Early motherhood and mental health in midlife: a study of British and American cohorts

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Abstract

An analysis of data from a British national birth cohort (N=1300 women) and the US Health and Retirement Study (N= 4786 women) showed that in both samples first motherhood before 21 years was associated with a raised risk of mental health problems after age 50 years when compared with mental health in mothers who had their first child at a later age, after adjustment for early life disadvantage and midlife social support. Mental health problems tended to be more severe in younger compared with later first mothers. Our analysis suggests that this association is largely the outcome of the poorer socioeconomic status and physical health experienced in midlife by women who had an early first motherhood. In both countries changes in age at first birth, in abortion laws, and in opportunities in education and employment mean that our finding is likely to be age cohort specific.

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Introduction

Increasingly, research has shown that early childbearing, especially in the teenage years is associated with a range of adverse outcomes in mid and later life (Hofferth and Moore 1979; Geronimos and Korenman 1992; Grundy and Tomassini 2005), including raised risk of poor mental health and depression. Studies consistently show poorer mental health in women, in terms of anxiety, depression and neuroticism, at various intervals after an early first birth (McGee et al. 1983; Simms and Smith 1986; Williams et al 1997; Wagner et al 1998; Coley et al 1998; Deal and Holt 1998; Kalil and James 2002; Liao 2003; Mirowsky and Ross 2002; Butterworth et al forthcoming).

This is a complex rel ationship to explain because of the different potential pathways. The disadvantaged situation and poorer mental health of early mothers may, for example, be a result of adverse childhood circumstances that are also independently associated with early motherhood (Chase-Lansdale and Kiernan 2004). It is difficult to allow for that in analysis, although attempts to do so have been undertaken using instrumental variables (Ermisch and Pevalin 2003), whereas other studies have tried to do so by using a wide range of information about early life characteristics. This includes our own analysis of data from a birth cohort study, showing that early lone motherhood had a lasting and substantial impact, even after adjustment for pre-pregnancy risks (Butterworth et al. forthcoming).

Another possible explanation for associations between early childbearing and poor later mental health may be that early childbearing is associated with low educational attainment, and has negative effects on earnings and income, that are in turn associated with differentials in mental health risks (Hofferth and Moore 1979). Inconsistent employment and low income among early mothers could be associated with mental health risks, since some studies show a beneficial effect of employment on women's mental and physical health: however that effect was less true for those in unskilled employment or working full time whilst living with independent children (Macran et al 1996; Waldron et al 1998). The lower income of early mothers may be more associated with higher unemployment rates among partners (Ermisch and Pevalin 2003; Hofferth and Moore 1979) than with own earning potential, and family income rather than own earnings may be a more important determinant of mothers' mental health (Ross and Huber 1985).

Poor family functioning may be another risk to health of early mothers, as 2 studies have reported, even among those with high levels of employment and educational attainment (Department for Education and Science Teenage Pregnancy Unit 2005). Younger mothers also tend to experience higher levels of partnership instability (Kalil et al. 2002; Liao 2003). Past experience of divorce or separation, rather than current partnership status, predicted current mental health in British women, and accounted for part of the association between early motherhood and mental health Liao 2003). Partnership status around the time of first birth may be critical. In one study, adjusting for lack of a cohabiting partner at that time accounted for most of the association between teenage motherhood and poor mental health at ages 27-29 years (Kalil et al. 2002). Earlier mothers may experience less social support than later mothers because of differences in their lifestyle, and they may be more likely than later mothers to experience family estrangement (Hofferth and Moore 1979; Moffitt et al. 2002).

Poor physical health is a common co-morbidity with psychological distress (Liao 2003; Kuh et al. 2002), and is more prevalent among women with a younger age at first birth (Butterworth et al. Forthcoming; Moffitt et al. 2002; Kington et al. 1997). Younger age at first birth may adversely affect the mother's physical health, and the later socioeconomic disadvantage of early motherhood may also lead to poorer physical health (Mirowsky et al. 2002; Waldron et al. 1998; Miech and Shanahan 2000).

The analysis presented here uses longitudinal data from a British and a US study to examine whether the mental health disadvantage associated with early first birth extends into the sixth decade of life. To our knowledge the impact of timing of first birth on mental health has not been examined exclusively after so many years of life. Our hypothesis is that poorer mental health will be found at this later age to be associated with first birth before age 21 years, and will be explained by these early mothers' greater risk of adverse socioeconomic circumstances and poorer physical health, as well as greater disadvantage in childhood.

Methods

The samples

The Health and Retirement Study (referred to here as the US study) is a probability sample of the US non-institutionalized population (Juster and Richard 1995). The data used here come from the 1992 interview of the original HRS cohort who were born 1931-41 and were aged 51-61 at the interview, when a great amount of information was collected, in retrospect, on earlier life, including marriage and childbearing history. The response rate to this interview was 82%. The study design includes over samples of African Americans, Hispanics, and

residents of Florida. Sampling weights are used in the analysis to adjust for these over samples. Data from 4799 women were used in this analysis.

The MRC National Survey of Health and Development (referred to here as the British study) is a socially stratified sample of all single, legitimate births occurring in England, Scotland and Wales during the week 3-9 March 1946, consisting of 2547 women and 2815 men. They have been followed up throughout life, most recently at age 53 years, when 3,035 were interviewed (61.4% of the cohort), 83% of those available. Non availability resulted from death (7.7% of the cohort), refusal (14.4%), emigration (8.1%) and having no traceable address (8.5%). Altogether 1798 mothers (70.6% of women in the sample) gave information on their age at the birth of their first child. Of these, 454 (25.3%) were aged under 21 years at that time and were classified as 'early mothers'. Loss to follow-up by age 53 years was greater among early mothers (77.7%) than other mothers (70.9%); data from 1300 women were used in this analysis.

The measures

Adult mental health

The US study measured psychological distress and symptoms of depression using eleven items from the twenty-item Center for Epidemiologic Studies Depression Scale (CES-D), originally developed for survey measurement of depressive symptoms (Radloff 1977), and used extensively (Steffick 2000). Each item requests a frequency response, ranging from never to almost all the time. These are coded between zero and three, resulting in a scale that runs between zero and 33. We chose cut-points that produced proportions in the three categories as close as possible to the British data with 8.1% 'high' compared to 7.5% in the British data) and 16.2% 'medium' (compared to 17.2%).

The British study used the General Health Questionnaire-28 (GHQ-28), a validated measure of mental health designed to detect symptoms of anxiety, depression and somatic problems. One point is scored for each symptom to give a maximum of 28. A score higher than 4 has a sensitivity of 88.0% and a specificity of 84.2% for detecting psychiatric disorder (Goldberg and Hillier 1979). This threshold score gave a prevalence of 19.4% when including men and women, comparable to other British studies (Singleton et al. 2003). Measurement of psychiatric morbidity in this cohort at age 36 used the Present State Examination (PSE) (Wing et al. 1974), and gave a prevalence of 6.4% (Paykel et al. 2001), so we chose a cut off score of 14 or more on the GHQ to group approximately the same proportion (5.9%). The GHQ scores are therefore in three groups: 0-4 (low), 5-13 (medium) and 14-28 (high).

Timing of motherhood

The US study collected a roster of living biological children of each respondent, including each child's age. In combination with mother's birth year, these data allowed calculation of the timing of first birth. The data exclude any children who died before the 1992 interview.

In the British study age at first birth was computed using interview data from multiple time points. Since there is no data on adoptions, some data represents age at first motherhood rather than first birth.

In both samples age at first motherhood is categorised into under 21 years and 21 years or older, and referred to as 'early' and 'later' motherhood, respectively.

Childhood socio-economic circumstances

In the US study father's education was used to measure the socioeconomic status of households in the 1930s and 1940s, and is coded as fewer or greater than or equal to 12 years of schooling (high school completion).

In the British study the measure of childhood social class was determined from records of the father's occupation when the survey member was aged 11 years if available, otherwise at age 15 years, and otherwise at age 4 years.

Education

In the US study responses to the question of the highest grade of school or college completed were coded into three categories: less than high school completion (0-11 years); high school completion (12 years); more than high school (13 or more years).

In the British study highest levels of educational and training attainment, at age 26 years, were classified into 'None' (score 0), 'up to GCE O level' (qualifications up to and including those usually taken at age 15 years at the end of compulsory schooling) (score 1), 'A levels/higher' (qualifications usually taken at age 17 years i.e. university entrance level, and graduate or postgraduate) (score 2).

Partnership

In the US study current partnership was described as yes/no. Partnership at the time of first birth used the age of the oldest living child and a marital history that included the beginning and end dates of the current or last marriage plus up to three previous marriages.

The British study measured current partnership as yes/no. Partnership at the time of the first birth was estimated by marital status (married/unmarried), defined by marriage prior to or in the same year as the first child's birth, rather than later or never.
Widowhood/separation/divorce in the same year or prior to the first child's birth were classed as unmarried.

Socioeconomic circumstances in adulthood

In the US study the measurement of current paid employment was yes/no, and unemployment was classified as current or had ever been on temporary layoff or unemployed and looking for work in the previous ten years. Household social class was measured using own social class (manual/non-manual occupation coded using the 2 digit US Census codes; managerial, professional, sales and clerical occupations were coded as non-manual, others as manual: responses for those currently unemployed were imputed), and partner's social class measured in the same way, and coded using the highest reported of own and partner's. Mean household annual income before-tax, and housing tenure (owned/not owned) were also measured. The perceived financial situation was assessed using the question 'Are you very/somewhat/about evenly satisfied or somewhat/very dissatisfied with your financial situation?'

In the British study, measures of socio-economic circumstances included current paid employment (yes/no), history of unemployment (ever unemployed for 6 months+ in the last ten years), household social class (whichever was higher of own or spouse's social class),

mean annual household annual income (before dedu ctions), and housing tenure (owned/not owned) accommodation). The perceived financial situation was assessed by asking how well the family managed on its income (comfortably/fairly well/hard to manage), and whether it was unable to pay bills in the past year (often/sometimes/never).

Social support and satisfaction in adulthood

The US study measured social support by asking whether they had relatives in the neighbourhood (yes/no), by asking about frequency of visits with neighbours (daily or almost daily/several times a week, month, year/hardly ever or never/none known), and about social closeness of neighbours by asking how many of the closest neighbours were known by name (all/most/some/none) and whether they had good friends in the neighbourhood (yes/no).

In the British study social support was assessed by frequency of visits of friends/relatives (never/once every few months/once a month/once a week/daily), the number seen once a month or more (0/1-2/3-5/6-10/10+), whether help would be available in a crisis (no/sometimes/often/always), and satisfaction with social life (about right/prefer more/ prefer less).

Adult physical health, disability, use of psychotropic medication, and hospitalisation

In the US study the number of health conditions was the count of serious specified conditions ever doctor diagnosed, and self-diagnosis of other specified conditions (asthma; back problems; foot or leg problems; kidney or bladder problems; and stomach or intestinal ulcers). A disability score (0-36) summed reports of whether performing specified activities (e.g. walk one block) was not at all (coded 0)/a little/somewhat or very difficult (coded 3), or could not be done or not done (coded 3). Psychotropic medicine use was derived from a

question to those reporting emotional, nervous or mental health problems in the previous 12 months, about current use of tranquilizers, antidepressants, or pills for nerves. Hospitalisation was recorded as measure whether any nights in hospital in the previous 12 months (yes/no).

Adult physical health in the British study was measured using the sum of numbers of self-report of serious conditions (0,1,2,3,4 and 4+) experienced and medically diagnosed in the last 10 years. Disability was measured by a count (scored 0,1,2,3,3+) of the number of difficulties with everyday activities because of long-term health problems (e.g. walking for a quarter of a mile on the level). Psychotropic medication use (yes/no) was defined as current use of anxiolytics, hypnotics, antidepressants or drugs used for treatment of psychoses and related disorders. Hospital admissions were measured by the number of nights spent in hospital during the previous 12 months.

Missing data

The US data are complete or imputed by the data producers for 3782 (79%) of the 4766 women with living children. Most missing data arise from the father's education variable (n=665) and occupation (n=251), and without those 4573 of the 4766 women would have had complete data. The British study did not impute missing data for this analysis.

Results

Table 1 shows the relationship of each variable with timing of first birth (using pairwise missing data deletion) and includes a chi square or difference of means test for the association of each variable with early birth. The results indicate a general pattern of adversity among early mothers in both British and US study populations. Compared to later mothers, there was a greater risk of a disadvantaged early life and poorer adult

socioeconomic circumstances and physical health. Early mothers were less likely to have been married at the time of the first birth, and in later adulthood were slightly less likely to live with a partner in the US sample, but there was no difference in partnership in the British sample at this stage. In the British sample social support for early mothers was either similar or better than that of later mothers. Although there were statistically significant differences between early and later mothers on all social support measures in the US sample, some indicated disadvantage for early mothers and some advantage, while others had no clear trend. In the US sample, early mothers were at greater risk of both mild and severe common mental illness, whereas in the British sample, this was apparent only at the severe end of the spectrum.

Table 2 uses generalized logistic regression to estimate the bivariate association (using pairwise deletion) between the potential confounders or mediators of interest and mental health of mothers in late middle age (Butterworth et al. Forthcoming). Variables are grouped into seven categories for presentation in the table: (1) childhood socioeconomic circumstances, (2) education, (3) partnership, (4) socioeconomic circumstances in adulthood, (5) physical health in adulthood, (6) psychotropic medication in adulthood, and (7) social support in adulthood. In describing the effect of adjusting the association between early motherhood and mental health questionnaire scores for different factors, we focus mainly on the results involving the high bands of the GHQ or CESD scores, since there was little additional risk of early mothers scoring in the middle CESD band compared to later mothers in the US sample, and none in the British sample.

In the US sample, poorer mental health was associated with most measures examined: a poorer childhood socioeconomic background, shorter time spent in education, lack of a

partner or spouse both currently and at the time of the first birth, disadvantaged adult socioeconomic circumstances, poorer physical health and less social support. Trends were similar although less clear in the British sample; the associations of childhood socioeconomic background, educational attainment and previous and current partnership with mental health at age 53 years were not statistically significant. Poor adult socioeconomic status and physical health however, were associated in the British sample with a higher (worse) GHQ score group at age 53 years. In the British sample, indicators of perception of a poor level of social support, were associated with mental health score in the expected direction, whereas frequency of social visits and number of different people visiting were not.

Table 3 focuses on change in the effect of early birth as mediating and confounding variables are added to the equations. To develop the models, we first eliminated any variable that did not reduce the odds of poor mental health associated with early mothrhood by five percent when it was added to a model with early birth (using pairwise deletion). In the second step, we added variables within each group, beginning with the strongest, and retaining those that changed the odds associated with early motherhood from the preceding equation by one percent or more (Butterworth et al. forthcoming). Table 3 presents separate models for each of the seven categories of variables discussed above (except for psychotropic medication in adulthood which did not meet the five percent criterion). In addition, we estimated a fully adjusted model for each country including all variables meeting the one percent criterion as well as a common model that included all variables meeting the one percent criterion in either country's model. The p value for each equation indicates the statistical significance of the early motherhood variable net of the other covariates.

The model building procedure identified which factors were most important in explaining the association between early motherhood and poorer mental health. Interestingly these were very similar in both samples. Marital status at the time of first birth was more important than current partnership. Adjustment by groups of variables showed that in both samples physical health and socioeconomic circumstances in later middle age were critical in explaining the association between early motherhood and poorer mental health. In the US sample, education was also a very important explanatory factor, but adjusting for this had a minor effect in the British sample. Adjusting for childhood socioeconomic background and partnership factors caused in both samples only a very small attenuation in the association between early motherhood and high GHQ or CESD scores. Adjusting for social support also caused a small attenuation in this association in the US sample, however in the British sample, it increased the estimate of the association between early motherhood and poorer mental health at age 53 years, because these social support factors were better among early mothers.

When taken together, the mental health risk factors investigated explained the association between early motherhood and poor mental health in both samples. After adjusting for all important factors, early motherhood was no longer associated with poorer mental health in the US sample, in fact it became weakly associated with better mental health. The same process in the British sample reduced the association to statistical non-significance, although early mothers were still estimated to be about 1.5 times at risk of poor mental health compared to later mothers. A common model including factors in both US and British fully adjusted models did not change the results in either sample, since the factors included were virtually the same. There were no significant interactions between early motherhood and any of the mental health risk factors that remained when tested in the final model.

The groups of variables that had the strongest attenuating effects were investigated in the British sample to see whether they were linked, in order to provide information on possible pathways. Adjusting simultaneously for physical health and adult socioeconomic circumstances gave an odds ratio of 1.37 (95% CI 0.80-2.32), comparing early mothers to later mothers in their risk of poor mental health. In contrast, the socioeconomic and health variables separately produced an odds of 1.54 and 1.42, respectively. This result indicated that each group of variables had an additional attenuating effect compared to the estimates that were adjusted for only one of the groups, but there was also extensive shared variance in their association with mental health scores. Omitting one group of variables at a time from the final model showed that partnership, social support and in particular, physical health was the only area that altered the estimate of association independently of all other groups of variables. In the US sample, inclusion of either health or socioeconomic status reduced the effect of early birth to non-significance. Omitting one group of variables at a time in the US sample did not alter the estimate of the effect of early birth substantially.

While early mothers were slightly more likely overall to be taking psychotropic medication in both British and US samples (Table 1), in the British sample, those that had medium and high GHQ scores were less likely to be using it than later mothers in the same GHQ score bands, at 9.8% compared to 11.5%, and 21.2% compared to 27.7%, respectively. This interaction was not significant, however (p=0.524). Among US respondents, later mothers were slightly less likely to use medication than early mothers – 9.2% vs. 10.3% in the medium CESD score group and 29.9% vs. 34.6% in the high group. These interactions were not significant (p=.325). Adjusting for medication when taking mental health score as an outcome made negligible difference in US and British samples.

Discussion

We found that women who give birth at a younger age experienced a higher level of common mental disorders long after the birth itself. The results suggest that poorer average mental health in midlife among early mothers can be explained by worse midlife physical health and socioeconomic circumstances, and in the US, education. Socioeconomic circumstances of the family of origin, and marital status at the time of first birth had a relatively minor explanatory effect among the variables we included. The similarity of mental health risk factors among early and later mothers implies that they share common pathways to poor mental health. Results in both data sets support these general conclusions. Differences between the two samples may reflect the different measures used in the studies, rather than any true country or cohort differences.

The direction and degree of any causality in these relationships is uncertain. First, because we had limited controls for early life circumstances, it cannot be ruled out that both early motherhood and later life disadvantage are independent results of common early risk factors, rather than early motherhood itself having any adverse consequences. Investigations of other outcomes of early motherhood which controlled rigorously for childhood background found fewer differences between early and later mothers once early-life differences were taken into account (Geronimus and Korenman 1992). Causality is also uncertain because poor adult socioeconomic circumstances, physical health, and social support are possible consequences of long term poor mental health as well as risk factors for it.

Despite the uncertainties in causal pathways, the factors adjusted for account for a large proportion of the mental health difference between early and later mothers in both samples. Earlier work has pointed out, plausibly, that early motherhood could affect later physical

health both directly, if the physiological stress of childbearing is greater when physically less developed, and indirectly, through poorer socioeconomic circumstances resulting from possibly reduced life chances (Kuh et al 2002; Tomassini and Grundy 2005). The hypothesized physiological pathway is controversial and it may be that all association between young age at first birth and poorer subsequent physical health can be accounted for by previous socioeconomic circumstances and other confounding factors (Lawler and Shaw 2002). Our results confirm only that the explanatory effects of physical health and socioeconomic circumstances in midlife are closely linked. While education level is strongly related to early birth in both data sets, education has a strong explanatory effect on mental health only in the US.

To some extent our findings may be specific to our cohorts of mothers, particularly bearing in mind the changes in prevalence of early motherhood throughout the 20th century, and in the means of avoiding it. Early mothers in the British cohort had their children between 1961 and 1966 when, in comparison with other periods, early motherhood was common (Butterworth et al. forthcoming). That was before the Abortion Act of 1967, which gave much easier access to abortion, before wide availability of hormonal methods of contraception began in the mid 1960s, and before the steep increase in incidence of extramarital births that began in the 1980s. Thus, later mothers in our British sample may have been able to take advantage of these changes to delay having children, and perhaps also to improve birth spacing and reduce family size, aspects which are likely to also improve their financial situation. Hence the impact of early motherhood may be greater in this cohort than in others. There have also been major changes in the social context of early childbearing in the United States. Early mothers in the HRS had their children primarily during the 1950s. While the overall rate of teenage childbearing has declined from the 1950s to today, the rate of childbearing among married

teenage w omen has declined while the rate of unmarried teenage childbearing has increased (National Center for Health Statistics 1999). Over the same period, the proportion of teenagers who are married has declined (US Bureau of the Census 2005). Young women who were bearing children in the 1950s tended to be married; in the US data, 82% of the early mothers were married at the time of the birth. Today, fewer teenagers are married and teenage mothers tend to be unmarried. The long -term effects of early motherhood may well be greater today than for the US cohort used in our analysis.

While the applicability of our findings to today's early mothers remains an open question, there is considerable evidence that women with a younger age at first birth are still more likely to experience socioeconomic disadvantage both prior to and after the first birth, and to have had less education (Moffitt et al. 2002; Social Exclusion Unit 1999). In a recent British study, more than a third of young mothers left education before standard leaving age and over half had not returned to education, training or work since the birth (Department for Education and Science Teenage Pregnancy Unit 2005). A socioeconomic gradient in access to abortion in Britain existed both before and after the Abortion Act. Those who were better off were more likely to be able to pay for illegal abortions from private practitioners before the Act, and have found it easier to get access to NHS services since the Act (Sims and Smith 1986). The results for the US data show that being unmarried at the time of the first birth is associated with poor mental health many years later. While the general decline of marriage may mean there is less stigma to bearing children while unmarried, that status increasingly characterizes teenage mothers and may indicate that today's teenage mothers will experience increased socioeconomic disadvantage as they age compared to early mothers in the 1950s.

The similarity in results across studies is particularly noteworthy because the two data sets use different data collection strategies, each with its own strengths and weaknesses. The British data used a panel design in which events were measured near the time of their occurrence. However, there has also been attrition over the many years of the study, and this loss is greater among early compared to later mothers. The retrospective study design in the single wave of the HRS study used in this analysis avoids the problem of attrition found in panel studies. However, the design meant that childbearing histories were collected when respondents were aged 51-61. The data set includes only the age of children who were alive when the respondent was interviewed. Hence errors in construction of age at first birth are likely to be greater than in the British prospective cohort study because of errors in age reporting and omission of children who died. Moreover, there is likely to be underreporting of illegitimate births. Futhermore, marital status at the time of first birth is based on the retrospective marital history, resulting in greater error than in a prospective design. Despite these differences, the results in the two data sets are similar.

Conclusions

Our results suggest that the association of early motherhood with poor midlife socioeconomic status and physical health explain poorer midlife mental health, rather than a significant long-term independent psychological effect of an early first birth. In particular, the co-morbidity between poorer midlife physical and mental health among early mothers explained much of the association. We do not adequately address in this paper whether it is early motherhood itself or prior disadvantage that begin the pathway towards poorer midlife mental health. Nonetheless, the significant association found in the British and US data suggest the need for further research to address this unanswered question as well as to understand better the lifetime linkage between early birth and later mental health.

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NOTES

[1]We examined the interaction of each covariate with early birth. Three were significant in the US data: social class, disability, and the social support item asking whether the respondent had relatives in the neighborhood. Because the interactions were not significant in the final model, they are not included in the reported models.

[2] In the US data, results differed somewhat in this step depending on whether listwise or pairwise deletion was used. The results shown used listwise deletion. Results did not differ across missing value deletion approaches in the British data.

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TABLES

Table 1. Mental health, education, partnership, socioeconomic circumstances, physical health and social support among NSHD (British) and HRS (US) mothers by age at first birth, using all available cases.*

Britain				US			
	Age at first birth (years)				Age at first birth (years)		
	21+ (later mothers)	<21 (early mothers)	P value†		21+ (later mothers)	<21 (early mothers)	P value†
Mental health							
GHQ score group age 53				**CES-D score group ages 51-61**			
Low	745 (75.1%)	234 (76.0%)		Low	2320 (78.2%)	1286 (71.5%)	
Medium	182 (18.4%)	41 (13.3%)	0.012	Medium	456 (15.4%)	316 (17.6%)	<0.001
High	65 (6.6%)	33 (10.7%)		High	193 (6.5%)	195(10.9%)	
Childhood socioeconomic circumstances							
Father's occupation				**Father's education**			
Non-manual	572 (44.9%)	94 (21.9%)	<0.001	12 years or more	1046 (39.7%)	414 (23.2%)	
Manual	703 (55.1%)	335 (78.1%)		0-11 years	1586 (60.3%)	1055 (71.8%)	<0.001
Education							
Educational qualifications age 26				**Years of schooling**			
None	425 (33.5%)	275 (64.0%)		0-11	492 (16.6%)	759 (42.2%)	
Up to GCE O level	455 (35.9%)	128 (30.0%)	<0.001	12 (high school)	1238 (42.0%)	709 (39.4%)	<0.001
Sixth form/higher	389 (30.7%)	27 (6.2%)		13 or more	1237 (41.7%)	329 (18.4%)	
Further education after age 26							
None	478 (47.9%)	175 (60.1%)					
At 1 time point	333 (33.3%)	82 (28.2%)	<0.001				
At 2 or 3 time points	188 (18.8%)	34 (11.7%)					
Partnership							
Living with partner age 53				**Living with partner ages 51-61**			
Yes	860 (91.8%)	262 (93.2%)	0.427	Yes	2223(74.9%)	1283 (71.4%)	0.008
No	77 (8.2%)	19 (6.8%)		No	745 (25.1%)	515 (28.6%)	
Partnership status at first birth				**Partnership status at first birth**			
Married	1276 (94.9%)	381 (83.9%)		Married	2697 (91.2%)	1476 (82.3%)	<0.001
Unmarried	68 (5.1%)	73 (16.1%)	<0.001	Unmarried	261 (8.8%)	317 (17.7%)	

Socioeconomic circumstances in adulthood						
In paid work age 53				**In paid work ages 51-61**		
Yes	779 (76.7%)	224 (70.9%)	0.040	Yes	1878 (63.3%)	1001 (55.7%)	<0.001
No	238 (23.4%)	92 (29.1%)		No	1088 (36.7%)	797 (44.3%)	
6 months period or longer of unemployment in last 10 years age 53				**Unemployed now or in the last 10 years ages 51 61**		
No	938 (92.7%)	285 (91.1%)	0.343	No	1433 (48.5%)	742 (41.4%)	
Yes	74 (7.3%)	28 (9.0%)		Yes	493 (16.7%)	307 (17.1%)	<0.001
				Not asked	1027 (34.8%)	742 (41.4%)	
Household social class age 53				**Household social class ages 51-61**		
Non-manual	587 (59.1%)	104 (34.8%)	<0.001	Non-manual			
Manual	407 (41.0%)	195 (65.2%)		Manual	2120 (74.9%)	943 (56.0%)	<0.001
					712 (25.1%)	740 (44.0%)	
Household income age 53 (mean annual £)				**Household income ages 51-61 (mean annual $)**		
	12.1	10.7	<0.001		54,152	$38,490	<0.001
Household owns accommodation age 53				**Household owns accommodation ages 51-61**		
No	102 (10.1%)	67 (21.2%)	<0.001	**No**	470 (16.0%)	404 (22.8%)	<0.001
Yes	913 (90.0%)	249 (78.8%)		Yes	2467 (84.0%)	1368 (77.2%)	
On present income age 53				**Perceived financial situation ages 51-61**		
Manage comfortably	522 (51.3%)	153 (48.6%)		Very satisfied	9.6%)	423 (24.0%)	
Manage fairly well	379 (37.3%)	116 (36.8%)	0.302	Somewhat satisfied	1146(39.2%)	675 (38.3%)	
Hard to manage	116 (11.4%)	46 (14.6%)		Even	332 (11.3%)	176(10.0%)	<0.001
				Somewhat dissatisfied	339 (11.6%)	277 (15.7%)	
				Very dissatisfied	241 (8.2%)	211 (12.0%)	
Been unable to pay the bills in past year age 53							
No	947 (93.1%)	282 (89.2%)					
Yes, sometimes	52 (5.1%)	20 (6.3%)	0.017				
Yes, often	18 (1.8%)	14 (4.4%)					
Physical health in adulthood						
Health conditions age 53				**Number of health conditions (mean) ages 51-61**		
0	352 (35.1%)	102 (32.7%)				
1	333 (33.2%)	89 (28.5%)			2.26	2.88	<0.001
2	197 (19.6%)	68 (21.8%)	0.052				
3	77 (7.7%)	27 (8.7%)					
4+	45 (4.5%)	26 (8.3%)					

Disability score age 53			
0	656 (64.5%)	158 (50.0%)	
1	183 (18.0%)	64 (20.3%)	<0.001
2	84 (8.3%)	45 (14.2%)	
3+	94 (9.2%)	49 (15.5%)	
One or more nights in hospital in 1998 age 53			
No	943 (93.8%)	286 (92.3%)	0.327
Yes	62 (6.2%)	24 (7.7%)	

Disability score (mean) ages 51 -61			
	6.99	9.37	<0.001
One or more nights in hospital in previous 12 months age 51-61			
No	254 (8.6%)	207 (11.5%)	
Yes	2713 (91.4%)	1589 (88.5%)	0.001

Psychotropic medication in adulthood

Psychotropic medication age 53			
No	941 (92.5%)	289 (91.5%)	0.533
Yes	76 (7.5%)	27 (8.5%)	

Use tranquilizers, anti-depressants or 'pills for nerves' ages 51 -61			
No	2820 (95.0%)	1674 (93.1%)	
Yes	148 (5.0%)	124 (6.9%)	0.006

Social support in adulthood

Relatives/friends outside household in regular contact age 53			
Yes	1011 (99.4%)	315 (99.7%)	0.557
No	6 (0.6%)	1 (0.3%)	
Frequency of visits age 53			
Never/once every few months	76 (7.5%)	21 (6.7%)	
Once a month	121 (12.0%)	24 (7.6%)	<0.001
Once a week	461 (45.6%)	116 (36.8%)	
Daily	353 (34.9%)	154 (48.9%)	
Number of relatives/friends seen once a month or more age 53			
0	29 (2.9%)	3 (1.0%)	
1-2	116 (11.4%)	30 (9.5%)	
3-5	332 (32.7%)	87 (27.5%)	0.041
6-10	272 (26.8%)	97 (30.7%)	
>10	268 (26.4%)	99 (31.3%)	
Would get help in a crisis age 53			
No	9 (0.9%)	0 (0.0%)	
Sometimes	38 (3.7%)	16 (5.1%)	0.060
Often	60 (5.9%)	10 (3.2%)	
Always	910 (89.5%)	290 (91.8%)	

Relatives live in neighbourhood ages 51 -61			
Yes	938 (31.6%)	737 (41.0%)	<0.001
No	2030 (68.4%)	1061(59.0%)	
Frequency of visits with neighbours ages 51-61			
Daily/Almost Daily	235 (7.9%)	194 (10.8%)	
Several Times/Week	495 (16.7%)	298 (16.7%)	
Several Times/Month	730 (24.7%)	389 (21.7%)	<0.001
Several Times/Year	493 (16.6%)	244 (13.6%)	
Hardly Ever/Never	852 (28.8%)	539 (30.1%)	
Don't know any neighbours	154 (5.2%)	126 (7.0%)	
Number of 10-15 closest neighbours known by name ages 51-61			
All	586(19.8%)	399(22.2%)	
Most	965 (32.5%)	525 (29.2%)	0.004
Some	1263(42.5%)	748 (41.6%)	
None	154 (5.2%)	126 (7.0%)	
Good friends in neighbourhood ages 51-61			
No	823 (27.7%)	605 (33.6%)	
Yes	2145(72.3%)	1193 (66.4%)	<0.001

Perceived social life age 53				
About right	801 (78.8%)	259 (82.0%)		
Prefer less	12 (1.2%)	5 (1.6%)	0.325	
Prefer more	204 (20.1%)	52 (16.5%)		

* Based on all available cases for each variable. In US data, number of observations may not sum to total N because counts are rounded estimates based on weighted data.

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† Pearson's χ^2 for tables and t test for quantitative variables.

Table 2. Unadjusted results: GHQ score group or CES D score group (medium and high compared separately with low) by age at first birth, education, partnership, socioeconomic circumstances, physical health and social support in the NSHD (Britain) and HRS (US), using all available cases.

Britain					US				
	N	OR (95% CI)		P value*		N	OR (95% CI)		P value*
		Medium (7th-19th percentiles)	High (1st-6th percentiles)				Medium (7th-19th percentiles)	High (1st-6th percentiles)	
Age at first birth					**Age at first birth**				
21+	992	1.00	1.00	0.013	21+	2968	1.00	1.00	<0.001
<21	308	0.72 (0.50-1.04)	1.62 (1.04-2.52)		<21	1798	1.25 (1.07-1.47)	1.83 (1.48-2.25)	
Childhood socioeconomic circumstances									
Father's occupation					**Father's education**				
Non-manual	592	1.00	1.00	0.117	0-11 years	2641	1.46 (1.22-1.76)	2.18 (1.65-2.88)	<0.001
Manual	803	0.76 (0.57-1.01)	1.13 (0.76-1.68)		12 or more years	1460	1.00	1.00	
Education									
Educational qualifications age 26					**Years of schooling**				
None	514	1.00	1.00	0.162	0-11	1251	1.00	1.00	<0.001
Up to GCE O level	483	1.11 (0.79-1.56)	0.99 (0.64-1.53)		12 (high school)	1947	0.61 (0.50-0.73)	0.37 (0.29-0.47)	
Sixth form/ higher	401	1.11 (0.78-1.58)	0.56 (0.33-0.96)		13 or more	1568	0.43 (0.35-0.53)	0.12 (0.09-0.17)	
Further education after age 26									
None	605	1.00	1.00	0.604					
1 time	433	1.01 (0.72-1.41)	0.74 (0.47-1.15)						
2 or 3 times	235	0.99 (0.65-1.49)	0.69 (0.39-1.22)						
Partnership									
Living with partner age 53					**Living with partner ages 51-61**				
Yes	1201	1.00	1.00	0.038	Yes	3506	1.00	1.00	<0.001
No	109	1.85 (1.17-2.94)	0.95 (0.42-2.12)		No	1260	1.74 (1.47-2.06)	3.20 (2.59-3.97)	
Partnership status at first birth					**Partnership status at first birth**				
Married	1214	1.00	1.00	0.236	Married	4173	1.00	1.00	<0.001
Unmarried	86	0.73 (0.38-1.41)	1.60 (0.79-3.22)		Unmarried	578	1.96 (1.58-2.43)	2.79 (2.15-3.62)	

Socioeconomic circumstances in adulthood						
In paid work age 53					**In paid work ages 51 - 61**				
Yes	1109	1.00	1.00	<0.001	Yes	2879	1.00	1.00	<0.001
No	370	1.80 (1.33-2.44)	2.86 (1.94-4.23)		No	1885	1.35 (1.16-1.58)	3.59 (2.88-4.49)	
6 months + unemployment in last 10 years					**Unemployed now or in the last 10 years**				
No	1358	1.00	1.00	0.010	No	2175	1.00	1.00	<0.001
Yes	118	1.40 (0.86-2.28)	2.40 (1.38-4.17)		Yes	800	1.43 (1.15-1.77)	1.72 (1.21-2.44)	
								3.86 (3.00-4.97)	
					Not asked	1769	1.49 (1.25-1.77)		
Household social class					**Household social class**				
Non-manual	792	1.00	1.00	0.071	Non-manual	3063	1.00	1.00	<0.001
Manual	639	1.06 (0.80-1.40)	1.58 (1.07-2.33)		Manual	1452	1.71(1.44-2.01)	2.85 (2.27-3.57)	
Household annual income					**Household annual income**				
per £1000 increase	1374	0.93 (0.90-0.97)	0.90 (0.86-0.95)	<0.001	per $1000 increase	4709	0.99 (0.98-0.99)	0.96 (0.96-0.97)	<0.001
Household owns accommodation					**Household owns accommodation**				
Yes	1289	1.00	1.00	0.053	Yes	3835	1.00	1.00	<0.001
No	184	1.42 (0.96-2.11)	1.70 (1.02-2.82)		No	874	2.15 (1.79-2.59)	3.89 (3.10-4.87)	
On present income					**Perceived financial situation**				
Manage comfortably	752	1.00	1.00	<0.001	Very satisfied	1287	1.00	1.00	<0.001
Manage fairly well	550	1.17 (0.86-1.59)	1.06 (0.69-1.63)		Somewhat satisfied	1821	2.07 (1.63-2.63)	2.32 (1.51-3.57)	
Hard to manage	176	2.80(1.88-4.16)	2.91 (1.74-4.87)		Even	508	3.20 (2.38-4.30)	3.99 (2.41-6.60)	
					Somewhat dissatisfied	616	4.31 (3.27-5.68)	9.59 (6.20-14.83)	
					Very dissatisfied	451	7.53 (5.57-10-18)	29.95 (19.47-46.07)	
Unable to pay the bills in past year									
No	1371	1.00	1.00	<0.001					
Yes, sometimes	73	3.13 (1.82-5.36)	3.33 (1.68-6.57)						
Yes, often	35	5.53 (2.63-11.64)	4.51 (1.70-12.00)						

Physical health in adulthood								
Health conditions					**Number of health conditions**			
0	514	1.00	1.00		4766	1.31 (1.26-1.37)	1.67 (1.58-1.76)	<0.001
1	482	1.59 (1.11-2.29)	1.15 (0.65-2.01)					
2	284	2.51 (1.70-3.72)	2.72 (1.57-4.71)	<0.001				
3	120	2.09 (1.22-3.58)	3.51 (1.82-6.76)					
4+	78	2.48 (1.30-4.73)	7.13 (3.65-13.90)					
Disability score					**Disability score**			
0	905	1.00	1.00		4766	1.10 (1.08-1.11)	1.18 (1.17-1.20)	<0.001
1	282	1.40 (0.97-2.01)	2.08 (1.22-3.57)					
2	135	1.69 (1.05-2.72)	3.52 (1.91-6.47) 10.57 (6.39-17.48)	<0.001				
3+	157	3.74 (2.46-5.68)						
One or more nights in hospital in 1998					**Hospital nights in previous 12 months**			
No	1360	1.00	1.00	0.012	No	4302	1.00	1.00	<0.001
Yes	96	1.15 (0.65-2.03)	2.62		Yes	461	1.74 (1.36-2.23)	3.55 (2.72-4.64)	
Psychotropic medication in adulthood								
Psychotropic medication					**Use tranquilizers or anti-depressants**			
No	1356	1.00	1.00	<0.001	No	4494	1.00	1.00	<0.001
Yes	123	2.05 (1.27-3.28)	6.05 (3.75-9.75)		Yes	272	5.08 (3.68-7.02)	18.94 (13.86-25.88)	
Social support in adulthood								
Frequency of visits from relatives/friends					**Relatives live in neighbourhood**			
Daily	542	1.00	1.00		No	3091	1.00	1.00	0.012
Once a week	644	1.12 (0.81-1.55)	0.95 (0.62-1.44)		Yes	1674	1.17 (1.00-1.38)	1.32 (1.06-1.63)	
Once a month	166	1.71 (1.10-2.67)	1.19 (0.64-2.21) 0.73 (0.32-1.67)	0.297					
Never/once every few months	117	1.40 (0.83-2.34)							
Number of relatives/friends seen once a month or more					**Good friends in neighbourhood**			
>10	392	1.00	1.00		No	14283338	1.00	1.00	0.009
6-10	406	0.99 (0.67-1.46)	1.16 (0.67-2.00)		Yes		0.78 (0.66-0.92)	0.85 (0.68-1.06)	
3-5	470	1.08 (0.74-1.56) 1.74 (1.13-2.67)	1.33 (0.79-2.22)	0.096					
0-2	211		1.84 (1.01-3.35)						

Would always get help in a crisis				
Yes	1325	1.00	1.00	<0.001
No	154	1.74 (1.14-2.65)	2.86 (1.75-4.66)	
Perceived social life				
About right	116	1.00	1.00	
Prefer less	8	1.73 (0.56-5.37)	4.23 (1.34-13.31)	<0.001
Prefer more	21	2.46 (1.79-3.39)	3.82 (2.54-5.73)	
	290			
Number of 10 -15 closest neighbours known by name				
All	985	1.00	1.00	<0.001
Most	1490	0.94 (0.75-1.19)	0.81 (0.58-1.12)	
Some	2010	1.26 (1.02-1.56)	1.34 (1.01-1.79)	
None	280	2.11 (1.51-2.96)	2.99 (1.99-4.50)	
Frequency of visits with neighbours				
Daily/Almost Daily	429	1.00	1.00	
Several Times/Week	794	0.94 (0.68-1.32)	0.53 (0.34-0.81)	
Several Times/Month	1119	1.01 (0.74 - 1.39)	0.60 (0.41-0.88)	
Several Times/Year	737	1.10 (0.79-1.54)	0.29 (0.18-0.49)	<0.001
Hardly Ever/Never	1391	1.12 (0.82-1.52)	0.97 (0.68-1.39)	
Don't know any neighbours	280	2.02 (1.37-2.99)	1.90 (1.21-2.98)	

* Likelihood ratio χ^2

Table 3. Effect of early motherhood on GHQ score or CESD score adjusted separately for groups of factors (childhood, education, partnership, socioeconomic and social support), including only variables which altered the association. The dataset was restricted to those who had no missing values for these variables (British NSHD n=1067, US HRS n=3782).

	Britain				US			
	N	OR (95% CI)		P value*	N	OR (95% CI)		P value*
		Medium (7th-19th percentiles)	High (1st-6th percentiles)			Medium (7th-19th percentiles)	High (1st-6th percentiles)	
(Unadjusted)								
Age at first birth								
21+	819	1.00	1.00	0.022	2445	1.00	1.00	<0.001
<21	248	0.78 (0.52-1.16)	1.80 (1.10-2.92)		1337	1.25 (1.04-1.50)	1.61 (1.25-2.07)	
Adjusted for childhood factors[1]								
Age at first birth								
21+	819	1.00	1.00	0.057	2445	1.00	1.00	<0.001
<21	248	0.84 (0.55-1.26)	1.72 (1.05-2.84)		1337	1.21 (1.00-1.45)	1.50 (1.16-1.94)	
Adjusted for educational factors[2]								
Age at first birth								
21+	819	1.00	1.00	0.069	2445	1.00	1.00	0.876
<21	248	0.82 (0.54-1.25)	1.70 (1.01-2.84)		1337	1.03 (0.84-1.25)	1.07 (0.82-1.40)	
Adjusted for partnership factors[3]								
Age at first birth								
21+	819	1.00	1.00	0.047	2445	1.00	1.00	0.002
<21	248	0.79 (0.52-1.18)	1.68 (1.02-2.77)		1337	1.21 (1.01-1.46)	1.52 (1.18-1.96)	
Adjusted for socioeconomic factors in adulthood[4]								
Age at first birth								
21+	819	1.00	1.00	0.048	2445	1.00	1.00	0.591
<21	248	0.72 (0.48-1.09)	1.54 (0.92-2.57)		1337	1.06 (0.87-128)	1.13 (0.87-1.48)	
Adjusted for physical health in adulthood[5]								
Age at first birth								
21+	819	1.00	1.00	0.061	2445	1.00	1.00	0.996
<21	248	0.70 (0.47-1.07)	1.42 (0.85-2.39)		1337	1.01 (0.83-1.22)	1.01 (0.76-1.34)	
Adjusted for social support in adulthood[6]								

Age at first birth								
21+	819	1.00	1.00	0.010	2445	1.00	1.00	0.001
<21	248	0.83 (0.55-1.24)	2.06 (1.24-3.42)		1337	1.23 (1.02-1.49)	1.53 (1.18-1.98)	
Fully adjusted[7]								
Age at first birth								
21+	819	1.00	1.00	0.178	2445	1.00	1.00	0.047
<21	248	0.82 (0.52-1.28)	1.52 (0.86-2.71)		1337	0.84(0.68-1.03)	0.72 (0.54-0.98)	
Common model[8]								
Age at first birth								
21+	819	1.00	1.00	0.208	2445	1.00	1.00	0.043
<21	248	0.84 (0.53-1.32)	1.53 (0.85-2.73)		1337	0.84 (0.68-1.03)	0.72 (0.53-0.97)	

* Likelihood ratio χ^2

[1] **Britain** Father's occupation. **US** Father's education

[2] **Britain** Educational attainment age 26. **US** Years of schooling

[3] **Britain** Marital status at the time of first birth. **US** Marital status at the time of first birth

[4] **Britain** Household income, household social class, in paid employment. **US** Household income, household social class, unemployment history

[5] **Britain** Disability score, number of health conditions. **US** Disability score, number of health conditions

[6] **Britain** Perceived social life, perceived help available in a crisis. **US** Frequency of visits with neighbours

[7] Including all variables from either British or US models, respectively

[8] Including all variables from both British and US models