation Irish people enjoyed social circumstances at parity with the rest of the cohort, an inheritance of growing up in adversity as a result of parental migration and settlement experiences has continued to influence downstream health outcomes. The relative non-specificity of childhood disadvantage in being detrimental to later health suggests important priorities for future research on the health of migrant groups now settling in Britain. Although the process of migration and settlement may mean that the experiences of relative social deprivation are transient[15, 55], tackling health inequalities in second generation groups may mean directing concerted attention to childhood. The findings suggest the importance of considering the life-course in its entirety, rather than taking 'snapshot' measures of socioeconomic position at single time-points[55], as it is clear that the experiences of adversity over the life-course have differed greatly for second generation Irish people, relative to their non-Irish counterparts.

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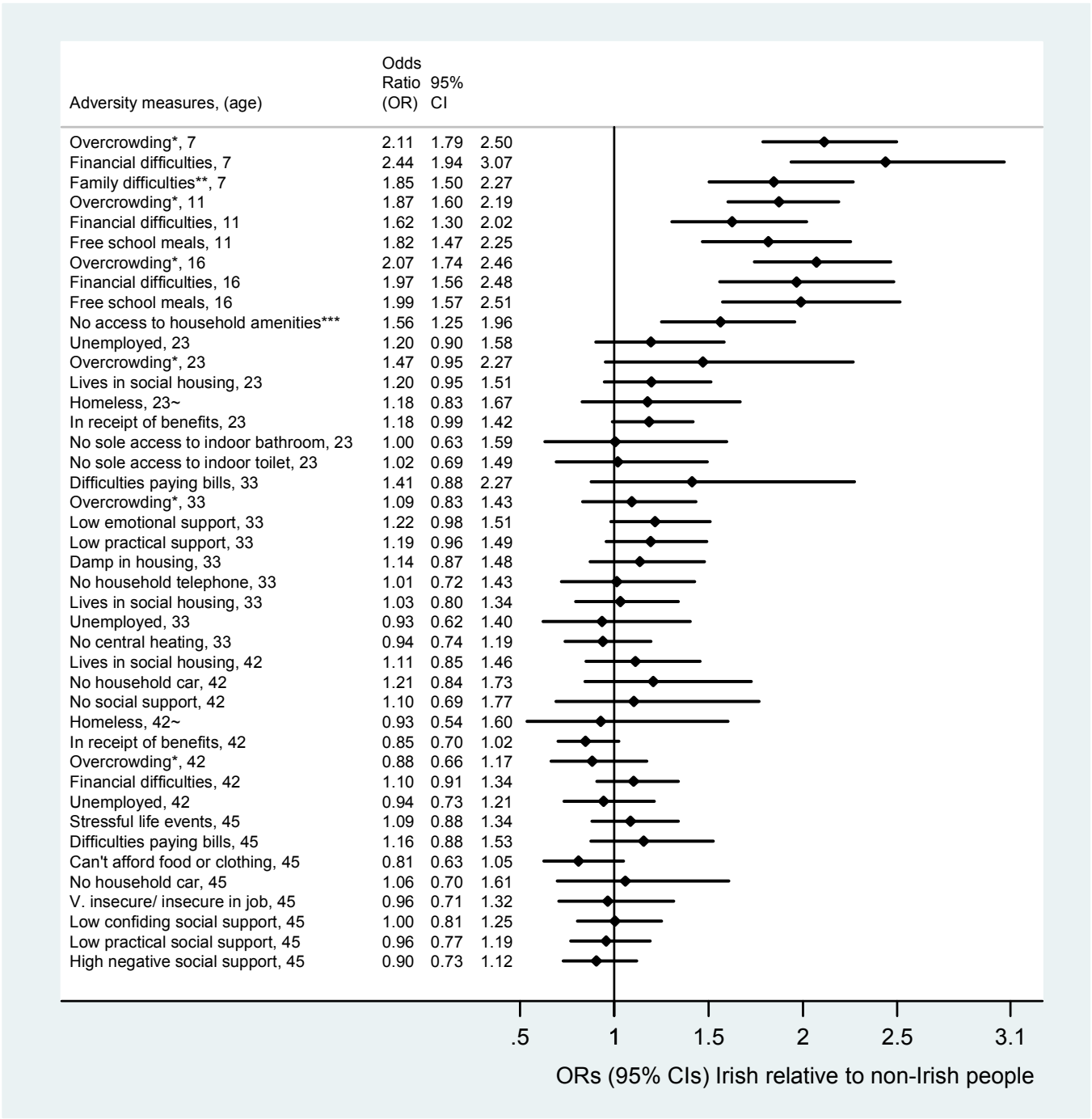
Figure 1: Odds ratios for social adversity across the life-course; Second generation Irish cohort members relative to non-Irish cohort members.
Estimates on the vertical line represent no difference between the two groups



Key: **more than one person/ room; **one or more family difficulties as prospectively rated by health visitor (difficulties with: housing, finances, physical illness/ disability, mental illness/ neurosis, mental sub-normality, death of child's mother or father, divorce/ separation/ desertion, domestic tension, "in-law" conflicts, unemployment, alcoholism, or any 'other serious family difficulties affecting child's development'); ***no access to at least one of: indoor bathroom, indoor toilet or hot water at either age 7, 11, or 16; ~periods of homelessness since last assessment*

Table 1: Common mental disorders and self-rated health in second generation Irish people across the life course

Common mental disorders				
Age		**Number of observations**	**OR**	**(95% CI)**
23†	All other	11036	1.00	(ref)
	Second generation Irish		1.44	1.06,1.94
33†	All other	9980	1.00	(ref)
	Second generation Irish		1.31	0.94,1.81
45‡	All other	8403	1.00	(ref)
	Second generation Irish		1.27	0.96,1.69
Poor self-rated health				
Age				
23	All other	11067	1.00	(ref)
	Second generation Irish		1.06	0.79,1.43
33	All other	10045	1.00	(ref)
	Second generation Irish		1.06	0.81,1.37
45	All other	8243	1.00	(ref)
	Second generation Irish		1.25	0.98,1.60

Key
† *Assessed with the Malaise Inventory*
‡ *Assessed with the CIS-R*
All models adjusted for gender

Table 2: Association of parental migration history (Irish vs non-Irish) with common mental disorders at mid-life (age 44/ 45), with adjustment for putative mediators

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life common mental disorders, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.27	0.96,1.69
Models adjusting for gender + material adversity over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.28	0.95,1.72
42	Material adversity[2]	1.28	0.95,1.72
33	Material, adversity[3]	1.26	0.94,1.69
23	Material adversity[4]	1.18	0.88,1.57
7, 11, 16	Material adversity[5]	1.12	0.84,1.50
Models adjusting for gender + health-related behaviours over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.25	0.94,1.67
33, 42	Hazardous alcohol use[7]	1.23	0.92,1.64
Models adjusting for gender + previous mental health over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[8]	1.33	0.97,1.81
7, 11, 16	Childhood emotional or behavioural health problems[9]	1.21	0.91,1.62
Models adjusting for gender + social support over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[10]	1.30	0.97,1.73
42	Social support[11]	1.27	0.95,1.69
33	Social support[12]	1.25	0.94,1.67
Models adjusting for gender + stressful life events over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[13]	1.28	0.96,1.72
44/ 45	Stressful life events[14]	1.24	0.93,1.66
7	Family adversity[15]	1.19	0.89,1.58
Key:			
1	*Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*		
2	*Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*		
3	*Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in house, shared household amenities*		
4	*No access/ shared access to indoor toilet, none/ shared access to indoor bathroom, lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, unemployed*		
5	*Household overcrowding, financial difficulties, qualifies for free school meals, no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16*		

6	*Scored ≥8 on the AUDIT*
7	*Scored ≥1 on the CAGE*
8	*Scored ≥8 on the Malaise inventory at least once*
9	*Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)*
10	*Emotional & confiding, practical and negative social support (Close Person's Questionnaire)*
11	*Has someone they could turn to for support*
12	*Emotional and practical social support*
13	*Feel 'not very secure' or 'insecure' in current job (versus 'secure')*
14	*One or more stressful life events experienced in last six months*
15	*Prospectively assessed family adversities*

Table 3: Association of parental migration history (Irish vs non-Irish) with poorer self-rated health at age mid-life (age 44/ 45), with adjustment for putative mediators

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life poorer self rated health, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.25	0.98,1.60
Models adjusting for gender + material adversity across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.27	0.99,1.64
42	Material adversity[2]	1.27	0.98,1.64
33	Material, adversity[3]	1.23	0.96,1.59
23	Material adversity[4]	1.16	0.91,1.49
7, 11, 16	Material adversity[5]	1.10	0.85,1.41
Models adjusting for gender + health-related behaviours across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.24	0.97,1.58
33, 42	Hazardous alcohol use[7]	1.22	0.95,1.55
23, 33, 42	Life-course tobacco use[8]	1.23	0.96,1.57
Models adjusting for gender + previous mental health across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[9]	1.20	0.94,1.55
7, 11, 16	Childhood emotional or behavioural health problems[10]	1.20	0.94,1.53
Models adjusting for gender + previous poorer self-rated health			
Age	**Adjustments**	**OR**	**95% CI**
23, 33, 42	Previous poorer self-rated health	1.35	1.03,1.77
Models adjusting for gender + social support across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[11]	1.27	0.99,1.62
42	Social support[12]	1.25	0.98,1.59
33	Social support[13]	1.24	0.97,1.58
Models adjusting for gender + stressful life events across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[14]	1.26	0.98,1.61
44/ 45	Stressful life events[15]	1.24	0.97,1.59
7	Family adversity[16]	1.17	0.92,1.50
Key to variables:			
1	*Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*		
2	*Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*		

3	Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in housing, shared household amenities (bathroom, shower/ wash facilities, toilet, kitchen)
4	No access or shared access to indoor toilet, none or shared access to indoor bathroom, lives in council housing, has been homeless, in receipt of benefits, household overcrowding, unemployed
5	Household overcrowding, financial difficulties, child qualifies for free school meals, and no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16
6	Scored ≥8 on the AUDIT
7	Scored ≥1 on the CAGE
8	Current or ex-smoker at least once
9	Scored ≥8 on the Malaise inventory at least once
10	Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)
11	Emotional & confiding, practical and negative social support (Close Person's Questionnaire)
12	Has someone they could turn to for support
13	Emotional and practical social support
14	Feels 'not very secure' or 'insecure' in current job (versus 'secure')
15	One or more stressful life events experienced in last six months
16	Prospectively assessed family adversities

CONTRIBUTORSHIP STATEMENT

JD designed the study, analysed the data, and prepared the manuscript for publication. JD is guarantor of the data and for the analysis. CC advised on aspects of the analysis and assisted in part with the analysis. CC also helped to prepare the manuscript. MED advised on statistical aspects of the analysis and helped in the preparation of the manuscript. GL advised on the study design and assisted with the literature review. GL assisted in the interpretation of results and in the preparation of the manuscript. SAS advised on the study design, assisted in the interpretation of results and advised on analytic methods. SAS assisted in the preparation of the manuscript. MJP advised on the study design, the analytic methods and in the interpretation of the results. MJP advised and helped in the preparation of the manuscript, figures and tables.

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ETHICS

Access to most of the dataset for the purposes of secondary analysis was subject to the terms of an End User License (EUL) agreement. A ‘special license’ for data held under ‘special conditions’ (as specified in section 5 of the Economic and Social Data Service (ESDS) EUL) was needed to access additional biomedical data.

Title: Does childhood adversity account for poorer mental and physical health in second generation Irish people living in Britain? Birth cohort study from Britain (NCDS)

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Objectives: Worldwide, the Irish diaspora experience elevated mortality and morbidity across generations, not accounted for through socioeconomic position. The main objective of the present study was to assess if childhood disadvantage accounts for poorer mental and physical health in adulthood, in second generation Irish people.

Design: Analysis of prospectively collected birth cohort data, with participants followed to mid-life.

Setting & participants: 17,000 babies born in a single week in 1958 in England, Scotland and Wales. 6% of the cohort were of second generation Irish descent.

Outcomes: Primary outcomes were common mental disorders assessed at age 44/ 45 and self-rated health at age 42. Secondary outcomes were these assessed at age 23 and 33.

Results: Relative to the rest of the cohort, second generation Irish children grew up in marked material and social disadvantage, which tracked into early adulthood. By mid-life, parity was reached between second generation Irish cohort members and the rest of the sample on most disadvantage indicators. At age 23 Irish cohort members were more likely to screen positive for common mental disorders (OR: 1.44; 95% CI: 1.06, 1.94). This had reduced slightly by mid-life (OR: 1.27; 95% CI: 0.96, 1.69). Whereas at age 23 second generation cohort members were just as likely to report poorer self-rated health (OR: 1.06; 95% CI: 0.79, 1.43), by mid-life this difference had increased (OR: 1.25; 95% CI: 0.98,1.60). Adjustment for childhood and early adulthood adversity fully attenuated differences in adult health disadvantages.

Conclusions: Social and material disadvantage experienced in childhood continues to have long-range adverse effects on physical and mental health at mid-life, in

second generation Irish cohort members. This suggests important mechanisms over the life-course, which may have important policy implications in the settlement of migrant families.

ARTICLE SUMMARY

Article focus

- In a nationally representative birth cohort from Britain, to assess the prevalence of mid-life common mental disorders and poorer self-rated health in second generation Irish respondents relative to the rest of the cohort.
- To assess the contribution of psychosocial and material disadvantage over the life-course (from childhood through to adulthood) in accounting for any observed health inequalities noted in Irish cohort members.

Key messages

- Second generation Irish children were more likely to grow up under circumstances of marked material and social adversity relative to the rest of the cohort. By mid-life, second generation Irish cohort members were no longer disadvantaged, relative to the rest of the cohort, suggesting a degree of differential upward social mobility.
- Yet, compared to the rest of the cohort, second generation Irish people experienced an elevated relative odds of common mental disorders and poorer self-rated health at mid-life. This disappeared after adjusting for childhood disadvantage.
- The findings imply that adult health disadvantages in migrant or ethnic minority groups may be 'transmitted' through exposure to childhood adversity, a factor which may be related to migrant settlement experiences.

Strengths and Limitations

- The study used mostly prospectively collected data from a nationally representative birth cohort from Britain.
- Detailed assessment of psychosocial and material circumstances in childhood and adulthood were obtained. Main outcomes were assessed using structured, validated scales (for mental health) or a standardised question around self-rated health.
- Limitations of the study include the use of parental country of birth to determine ethnicity and the lack of measures assessing the specific migration experiences of Irish cohort members, as this was a historical cohort study.

Introduction

Four decades of research has suggested that Irish people living in Britain experience elevated mortality[1-4] and morbidity[5, 6], relative to the rest of the population. A similar phenomena has been noted worldwide[7-9]. These inequalities persist into second[1, 5] and later generations[2, 10]. An elevated prevalence and incidence of depression and suicidality has also been noted in Irish-born and second or later generation Irish people[7, 11-14]. This is out of keeping with the assertion that over time and subsequent generations, the health of migrant groups should start to approximate to that of the receiving country[3].

There have been few longitudinal studies which have examined the health of Irish people or other migrant groups using a life-course informed approach. Longitudinal studies from North America have suggested disadvantage related to the processes of migration and settling into a new host country interact dynamically over the life course and lead to specific health effects in migrants which diverge from the host population[15]. The policy benefits of using a life course approach are obvious; by identifying structural factors that impact on the health of second generation Irish people from childhood through to adulthood, it may be possible to identify earlier 'intervention points', which could reduce later 'downstream' adverse health outcomes.

We analysed data from a nationally representative British birth cohort to establish if second generation Irish people were more likely to grow up under, and live in, circumstances of material and social disadvantage over their life-course, relative to people without a parental history of migration. Our second objective was to establish

if the prevalence of common mental disorders and self-rated health (a predictor for mortality[16]) would be elevated in second generation Irish cohort members relative to the rest of the cohort, at age 23, 33, and at mid-life (age 44/ 45). Finally, we sought to establish if disadvantage over the life-course mediated any health disparities observed at mid-life (age 44/ 45). In particular, we wished to assess the contribution of disadvantage broken down by *timing* of exposure (childhood, early adulthood, mid-life) and *type* of exposure (material disadvantage, social adversity, health-related behaviours and prior mental health/ self-rated health).

Methods

Study sample

The National Child Development Survey (NCDS) surveyed 17415 babies born during March 3-9 in 1958 (98% of live births), and followed respondents into adulthood. Parents, teachers and medical personnel were interviewed when children were 7, 11 and 16. At age 23, 33, 42 and 44/ 45 cohort members were interviewed. For the analysis, the 'target sample' was: children born in England, Scotland and Wales in the selected week, and children with both parents born in England, Scotland and Wales, or who had one or both parents born in Ireland or Northern Ireland.

Parental migration status

At sweeps two and three, parents reported their country of birth. Cohort members with one or both parents reporting that they were born in Ireland or Northern Ireland were classified as 'second generation Irish'. Excluding non-responders, kappa assessing reliability of parental responses to this question between the two sweeps was high (kappa=0.97).

MEASURES

CHILDHOOD

Material and social adversity measures

At 7, 11 and 16 parents of children were asked if they had experienced financial difficulties in the previous year, or lived in overcrowded housing (1+ persons/ room). Parents were asked if they had access to hot water, an indoor toilet and an indoor bathroom. At 11 and 16 parents reported if their child received free school meals. At age 7 health visitors assessed family difficulties, these were problems with: housing,

finances, physical or mental illness/ disability, learning disabilities, death, divorce, parental separation, domestic tensions, in-law conflicts, unemployment, alcoholism, or any other difficulties 'affecting child's development'.

Childhood psychological health

At 7 and 11, teachers rated children's emotional and behavioural health using the Bristol Social Adjustment Guide (BSAG)[17]. At age 16, the Rutter School Behavioural Scale (Rutter-B), was completed by teachers[18]. Scores on both scales were summed, square root transformed, with the top 13% indicating children who were a 'case'[19].

ADULTHOOD

Material and social adversity measures

Cohort members were asked if they lived in overcrowded housing (1+ persons/ room) (age 23, 33, 42), were unemployed (23, 33, 42), lived in council housing (23, 33, 42), had been homeless (23, 42), received benefits (23, 42), had access to an indoor toilet/ bathroom (23), had experienced difficulties paying bills (33, 45), had a telephone (33), had damp or lacked central heating in their house (33), had no car (42, 45), had experienced financial difficulties (42), or couldn't afford food or clothing (45).

At age 33 cohort members rated emotional and practical social support provided from four sources of support[20]. At age 42, cohort members reported if there was someone they could turn to for support. At 44/ 45, the Close Person's Questionnaire[21] assessed social support provided from the closest nominated

person.

Stressful life events within the previous six months were assessed at 44/ 45. These were: cohort member/ close relation suffering serious illnesses, injury/ assault, death of parent/ child/ partner or close friend/ relative, end of serious relationship, serious problems with a close friend/ neighbour/ relative, serious disappointments at work, cohort member/ partner fears losing their job, losing one's job, major financial crises, problems with the police, and theft. Responses were dichotomised into '*experienced no stressful life events'* versus '*experienced 1+ stressful life events'*. At age 44/ 45, cohort members' job security was also enquired after.

Health-related behaviours

At age 33, and 42, people responding in the affirmative to ≥1 items on the CAGE were classed as reporting hazardous alcohol use[22]. This questionnaire comprises four questions *("Have you wanted to **C**ut down your alcohol use lately?" "Do you get **A**ngry if other people suggest you should cut down your alcohol use?" "Do you feel **G**uilty about the amount of alcohol you consume?" "Have you ever needed an **E**ye-opener?"*)[22]. At age 44/ 45, people scoring ≥8 on the *Alcohol Use Disorders Identification Test* (AUDIT) were classed as reporting hazardous use[23]. Cohort members also reported if they were current or previous smokers at 23, 33 and 42.

ADULT HEALTH OUTCOMES

Mental Health

Malaise Inventory

At age 23 and 33 cohort members completed the Malaise Inventory, which is a

structured self-report tool which assesses recent psychiatric morbidity[24]. Questions asked include "*Do you often feel miserable or depressed?", "Do you wake unnecessarily early in the morning?"*[24]. Scores of ≥8 indicated depression[25].

Clinical Interview Schedule-Revised (CIS-R)

The CIS-R assessed mid-life common mental disorders at age 44/45 [26]. This is a structured validated instrument administered by trained lay interviewers, where scores of ≥12 indicate common mental disorders[26]. In the NCDS, a shortened form of the CIS-R was used, in which sections enquiring after worry, obsessions, somatic symptoms, compulsions and physical health worries were omitted[27], thus focusing on depressive and anxiety disorders. To ensure that the results of the present analysis would be comparable to previous surveys[28, 29], an equivalent cut-point on the abbreviated CIS-R scale was determined.

Data from the 2000 National Psychiatric Morbidity Survey (NPMS)[29] and from the 2000 Ethnic Minorities Psychiatric Illness Rates in the Community Survey (EMPIRIC) [28]were used to devise an abbreviated scale of symptoms on the CIS-R, with the same items which had been omitted in the 2000 sweep of the NCDS also omitted. To determine equivalent cut-points to conventional cut-points of 11/12 on the full-scale CIS-R, a linear regression of the full-scale CIS-R was performed against the abbreviated scale from the CIS-R using NPMS and EMPIRIC data. The resultant regression equation was used to predict the equivalent cut-point on the abbreviated CIS-R scale. Using this approach, a cut-point of ≥9 was equivalent to the conventional cut-point of ≥12. Kappa comparing the cut-point for 11/12 on the full-scale CIS-R to a cut-point of 8/9 on the abbreviated scale was 0.86 for the NPMS

and 0.85 for the EMPIRIC (both p<0.001).

Self-rated health

At age 23, 33 and 44/ 45 cohort members asked: *"How would you describe your health generally?"* Responses were dichotomised into 'excellent/ good' versus 'fair/ poor'.

Statistical analysis

STATA 10.1 was used for analyses[30]. The association of social and material adversity measures over the life course, from childhood to adulthood, was assessed in second generation Irish cohort members, relative to non-Irish cohort members. Next, the odds of screening positive for common mental disorders and poorer self-rated health, in second generation Irish cohort members, relative to non-Irish cohort members, was assessed at 23, 33, and 44/ 45, using multivariable logistic regression. Common mental disorders and poorer self-rated health at these time points was specified as the dependent variables.

The contribution of adversity variables over the life-course in mediating excess risks of common mental disorders and poorer self-rated health at mid-life was assessed[31]. To assess mediation, three criteria needed to be fulfilled[31]. First, the association of parental migration history with putative mediator was assessed using multivariable logistic regression[31]. Second, the association of the putative mediator with the outcome variable (poorer self-rated health and common mental disorders at mid-life) was assessed using multivariable logistic regression[31]. Finally the association of parental migration history with outcome- (either mid-life common

mental disorders or poorer self-rated health at mid-life) was assessed in the presence of the putative mediator[31]. If the coefficient for the association between parental migration history and outcome was reduced in the presence of the putative mediator, then it was presumed that the data were consistent with mediation[31].

Missing data

As with any prospective survey, missing data due to attrition was a concern. At age 7, 11 and 16 response rates were 89%, 88%, 84%, and at 23, 33, 42 response rates were 72%, 65% and 66%[32]. At age 44/ 45, complete data was available for the CIS-R for 9297 individuals (which was 99% of the biomedical sample), and complete data was available on self-rated health in 9115 individuals (97% of the biomedical sample).

As missing values were likely to be missing at random[33], missing values were imputed using the chained equations approach ('ICE') in STATA 10 [30, 34]. Imputations were conducted on all cohort members known to be alive at the time of the biomedical survey (age 44/45). 50 imputed datasets were created using proper imputation from an imputation model in which all covariates as well as variables known to predict attrition (mother's education, region of birth, employment at 33 and social class at all sweeps) were included[35, 36]. Analyses were performed on each imputed dataset using multivariable logistic regression, and estimates combined using Rubin's Rules[33]. Wald tests assessed strength of associations.

Results

Rates of attrition were similar in second generation Irish respondents compared to the rest of the sample (supplementary table 1). In un-imputed data 90% of Irish children had a father of a manual social class background, compared to 82% of non-Irish children, at age 7. This figure remained fairly similar at mid-life (age 42) (90% and 81% respectively), indicating that there had not been differential attrition by childhood social class over the course of follow-up. 9377 cohort members provided data at age 44/45. Excluding migrants and children with parents not born in England, Scotland, Wales, Ireland or Northern Ireland, analyses were performed on 8403 individuals providing complete information on the CIS-R, and on 8243 individuals providing a response to the self-rated health at mid-life question.

Experiences of social adversity over the life course

Figure 1 displays how social adversity differed for second generation Irish cohort members, compared to non-Irish counterparts, over the life-course. Irish cohort members experienced marked social adversity across all childhood sweeps, relative to the rest of the cohort. These inequalities tracked into early adulthood, with differences still apparent at age 23, and to an extent, at 33. By mid-life (42, 44/ 45) life-course social adversity measures were equivalent in second generation Irish cohort members relative to non-Irish cohort members.

[FIGURE 1 HERE]

Assessment of health over the life course

Table 1 displays differences in common mental disorders and self-rated assessments of health, assessed prospectively at age 23, 33, and 44/45. After adjusting for gender, second generation Irish cohort members were 1.44 times more

likely to screen positive for depression at 23 (95% CI: 1.06, 1.94) (Table 1). Second generation Irish cohort members continued to carry this relative excess risk throughout their life course, although the magnitude of the difference had diminished by age 33. In contrast, second generation Irish cohort members were no more likely to report fair or poorer self-rated health in early adulthood (age 23, 33), although by mid-life (age 44/45) there was a suggestion of widening inequalities affecting the Irish group with respect to this measure (Table 1).

[TABLE 1 HERE]

Mid-life health in second generation Irish cohort members

The association of being second generation Irish and screening positive for common mental disorders and poorer self-rated health at mid-life was assessed after taking into account exposures at earlier time points (tables 2 & 3). The largest attenuation for both common mental disorders as well as poorer self-rated health at mid-life was from material adversity assessed in childhood. A similar attenuation in the excess risk was seen when prospectively assessed family adversity (at age 7) was added into the models (tables 2& 3). Material adversity at age 23 attenuated the excess risk of being Irish with poorer health at mid-life, albeit to a lesser extent than childhood adversity variables. Health-related behaviours, prior mental health/ self-rated health, and covariates assessed from age 33 onwards, did not attenuate associations of being second generation Irish with poorer mid-life health. The tables in the online repository show full associations for tables 2 and 3.

[TABLE 2 HERE]

[TABLE 3 HERE]

Discussion

The findings suggest that second generation Irish children born in the late 1950s experienced greater levels of childhood adversity than those of English, Scottish or Welsh heritage, although social and economic inequalities diminished between the two groups as the cohort entered mid-life. Despite improvements in material and social conditions by adulthood, an inheritance of poorer health at mid-life for second generation Irish people was evident, relative to the rest of the cohort. Childhood material and social adversity as well as early adulthood material adversity accounted for these differences, whereas health-related behaviours and earlier psychological health/ self-rated health did not.

Second generation Irish cohort members had an elevated risk of common mental disorders in early adulthood (age 23) which had partially reduced by mid-life. In contrast, for poorer self-rated health, (also a predictor for mortality[16]), although there were no differences between second generation Irish cohort members and the rest of the cohort at earlier time-points, by mid-life differences had started to become apparent.

Our findings are consistent with a large body of evidence which has shown that childhood adversity exerts long range effects on a variety of adult health outcomes, including (but not limited to): mental health[37-39], self-rated health[40], mortality[41, 42], poorer cardiovascular health, dental health and substance abuse[43]. Studies using data from birth cohorts[43] (including those using data from the NCDS[38]) have shown that social class gradients in health do not emerge exclusively in adulthood but have origins in childhood, and social and material adversity may

accumulate in individuals both cross-sectionally and longitudinally, over time[38]. In the present study, there was evidence to suggest that Irish cohort members were more likely than the rest of the cohort to experience an accumulation of adversity in childhood and in early adulthood; and that this to a certain extent, accounted for a greater risk of mid-life common mental disorders and poorer self-rated health, compared to the rest of the cohort. The findings of the present study are therefore in keeping with a 'sensitive period' in childhood/ early adulthood which continues to adversely influence adult health many years later[44], and may be relevant in understanding previously reported adult health inequalities experienced by second generation Irish people, despite apparent improvements in socioeconomic position across generations [1, 12].

Strengths and limitations

The data derives from a nationally representative sample from England, Scotland and Wales, therefore the findings are generalisable to second generation Irish people, now in mid-life. Most assessments were prospective, reducing the possibility of measurement bias. The possibility of reverse causality may have been an issue, as people who had poorer health at the earlier time-points may have been more likely to move into or stay in conditions of adversity. The isolated mediating effect of early life disadvantage is therefore striking, as one would have expected a larger contribution of adult social and material adversity in mediating differences.

We could not assess exposures which may have been important in understanding the specific settlement experiences of Irish people living in Britain, as these were

unavailable. These might include factors relating to migration and settlement, such as the pre-migration health of parents, reasons and circumstances surrounding migration[11] experiences of discrimination[11] and residential or neighbourhood context[45]. Future research should endeavour to understand how these factors operate within a life-course framework.

There has been one other study from the 1970 British birth cohort which has also shown that second generation Irish children were more likely to be born into disadvantage, compared to the rest of the population[46]. This suggests a degree of consistency across periods and cohorts. However we cannot be sure if period-specific effects accounted for some of the findings. In 1958 it was common for Irish people to experience overt discrimination, for example signs reading "*No Irish Need Apply*"[47], would have been frequently encountered when applying for employment or accommodation. By the time cohort members were aged 23 (1981) the conflict in Northern Ireland had escalated such that anti-Irish discrimination and issues relating to identity may have had a particular salience for second generation Irish people at that time[48]; this may have contributed to the mental health inequalities noted at this age, although it was not possible to discern this from the present analysis.

Relationship to historical context and policy implications

In 1958 Irish citizens would have been subject to the recently instated 'common travel area', which enabled relatively informal migration between Ireland to Britain. Irish-born people migrating to Britain at this time took up employment in industries in which post-war labour shortages in Britain were greatest, this included the construction industry, domestic and personal industry, and nursing[49]. Adverse

health outcomes previously noted in Irish-born migrants to Britain have been suggested to have been due to a relative lack of barrier to migration[3], alongside post-migration settlement experiences where work in transient and poorly paid employment was more likely[11]. The present analysis suggests mechanisms by which such inequalities were then subsequently 'transmitted' to the next generation.

We did not have data to directly examine the childhood circumstances of Irish-born parents of cohort members. Irish-born migrants to Britain in the immediate post-war period were more likely to be shorter in height, and less well educated than both Irish people who stayed behind in Ireland, as well as English people living in England at this time[50]. This might support the assertion that Irish-born migrants to Britain in the 1950s were selectively of poorer health[3, 50]. This is also consistent with the assertion that parents of second generation Irish cohort members may have experienced material adversity in their own childhoods. Although this cannot be examined directly in this dataset, findings from other cohorts have indicated that material adversity[51], as well as other risk factors for poorer adult health, such as birth weight, may 'transmit' across generations[52]. It has been suggested that the economic and social resources of parents may impact on the adult health of their offspring, through the exposure of offspring to environmental factors in early life[51], or that early childhood adversity may impact not only on later adult health, but also on the birth-weight of future offspring[53] In addition, a study of first and second generation ethnic minority women in Britain (women of Indian, Pakistani, Bangladeshi, Black Caribbean and Black African origin) found that the mean birth weight of first and second generation ethnic minority women was lower than that of white British women, with no evidence of an increase in birth weight across

generations, despite it being known that these groups experience high levels of upward social mobility across generations[54]. Given the links between low birth weight and later poorer adult health, such an intergenerational 'lag' in low birth-weight may lead to persistent poorer health in ethnic minority groups, even if improved social circumstances had been experienced at later time points over the life-course, or across subsequent generations. Potentially, this has implications in the understanding of the 'transmission' of health inequalities in other migrant groups who may have experienced social deprivation in their childhoods, relative to people of the receiving country, and who may therefore continue to experience health inequalities in adulthood across subsequent generations, despite apparent improvement in their material circumstances.

Although by mid-life, second generation Irish people enjoyed social circumstances at parity with the rest of the cohort, an inheritance of growing up in adversity as a result of parental migration and settlement experiences has continued to influence downstream health outcomes. The relative non-specificity of childhood disadvantage in being detrimental to later health suggests important priorities for future research on the health of migrant groups now settling in Britain. Although the process of migration and settlement may mean that the experiences of relative social deprivation are transient[15, 55], tackling health inequalities in second generation groups may mean directing concerted attention to childhood. The findings suggest the importance of considering the life-course in its entirety, rather than taking 'snapshot' measures of socioeconomic position at single time-points[55], as it is clear that the experiences of adversity over the life-course have differed greatly for second generation Irish people, relative to their non-Irish counterparts.

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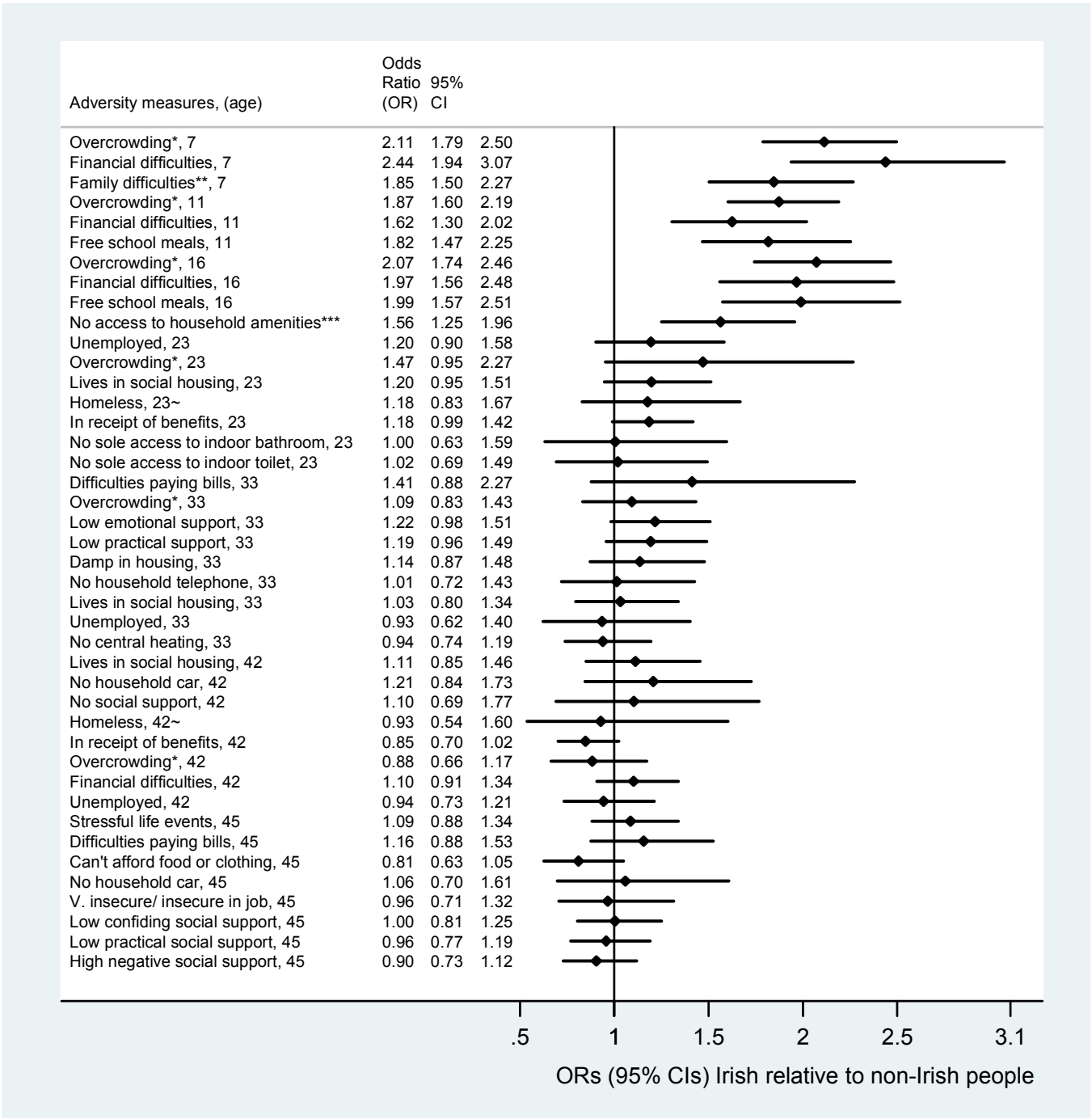
Figure 1: Odds ratios for social adversity across the life-course; Second generation Irish cohort members relative to non-Irish cohort members.
Estimates on the vertical line represent no difference between the two groups



Key: **more than one person/ room; **one or more family difficulties as prospectively rated by health visitor (difficulties with: housing, finances, physical illness/ disability, mental illness/ neurosis, mental sub-normality, death of child's mother or father, divorce/ separation/ desertion, domestic tension, "in-law" conflicts, unemployment, alcoholism, or any 'other serious family difficulties affecting child's development'); ***no access to at least one of: indoor bathroom, indoor toilet or hot water at either age 7, 11, or 16; ~periods of homelessness since last assessment*

Table 1: Common mental disorders and self-rated health in second generation Irish people across the life course

Common mental disorders				
Age		**Number of observations**	**OR**	**(95% CI)**
23†	All other	11036	1.00	(ref)
	Second generation Irish		1.44	1.06,1.94
33†	All other	9980	1.00	(ref)
	Second generation Irish		1.31	0.94,1.81
45‡	All other	8403	1.00	(ref)
	Second generation Irish		1.27	0.96,1.69
Poor self-rated health				
Age				
23	All other	11067	1.00	(ref)
	Second generation Irish		1.06	0.79,1.43
33	All other	10045	1.00	(ref)
	Second generation Irish		1.06	0.81,1.37
45	All other	8243	1.00	(ref)
	Second generation Irish		1.25	0.98,1.60

Key
† *Assessed with the Malaise Inventory*
‡ *Assessed with the CIS-R*
All models adjusted for gender

Table 2: Association of parental migration history (Irish vs non-Irish) with common mental disorders at mid-life (age 44/ 45), with adjustment for putative mediators

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life common mental disorders, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.27	0.96,1.69
Models adjusting for gender + material adversity over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.28	0.95,1.72
42	Material adversity[2]	1.28	0.95,1.72
33	Material, adversity[3]	1.26	0.94,1.69
23	Material adversity[4]	1.18	0.88,1.57
7, 11, 16	Material adversity[5]	1.12	0.84,1.50
Models adjusting for gender + health-related behaviours over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.25	0.94,1.67
33, 42	Hazardous alcohol use[7]	1.23	0.92,1.64
Models adjusting for gender + previous mental health over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[8]	1.33	0.97,1.81
7, 11, 16	Childhood emotional or behavioural health problems[9]	1.21	0.91,1.62
Models adjusting for gender + social support over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[10]	1.30	0.97,1.73
42	Social support[11]	1.27	0.95,1.69
33	Social support[12]	1.25	0.94,1.67
Models adjusting for gender + stressful life events over the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[13]	1.28	0.96,1.72
44/ 45	Stressful life events[14]	1.24	0.93,1.66
7	Family adversity[15]	1.19	0.89,1.58
Key:			
1	*Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*		
2	*Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*		
3	*Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in house, shared household amenities*		
4	*No access/ shared access to indoor toilet, none/ shared access to indoor bathroom, lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, unemployed*		
5	*Household overcrowding, financial difficulties, qualifies for free school meals, no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16*		

6	*Scored ≥8 on the AUDIT*
7	*Scored ≥1 on the CAGE*
8	*Scored ≥8 on the Malaise inventory at least once*
9	*Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)*
10	*Emotional & confiding, practical and negative social support (Close Person's Questionnaire)*
11	*Has someone they could turn to for support*
12	*Emotional and practical social support*
13	*Feel 'not very secure' or 'insecure' in current job (versus 'secure')*
14	*One or more stressful life events experienced in last six months*
15	*Prospectively assessed family adversities*

Table 3: Association of parental migration history (Irish vs non-Irish) with poorer self-rated health at age mid-life (age 44/ 45), with adjustment for putative mediators

Baseline model; association of parental migration history (Irish vs. non-Irish) with mid-life poorer self rated health, after adjusting for gender only:			
	Adjustments	**OR**	**95% CI**
	Gender	1.25	0.98,1.60
Models adjusting for gender + material adversity across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Material adversity[1]	1.27	0.99,1.64
42	Material adversity[2]	1.27	0.98,1.64
33	Material, adversity[3]	1.23	0.96,1.59
23	Material adversity[4]	1.16	0.91,1.49
7, 11, 16	Material adversity[5]	1.10	0.85,1.41
Models adjusting for gender + health-related behaviours across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Hazardous alcohol use[6]	1.24	0.97,1.58
33, 42	Hazardous alcohol use[7]	1.22	0.95,1.55
23, 33, 42	Life-course tobacco use[8]	1.23	0.96,1.57
Models adjusting for gender + previous mental health across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
23, 33	Adult depression[9]	1.20	0.94,1.55
7, 11, 16	Childhood emotional or behavioural health problems[10]	1.20	0.94,1.53
Models adjusting for gender + previous poorer self-rated health			
Age	**Adjustments**	**OR**	**95% CI**
23, 33, 42	Previous poorer self-rated health	1.35	1.03,1.77
Models adjusting for gender + social support across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Social support[11]	1.27	0.99,1.62
42	Social support[12]	1.25	0.98,1.59
33	Social support[13]	1.24	0.97,1.58
Models adjusting for gender + stressful life events across the life-course			
Age	**Adjustments**	**OR**	**95% CI**
44/ 45	Job insecurity[14]	1.26	0.98,1.61
44/ 45	Stressful life events[15]	1.24	0.97,1.59
7	Family adversity[16]	1.17	0.92,1.50
Key to variables:			
1	*Difficulties paying bills, sometimes/ often can't afford food or clothing, no household car*		
2	*Lives in council housing, has been homeless since last sweep, in receipt of benefits, household overcrowding, finances- 'just about getting by/ finding it quite/ v. difficult', unemployed*		

3	Unemployed, household overcrowding, in arrears with bills, no access to phone, damp in housing, lives in council housing, no central heating in housing, shared household amenities (bathroom, shower/ wash facilities, toilet, kitchen)
4	No access or shared access to indoor toilet, none or shared access to indoor bathroom, lives in council housing, has been homeless, in receipt of benefits, household overcrowding, unemployed
5	Household overcrowding, financial difficulties, child qualifies for free school meals, and no access to indoor toilet, hot water or bathroom at either age 7, 11, or 16
6	Scored ≥8 on the AUDIT
7	Scored ≥1 on the CAGE
8	Current or ex-smoker at least once
9	Scored ≥8 on the Malaise inventory at least once
10	Emotional and/ or behavioural problems at age 7, 11 (BSAG), or age 16 (Rutter-B)
11	Emotional & confiding, practical and negative social support (Close Person's Questionnaire)
12	Has someone they could turn to for support
13	Emotional and practical social support
14	Feels 'not very secure' or 'insecure' in current job (versus 'secure')
15	One or more stressful life events experienced in last six months
16	Prospectively assessed family adversities

CONTRIBUTORSHIP STATEMENT

JD designed the study, analysed the data, and prepared the manuscript for publication. JD is guarantor of the data and for the analysis. CC advised on aspects of the analysis and assisted in part with the analysis. CC also helped to prepare the manuscript. MED advised on statistical aspects of the analysis and helped in the preparation of the manuscript. GL advised on the study design and assisted with the literature review. GL assisted in the interpretation of results and in the preparation of the manuscript. SAS advised on the study design, assisted in the interpretation of results and advised on analytic methods. SAS assisted in the preparation of the manuscript. MJP advised on the study design, the analytic methods and in the interpretation of the results. MJP advised and helped in the preparation of the manuscript, figures and tables.

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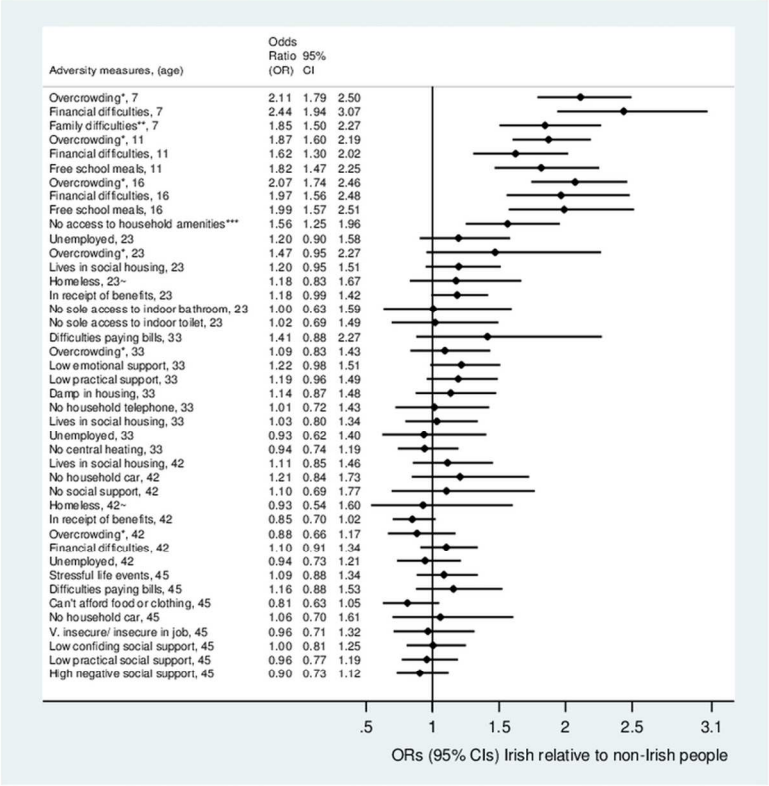
ETHICS

Access to most of the dataset for the purposes of secondary analysis was subject to the terms of an End User License (EUL) agreement. A ‘special license’ for data held under ‘special conditions’ (as specified in section 5 of the Economic and Social Data Service (ESDS) EUL) was needed to access additional biomedical data.

Figure 1: Odds ratios for social adversity across the life-course; Second generation Irish cohort members relative to non-Irish cohort members.
Estimates on the vertical line represent no difference between the two groups



Key: **more than one person/ room; **one or more family difficulties as prospectively rated by health visitor (difficulties with: housing, finances, physical illness/ disability, mental illness/ neurosis, mental sub-normality, death of child's mother or father, divorce/ separation/ desertion, domestic tension, "in-law" conflicts, unemployment, alcoholism, or any "other serious family difficulties affecting child's development"); ***no access to at least one of: indoor bathroom, indoor toilet or hot water at either age 7, 11, or 16; ~periods of homelessness since last assessment*

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ONLINE REPOSITORY MATERIAL

Supplementary table 1: Response rates at each sweep of NCDS (un-imputed data)

NCDS								
Sweep (age- years)	**0 (0)**	**1 (7)**	**2 (11)**	**3 (16)**	**4 (23)**	**5 (33)**	**6 (42)**	**Biomedical sweep (44/45)**
Year	1958	1965	1969	1974	1981	1991	2000	2002
Number (% of total (n=16765*)) present in analysis sample at each sweep	16553 (99%)	14258 (85%)	13915 (83%)	13138 (78%)	11411 (68%)	10460 (62%)	10412 (62%)	8690 (52%)
	The above figures include Irish respondents in the totals							
Number (% of total (n=791)) of second generation Irish respondents in analysis sample**	782 (99%)	710 (90%)	761 (96%)	699 (88%)	544 (69%)	509 (64%)	505 (64%)	417 (53%)

***Key**:*Excludes children who migrated to Britain and were not born in England, Scotland or Wales in the index week, 1958 (n=920). Also excludes children who had one or both parents born outside England, Scotland, Wales, Ireland or Northern Ireland (n=1251); **After excluding migrant children, there were 791 children who were second generation Irish within NCDS*

ONLINE REPOSITORY MATERIAL

Supplementary table 2: Association of parental migration history (Irish-born versus non-Irish) with mid-life common mental disorders in cohort members, taking into account proximal and distal risk factors, across the life-course

All displayed covariates have been adjusted for each other in each model

MODEL 1: ADJUSTED FOR GENDER ONLY

Covariate	OR	95% CI	p value
Second generation Irish	1.27	0.96,1.69	0.10
Female gender	1.81	1.57,2.07	p<0.001

MODEL 2: ADJUSTING FOR MATERIAL ADVERSITY ACROSS THE LIFE-COURSE

Model 2a

Childhood material adversity (age 7, 11, 16)

Covariate	OR	95% CI	p value
Second generation Irish	1.12	0.84,1.50	0.44
Female gender	1.79	1.56,2.06	p<0.001
Household crowding once	1.05	0.84,1.31	0.67
Household crowding twice	1.15	0.92,1.44	0.23
Household crowding thrice	1.08	0.88,1.31	0.46
Financial difficulties once	1.52	1.20,1.92	p<0.001
Financial difficulties twice	1.88	1.31,2.69	p<0.001

Model 2b

Material adversity (age 23)

Covariate	OR	95% CI	p value
Second generation Irish	1.18	0.88,1.57	0.27
Female gender	1.71	1.49,1.97	p<0.001
No access/ shared access to indoor toilet	1.48	0.97,2.27	0.07
None/ shared access to indoor bathroom	0.76	0.43,1.32	0.33
Lives in council house	1.55	1.25,1.92	p<0.001
Has been homeless	1.72	1.33,2.23	p<0.001
Receiving benefits	1.46	1.23,1.74	p<0.001

Model 2c

Material adversity, (age 33)

Covariate	OR	95% CI	p value
Second generation Irish	1.26	0.94,1.69	0.12
Female gender	1.86	1.61,2.14	p<0.001
Unemployed	1.71	1.26,2.31	p<0.001
Household crowding	0.93	0.74,1.17	0.54
In arrears with bills	1.82	1.27,2.60	p<0.001
No access to phone	0.69	0.52,0.90	0.01
Damp in housing	1.31	1.06,1.61	0.01

Financial difficulties thrice	2.91	1.77,4.79	p<0.001	Household crowding	1.03	0.66,1.62	0.89	Lives in council house	2.12	1.74,2.58	p<0.001
Free school meals once	1.24	0.94,1.64	0.12	Unemployed	1.24	0.96,1.60	0.10	No central heating in house	0.92	0.76,1.12	0.41
Free school meals twice	1.43	1.01,2.04	0.04					Shared/ reduced access to amenities	1.59	0.86,2.92	0.14
No access to indoor toilet, bathroom or hot water at either 7, 11 or 16	1.22	1.00,1.50	0.05								
Model 2d				**Model 2e**							
Material adversity, (age 42)				***Material adversity, (age 44/ 45)***							
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**				
Second generation Irish	1.28	0.95,1.72	0.10	Second generation Irish	1.28	0.95,1.72	0.10				
Female gender	1.68	1.45,1.94	p<0.001	Female gender	1.82	1.58,2.09	p<0.001				
In council housing	1.91	1.57,2.31	p<0.001	Difficulties paying bills	2.29	1.89,2.78	p<0.001				
No access to car	1.04	0.77,1.42	0.80	Sometimes/ often/ always can't afford food or clothing	1.92	1.61,2.29	p<0.001				
Has been homeless	1.47	1.07,2.02	0.02	Access to household car	1.51	1.18,1.93	p<0.001				
Receiving benefits	0.85	0.72,1.00	0.05								
Overcrowding	0.90	0.71,1.15	0.41								
Financial difficulties	1.92	1.65,2.23	p<0.001								
Unemployed	2.00	1.68,2.38	p<0.001								
MODEL 3: ADJUSTING FOR HEALTH-RELATED BEHAVIOURS ACROSS THE LIFE-COURSE											
Model 3a				***Model 3b***							

Hazardous alcohol use (1+ on CAGE) (age 33, 42)				*Harmful alcohol use (8+ on AUDIT) (age 44/ 45)*			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.23	0.92,1.64	0.16	Second generation Irish	1.25	0.94,1.67	0.12
Female gender	1.98	1.72,2.27	p<0.001	Female gender	2.05	1.77,2.37	p<0.001
Hazardous alcohol use on one occasion	1.47	1.24,1.74	p<0.001	Harmful alcohol use (8+ on AUDIT)	1.65	1.41,1.94	p<0.001
Hazardous alcohol use on two occasions	1.61	1.35,1.93	p<0.001				

MODEL 4: ADJUSTING FOR PREVIOUS MENTAL HEALTH ACROSS THE LIFE COURSE

Model 4a *Childhood psychological health (age 7, 11, 16)*				**Model 4b** *Previous depression (age 23, 33)*			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.21	0.91,1.62	0.19	Second generation Irish	1.33	0.97,1.81	0.08
Female gender	1.99	1.73,2.29	p<0.001	Female gender	1.42	1.23,1.65	p<0.001
Case once	1.70	1.42,2.05	p<0.001	Depressed on at least one occasion, age 23, 33	7.86	6.76,9.13	p<0.001
case twice	2.43	1.84,3.21	p<0.001				
Case thrice	3.63	2.27,5.80	p<0.001				

MODEL 5: ADJUSTING FOR SOCIAL SUPPORT ACROSS THE LIFE COURSE

Model 5a **Social support*** (age 33)**				**Model 5b** **Social support** (age 42)**				**Model 5c** **Social support* (age 44/ 45)**			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.25	0.94,1.67	0.12	Second generation Irish	1.27	0.95,1.69	0.10	Second generation Irish	1.30	0.97,1.73	0.07
Female gender	1.93	1.67,2.22	p<0.001	Female gender	1.86	1.62,2.13	p<0.001	Female gender	1.83	1.59,2.10	p<0.001
Emotional support	0.79	0.61,1.01	0.06	Social support	1.94	1.39,2.70	p<0.001	Confiding emotional support	0.92	0.78,1.08	0.29

Practical support	0.75	0.59,0.97	0.03						Practical support	0.98	0.84,1.14	0.76
									Negative support	0.50	0.43,0.58	p<0.001
MODEL 6: ADJUSTING FOR STRESSFUL LIFE EVENTS ACROSS THE LIFE COURSE												
Model 6a				**Model 6b**					**Model 6c**			
Prospectively assessed family adversity (age 7)				***One or more stressful life events in preceding six months (age 44/ 45)***					***Job insecurity (age 44, 45)***			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**		**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.19	0.89,1.58	0.25	Second generation Irish	1.24	0.93,1.66	0.14		Second generation Irish	1.28	0.96,1.72	0.09
Female gender	1.80	1.57,2.06	p<0.001	Female gender	1.80	1.57,2.07	p<0.001		Female gender	1.99	1.73,2.30	p<0.001
One or more family difficulties, age 7	1.73	1.45,2.07	p<0.001	One or stressful life events (vs. none)	2.51	2.15,2.93	p<0.001		Not v. secure/ insecure in current job (vs. secure)	2.62	2.15,3.18	p<0.001

ONLINE REPOSITORY

Supplementary table 3: Association of parental migration history (Irish-born versus non-Irish) with poorer self-rated health at mid-life (age 44/ 45), in cohort members, taking into account proximal and distal risk factors, across the life-course

All displayed covariates have been adjusted for each other in each model

MODEL 1: ADJUSTED FOR GENDER ONLY

Covariate	OR	95% CI	p value
Second generation Irish	1.25	0.98,1.60	0.07
Female gender	1.02	0.91,1.14	0.77

MODEL 2: ADJUSTING FOR MATERIAL ADVERSITY ACROSS THE LIFE-COURSE

Model 2a

Childhood material adversity (age 7, 11, 16)

Covariate	OR	95% CI	p value
Second generation Irish	1.10	0.85,1.41	0.46
Female gender	1.00	0.89,1.12	0.99
Household crowding once	1.22	1.01,1.47	0.03
Household crowding twice	1.25	1.04,1.50	0.02
Household crowding thrice	1.27	1.08,1.50	p<0.001
Financial difficulties once	1.41	1.17,1.71	p<0.001

Model 2b

Material adversity (age 23)

Covariate	OR	95% CI	p value
Second generation Irish	1.16	0.91,1.49	0.24
Female gender	0.94	0.84,1.06	0.32
No access/ shared access to indoor toilet	1.10	0.76,1.60	0.62
None/ share access to indoor bathroom	1.22	0.78,1.93	0.38
Lives in council house	1.57	1.32,1.86	p<0.001
Has been homeless	1.23	0.95,1.59	0.11

Model 2c

Material adversity, (age 33)

Covariate	OR	95% CI	p value
Second generation Irish	1.23	0.96,1.59	0.11
Female gender	1.03	0.92,1.16	0.59
Unemployed	2.09	1.63,2.68	p<0.001
Household crowding	1.25	1.04,1.49	0.02
In arrears with bills	1.82	1.32,2.51	p<0.001
No access to phone	0.66	0.53,0.84	p<0.001

3/bmjopen-2012-001335 on 1 March 2013. Downloaded from

Financial difficulties twice	1.82	1.34,2.49	p<0.001	Receiving benefits	1.59	1.37,1.83	p<0.001	Damp in housing	1.29	1.08,1.55	p<0.001
Financial difficulties thrice	1.58	0.96,2.61	0.07	Household crowding	1.56	1.12,2.19	0.01	Lives in council house	2.03	1.71,2.41	p<0.001
Free school meals once	1.09	0.86,1.38	0.45	Unemployed	1.19	0.97,1.47	0.10	No central heating in house	0.73	0.63,0.86	p<0.001
Free school meals twice	1.16	0.85,1.59	0.35					Shared/ reduced access to amenities	1.47	0.86,2.50	0.16
No access to indoor toilet, bathroom or hot water at either 7, 11 or 16	1.29	1.07,1.54	0.01								

Model 2d				***Model 2e***			
Material adversity, (age 42)				***Material adversity, (age 44/ 45)***			
Covariate	**OR**	**95% CI**	**p value**	**Covariate**	**OR**	**95% CI**	**p value**
Second generation Irish	1.27	0.98,1.64	0.07	Second generation Irish	1.27	0.99,1.64	0.06
Female gender	0.91	0.81,1.02	0.11	Female gender	1.00	0.89,1.12	0.94
In council housing	2.43	2.05,2.88	p<0.001	Difficulties paying bills	1.94	1.64,2.30	p<0.001
No household car	1.04	0.80,1.34	0.77	Sometimes/ often/ always can't afford food or clothing	1.86	1.61,2.16	p<0.001
Has been homeless	1.01	0.72,1.42	0.94	No household car	1.86	1.51,2.29	p<0.001
Receiving benefits	0.81	0.70,0.93	p<0.001				

Overcrowding	0.8	0.66,0.98	0.03
Financial difficulties	1.96	1.72,2.22	p<0.001
Unemployed	2.18	1.86,2.55	p<0.001

MODEL 3: ADJUSTED FOR HEALTH-RELATED BEHAVIOURS ACROSS THE ADULT LIFE COURSE

Model 3a ***Hazardous alcohol use (1+ on CAGE) (age 33, 42)***	**OR**	**95% CI**	**p value**	***Model 3b*** ***Harmful alcohol use (8+ on AUDIT) (age 44/ 45)***	**OR**	**95% CI**	**p value**	**Model 3c** ***Life-course tobacco use (age 23, 33, 42)***	**OR**	**95% CI**	**p value**
Second generation Irish	1.22	0.95,1.55	0.11	Second generation Irish	1.24	0.97,1.58	0.09	Second generation Irish	1.23	0.96,1.57	0.10
Female gender	1.10	0.98,1.23	0.11	Female gender	1.11	0.99,1.24	0.09	Female gender	1.04	0.93,1.16	0.53
Hazardous alcohol use on at least one occasion	1.31	1.13,1.51	p<0.001	Harmful alcohol use	1.43	1.26,1.64	p<0.001	Current or ex-smoker on at least one occasion	1.55	1.36,1.78	p<0.001
Hazardous alcohol use on two occasions	1.56	1.34,1.81	p<0.001								

MODEL 4: ADJUSTING FOR PREVIOUS MENTAL HEALTH ACROSS THE LIFECOURSE

Model 4a **Childhood mental health (age 7, 11, 16)**	**OR**	**95% CI**	**p value**	***Model 4b*** **Adult depression (age 23, 33)**	**OR**	**95% CI**	**p value**
Second generation Irish	1.20	0.94,1.53	0.15	Second generation Irish	1.20	0.94,1.55	0.15
Female gender	1.09	0.98,1.22	0.13	Female gender	0.86	0.77,0.97	0.01
Childhood psychological disturbance†	1.94	1.70,2.21	p<0.001	Adult depression at least once	4.04	3.44,4.74	p<0.001

MODEL 5: ADJUSTING FOR PREVIOUS POORER SELF RATED HEALTH

Model 5a

Previous poor self-rated health (age 23, 33, or 42)

	OR	95% CI	p value
Second generation Irish	1.35	1.03,1.77	0.03
Female gender	0.98	0.87,1.11	0.80
Previous poorer self-rated health‡	8.93	7.88,10.13	p<0.001

MODEL 6: ADJUSTING FOR SOCIAL SUPPORT ACROSS THE LIFE COURSE

Model 6a

Social support at age 33***

	OR	95% CI	p value
Second generation Irish	1.24	0.97,1.58	0.09
Female gender	1.07	0.95,1.19	0.27
Emotional support	0.85	0.70,1.03	0.09
Practical support	0.78	0.64,0.95	0.01

Model 6b

Social support** at age 42

	OR	95% CI	p value
Second generation Irish	1.25	0.98,1.59	0.07
Female gender	1.04	0.93,1.16	0.54
Social support	1.65	1.24,2.20	p<0.001

Model 6c

Social support* at age 44/ 45

	OR	95% CI	p value
Second generation Irish	1.27	0.99,1.62	0.06
Female gender	1.05	0.94,1.17	0.40
Confiding emotional support	0.66	0.58,0.76	p<0.001
Practical support	1.12	0.99,1.28	0.08
Negative support	0.74	0.66,0.84	p<0.001

MODEL 7: ADJUSTING FOR STRESSFUL LIFE EVENTS ACROSS THE LIFE COURSE

Model 7a

Adjusting for prospectively assessed family adversity, age 7

	OR	95% CI	p value
Second generation Irish	1.17	0.92,1.50	0.21
Female gender	1.01	0.90,1.13	0.88

Model 7b

Stressful life events in the previous six months (age 44/ 45)

	OR	95% CI	p value
Second generation Irish	1.24	0.97,1.59	0.08
Female gender	1.01	0.91,1.13	0.84

Model 7c

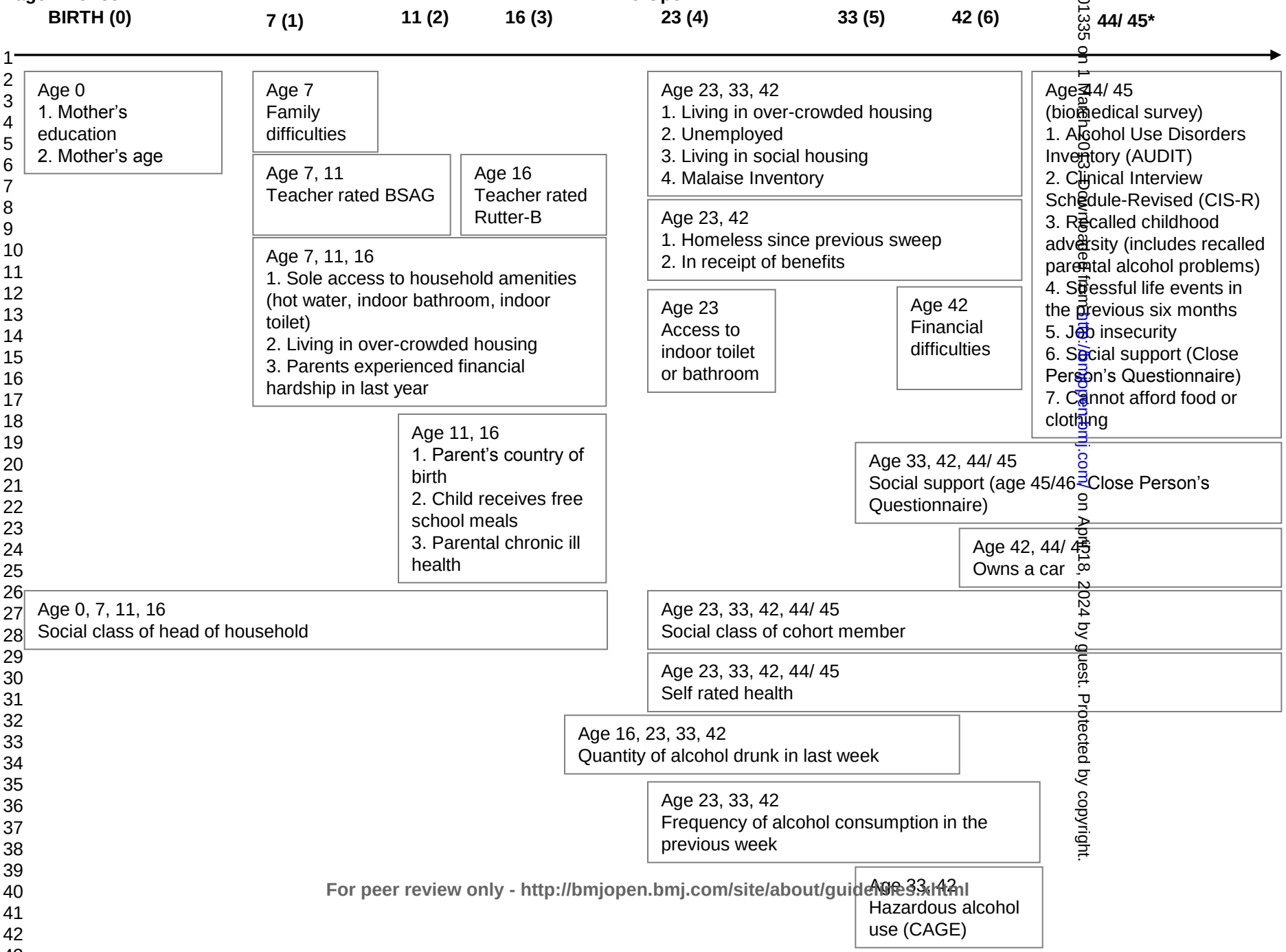
Adjusting for job security, age 44/ 45

	OR	95% CI	p value
Second generation Irish	1.26	0.98,1.61	0.07
Female gender	1.07	0.95,1.19	0.26

One or more family difficulties, age 7	1.64	1.40,1.91	p<0.001	One or more stressful life events in the previous six months	1.48	1.31,1.66	p<0.001	Feels not v.secure/ insecure (vs secure) in current job	1.80	1.51,2.16	p<0.001

***Key to OR table 1 & 2**: † screened positive as a 'case' on the Bristol Social Adjustment Guide or Rutter-B at age 7, 11 or 16; ‡ Rated health as 'fair' or 'poor' at least once, at age 23, 33, or 42; *social support assessed on the Close Person's Questionnaire- intermediate to high levels of confiding emotional and practical social support versus low levels, and low levels negative social support versus intermediate to high levels; **cohort member has someone they could turn to for advice and support (versus none); ***medium to high (versus low) levels of emotional and practical social support*

Figure 1: Variables and measures used in NCDS by sweep (age)



STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract The study design is a historical cohort study; 'birth cohort study' has been indicated in the title
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found The main findings relating to differential experiences of disadvantage in childhood and in early adulthood amongst UK-born Irish people relative to the rest of the cohort, and its role in accounting for observed differences at mid-life for common mental disorders and self-rated health has been described in the abstract.
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Four decades of research has continued to show that second generation Irish people living in Britain experience excess mortality and psychological morbidity, however these differences are not accounted for through socioeconomic position. This is a concern as Irish people living in Britain constitute one of the largest ethnic minority groups however their health needs have been neglected until fairly recently. There have been no studies using prospective cohort data to examine potential life-course antecedents of poorer health in this group of people.
Objectives	3	State specific objectives, including any prespecified hypotheses Main objectives: 1. To establish if second generation Irish people are more likely to grow up under, and live in, circumstances of material and social disadvantage over their life-course, relative to people without a parental history of migration; 2. To establish if the prevalence of common mental disorders and self-rated health (a predictor for mortality) is elevated in second generation Irish cohort members relative to the rest of the cohort, in early adulthood (at age 23, 33), and in mid-life (age 44/ 45); 3. To establish if disadvantage over the life-course mediates any health disparities observed at mid-life (age 44/ 45) in second generation Irish people.
Methods		
Study design	4	Present key elements of study design early in the paper This has been done.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection This has been done.
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Data from all eligible participants (children born in England, Scotland or Wales in the selected week who had one or both parents reporting that they were born in England, Scotland, Wales, Ireland or Northern Ireland) was used. Participants were followed up at age 7, 11, 16, 23, 33, 42, 45/ 46.
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed Not applicable

Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Main outcomes: common mental disorders assessed at age 23, 33, 44/ 45, self-rated health assessed at 23, 33, 42. Main exposure: parental migration history. Effect modifier: gender- which was adjusted for as no interactions with gender were found. Other exposures/ covariates were social and adversity indicators assessed over the life-course which were analysed in models as putative mediators for the association between parental migration history and mid-life common mental disorders and poorer self rated health.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group This has been done.
Bias	9	Describe any efforts to address potential sources of bias Bias due to missing data/ attrition was handled using multiple imputation under assumptions of Missing At Random (MAR)
Study size	10	Explain how the study size was arrived at This was a secondary analysis of an existing dataset.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Not applicable
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding This has been done- see 'statistical analysis' section in manuscript
		(*b*) Describe any methods used to examine subgroups and interactions Only gender interactions with ethnicity for mid-life common mental disorders and poorer self rated health were assessed. These were specified in the imputation regression and then assessed in the analysis using standard multivariate techniques. No interactions with gender were found, so models have been adjusted for gender.
		(*c*) Explain how missing data were addressed This has been explained in the text, under section entitled 'Missing Data'. Multiple Imputation using the chained equations approach in STATA 10 was the main method used, followed by analysis using MIM in STATA 10.
		(*d*) If applicable, explain how loss to follow-up was addressed As above- assumed that data was missing at random. Predictors for attrition were entered into the imputation regression. Estimates derived through multiple imputation and through complete case analysis were compared as a sensitivity analysis and very little differences were found.
		(*e*) Describe any sensitivity analyses Estimates derived through multiple imputation were compared to estimates derived through complete case analysis and very little differences were found.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the

		study, completing follow-up, and analysed This has been done
		(b) Give reasons for non-participation at each stage A supplementary table showing rates of attrition in the sample has been provided.
		(c) Consider use of a flow diagram A table has been provided instead.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders This has been done within the text.
		(b) Indicate number of participants with missing data for each variable of interest Overall proportions of missing data for the main dependent variables have been provided in the text. Table 1 shows the number of cohort members used for each part of the analysis for the main dependent variables, as analysis of imputed data was restricted to individuals with complete information on outcomes.
		(c) Summarise follow-up time (eg, average and total amount) Follow-up time was the same for all cohort members and is provided in the methods section
Outcome data	15*	Report numbers of outcome events or summary measures over time This has been done – see table 1 and figure 1
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included All models have been adjusted for gender. In addition the analysis examined a number of potential mediators over the life course in accounting for mid-life health inequalities in second generation Irish people in the cohort. The rationale for this approach is explained in the text.
		(*b*) Report category boundaries when continuous variables were categorized Not applicable
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period Not thought to be applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses See statistical methods section- interactions with gender were assessed
Discussion		
Key results	18	Summarise key results with reference to study objectives This has been done- first few paragraphs in the 'Discussion section' of the manuscript
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Limitations have been discussed under a separate heading in the 'Discussion' section.

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence This has been done- the findings are consistent with findings from a wider body of work which has examined childhood adversity or the role of 'sensitive periods' in increasing the risk of downstream adult health outcomes.
Generalisability	21	Discuss the generalisability (external validity) of the study results This has been done under the 'Strengths and limitations' in the Discussion section.
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based This has been done- see 'Acknowledgements' section of the manuscript

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

PROTOCOL
SUBMITTED TO MRC PANEL OCTOBER 2007

Does childhood disadvantage lead to poorer health in second generation Irish people living in Britain?

BACKGROUND

Three decades of research[1-3] have indicated that Irish people living in Britain suffer elevated mortality and morbidity[3] compared with non-Irish White British people. These health effects persist into the second[1] and third generations[2] despite greater upward social mobility and improvements in socioeconomic circumstances. High rates of ischaemic heart disease[3], cerebrovascular disease[3], and hypertension[4] may partly account for elevated mortality in Irish people. Irish people also experience higher rates of common mental disorders[5] and suicide[6]. Putative factors which have been suggested to account for these health effects include 'selection effects', identity difficulties[6] and social deprivation[7]. Although controversial, alcohol misuse may be an additional aetiological factor[8].

There have, however, been very few longitudinal studies that have examined the health of Irish people or other migrant groups in Britain using a life-course approach. Longitudinal studies elsewhere have suggested that social class and the processes of migration and settling into a new host country interact dynamically over the life course and lead to specific health effects in migrants which diverge from the host population[9]. The policy benefits of using a life course approach are obvious; by identifying structural factors that impact on the health of second generation Irish people from childhood through to adulthood, (including later morbidity linked to elevated mortality risk), it may be possible to identify earlier 'intervention points', which could reduce later 'downstream' adverse health outcomes. This proposal will seek to explore the mechanisms through which morbidity may be 'transmitted' across generations, amongst Irish people living in Britain, by using data from two ongoing birth cohorts; the National Child Development Survey (NCDS), which first commenced in 1958, and the 1970 British Birth Cohort (BCS70). The findings will be compared with the Ethnicity Minority Psychiatric Illness Rates in the Community survey (EMPIRIC)[5], a cross-sectional survey.

In this proposal the shorthand '*poorer health outcomes*' refers to the following adult health outcomes: common mental disorders, hazardous alcohol use, suicidal ideation, self-reported longstanding illness, and hypertension. Gender will also be specifically examined in each of the models.

OBJECTIVES: 1) To determine the prevalence of poorer health outcomes in second generation Irish people in the most recent sweeps of the 1958 & 1970 British Birth Cohorts (age 34 in the BCS70 and age 46 in the NCDS) and to compare these with data from the EMPIRIC. **2)** Using a longitudinal approach, to determine those childhood and early adulthood factors which may predispose or protect against (downstream) poorer health outcomes in second generation Irish people, compared to non-Irish respondents in the 1970 and 1958 British birth surveys.

HYPOTHESES: 1) Early adverse experiences in childhood will predispose to childhood internalising and externalising disorders which will predispose to later life (adult/ downstream) poorer health outcomes and tobacco use in adulthood; this will be more evident in Irish-descended people, compared to the rest of the sample **2)** Amongst the sample as a whole, upwards social mobility will be more likely amongst Irish-descended cohort members compared to the rest of the sample. However, any protective effect of upward social mobility on adult health

will be less evident among Irish-descended cohort members **3)** Increased prevalence rates in adulthood of hazardous alcohol use and tobacco use, will be predicted by poorer psychological health across the life course in Irish-descended cohort members, compared to non-Irish cohort members.

METHODS 1) Datasets: NCDS & BCS70 The 1958 birth cohort included all children born in England, Scotland, and Wales during 3-9 March 1958. 98% of live births in this week were included in the survey, which totalled 17,414 live births. The 1970 birth cohort was similar, with over 17,000 births in Britain over the week of 5-11 April 1970. Data for both of the surveys were taken from parents, teachers, doctors, school records, as well as by interview of cohort members at ages 7, 11, 16, 23, 33, 42 (1958 cohort), and at ages 5,10,16,26, 30, 34 (1970 cohort). Parents of children in the cohort were asked to confirm their country of birth. Using this method there are 627 cohort members with one or both parents born in the Republic of Ireland or in Northern Ireland, in the 1958 cohort. In the 1970 cohort 847 children were similarly identified and followed up over the subsequent sweeps of the BCS70 survey, into adulthood. **EMPIRIC:** For the purposes of comparison, the Ethnicity Minority Psychiatric Illness Rates in the Community (EMPIRIC) survey[5] will be used. This was a follow-up of ethnic minority groups covered in the 1999 Health Survey for England (HSE) study along with the white English sample who had previously taken part in the 1998 HSE. There were 733 people describing their ethnicity as Irish.
2) MAIN MEASURES: (due to space limitations the following list is not exhaustive) Socioeconomic variables: (Birth): 1) Social class, occupation, employment status of cohort member's father at birth (1958 & 1970 cohorts) **(Adulthood):** Occupational social class at ages 42 (NCDS) & 34 (BCS70). '**Social mobility'** will be determined across the life course by taking father's occupation at birth and comparing with cohort member's occupation in adulthood (age 46 in NCDS and age 34 in BCS70) **Childhood variables:** 1) **Behaviour**- Parents completed the Rutter Home scale for behaviour at ages 7, 11, and 16 (NCDS) and age 10, 16 (BCS70)[12,13], to assess for emotional & conduct disorders in childhood. Examples of statements used to identify conduct disorders included: *Destroys own or others belongings;* whilst statements used to identify childhood emotional disturbances included *Is miserable or tearful*[12,13]. Items will be scored according to the scale[12,13]. 2) **Stressful events in childhood**: Parents were asked about; their child being bullied at school (NCDS only); number of family moves since birth; their child spending any time in care or experiencing any significant maternal separation; any outside agencies being involved with the child's care; domestic tension at home; financial & housing difficulties at home (age 5 BCS70; age 7 NCDS); death of mother or father; significant parental illnesses (mental health problems, alcoholism, chronic physical illnesses or disabilities) (age 7 NCDS; age 5 BCS70). **Outcomes *('poorer health outcomes'):* NCDS:** 9377 participants took part in the biomedical sweep of the NCDS at age 45, with a response rate of 78%[10]. Measures to be used from this phase: 1) **Blood pressure**- Hypertension will be treated as a categorical variable and considered present if blood pressure was greater than 140/90, or if cohort members report being prescribed antihypertensive medication. If numbers permit, Metabolic Syndrome[20] will also be examined as an outcome, using other relevant data from this sweep (ie. glucose, cholesterol & triglycerides, blood pressure, waist:hip measurements). 2)**Self-reported longstanding illness** 3)**Common mental disorders** & **suicidal ideation**- ICD10 diagnoses[15] determined through the *Clinical Interview Schedule-Revised* (CIS-R)[16] 5)**Hazardous alcohol use**- determined through the Alcohol Use Disorders Inventory Tool (AUDIT)[17]. Hazardous alcohol use will be defined as a score above 8[17]. **BCS70:** 9664 individuals in the 1970 cohort completed interviews at the age of 34 (2004). Outcome measures to be used from this phase; 1) **Self-reported longstanding illness**; 2) **Psychological malaise**- the malaise inventory was used to indicate

psychological morbidity. Cut-offs above 6/7 suggests caseness for depression, with sensitivity 0.64 and specificity of 0.88[14] 3)**Alcohol**- The CAGE questionnaire was used to enquire after drinking habits within the previous year (cut off>2 suggest harmful use), questions around heavy alcohol use were also asked: >50 units of alcohol/ week (men), >35 units of alcohol/ week (women) indicating hazardous use. **Tobacco**- 'Regular smoking', defined as ≥1+ cigarettes/ day for at least 12 months, measured in most recent sweeps, of both NCDS and BCS.

Selected health indicators in the 1958 and 1970 cohorts, recent sweeps (2000 survey)

	Cohort year	Irish CM	Non-Irish CM	N
One or more longstanding illnesses	1958	**34.1%***	**29.1%***	3327
	1970	26.7%	23.4%	2422
Psychological malaise†	1958	18.9%	17.8%	2004
	1970	**22.6%***	**16.9%***	1744
Harmful alcohol use¥	1958	16.7%	15.1%	1442
	1970	17.1%	14.2%	1452
Hypertension (self report)	1958	11.4%	11.4%	1300
	1970	**11.8%***	**7.8%***	797

**p≤0.05; †Scores of 7 or more on malaise inventory; ¥ Scores of 2 or more on CAGE questionnaire; 'CM': cohort members*

STATISTICAL ANALYSIS: STATA[18] will be used to generate prevalence figures of poorer health outcomes in adulthood in the NCDS & BCS70 and will be compared with age and gender adjusted prevalence from the EMPIRIC. Factors associated with these outcomes (social support, marital status, educational level, stressful life events, gender and social class) will be examined using multivariable logistic regression techniques. **Structural Equation Models:** Mplus[19] will be used to model complex interactions between downstream health effects & earlier exposures (eg. childhood internalising/ externalising disorders), with potential interactions such as the impact of social mobility on these effects. **Handling of sample attrition and missing data within the NCDS & BCS70:** As with any longitudinal survey both the NCDS and BCS70 suffered from loss to follow up over time. Overall, response rates/ attrition for second generation Irish people within the two cohorts did not differ significantly from overall response rates for the 1958 and 1970 cohorts. Attrition within this study will be handled using the techniques previously described by Clark *et al* (2007)[10], with weighting for missing data and missing data imputation, where appropriate. **Cohort, period and age effects:** Cohort, period and age effects potentially impacting on outcomes in the 1958 and 1970 cohorts will be examined in the first instance descriptively. If sample sizes permit then this will be subjected to more formal statistical analysis using the methods described by Sacker *et al* (2002)[11]. Age effects will be further compared using the EMPIRIC.

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