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RESEARCH ARTICLE

The role of parental and child physical and mental health on behavioural and emotional adjustment in mid-childhood: a comparison of two generations of British children born 30 years apart

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Poor physical health and behavioural and emotional problems in childhood have a lasting impact on well-being in adolescence and adulthood. Here we address the relationship between poor parent and child physical and mental health in early childhood (age 5) and conduct, hyperactivity and emotional problems in mid-childhood (age 10/11). We compare results across two generations of British children born 30 years apart in 1970 ($n = 15,856$) and 2000/2 ($16,628$). We take advantage of rich longitudinal birth cohort data and establish that a child's own poor health was associated with conduct, hyperactivity and emotional problems in mid-childhood in both generations, and that with the exception of conduct problems in the 1970 cohort these relationships remained when family socio-economic status and individual characteristics were accounted for. Poor maternal mental health was similarly associated with conduct, hyperactivity and emotional problems in both generations; poor parental physical health with a child having later hyperactivity and emotional problems in the younger generation. Results also indicated that earlier behaviour problems had more influence on later problems for children in the more recent cohort. Given the increasing proportion of children and adolescents with mental health problems and that socio-economic disadvantage increases physical and mental well-being concerns within families, policy solutions must consider the holistic nature of a child's family environment to prevent some children experiencing a 'double whammy' of disadvantage. The early years provide the best opportunity to promote children's resilience and well-being and minimise the development of entrenched negative behaviours and their subsequent costs to society.

Key words health • behavioural and emotional adjustment • parents • childhood • socio-economic inequality

Key messages

- Poor parental physical and mental health each have a negative association with behavioural adjustment in (two generations of British) children.
- A child's poor health has a negative association with later behavioural adjustment in (two generations of British) children.
- The relationships remain even after family background and a child's earlier behaviour scores are taken into account.

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Introduction

While all infants and young children display some degree of emotional or behavioural disturbance over the course of their development (Earle, 2013), most children grow up to be mentally healthy in adolescence and adulthood. However, increasing numbers of children and young people around the world experience problems with their behaviour and mental health (Green et al, 2005; Smith and Smith, 2010; Pitchforth et al, 2018; Patalay and Gage, 2019). Current estimates for the UK suggest as many as one in eight children and young people have mental health problems (NHS Digital, 2018) and rates of psychiatric disorders in young people are also rising (Collishaw et al, 2004; Borschmann et al, 2017; Borschmann and Kinner, 2019). In terms of physical health, it is estimated that 12% of young people in the UK live with a long-term condition (Sawyer et al, 2007), and the presence of a chronic condition increases the risk of mental health problems (Davies et al, 2003; Parry-Langdon, 2008). Having poor physical health or mental well-being can cast a long shadow on a wide range of outcomes over the life course, including educational attainment, employment, relationships, wages, income and progressive co-morbidity of health problems and early mortality (Graham and Power, 2004; Palloni, 2006; Parks et al, 2006; Egan et al, 2015; Goodman et al, 2011). Poor childhood behavioural adjustment in particular has been shown to be associated with substantial social and economic detriments in adult life (Goodman et al, 2011).

Poor parent physical and mental well-being impact negatively on children's health and behaviour at young ages (Hansen and Joshi 2008; Kiernan and Huerta, 2008; Hobcraft and Kiernan, 2010; Thoits, 2010), with maternal mental health in particular being intricately related to both child physical and mental health (Stein et al, 2008; Manning and Gregoire, 2009; Avan et al, 2010) and social and emotional development (Mensah and Kiernan, 2010). Currently almost one in four children aged 0–16 years are exposed to maternal mental illness in the UK, with the prevalence of diagnosed and treated maternal mental illness increasing, with depression and anxiety being the most prevalent illnesses (Abel et al, 2019). In 2011, the UK Government and the Social Care Institute for Excellence published a series of policy documents (Social Care Institute for Excellence, 2011) recognising that children exposed to parental

mental illness are more likely to experience adversities, with psychosocial development and behavioural problems being the most common and well recognised (Cullis and Hansen, 2008; Kiernan and Huerta, 2008; Stein et al, 2014; Turney, 2011; Reid, 2015; Zilanawala et al, 2019). Having a mother in poor general health or with a long-standing physical health problem (Straatmann et al, 2018) is also associated with the child displaying higher levels of socio-emotional problems, although maternal mental health matters more than physical health problems or paternal mental health (Fitzsimons et al, 2017).

In terms of a child's own physical health, many cross-sectional studies have shown that chronic physical health problems are associated with more concurrent behaviour problems (see Pinquart and Shen, 2011 for a meta-analysis of results from 569 studies). However, although there is an acknowledged interface between chronic conditions and mental health problems (Parry-Langdon, 2008; Campo, 2012) there is relatively little longitudinal literature about how physical health concerns relate to later behaviour problems. Exceptions include Straatmann et al (2018) who show a higher prevalence of behaviour problems among children with poor health, and research on childhood disability shows how the behaviour of disabled children diverges from their non-disabled peers during the early years (Fauth et al, 2017).

Socio-economic inequalities in health and behaviour

The social gradient in physical and mental health over the whole life course is well established (for example, Marmot, 2010; Marmot and Bell, 2012). Socio-economic inequality in child health and health behaviours is present at birth, for example in birthweight (Weightman et al, 2012) and breastfeeding practices (Kelly and Watt, 2005), and persists in health and behaviour outcomes over the early years (Dex and Joshi, 2004; Hansen and Joshi, 2007; Hansen and Joshi, 2008; Reiss, 2013; Deighton et al, 2019).

While the link between health and poverty is well established, child poverty in the UK has been increasing since 2011–12, largely due to reductions in benefits and tax credits (Barnard et al, 2017). This may promote persistence or even an increase in childhood health inequalities (CQC, 2017), with both adult and child mental health services remaining under pressure as the impact of the 2008 economic recession under successive governments continues to be felt (CQC, 2017; BMA, 2018).

Using data from the 1970 British Cohort Study (BCS70) and the UK Millennium Cohort Study (MCS), Shackleton et al (2016) looked at a wide range of health measures in preadolescents (age 10 or 11) and found evidence for growing health inequalities with an increased social gradient found in the proportions with a limiting long-standing illness, being overweight, glasses wearing, asthma and the onset of puberty.

Income, education and occupation class are the key indicators of socio-economic status (SES), with lower levels of education (McLaughlin et al, 2011), social class (Sabates and Dex, 2012) and income (Ayre, 2016) each being associated with poor health and behaviour problems in children. But, however SES is captured, single risk factors are less powerful than multiple risk factors for, although correlated, each measure has an independent influence on children's development, behaviour and health outcomes (Oakes and Rossi, 2003; Geyer et al, 2006; Kiernan and Huerta, 2008). These key SES measures invariably cluster around a range of other family

structure and environment measures, such as housing conditions, family status (lone parenthood) and family size that influence both parental health and well-being and child outcomes. For example, single-parent families experience more economic deprivation (Kiernan and Huerta, 2008), are more likely to be depressed (Osborn et al, 1984; Kiernan and Huerta, 2008), and their children have three times as many behaviour problems as children in stable married families by age five (Hansen et al, 2010). Children living with married parents also have better general physical health (Harknett, 2009) and children show increased levels of anxiety and depression following a divorce (Strohschein, 2005), while those from larger families are twice as likely to develop conduct disorder problems and become delinquent than children from smaller families (Meltzer et al, 2000). Poor housing and overcrowding in the home are related to poor health and behaviour problems (Office of the Deputy Prime Minister, 2004; Evans, 2006; Coley et al, 2015; Mind, 2017) and increased arguments and fighting among children (Reynolds and Robinson, 2005).

Individual characteristics and poor health and behavioural and emotional adjustment

There is a wide literature showing how gender, age, ethnicity, birth order, birthweight, breastfeeding and cognition relate to early behaviour problems. For example, in the 1970 cohort when age 5, being non-white (BAME), part of a larger family and low birthweight were all associated with increased temper tantrums (Golding and Rush, 1986) and more antisocial and neurotic behaviour (Osborn et al, 1984). Firstborn boys had higher neurotic scores, with more recent research, largely based on MCS data, showing that boys score significantly higher in all scales in the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997; 2001) at younger ages (Davis et al, 2010; Straatmann et al, 2018), and that they continue to show more externalising behaviour problems as they age, with girls exhibiting more internalising, particularly emotional problems (Cullis and Hansen, 2008). Younger children display more behaviour problems than older children (Fauth et al, 2017) and low birthweight babies are consistently shown to exhibit more behaviour problems later on in childhood even when family circumstances have been taken into account (Linver et al, 2002; Straatmann et al, 2018). At school entrance very low birthweight (<1,500 g) children were more likely to have behavioural and emotional problems after adjusting for family-background characteristics (Reijneveld et al, 2006). Lower cognitive scores and behaviour problems in the early years are a key predictor of later problems (Fauth et al, 2017) and breastfeeding a child for at least three to four months was found to be associated with fewer behaviour problems in early childhood in the majority of papers in a review of evidence (Poton et al, 2018).

Aims and research questions

In this paper we take advantage of uniquely rich longitudinal data collected across two generations of British children born 30 years apart in 1970 and 2000/2, to expand understanding of how both parental and child physical and mental health statuses in early childhood are associated with later behavioural and emotional problems in the child. Although we know that child behaviour problems are associated with poor parental and child health and well-being, we do not know how much of this can be explained by the more disadvantaged socio-economic circumstances that accompanies

poorer health. A great strength of using these two British birth cohorts is that we can operationalise near-identical measures of behavioural and emotional problems together with a wide range of comparable information on family-background and individual characteristics known to be related to child behaviour. By comparing across generations we can ascertain how far behavioural and emotional problems in mid-childhood are a function of age or birth cohort and how far they are consistently associated with a child's own and parental poor physical and mental health in early life across generations. We answer the following research questions:

- Is a child's own health status in early life associated with their behavioural and emotional adjustment in mid-childhood?
- Is parental physical health and maternal mental well-being each independently associated with a child's behavioural and emotional adjustment in mid-childhood?
- Do these relationships stand once indicators of socio-economic status are accounted for?
- Does the relationship with a child's own health status stand once a child's earlier cognition and behavioural and emotional problems are also accounted for?
- How do these relationships vary across generations?

The paper proceeds as follows. In the next section we describe the data before detailing our key measures and presenting the results. A discussion of results follows, including implications for policy, and we conclude by outlining strengths and limitations of the study.

Data

We use data from two longitudinal British birth cohort studies, which have followed up children born in 1970 and 2000/2. We look at behaviour scores in mid-childhood, at age 10 or 11, across a range of family-background and individual characteristics from data broadly 'matched' across the studies. While most measures are comparable, we highlight any relevant differences due to question wording or answer categories.

1970 cohort: the 1970 British Cohort Study

The 1970 British Cohort Study (BCS70) follows the lives of more than 17,000 people born in England, Scotland and Wales in one week of 1970 (Elliott and Shepherd, 2006). Since the birth survey in 1970, there have been nine waves at ages 5, 10, 16, 26, 30, 34, 38, 42 and 46–48 when 8,581 study members participated. Over the cohort members' lives, the BCS70 has collected information on health, physical, educational and social development, and economic circumstances, among other factors. We use information from the first three waves, from parents and cohort members (University of London, 2013; 2016a; 2016b).

2000/2 cohort: the Millennium Cohort Study

The Millennium Cohort Study (MCS) is a longitudinal study of approximately 19,000 babies born to families living in the UK between September 2000 and January 2002 (Plewis, 2007; Connelly and Platt, 2014; Joshi and Fitzsimons, 2016). Data has

been collected when the children were aged around 9 months and 3, 5, 7, 11, 14 and 17 years, when approximately 10,500 study members participated. We draw on information from parents and children from sweeps that took place at 9 months, 5 and 11 years (University of London, 2017a; 2017b; 2017c).

In both studies, the majority of the information used in this research was collected from in-person interviews with the parent (overwhelmingly the child's mother); and maternal mental well-being and child behaviour from self-completion questionnaires with the child's mother.

Our samples include those living in Great Britain at baseline (those living in Northern Ireland in MCS were dropped for comparability). In BCS70 we also exclude those who had died by age 10 (3.5%), with the overwhelming majority of these having died during the first few days or months of life. (As recruitment to MCS was conditional on being alive at 9 months, this exclusion did not apply.) The sample size for BCS70 is $n = 15,856$, for MCS $n = 16,628$. We used Multiple Imputation (MI) to deal with attrition and item non-response, adopting a chained equations approach (White et al, 2011) under the assumption of 'missing at random' (MAR), which implies that the most important predictors of missing data are included in our models. In order to maximise the plausibility of the MAR assumption we also included a set of auxiliary variables in our imputation model. All reported analyses are averaged across 20 replicates based on Rubin's Rule for the efficiency of estimation under a reported degree of missingness across the whole data of around 0.20 (Little and Rubin, 2002). Based on an average across all measures included in the analyses, the degree of missingness is 17% in BCS70 and 13% in MCS (see Tables A1 and A2 in the appendix).

The MCS analyses are additionally weighted to adjust for the survey's stratified clustered sampling design.

Measures

Behavioural and emotional adjustment

We measure behavioural and emotional adjustment in BCS70 using the Rutter Behaviour scales (Rutter et al, 1970) and in MCS, the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997; 2001). The SDQ was developed from the long established Rutter questionnaires (Rutter et al, 1970; Elander and Rutter, 1996). The Rutter *parental questionnaire*, or *Child Scale A*, has 31 descriptions of behaviour in three sections and the SDQ has 25 questions that are divided into five scales of five questions each. Fourteen very similar questions were included in both, which covered four of the five SDQ scales: conduct (6), hyperactivity (3), emotional (3) and peer problems (2). The questions are detailed in Table 1. (As there were only two questions from the peer problems scale we did not take these any further.)

In the SDQ there are three answer categories for each question: not true (0) somewhat true (1) certainly true (2). When the Rutter questionnaire is administered in its standard format behavioural adjustment is similarly measured on a three-category scale: Does not apply (0), Applies somewhat (1) and Certainly applies (2). However, in the age 10 questionnaire a visual analogue scale was used, whereby the mother/father figure had to draw a vertical line through a printed line to show how much a

Table 1: Comparable Rutter and SDQ questions

BCS: Rutter (age 5 and age 10)	MCS: SDQ (age 5 and age 11)
Conduct [6 questions¹]	Conduct [5 questions]
<i>Frequently fights other children.²</i>	<i>Often fights with other children or bullies them.²</i>
<i>Bullies other children.</i>	
Irritable. Is quick to fly off the handle	Often has temper tantrums or hot tempers.
<i>Sometimes takes things belonging to others.²</i>	<i>Steals from home, school or elsewhere.²</i>
Is often disobedient.	Is generally obedient, usually does what adults request. ³
Often tells lies.	Often lies or cheats.
Hyperactivity [3 questions]	Hyperactivity [3 questions]
Very restless. Often running about or jumping up and down. Hardly ever still.	Is restless, overactive, cannot stay still for long.
Is squirmy or fidgety.	Is constantly fidgeting or squirming.
Tends to be fearful or afraid of new things or new situations.	Is nervous or clingy in new situations, easily loses confidence.
Emotional [3 questions]	Emotional [3 questions]
Often worried, worries about many things.	Has many worries, often seems worried.
Often appears miserable, unhappy, tearful or distressed.	Is often unhappy, down hearted or tearful.
Cannot settle to anything for more than a few moments.	Sees tasks through to the end, has good attention span. ³

Notes:

1 There are six conduct questions in the Rutter questionnaire (BCS70) as fighting and bullying were asked separately. In the SDQ (MCS), fighting and bullying are combined into one question.

2 Questions in italic were excluded from the scale.

3 Reverse coded.

particular behaviour applied (or not) to their child. Answers to each question ranged from 0 (does not apply) to 100 (certainly applies).

We used the cluster *kmeans* command in Stata 15 (StataCorp, 2017) to group age 10 responses to be compatible with responses to questions when asked in the standard format, and to be compatible with the SDQ response format.

After running exploratory factor analysis (EFA) in MPlus (version 8, Muthén and Muthén, 2017) on the items in each of the scales at both age points, we tested whether parents in both cohorts interpreted a question in a conceptually similar manner by checking for measurement invariance. After excluding two questions from the conduct scale given the wording varied considerably and they did not capture the same behaviour, we found metric invariance for all three scales at both age points, but not scalar invariance. We are therefore not able to compare mean scores across cohorts, as cohort differences may reflect other sources of variance other than true differences in behaviours. However, metric invariance allows us to compare regression coefficients of associations between health and behavioural and emotional adjustment in the two cohorts. This supports the findings in Attanasio et al (2018), which also compares BCS70 and MCS socio-emotional scores.

We derived harmonised conduct, hyperactivity and emotional scales for both cohorts by summing scores across questions in each subscale, with a high score

indicating higher problems. Scores ranged from 0–6 in all scales. We use both raw and standardised scores in our analyses. In both cohorts mean hyperactivity and conduct scores decreased with age whereas mean emotional scores increased. Mean scores in all three scales were higher at age 5 in the earlier cohort, with mean scores being more comparable in mid-childhood (age 10 or 11). See Appendix [Table A2](#).

Cohort member physical health

In MCS parents reported whether, at age 5, their child had a long-standing illness and in the 1970 cohort, parents were asked whether their child had had a range of health concerns, and whether this occurred pre-4, post-4 or at both time points. To best match the measure in MCS, we concentrated on health concerns that were current. We created a binary ‘no/yes’ variable in each cohort. In MCS, although a wide range of conditions are captured in the variable, the most commonly reported long-standing and limiting health concerns are acute or chronic lower or upper respiratory infections/diseases (overwhelmingly asthma), dermatitis or eczema, ear disorders, visual problems, various congenital malformations and episodic and paroxysmal disorders (authors’ own analysis of the list of conditions). In BCS70 our measure concentrated on eczema, hay fever, wheezing (asthma), and ‘fits’ (seizures) and showed 30% of BCS70 had a health concern compared with 20% of MCS.

Parent physical health

In the same questionnaires, at child age 5, the parent(s) reported on their own physical health. In BCS70 the parent (overwhelmingly the mother) reported whether she, her partner (if applicable) and other members of the household had any severe or prolonged illness, handicap or disability. In MCS, the main carer and partner (if applicable) each reported whether they had a long-standing illness. Again, a simple binary variable was constructed, with a value of 1 indicating if one or both parents (if applicable) had a health concern. In BCS70, 14% had a parent with a health concern compared with 37% of MCS.

Maternal mental well-being

BCS70 mothers completed the *Malaise Inventory* in surveys at child age 5, 10 and 16. It is an established scale to measure psychological distress or depression in teenagers and adults ([Rutter et al, 1970](#)). It consists of a set of 24 ‘yes/no’ self-completion questions which cover emotional disturbance and associated physical symptoms. Individuals responding ‘yes’ to eight or more of the 24 items are considered to be at risk of depression ([Rodgers et al, 1999](#)). In MCS the six-item Kessler Psychological Distress (K6) scale was used, which is an abbreviated version of the K10 ([Kessler et al, 2003](#)). Each question pertains to an emotional state and response choices are based on five-point Likert-type scale ranging from 0 (*none of the time*) to 4 (*all of the time*). A cut-off of 6+ indicates psychological distress. MCS mothers have completed the scale in surveys at child age 5, 7, 11, 14 and 17. For both studies we use scores when the child was age 5: 19% of mothers in BCS70 experienced psychological distress compared with 21% of MCS. We did not include a measure of paternal mental health as this was not available for BCS70.

Additional controls

In our analyses we include a wide range of individual and family-background characteristics that our review of the literature has shown to be associated with both health and behaviour problems. The individual characteristics are gender, ethnicity, birthweight, birth order, breastfeeding, age in months (MCS only, due to lack of variation in BCS70 as all babies born within one week), vocabulary skills. Measures of family socio-economic circumstances are taken from baseline, or if not available, from when the measure was first asked. This included parental occupation and qualifications, family income, housing tenure and overcrowded living conditions.

Reflecting the increased value attached to qualifications and the shift towards white-collar occupations that has occurred in developed countries from the 1980s (for UK figures see [Holmes and Mayhew, 2012](#)), appendix [Table A1](#) shows 43% of MCS parent(s) held a degree level qualification and 45% were in managerial or professional occupations. This compared to 14% and 18% of BCS parent(s) respectively. Other society level changes are reflected in fewer MCS children living in an overcrowded home (25% to 41%) and more living in single-parent households (14% to 5%). The other notable difference between the cohorts was the high proportion of BCS children who had never been breastfed – 59% compared to 29% of MCS ([Table A2](#)).

To highlight the importance of imputation in longitudinal data to reduce bias and maintain power, appendix [Tables A1](#) and [A2](#) also compare the distribution of the original and imputed samples across all measures and appendix [Tables A3](#) and [A4](#) compare the characteristics of the ‘non-missing’ and ‘missing’ children in surveys at child age 10 or 11. In both cohorts ‘missing’ children scored lower in the age 5 vocabulary test and more were BAME. In MCS, the missing were also more likely to have never been breastfed and to have had more behaviour problems at age 5. In terms of family characteristics, the missing children in both studies were from lower socio-economic groups – in terms of parent occupation class, parental education, family income and rented housing – and more were from single-parent households. More missing MCS children had also lived in overcrowded housing.

Results

Descriptive statistics

For each cohort, we first show the mean (raw) conduct, hyperactivity and emotional behaviour scores at age 10 for the individual ([Table 2](#)) and family characteristics ([Table 3](#)). We summarise results by health status, child and family characteristics.

In both cohorts, children with poor physical health at age 5 had higher conduct, hyperactivity and emotional problems at age 10 or 11 compared to their healthier peers at age 5. Similarly, children with a mother who had a higher number of symptoms associated with depression also had higher conduct, hyperactivity and emotional problems at age 10 or 11 compared to children with a mother who had fewer symptoms. Having a parent with poor physical health at child age 5 also increased conduct behaviour scores for children in both cohorts, but only for hyperactivity and emotional scores for children born in 2000/2.

Low birthweight children had higher hyperactivity scores in both cohorts, and higher conduct and emotional problems in MCS. Boys in both cohorts had higher conduct and hyperactivity scores, and girls born in 1970 had higher emotional

Table 2: Mean raw conduct, hyperactivity and emotional problems in mid-childhood (age 10 or 11) by child characteristics

	Conduct [score range 0–6]		Hyperactivity [score range 0–6]		Emotional [score range 0–6]	
	BCS	MCS	BCS	MCS	BCS	MCS
Gender (0:9mths)¹						
Male	1.44	1.39	1.35	1.92	0.94	1.05
Female	1.05	1.19	0.95	1.37	1.02	1.04
Ethnicity (5:9mths)						
White	1.24	1.30	1.15	1.65	0.98	1.06
BAME	1.55	1.26	1.32	1.66	0.70	0.98
Birthweight (0:9mths)						
Normal	1.25	1.28	1.15	1.63	0.97	1.04
Low birthweight	1.31	1.49	1.29	1.97	1.04	1.20
Breast Fed (5:9mths)						
Never	1.29	1.51	1.23	1.90	1.00	1.12
<1 month	1.29	1.37	1.09	1.75	0.96	1.11
<3 months	1.16	1.32	1.04	1.61	0.91	1.05
>3 months	1.06	1.04	0.98	1.41	0.99	0.92
Breastfeeding at S1 interview		1.05		1.36		0.97
Birth Order (0:9mths)						
Older siblings	1.25	1.30	1.19	1.70	0.88	1.01
Firstborn	1.25	1.29	1.10	1.60	1.13	1.09
Ill health (5:5)						
No	1.21	1.25	1.11	1.57	0.93	0.98
Yes	1.33	1.49	1.27	1.99	1.08	1.33
Vocabulary² (5:5)						
Lowest quintile	1.52	1.60	1.33	2.08	0.99	1.24
2nd	1.36	1.47	1.18	1.88	0.97	1.14
3rd	1.24	1.37	1.14	1.74	0.99	1.07
4th	1.14	1.15	1.14	1.54	0.99	1.03
Highest quintile	1.03	1.09	1.02	1.37	0.95	0.91
Behaviour problems (5:5)						
Conduct [score range 0–6]						
0	0.55	0.63	0.91	1.05	0.99	0.75
1	0.89	1.08	1.24	1.48	1.15	0.93
2	1.32	1.62	1.60	1.90	1.34	1.20
3	1.77	2.08	1.90	2.39	1.46	1.42
4+	2.66	3.82	2.57	3.09	1.73	1.74
Hyperactivity [score range 0–6]						
0	0.77	0.79	0.65	0.80	0.73	0.79
1	1.02	1.11	0.83	1.31	1.00	0.91
2	1.26	1.35	1.22	1.77	1.09	1.09
3	1.47	1.62	1.68	2.25	1.17	1.26
4+	1.94	2.15	2.44	3.09	1.35	1.49

(Continued)

Table 2: (Continued)

	Conduct [score range 0–6]		Hyperactivity [score range 0–6]		Emotional [score range 0–6]	
	BCS	MCS	BCS	MCS	BCS	MCS
Emotional [score range 0–6]						
0	1.11	1.13	1.02	1.48	0.62	0.79
1	1.27	1.42	1.20	1.80	1.06	1.25
2	1.33	1.64	1.29	2.01	1.42	1.60
3	1.48	1.97	1.56	2.20	1.92	1.96
4+	1.66	2.11	1.68	2.68	2.44	2.65

Notes:

1 Number in parentheses () indicates child age when information collected (BCS:MCS).

2 BCS70 children completed the English Picture Vocabulary Test (Brimer and Dunn, 1962); MCS children the BAS Naming Vocabulary test (Elliott et al, 1996). Both provide an assessment of expressive verbal ability.

problems than boys. Ethnicity did not differentiate behaviour scores in MCS, but the small proportion of BAME children in the earlier cohort had more conduct and fewer emotional problems than their white peers. Children who had low vocabulary scores at age 5 had higher conduct and hyperactivity scores in both cohorts and higher emotional problems in MCS. Higher behaviour problems at age 5 were also related to higher behaviour problems at age 10 or 11. Being firstborn was associated with increased hyperactivity and lower emotional problems in both cohorts.

In line with expectations, socio-economic disadvantage, as captured by parental occupation class, educational qualifications and family income, homeownership and overcrowding, was associated with more behaviour problems: higher conduct and hyperactivity scores in both cohorts and higher emotional problems among MCS. Single parenthood was associated with increased conduct problems in both cohorts, higher hyperactivity and emotional scores in MCS but lower emotional scores in the 1970 cohort.

Estimation results

We next estimated a series of OLS regression models for each (standardised) behaviour score and its association with child physical health (model 1), first adjusting for parental physical health and maternal mental health (model 2), and then adding the child’s individual characteristics (model 3), family social background (model 4), child’s standardised vocabulary (model 5) and their earlier standardised behavioural or emotional score (model 6). The usual tests were carried out to show that the assumptions were met. Specifically, the residuals are normally distributed and there was no evidence of multicollinearity among the wide range of predictor variables included in the model. Results are shown in Table 4 (BCS70) and Table 5 (MCS) and include the unstandardised coefficients for the three key health measures from the six regression models. This shows how the direct relationship between health and behaviour changes once other family and individual characteristics are taken into account. We take the results of model 4 as the final model for the relationship between parental health measures and child behaviour, and model 6 as the final model for the relationship between a child’s own physical health and later behaviour. We do this as child vocabulary and earlier behaviour problems would not influence the role of parent health and well-being on child behaviour. The magnitude of the effect

Table 3: Mean raw conduct, hyperactivity and emotional problems in mid-childhood (age 10 or 11) by family characteristics

BCS categories	Conduct (0–10)		Hyperactivity (0–6)		Emotional (0–6)		MCS categories
	BCS	MCS	BCS	MCS	BCS	MCS	
Social class (RGSC) (0)¹							Social class (NSSEC) (9mths)
V/IV	1.53	1.77	1.23	2.01	0.93	1.26	Not in work
III manual	1.27	1.70	1.23	2.01	1.02	1.23	Semi/Routine
III non-manual	1.10	1.45	1.09	1.88	1.02	1.12	Lower Sup
II/I	0.98	1.35	0.92	1.77	0.90	1.07	Sm emp
		1.24		1.71		1.03	Intermediate
		1.02		1.37		0.92	Hi Man/Prof
Parent Highest Qual (5)							Parent Highest Qual (5)
No quals	1.49	1.83	1.34	2.16	0.98	1.32	No quals
Vocational	1.29	1.72	1.19	1.96	0.96	1.17	NVQ1
O Levels	1.13	1.44	1.09	1.89	0.99	1.09	NVQ2
A Levels	1.06	1.32	0.94	1.69	0.94	1.10	NVQ3
Degree +	0.90	1.06	0.87	1.40	1.00	0.95	NVQ4
		0.83		1.09		0.79	NVQ5
Weekly Income (banded) (10)							Weekly Income quintiles (9mths)
<£50	1.59	1.71	1.56	2.08	1.06	1.26	Lowest
£50–£99	1.40	1.63	1.40	1.93	1.09	1.16	2nd
£100–£149	1.24	1.32	1.17	1.75	1.02	1.08	3rd
£150–£199	1.09	1.12	0.92	1.46	0.86	0.97	4th
£200+	0.96	0.94	0.79	1.29	0.78	0.89	Highest
Housing Tenure (5)							Housing Tenure (9mths)
Own	1.07	1.08	1.05	1.45	0.98	0.95	Own

Table 3: (Continued)

BCS categories	Conduct (0–10)		Hyperactivity (0–6)		Emotional (0–6)		MCS categories
	BCS	MCS	BCS	MCS	BCS	MCS	
Other	1.48	1.65	1.29	1.99	0.97	1.21	Other
Overcrowded Home (5)							Overcrowded Home (9mths)
< 1 person per room	1.13	1.22	1.10	1.58	1.00	1.01	< 1 person per room
1+ person per room	1.44	1.52	1.24	1.88	0.94	1.15	1+ person per room
Parents (0)							Parents (9mths)
Two parents	1.23	1.23	1.16	1.57	0.99	1.01	Two parents
Single parent	1.69	1.70	1.05	2.14	0.79	1.26	Single parent
Parent ill health (5)							Parent ill health (5)
No	1.23	1.25	1.14	1.58	0.97	0.97	² No
Yes	1.38	1.36	1.23	1.78	1.04	1.17	Yes
Mother mental well-being [Malaise] (5)							Mother mental well-being [Kessler] (5)
Not depressed	1.12	1.18	1.05	1.51	0.91	0.94	Not depressed
Depressed (8+)	1.85	1.73	1.60	2.18	1.29	1.43	Depressed (6+)

Note

1 Number in parentheses () indicates child age when information collected.

Table 4: Health and well-being at child age 5 and behaviour problems at age 10 (BCS70)

Conduct Problems	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.09***	0.07**	0.06**	0.06**	0.06**	0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Parent poor health		0.02	0.02	0.02	0.02	0.01
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Mother poor mental well-being		0.48***	0.48***	0.41***	0.40***	0.21***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Conduct problems (age 5)						YES
R^2	.00	.04	.05	.07	.08	.18
Hyperactivity problems						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.10***	0.08***	0.07***	0.07***	0.07***	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Parent poor health		0.01	0.01	0.00	0.00	-0.01
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Mother poor mental well-being		0.31***	0.30***	0.26***	0.26***	0.11***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Hyperactivity problems (age 5)						YES
R^2	.00	.02	.03	.05	.05	.15
Emotional problems						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.10***	0.09***	0.09***	0.10***	0.10***	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Parent poor health		0.01	0.02	0.02	0.02	0.01
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Mother poor mental well-being		0.26***	0.26***	0.26***	0.26***	0.13***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Emotional problems (age 5)						YES
R^2	.00	.01	.02	.03	.03	.10
N	15,856	15,856	15,856	15,856	15,856	15,856

Notes:

Individual characteristics: gender, ethnicity, birth order (firstborn), birthweight, breastfed.

Family characteristics: parent(s) occupation, parent(s) qualification, family income, single parent, housing tenure, overcrowded home.

Standard errors in parentheses.

Significance: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5: Health and well-being at child age 5 and behaviour problems at age 11 (MCS)

Conduct Problems	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.19***	0.16***	0.14***	0.11***	0.11***	0.07**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Parent poor health		0.03	0.03	0.03	0.03	0.00
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Mother poor mental well-being		0.41***	0.38***	0.29***	0.29***	0.11***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Conduct problems (age 5)						YES
<i>R</i> ²	.01	.03	.06	.10	.10	.27
Hyperactivity problems	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.29***	0.25***	0.21***	0.19***	0.19***	0.11***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Parent poor health		0.08**	0.07**	0.08**	0.08***	0.05**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Mother poor mental well-being		0.42***	0.39***	0.33***	0.32***	0.14***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Hyperactivity problems (age 5)						YES
<i>R</i> ²	.01	.04	.09	.11	.12	.29
Emotional problems	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CM poor health	0.29***	0.25***	0.25***	0.24***	0.23***	0.19***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Parent poor health		0.10***	0.10***	0.10***	0.10***	0.09***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Mother poor mental well-being		0.38***	0.38***	0.35***	0.34***	0.22***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Included in the modelling						
Individual characteristics			YES	YES	YES	YES
Family characteristics				YES	YES	YES
Vocabulary (age 5)					YES	YES
Emotional problems (age 5)						YES
<i>R</i> ²	.01	.04	.04	.05	.05	.12
<i>N</i>	16,628	16,628	16,628	16,628	16,628	16,628

Notes:

Individual characteristics: gender, ethnicity, birth order (firstborn), birthweight, breastfed.

Family characteristics: parent(s) occupation, parent(s) qualification, family income, single parent, housing tenure, overcrowded home.

Vocabulary includes age at test.

Standard errors in parentheses.

Significance: * $p < .05$, ** $p < .01$, *** $p < .001$.

size is shown by the coefficient, which represents by how much the behaviour score would increase per standard deviation increase.

How is a child's own physical health status in early life associated with their behavioural and emotional adjustment in mid-childhood?

Having poor physical health in early childhood is significantly related to behaviour problems as children near the end of primary education at age 10/11. In both cohorts, even when individual characteristics including vocabulary scores and family socio-economic circumstances are accounted for (model 5), a child with poor physical health at school entry at age 5 is significantly more likely to have later conduct, hyperactivity and emotional problems. When earlier behaviour problems measured on the same scale are taken into account (model 6), a child with poor physical health remains more likely to have hyperactivity (BCS 0.04 $p = .036$; MCS 0.11 $p = .000$) and emotional (BCS 0.06 $p = .001$; MCS 0.19 $p = .000$) problems in both cohorts. For MCS, their own poor physical health remains similarly predictive of later conduct problems (MCS 0.07 $p = .007$). However, some caution should be taken when comparing these results across generations given the differences in how child physical health status was captured in the two studies.

How are parental physical health and maternal mental well-being associated with a child's behavioural and emotional adjustment in mid-childhood?

Even when family socio-economic circumstances and individual child characteristics are taken into account, having a mother with a high level of psychological distress in early childhood is strongly associated with later conduct (BCS 0.41 $p = .000$; MCS 0.29 $p = .000$), hyperactivity (BCS 0.26 $p = .000$; MCS 0.31 $p = .000$) and emotional problems (BCS 0.26 $p = .000$; MCS 0.32 $p = .000$) in both generations of children. Similarly, poor parental physical health remains associated with later hyperactivity (MCS 0.07 $p = .000$) and emotional problems (MCS 0.10 $p = .000$) in the younger generation. Again, some caution should be taken when comparing these results given the difference in how health was measured and the very different prevalence rates of poor health in the studies.

An important observation to highlight is how robust the relationships between child physical health, parental physical health and maternal mental health and later behaviour problems were to the inclusion of first individual characteristics and then family socio-economic circumstances. The size of the respective coefficients barely changed in the earlier cohort, though there was slightly more moderation in the relationship for the younger MCS cohort.

Evaluation of findings: Bonferroni correction calculations

From a null hypothesis significance testing perspective, carrying out multiple tests increases the probability of Type I error. We therefore further evaluated our findings with the Bonferroni correction that controls for family wise error rate (Frane, 2015). Considering our three behavioural outcomes as a 'family' of tests, with three 'health' exposures within each cohort the alpha level is $0.05 \div (3 \times 3) = 0.006$. Using this level we were able to detect associations between child physical health and emotional problems in both cohorts, and with hyperactivity in MCS. Maternal mental well-

being retained its association with all three behaviour outcomes in both cohorts, as did parental physical health with hyperactivity and emotional problems in MCS.

In a more conservative scenario, whereby all behavioural outcomes across both cohorts are now considered a ‘family’ of tests, the Bonferroni adjusted alpha level would be $0.05 \div (3 \times 3 \times 2) = 0.003$. Within this very conservative correction we were still able to detect an association between maternal mental well-being and all three behaviour outcomes in both cohorts, and between both child and parental physical health and hyperactivity and emotional problems in MCS.

How does the relationship between child and parental physical and mental health in early childhood and later child behaviour in mid-childhood vary across generations?

Our final quest was to establish if there were cohort differences in the associations between physical health and behaviour. By concentrating on 95% confidence intervals (CI) around the coefficients in the final models (model 6 for child physical health; model 4 for parental physical health and maternal well-being), we find poor child physical health in early childhood has a stronger impact on later emotional problems for the more recent cohort (BCS 0.06 [CI: 0.03–0.10]; MCS 0.19 [CI: 0.15–0.24]), and poor maternal mental well-being has a stronger association with later conduct problems in the earlier cohort (BCS 0.41 [CI: 0.36–0.46]; MCS 0.29 [CI: 0.24–0.35]). Returning to model 6, we also found that early conduct (BCS 0.35 [CI: 0.33–0.36]; MCS 0.43 [CI: 0.41–0.45]) and hyperactivity problems (BCS 0.33 [CI: 0.32–0.35]; MCS 0.47 [CI: 0.45–0.49]) have a stronger relationship with similar problems in mid-childhood in the more recent cohort.

Discussion

In this study we have estimated the relationship between child and parental physical health and well-being measures in early childhood and behavioural and emotional problems in mid-childhood. We compared the relationships across two generations of British children born 30 years apart.

We found a strong relationship between maternal mental health and conduct, hyperactivity and emotional problems in mid-childhood in both generations of children, which was only slightly reduced once we controlled for a wide range of family socio-economic background information and individual characteristics. The association between poor parental physical health and later hyperactivity and emotional problems was also present in the more recent cohort when socio-economic differences were adjusted for.

The relationship between a child’s own physical health in the early years and later hyperactivity and emotional problems also remained present for both generations, as it was for later conduct problems in the younger generation, even when earlier behaviour measured on the same scale was taken into account. That we were still able to detect an association between maternal mental well-being and all three behaviour outcomes in both cohorts, and between both child and parental physical health and hyperactivity and emotional problems in the younger MCS, even when evaluating our findings with the most conservative application of Bonferroni correction, supports the robustness of our findings.

The well-being of children is fundamental for them to make a positive transition into adulthood. Good mental health allows children and young people to develop the resilience to cope and grow into well-rounded, healthy adults. Both internalising and externalising behaviours in childhood are linked to a significant reduction in quality of life, often resulting in academic failure, juvenile delinquency and poor labour market outcomes (Caughy et al, 2016) and poor early mental health has a negative impact on a range of other socio-economic indicators across adult life (Goodman et al, 2011), with this relationship being much stronger than that between physical health problems and later socio-economic outcomes (Delaney and Smith, 2012).

Here we have shown that poor physical health *and* behavioural and emotional problems in early childhood are associated with later behavioural and emotional problems in mid-childhood, and that the strength of these relationships is (in some cases) stronger for the younger generation of children: in particular, poor physical health in early childhood is negatively associated with emotional well-being and early conduct and hyperactivity problems were predictive of later problems. These relationships stood even when the socio-economic gradient that accompanies poorer health and behaviour outcomes was controlled for. Given the high and increasing proportion of children and adolescents with mental health problems (Patalay and Gage, 2019), and their concentration among certain disadvantaged groups, having initiatives that invest in these different aspects of child well-being could greatly support the success and sustainability of future generations and prevent some children experiencing a ‘double whammy’ of disadvantage. Given that poverty and economic insecurity work to further undermine physical and mental well-being while also increasing psychological stress among parents and children (Yeung et al, 2002; Green et al, 2005; Duncan et al, 2010), to best support children and their families, policy solutions need to consider the holistic nature of a child’s family environment.

Our results also show a strong and consistent relationship between maternal mental health and behavioural and emotional problems in two generations of children, born 30 years apart. This suggests that the cost of maternal psychological distress is amplified by intergenerational transmission. The mechanisms may be genetic as well as social, but past research showing that maternal psychological distress is considerably more strongly associated with children’s well-being than paternal psychological distress is (Fitzsimons et al, 2017) tends to suggest the salience of mothers’ role as the primary caregiver. This supports the view that maternal depression must be seen as an important element of intervention programmes focused on healthy child development (National Research Council and Institute of Medicine, 2009; DoH, 2015), though paternal mental health should not be ignored as changing roles of parents within families have led to (some) fathers taking on increasing amounts of childcare (Tamm, 2019) and secure father-adolescent relationships are positive for adolescent mental health (Suh et al, 2016). As with many interventions, it is the early years that provide the best window of opportunity to promote young people’s resilience and well-being and minimise the development of entrenched negative behaviours and their subsequent costs to society.

Strengths and limitations

Strengths of this study include the availability of two large population-based and representative prospective studies, assessments of early life conduct, hyperactivity

and emotional problems at two age points that are comparable over time and across cohorts, together with the inclusion of the wealth of information on potential confounders. This underscores the importance of having longitudinal data with similar if not identical questions asked at different ages within studies, and at similar ages across studies, for researchers to be able to more fully test hypotheses in different time periods, rather than if each data set is relatively unique. Going forward, future studies would benefit from the addition of the genetic data that has been collected, and also to see whether the relationships found here between early childhood poor health and later behavioural-emotional problems continue to be observed in later adolescence and even adulthood. However, our findings can only be generalised to those born in Britain in 1970 or the UK in 2000/2 or close to these years. Furthermore, our data are derived from an observational longitudinal study and bias due to unmeasured confounding cannot be ruled out. As in any longitudinal survey, missing data due to attrition are unavoidable. We employed multiple imputation, augmenting our models with auxiliary variables in the imputation phase to maximise the plausibility of the missing at random assumption and restore sample representativeness, but bias due to a non-ignorable missing data generating mechanism cannot be ruled out. Two further limitations also need to be acknowledged. First, child behaviour is measured via parental reports, overwhelmingly the mother, which can be distorted by the mother's own mental health and is a key measure in our study. Second, that the measures of child and parent health reports differ between studies and in prevalence of health concerns. However, although measurement of maternal well-being differs, prevalence is very similar.

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Data availability

The authors take responsibility for the integrity of the data. The data is available to other researchers, free to download from the UK data service.

Conflict of interest

The Authors declare that there is no conflict of interest.

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Appendix

Table A1: Family-background characteristics: imputed, original and proportion missing

Variables (child age)	BCS70				MCS				Variables (child age)
	Imputed	Original	N	Missing	Imputed	Original	N	Missing	
Proportions									
Social class (RGSC) (0)			15,856	0			16,628	0	Social class (NSSEC) (9mths)
V/IV		.24				.05			Not in work
III manual		.44				.22			Semi/Routine
III non-manual		.14				.09			Lower Sup
II/I		.18				.07			Sm emp
						.13			Intermediate
						.45			Hi Man/Prof
Parent Highest Qual (5)			12,440	.22			16,606	.001	Parent Highest Qual (5)
No quals	.38	.40			.08	.08			No quals
Vocational	.17	.15			.07	.07			NVQ1
O Levels	.21	.21			.25	.25			NVQ2
A Levels	.10	.09			.16	.16			NVQ3
Degree +	.14	.15			.43	.43			NVQ4/5
Weekly Income (banded) (10)			11,639	.27			16,447	.01	Weekly Income quintiles (9mths)
<£50	.07	.07			.16	.16			Lowest
£50-£99	.27	.30			.16	.17			2nd
£100-£149	.34	.35			.20	.20			3rd
£150-£199	.19	.16			.22	.22			4th
£200+	.14	.12			.25	.24			Highest

Table A1: (Continued)

Variables (child age)	BCS70				MCS				Variables (child age)
	Imputed	Original	N	Missing	Imputed	Original	N	Missing	
Housing Tenure (5)			12,593	.21			16,579	.01	Housing Tenure (9mths)
Own	.56	.57			.62	.62			Own
Other	.44	.43			.38	.38			Other
Overcrowded Home (5)			12,448	.21			16,589	.01	Overcrowded Home (9mths)
<1 person per room	.59	.60			.75	.75			<1 person per room
1+ person per room	.41	.40			.25	.25			1+ person per room
Parents (0)			15,840	.001			16,628	0	Parents (9mths)
Two parents		.95				.86			Two parents
Single parent		.05				.14			Single parent
Parent ill health (5)			11,716	.26			13,093	.21	Parent ill health (5)
No	.86	.86			.63	.63			No
Yes	.14	.14			.37	.37			Yes
Mother mental well-being (5)			12,279	.23			12,370	.26	Mother mental well-being (5)
Not depressed	.81	.82			.79	.82			Not depressed
Depressed (8+)	.19	.18			.21	.18			Depressed (6+)

Table A2: Individual characteristics: imputed, original and proportion missing

Variables (child age)	BCS70				MCS			
	Imputed	Original	N	missing	Imputed	Original	N	missing
Proportions								
Gender (0)			15,856	0			16,628	0
Male		.52				.51		
Female		.48				.49		
Ethnicity (5)			12,206	.23			16,628	0
White	.97	.97				.87		
BAME	.03	.03				.13		
Birthweight (0)			15,856	0			16,567	.011
Normal		.94				.93		
Low birthweight		.06				.07		
Breastfed (5)			12,525	.21			16,578	.011
Never	.59	.63				.29		
<1 month	.20	.16				.23		
<3 months	.12	.10				.14		
>3 months	.09	.11				.21		
						.13		
Birth order (0)			15,856	0			16,628	0
Older siblings		.61				.58		
Firstborn		.39				.42		
Ill health (5)			11,780	.26			13,093	.21
No	.70	.71				.81		
Yes	.30	.29				.19		

Table A2: (Continued)

Variables (child age)	BCS70				MCS			
	Imputed	Original	N	missing	Imputed	Original	N	missing
Mean scores								
Vocabulary (5)			11,781	.26				
EPVT (raw score)	34.84	35.28			108.17	108.98	12,906	.22
Behaviour problems (5)								
Conduct	1.75	1.72	12,533	.21	1.37	1.32	12,731	.23
Hyperactivity	1.97	1.93	12,538	.21	1.73	1.66	12,718	.24
Emotional	1.11	1.07	12,527	.21	0.61	0.56	12,726	.23
Behaviour problems (10)								
Conduct	1.32	1.24	12,457	.21	1.29	1.22	11,086	.33
Hyperactivity	1.53	1.47	12,472	.21	1.65	1.57	11,084	.33
Emotional	1.38	1.24	12,458	.21	1.05	0.98	11,082	.33

Table A3: Comparison of family-background characteristics by missing v non-missing in age 10 behaviour scales

Variables (child age)	BCS70				MCS				Variables (child age)
	Non-Missing	N	Missing	N	Non-Missing	N	Missing	N	
Proportions									
Social class (RGSC) (0)		12,436		3,420		11,073		5,555	Social class (NSSEC) (9mths)
V/IV	22.5		27.8		3.4		7.8		Not in work
III manual	45.6		40.8		18.9		29.1		Semi/Routine
III non-manual	13.7		13.2		8.6		9.2		Lower Sup
II/I	18.3		18.3		6.2		7.6		Sm emp
					12.8		13.2		Intermediate
					50.2		33.0		Hi Man/Prof
Parent Highest Qual (5)		10,691		1,749		11,067		5,539	Parent Highest Qual (5)
No quals	38.7		48.1		6.0		13.9		No quals
Vocational	14.5		14.6		6.4		9.6		NVQ1
O Levels	21.8		16.1		24.1		26.7		NVQ2
A Levels	9.5		8.9		16.1		16.5		NVQ3
Degree +	15.5		12.3		47.5		33.2		NVQ4/5
Weekly Income (banded) (10)		11,368		271 ¹		10,966		5,481	Weekly Income quintiles (9mths)
<£50	6.9		12.6		13.1		22.4		Lowest
£50–£99	29.8		35.1		14.8		21.2		2nd
£100–£149	34.7		31.7		20.8		19.7		3rd
£150–£199	16.5		13.3		24.0		18.9		4th
£200+	12.1		7.4		27.3		17.9		Highest
Housing Tenure (5)		10,819		1,774		11,053		5,526	Housing Tenure (9mths)

Table A3: (Continued)

Variables (child age)	BCS70				MCS			
	Non-Missing	N	Missing	N	Non-Missing	N	Missing	N
Own	57.7		50.2		67.2		51.6	
Other	42.3		49.8		32.8		48.5	
Overcrowded Home (5)		10,693		1,755		11,060		5,529
<1 person per room	61.0		56.9		77.9		69.0	
1+ person per room	39.0		43.1		22.1		31.0	
Parents (0)		12,426		3,414		11,073		5,555
Two parents	95.9		89.5		88.3		79.8	
Single parent	4.1		10.5		11.7		20.2	
Parent ill health (5)		10,075		1,641		10,344		2,749
No	86.2		86.5		62.5		65.2	
Yes	13.8		13.5		37.5		34.8	
Mother mental well-being (5)		10,661		1,731		9,909		2,461
Not depressed	82.4		78.7		82.2		80.1	
Depressed (8+)	17.6		21.3		17.8		19.9	

Note:

1. Very low numbers reflect income data collected for the first time in the same age 10 survey as the behaviour outcomes measures.

Table A4: comparison of individual characteristics by missing v non-missing in age 10 behaviour scales

Variables (child age)	BCS70				MCS			
	Non-Missing	N (100%)	Missing	N (100%)	Non-Missing	N (100%)	Missing	N (100%)
Proportions								
Gender (0)		12,436				11,073		5,555
Male	51.4		52.2		50.2		53.7	
Female	48.6		47.8		49.8		46.3	
Ethnicity (5)		10,505				11,050		5,532
White	97.5		93.4		88.3		82.7	
BAME	2.5		6.6		11.7		17.3	
Birthweight (0)		12,436				11,049		5,518
Normal	93.6		93.1		93.3		92.6	
Low birthweight	6.4		6.9		6.7		7.4	
Breastfed (5)		10,762				11,058		5,520
Never	63.1		62.9		25.4		35.6	
<1 month	15.9		17.9		22.5		24.6	
<3 months	10.0		9.5		15.1		12.5	
>3 months	11.0		9.8		23.4		16.5	
					13.6		10.7	
Birth order (0)		12,436				11,073		5,555
Older siblings	61.4		60.3		57.8		57.3	
Firstborn	38.6		39.7		42.2		42.7	
Ill health (5)		10,124				10,332		2,739
No	71.1		71.6		80.5		81.5	
Yes	28.9		28.4		19.5		18.5	

Table A4: (Continued)

Variables (child age)	BCS70				MCS				Variables (child age)
	Non-Missing	N (100%)	Missing	Sample characteristics N (100%)	Non-Missing	N (100%)	Missing	N (100%)	
Mean scores									Mean scores
Vocabulary (5)									Vocabulary (5)
EPVT (raw score)	35.6	10,135	33.5	1,646	109.8	10,238	105.3	2,668	Naming vocabulary (raw score)
Behaviour problems (5)									Behaviour problems (5)
Conduct	1.71	10,781	1.73	1,752	1.29	10,133	1.43	2,598	Conduct
Hyperactivity	1.93	10,788	1.91	1,750	1.58	10,124	1.84	2,594	Hyperactivity
Emotional	1.08	10,780	1.01	1,747	0.54	10,132	0.64	2,594	Emotional