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# Poverty dynamics and parental mental health: Determinants of childhood mental health in the UK

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## Abstract

Using data from the British Millennium Cohort Study (MCS), an ongoing longitudinal study of a cohort of 18,827 children born in the UK in 2000–2001, we investigate important correlates of mental health issues during childhood. MCS respondents were sampled at birth, at age 9 months, and then when they were 3, 5, 7 and 11 years old. Each sweep contains detailed information on the family's SES, parenting activities, developmental indicators, parental relationship status, and indicators of parental mental health. The Strengths and Difficulties Questionnaire (SDQ) and the related Rutter scale were used to identify behavioral and emotional problems in children. In this paper, childhood problems are separated into four domains: hyperactivity, emotional symptoms, conduct problems, and peer problems. We focus on two aspects of this relationship at ages 5 and 11 – the role of temporary and persistent poverty and the role of temporary and persistent mental health problems of mothers and fathers. At ages 11 and 5, without other controls in the model, persistent and transitory poverty have strong estimated associations with all four domains, with somewhat stronger estimated effects for persistent poverty. After a set of controls are added, we document that both persistent levels of poverty and transitions into poverty are strongly associated with levels of and transitions into childhood mental health problems. Similarly, sustained levels and transitions into mothers' mental health problems are strongly associated with levels and transitions into children's mental health problems. This is much less so for fathers.

### Keywords

UK; childhood mental health; parental mental health; parental physical health; poverty

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## INTRODUCTION

Childhood psychological problems are a growing serious problem among children around the world (Anonymous, 2011; Anonymous, 2010). These mental health issues include depression, anxiety, and drug and alcohol abuse. There are severe consequences in the adult years associated with childhood mental health problems. Several longitudinal studies have shown that poor psychological health in childhood is associated with both a child's welfare and their long-run socioeconomic outcomes, including graduation from high school/college (Kessler et al., 1995; Anonymous, 2010 in the US; Farmer, 1993 in the UK), employment and lower earnings (Gregg & Machin, 1998; Anonymous, 2011 in the UK); and even marriage stability (Anonymous, 2011; Anonymous, 2010). The relationship between physical health problems during childhood and later outcomes is much weaker (Currie and Stabile, 2006; Anonymous, 2012).

Given its importance for long-term outcomes, understanding correlates of childhood mental health is a key research focus. We focus on two here: income and parental mental health. Our contribution considers transitions over time in both domains, and whether these transitions matter for components of children's mental health. We treat childhood mental health as multi-faceted and use measures capturing a wide set of emotions and behaviours, including externalising behaviour (conduct and hyperactivity) and internalising behaviour (peer interaction and emotional).

Regarding income, there is evidence that poorer children are more likely to suffer from both physical and mental health problems (see Currie 2009) for at least two reasons. The first is that low socioeconomic status creates stress within the household, causing poor child health. The second is that socioeconomic status is highly correlated with other factors affecting child health, such as housing quality or marital stability (Berger, Paxson, & Waldfogel, 2009) and temporal patterns of income (Strohschein, 2005). However, we are unaware of studies considering the extent to which transitions into and out of poverty affect sub-components of children's mental health, our key focus.

Our second contribution considers how transitions in parental mental health affect children's mental health. Whilst several studies find that parental mental health, particularly the mother, matters even after controlling for socioeconomic status (Cummings & Davies, 1994; Ackard et al., 2006;), we are unaware of any work considering how shifts in parental mental health – improvements and deteriorations – affect children's mental health.

We use a contemporary and nationally representative UK panel study that begins at birth, and analyse a critical period of childhood, spanning the beginning to almost the end of primary education in the UK (ages 5–11). We document that both persistent poverty and transitions into poverty are strongly associated with levels of and transitions into childhood mental health problems. Similarly, sustained levels and transitions into mothers' mental health problems are strongly associated with levels and transitions into children's mental health problems. This is much less so for fathers.

## METHODS

The Millennium Cohort Study (MCS) is an ongoing longitudinal cohort study of 18,827 children (from 18,552 families) born in the UK in 2000–2001. More specifically, it is a representative sample of those born between 1 Sept 2000 and 31 Aug 2001 in England and Wales and those born between 24 Nov 2000 and 10 Jan 2002 in Scotland and Northern Ireland. The sample was taken over a slightly different period to compensate for lower than expected birth rates, and to not coincide with other data collections taking place. An additional 650 were recruited to the study at age 3, who had not registered for child benefit at time of initial recruitment. These individuals are excluded from our sample. Thus, the vast majority are natural mothers (100% at first birth interview and a minimum 98% in other interviews). The MCS contains oversamples for Wales, Scotland and Northern Ireland, for areas with high child poverty and, in England, for areas with higher ethnic minority populations.

Six sweeps have been conducted so far, at ages 9 months, 3, 5, 7, 11 and 14, with the seventh (age 17) planned for 2017. The sixth sweep (age 14) was completed in 2016; data are not now available. 72% of the initial respondents were in the study at the fifth wave, though attrition is not absorbing, and re-entry is possible. Due to these differential patterns of response, weights are provided to adjust for inter-wave attrition (Ketende, 2010).

In each sweep, an interview is carried out with the main parent (normally the mother), resident partners, and, increasingly as the child grows older, with the child. Each sweep contains detailed information on the family, including: parental education; employment and income; housing; family structure; ethnicity; parenting activities – such as reading to child; developmental indicators such as bedwetting; parental relationship status; and parental mental health. Items specific to a certain stage of life are collected – at age 9 months, child birth weight and gestational age; as well as early life conditions including breastfeeding and infant development. Cognitive development is measured directly from children from 3 years. Social and behavioral development is measured via parental reports. For more information, see Connelly and Platt, 2014 and Joshi & Fitzsimons, 2016.

### Participants

The analyses reported are mainly based on sweeps 3 (age 5) and 5 (age 11) measures of childhood mental health. At age 5, there are 15,246 respondents. In 14,792 cases the main respondent was the natural mother, in 394 the natural father. The most common non-parent was a female grandparent (36). Of the 12,216 partner interviews, 11,145 were the natural father and 303 the natural mother. The most common partner response from a non-natural parent was a male step-parent/partner at 560 respondents.

At age 11, there were 13,287 cohort members. In 12,588 cases, the main respondent was the natural mother, who would answer all main questions about the SDQ; in 504 cases, the natural father answered questions. Once again, the largest non-natural parent category was grandparents (52). Of partners, 7,535 were natural fathers. The largest category of non-parental partner is step-parent or parent’s partner (at 898, with 840 of these men).

Control variables are measured at various sweeps. Results using outcomes from age 7 yield similar results to those at ages 5 and 11 and are available upon request.

## Measures

### Childhood mental health

The Strengths and Difficulties Questionnaire (SDQ) is a behavioral screening questionnaire for 3–16 year olds used to identify behavioral and emotional problems in children and adolescents (see http://www.sdqinfo.com/; Goodman et al., 2000; Goodman and Goodman, 2009). Goodman (1997) administered the Strengths and Difficulties Questionnaire along with the better-known Rutter questionnaire to parents and teachers of 403 children. He found that scores derived from the SDQ and Rutter questionnaires were highly correlated, and parents' self-reports of SDQ were highly correlated with teachers' reports on the same child.

The SDQ asks about 25 attributes, some positive and others negative, divided across five scales: hyperactivity, emotional symptoms, conduct problems, peer problems and prosocial behaviour (see supplementary material for item list and scoring). Since ours is a general population sample, following Goodman et al. (2010a) we use an alternative division of SDQ into 'internalising problems' (emotional + peer symptoms, 10 items) and 'externalising problems' (conduct + hyperactivity symptoms, 10 items). We do not use the prosocial scale (5 items) as it is not well validated. Both total and individual subscale scores were calculated using standard scoring as per SDQ guidelines, including standard rules for missing items or scales. Within each scale, cutoffs for serious problems are: emotional (5/10), conduct (4/10), hyperactivity (7/10), peer (4/10) (Goodman et al., 2010b). These are the conventional cut-offs used for 'abnormal behavior'.

The SDQ was used at 3, 5, 7 and 11 years, where it was self-completed by the main respondent, normally the child's mother. We use measures collected at ages 5 and 11, corresponding to the first and final years of children's primary schooling. We also estimated results for age 7, which are qualitatively similar to age 11 results and are available upon request. Our approach allows us to assess how determinants of childhood mental health change during this critical schooling period between early and late childhood.

Appendix Table 1 documents overlap in SDQ scores components in the MCS by listing fractions of respondents with a problem labelled 'BAD' score conditional on having a problem score on each of four components. Cutoffs for falling into the problem group were based on proportion of respondents in the worst group at similar ages. To illustrate, for respondents with a problem emotional score, about a third has a 'BAD' score on conduct, hyperactivity, and peer components. A similar pattern exists for degree of overlap for the other components.

### Family Background

There are several salient measures available about the background in which children were raised. The variables relating to "family structure" include: number of younger and older siblings at age 3 (1, 2+);; whether parents split between age 9 months and 7 years; whether parents got together between age 9 months and 7 years; whether a lone parent between ages

9 months and 7 years; child gender, child ethnicity (The ethnicity categories are:Black (Black Caribbean; Black African); Asian (Indian; Pakistani; Bangladeshi; Other Asian); Other (Mixed; any background; Other) with White British as the omitted category; housing tenure at age 5 (rents from Local Authority or Housing Association; rents privately; other); age mother and father left full-time education; young mother" (< 21 years old); maternal work status (not in work/on leave); partner's work status (not in work/on leave). As detailed below, we also construct variables on the mental health of mothers and fathers.

To capture childhood experience of family poverty, we construct variables on transitions into and out of poverty. Note within each sweep we use a standard indicator of poverty as less than 60% of median equalized income.

### Early childhood environment

We have a variety of indicators of early childhood environment, including child low birth weight (< 2.5 kg); how long the mother breast fed; early developmental indicators including bedwetting; whether parental concerns about child speech at age 3; and bedtime regularity at age 3 (never; sometimes; usually). These early childhood environment are important predictors of later outcomes. There is a large literature on the importance of birth weight and breastfeeding for later development; bedwetting and parental concerns around speech as parental-reported markers of development at age 3; and bedtime regularity at 3 as a proxy for parenting.

### Parental mental health

At age 9 months parental mental health is measured using the Malaise Inventory, a set of self-completion questions measuring levels of psychological distress, or depression. The 24 'yes-no' items cover emotional disturbance and associated physical symptoms. Scores range from 0 to 24; individuals responding 'yes' to 8 or more of the 24 items are considered to be at risk of depression. In surveys since age 3, psychological distress was measured with the widely used Kessler 6 scale, (Kessler et al., 2002). For each of six questions, respondents score 4 points if they answer 'all of the time', 3 points for 'most of the time', 2 points for 'some of the time', 1 point for 'a little of the time' and zero for 'none of the time'. A score of 5 or above is indicative of moderate mental distress, while a score of 13 or above indicates severe mental illness. For each wave, we create indicators for whether each parent has a Kessler score of at least 5, indicating at least moderate mental distress (Prochaska et al., 2012). Mental health transitions are created by comparing these indicators of mental distress between waves. We then create indicators of improving mental health (mental distress in an earlier wave but not in the later wave), deteriorating mental health (mental distress in the later wave but not the earlier wave) and poor mental health in both waves. For transitions of parents between age 9 months and age 3, we compare poor malaise scores at age 9 months to Kessler scores at age 3.

### Parental physical health

This includes whether mother and/or father have a longstanding physical health problem, and whether each parent smoked prior to becoming pregnant with the cohort member.

## Statistical analyses

Linear probability models (LPMs) were used for the binary outcome of all four childhood mental health problems at ages 5 and 11 – the internalizing outcomes (emotional and peer) and externalizing outcomes (hyperactivity and conduct). Results are robust to non-linear models including logit and probit. We tested that baseline results were robust to estimating models using Seemingly Unrelated Regression specifications allowing error terms in four childhood mental health outcome models to be correlated. Our models were robust to that alternative.

For each childhood mental health outcome, we estimate three models at age 11. The first estimates models with poverty transitions as independent variables to observe simple associations with type of poverty patterns, while the second adds the lag value at age 5 of the specific mental health outcome being estimated. The third model then adds the full set of other controls. Models are estimated at age 11 and 5. At age 11, the poverty transitions included are all transitions between ages 5 and 11 – moving into poverty at age 11 (not being in poverty at age 5), moving out of poverty at age 11 (being in poverty at age 5), and staying in poverty at ages 5 and 11. Similarly parental mental transitions at age 11 are changes between ages 5 and 7. For both mothers and fathers there are three transitions – moving into poor mental health, moving out of poor mental health and staying in poor mental health.

When we estimate mental health models at age 5, we only estimate two models since we do not have the mental health status at age 3. As independent variables, we include a parallel set of measures of poverty transitions between age 9 months and age 5. The parental mental health transitions are a parallel set of transitions as in the age 11 model using the Malaise measure at age 9 month and the Kessler score at age 3.

We also estimated models of changes in childhood mental health status between ages 5 and 11 for each of the four components of childhood mental health. The model estimated is the probability of moving into poor mental health at age 11 given that one was in good mental health at age 5.

The key explanatory variables are our measures of poverty and parental mental health transitions during childhood. In the ‘with controls’ model, we control for family background and parental mental health lagged one period, to mitigate simultaneity or reverse causality bias; for early childhood environment measured at either age 9 months or 3 years, and parental longstanding physical health measures. This allows us to estimate impacts of parental mental health, net of effects of these other variables. All tests of statistical significance use robust SEs and are weighted to account for the study’s stratified sampling using weights provided by MCS. We adjust for sample loss due to attrition using inverse probability weighting (Wooldridge, 2007). Estimates for our full models are available in a supplementary statistical appendix. In the paper, we focus primarily on the poverty and parental mental health variables.

We restrict the analysis sample to 11,049 that record responses to SDQ questions at age 5 and 11. At age 5, a total of 15,246 cohort members (parents) responded to the survey in some form. Of these 13,878 responded to SDQ questions, and of these 11,049 are included

in our sample. At age 11, a total of 13,287 members (parents) responded to the survey in some form. Of these 12,153 responded to SDQ questions, and 11,049 are included in our sample

## Results

### Descriptive statistics

Supplemental Appendix Table 2 shows mean values of SDQ outcomes and explanatory variables, separately at ages 5 and 11. The prevalence of externalising behaviour problems (conduct and hyperactivity) is higher than internalising problems (peer and emotional) at age 5. By age 11 prevalence of internalising problems increased, whilst externalising problems remained stable, so that by age 11 prevalence across all four domains is similar at around 10%.

Maternal mental health problems are similar at both ages, with just over 15% displaying moderate/high symptoms, compared to around 8% for fathers, again similar at both ages. Maternal malaise at 9 months is around 14%, double the prevalence amongst fathers. The presence of a longstanding physical health problem is about 18% in mothers and 13% in fathers.

Regarding parental SES, around 20% of families are social renters, one-third of mothers and 6% of fathers are not in work/on leave. The fraction of mothers not at work declines between age 5 and age 7. The average age when mothers and fathers left school is about the same – 17.6 years old. About a fifth of the sample are social rentals –living and renting at subsidized rates in government provided housing. Many children in this study have either or both younger and older siblings at both ages. The occurrence of family dissolution and formation is about 10%.

Around 5% of cohort members had a birth weight of 2.5 kg or less. At age 3, 15% of cohort members were still in diapers/nappies at least sometimes, and for 12% there was some parental concern about their speech development.

### Model Results

We briefly discuss results available in the supplemental appendix obtained for other controls in the model besides poverty and mental health of parents.

**Demographic Variables—**At age 11, boys have higher scores on both domains of externalizing behaviour (conduct problems and hyperactivity) and lower scores on the emotional domain, while at age 5 boys repeat that pattern also having higher scores on the peer dimension. Compared to White children, Black and Asian children have lower emotional, conduct and hyperactivity problems at age 11, but Asian children have more emotional and peer problems at age 5. When we compare the four countries, Scottish children score lower on emotional and peer dimensions at age 11 but not age 5, while children in Northern Ireland score lower on conduct at age 11 and hyperactivity at age 5.

**Other SES variables—**The age mothers left full-time education is not a significant predictor at age 11, while it is for father's education in lowering mental health disorders except for conduct suggesting that father's education is more important than mothers for childhood mental health outcomes. At age 5 the main effect for both parents involves lowering hyperactivity problems and conduct for fathers. Renting in subsidized Social Council housing is correlated with conduct problems at age 11 and all childhood problems at age 5 except emotional disorders. Mother not working is associated with higher problems at age 11 except for emotional, with much weaker associations except for emotional at age 5 and for fathers. There is some evidence of older siblings being protective for peer problems at both ages and for all but conduct problems at age 5. Having younger siblings raises conduct problems at ages 11 and 5 and emotional problems at age 5. At age 5, families splitting between waves matters for emotional and hyperactivity problems, whilst split up of families at age 11 increases all problems except emotional ones.

**Early child environment/development—**Warning signals manifest early – parental concerns around speech are correlated with a higher probability of all problems at ages 11 and 5. In addition, not having a regular bedtime is associated with higher scores at both ages. Bedwetting at both ages is generally associated with higher childhood mental health issues at both age 5 and 11. Family difficulties matter: families splitting between waves is particularly important at age 11, and there is evidence that parents' re-partnering is protective for conduct at age 11.

**Parental physical health—**Whilst the presence of a longstanding mother's physical health problem is generally associated with her child exhibiting higher emotional and peer problems, the association with a father's physical health problem is lower and not statistically significant. Maternal physical health problems matter considerably less for children's mental health than do maternal mental health problems.

## Effects of Poverty

A central question is the role of family income on mental health problems experienced by young children. An important issue concerns how to specify measurement of family income. We hypothesize that the role of family income is likely to be very non-linear and concentrated at low incomes. Table 1 supports that conjecture by showing fractions of respondents where children receive problem SDQ scores in five family income quintiles. These fractions are much higher in the lowest income quintile and decline significantly as we move across family income quintiles. The fraction of children with emotional issues range between 15–20% in the lowest income quintile and are typically less than 5% in the highest income quintile. Mental health problems are much more concentrated at the bottom when we control for other variables. This is why we concentrate our income analysis on poverty.

Table 2 summarizes results obtained for poverty variables for age 11. At age 11, our poverty variables reflect poverty transitions between ages 5 and 11 categorized into three groups (moved into poverty, moved out of poverty, remained in poverty, with never in poverty as the left-out category). With no other controls, all three dimensions of poverty have statistically

and quantitatively significant effects in being associated with poorer childhood mental health outcomes in all four domains. Being in any one of these poverty categories raises the probability of being in poor childhood mental health by 6 to 13 percentage points. To illustrate using the 'conduct' mental health domain, the estimated coefficient and 95% confidence limits for moving into poverty are 0.126 (0.155- 0.097). For staying in poverty, the corresponding numbers are 0.113 (0.138–0.089) and for moving out of poverty are 0.062 (0.085–0.039). In all four models, estimated effects associated with moving out of poverty are somewhat smaller in absolute value than the two poverty categories that left the child in poverty at age 11.

These patterns remain similar but estimated poverty coefficients are somewhat smaller when we add age 5 lag value of poor childhood health outcome in each of the four domains. The lag 5 values are statistically significant in all four childhood mental health domains, indicating significant persistence in mental health problems during the childhood years that remains even after controlling for other covariates in column 3 of Table 2. However, the magnitude of estimated coefficients of lagged mental health at age 5 is not that large in absolute value (i.e., much below the value of 1) indicating far less than complete persistence in childhood mental health outcomes over time.

The situation becomes more complicated when other controls are included. The full set of controls includes all variables listed above under headings family background, early childhood environment, parental mental health, and parental physical health. Estimated coefficients on poverty variables are always positive but remain independently statistically significant only for the movement into poverty variable for all childhood mental health outcomes except emotional health. Even with all other variables included, moving into poverty is quantitatively significant for all childhood mental health outcomes raising the probability of having poor childhood health by 2 to 5 percentage points. The largest estimated effect is for poor conduct disorders.

The age 5 outcomes for poverty variables are contained in Table 4. As for age 11 models, we have three poverty variables capturing persistence of poverty between age 9 months and age 5 (moved into poverty, moved out of poverty, and stayed in poverty). When we examine age 5 outcomes without controls, all dimensions of poverty have statistically significant effects on all four childhood mental health outcomes. But now estimated effects for remaining in poverty are much larger in absolute value than either moving into or out of poverty. When we add controls to age 5 models, persistent poverty maintains statistically significant and quantitatively significant associations for all four domains of childhood mental health outcomes (running about 3 percentage points)

## Parental mental health

We include in models indicators of mental health transitions of both parents. They are based both on the Kessler scale and the age 9 month Malaise measure. At age 11, we include three variables capturing persistence of Kessler-based mental health problems for both parents. These transitions include moved into Kessler score difficulty, moved out of Kessler score difficulty, and remaining in Kessler score difficulty all measured between ages 5 and 7. We use ages 5 and 7 since we want to use lagged values of Kessler score changes.

For the same reason, we use the combined Malaise at age 9 months and Kessler mental health at age 3, to capture similar transitions for the age 5 models. For mothers and fathers, we have three measures of persistence – for each parent no Malaise at 9 months and poor Kessler score at age 5 (moving into poor parental mental health), Malaise at age 9 months and good Kessler score at age 5 (moving out of poor parental mental health), Malaise at age 9 months and poor Kessler score at age 5 (persistent parent mental health problems). Table 3 contains our estimates for age 11 childhood mental outcomes and Table 4 contains estimates for age 5 childhood mental outcomes for parental health variables. These estimates in Tables 3 and 4 come from models including all other covariates mentioned above.

Turn to age 11 models in Table 3. The size of estimated association based on changes in Kessler measures with mother's mental health is much larger than for father's mental health. Once again using conduct mental health to illustrate, estimated effects and 95% confidence limits for mothers staying in poor mental health is 0.070 (0.097–0.044). For mothers moving into poor mental health it is 0.035 ((0.060–0.011) and for mothers moving out of poor mental health it is 0.006 (0.045- -0.007). For father's mental health, we only estimate two statistically significant associations. Fathers staying in poor Kessler mental health is associated only with worse childhood emotional health at age 11, and fathers moving into poor Kessler based mental health is associated with statistically significant effects only on childhood hyperactivity at age 11. In contrast, our three measures of mother's mental health transitions are all generally statistically associated with all four mental health problems of children at age 11. Estimated effects are larger for persistent mental health problems of mothers, with mothers moving into mental health problems having a solid second place. At age 11, we find similar results with age 9 month Malaise measure which is only statistically significant for mothers.

Turn to age 5 models in Table 4. Our parental mental health measures parallel in principle those used in our age 11 models (a desire to measure lag changes in parental mental health). As at age 11, there are much stronger associations at age 5 between mental health of mothers and children than that of fathers and children. Of the three measures of mother's mental health, by far the worse consequences take place when the mother is in poor mental health at both 9 months and age 3. Between the other two measures, consequences are somewhat worse when the mother's poor mental health is at 9 months.

We take a complementary perspective on dynamics of mental health changes for children in Table 5 when we model transitions in children's mental health in each children's health domains between ages 5 and 11. The transition we model is movement from good mental health at age 5 to poor mental health at age 11 since sample sizes are only sufficient for this transition. For all four children's mental health domains, movement into poverty between ages 5 and 11 is statistically significantly related to the transition into poor mental health at age 11. With the exception of hyperactivity, remaining in poverty at ages 11 and 5 promotes the transition into poor mental health at age 11. In contrast, moving out of poverty by age 11 has statistically significant effects only for the emotional and peer domains.

Similarly, mothers moving into or remaining in poor mental health are strongly associated with movements of their children into poor mental health in all four domains in Table 5.

Mothers moving into or staying in poor mental health has statistically and quantitatively significant effects for their children moving into poor mental health in all four childhood mental health domains. Fathers' mental health transitions remain less important than mothers', although fathers' moving into or remaining in poor mental health raises the odds of children experiencing a movement into poor emotional health by age 11. Finally parents' splitting up between ages 5 and 11 promotes transitions into poor children's mental health in all domains except peer, and being a lone parent leads to higher transition rates into poor mental health in all four childhood domains.

## Discussion

In this paper, we examined effects of persistent and transitory poverty and transitions in parental mental health on mental health of young children using an innovative panel survey following children and parents from birth. When we don't include other relevant variables, both persistent and transitory poverty have statistically significant associations with all domains of childhood mental health at both age 11 and age 5. The magnitude of coefficients on changes to poverty status and parental mental health are generally substantial relative to mean prevalence across the sample, and hence of some clinical significance as well as statistical significance.

Since both persistent and transitory poverty are associated with poor childhood mental health, considering one aspect of poverty in isolation can be misleading. In particular, only looking at current poverty, as most existing research tends to do, is missing an important dimension of the problem.

When we include other variables in models, the magnitude of estimated associations of our poverty variables with childhood mental health problems is much diminished. The inclusion of three measures of socioeconomic status, housing tenure, and whether mothers and fathers are in work reduced the magnitude of poverty by at least half for most outcomes. In general, parental mental health reduces the impacts of poverty the most on the emotional domain and the least on the conduct domain.

At age 11 with other controls included the movement into poverty has the largest estimated effects for childhood mental health problems while at age 5 persistent poverty has the largest estimated effect. An important implication is that childhood mental health is not a single construct but rather multifaceted with effects differing across our four childhood mental health domains.

When we analyse poverty cycles, at age 5 only the 'always in poverty' status persistently matters for these childhood mental health difficulties with once again hyperactivity being the principal exception. Children at age 5 may be too young to be aware of the economic transitions taking place around them.

Parental mental health is the most important correlates of childhood mental health in all childhood domains in our analyses. These effects remain strong even when all other co-variates are included. For all childhood mental health issues, estimated effects of mothers'

mental health problems are typically much larger than those of fathers' mental health problems.

The environmental transmission (e.g., through patterns of parenting) may be expected to be larger between mothers and their children compared to fathers, given that typically mothers take on a larger share of caregiving and child caring roles. Since the SDQ is typically reported by the mother in the MCS study, a stronger correlation may also be due to reporting bias in the SDQ among those who have mental health disorders.

Once again transitions of mothers dominate those of fathers. Estimated associations of mothers' mental health remain statistically significant even with all other co-variates in models, indicating the inherent importance of mothers for the mental health for their children. At ages 11 and 5, all three transitions in mother's mental health matter for all four childhood mental health domains. They are also quantitatively large with our estimates running from 5 to 10 percentage point higher poor mental health for children.

Among our three measures of transitions in mother's mental health, remaining in poor mother's mental health is the quantitatively largest effect in all four childhood health domains for both age 11 and age 5. This suggests that the cumulative effect of mother's poor mental health on children is large indeed –5 to 10 percentage points. This also indicates that we may be severely understating societal costs of poor mental health of mothers if we do not also include the consequent poor mental health of their children and its implications for the future economic and social lives of their children.

For the other two mother's mental health transitions, the largest estimated effects at age 11 take place on movement of mothers into poor mental health. Movement of mothers out of poor mental health has smaller effects but they remain statistically significant for emotional and hyperactive domains. This may suggest that legacy effects of mother's poor mental health will take at a minimum additional time for their children to recover and be indicative of a cumulative effect of parenting problems. At age 5, both movements of mothers into and out of poor mental health matter, perhaps reflecting the fact that children at this age may be less aware of the past compared to the present.

These 'BAD' childhood mental health outcomes are likely to have large effects on people's lives in their adult years. Using the same four components of 'BAD childhood health, we found using the 1958 British cohort data that a poor mental health outcome in each component reduced family income by around 10% for each of the childhood mental health components largely by reducing the probability of being married and being employed.

Like all studies, ours has strengths and weaknesses. The most important strength is the prospective data with high quality measurement in each wave of relevant domains for this analysis including children's mental health status, family incomes, and the mental health status of parents. The principal weakness at this point is that the available data does not go into the adolescent or adult years, but that weakness will be remedied in time as new waves of data become available over the next decades. While we control for a wide set of observable characteristics which should reduce omitted variables bias and estimate a dynamic model focusing on change rather than level of poverty, we cannot fully rule out that

there are unobserved characteristics correlated with key exposures and child mental health that are reflected in our estimates

## Conclusions

Using data from the UK MCS, we investigated important correlates of childhood mental health issues when children were 11 and 5 years old. We separate childhood problems into four domains: two externalizing domains (emotional and peer problems) and two internalizing domains (conduct and hyperactivity problems).

We focused on two aspects of this relationship at ages 5 and 11 – the role of temporary and persistent poverty and the role of temporary and persistent mental health problems of mothers and fathers. At ages 11 and 5, without any other controls in the model, persistent and transitory poverty have strong estimated associations with all four domains, with somewhat stronger estimated effects for persistent poverty. After a set of controls are added, estimated associations are strongest for persistent poverty for the peer and conduct outcomes. For all childhood mental health issues, estimated effects of mothers' mental health problems are much larger than those of fathers' mental health problems. Persistent mothers' mental health issues as well as transitions of mothers into poor mental health have the largest estimated effects on their children's mental health problems.

The economic implications of our findings are very significant. Our prior joint work and those of others has shown that poor childhood mental health has a large effect on reducing adult labor supply and earnings and family income as an adult. Each of our four domains of poor childhood health will contribute to that.

These findings reinforce the importance of taking a whole family approach to the problem of children's mental health, - thus protecting families from negative socio-economic shocks. The effective treatment of parental mental health problems is likely to be as important as the provision of mental health services for the child. Besides putting a focus on mental health issues, the importance for policy is don't wait until the adult years. Without recognition and treatment, childhood mental health problems persist into the adult years when they become longstanding and more difficult to treat. Dealing with childhood mental health problems was often a taboo subject and ignored. Resources should also be devoted to basic science to discover better treatments and meds for these childhood mental health problems.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Research Highlights

- Permanent poverty is related to levels and transitions into bad child mental health
- Transitions into poverty are related to transitions into bad child mental health
- Mom’s mental health transitions influence child’s mental health problems
- Influence of Dad’s mental health is small

**Table 1**

Overlap in ‘BAD’ Rutter Score Components

***Mean Rates of ‘BAD’ SDQ Scores Age 11 by Family Income Quintiles***

| | Emotional | Peer | Conduct | Hyperactivity |
|---|---|---|---|---|
| *Equivalised income quintile* | | | | |
| Lowest | 0.156 | 0.172 | 0.188 | 0.163 |
| Second | 0.132 | 0.140 | 0.138 | 0.145 |
| Third | 0.101 | 0.094 | 0.079 | 0.086 |
| Fourth | 0.091 | 0.078 | 0.051 | 0.072 |
| Highest | 0.065 | 0.071 | 0.033 | 0.058 |

***Mean Rates of ‘BAD’ SDQ Scores Age 5***

| | Emotional | Peer | Conduct | Hyperactivity |
|---|---|---|---|---|
| Lowest | 0.088 | 0.115 | 0.177 | 0.167 |
| Second | 0.071 | 0.100 | 0.135 | 0.130 |
| Third | 0.040 | 0.060 | 0.075 | 0.091 |
| Fourth | 0.040 | 0.043 | 0.055 | 0.061 |
| Highest | 0.024 | 0.038 | 0.046 | 0.053 |

## Table 2

Age 11 Model for Estimating Probability of Poor Mental Health for Poverty Variables

| | | | |
|---|---|---|---|
| **Internalizing Age 11 - Emotional** | | | |
| | **(1)** | **(2)** | **(3)** |
| | **Poverty Cycle** | **+ lag value** | **+ controls** |
| Change 5–11: Moved into poverty | 0.0638*** (0.0134) | 0.0479*** (0.0130) | 0.0235 (0.0151) |
| Change 5–11: Moved out of poverty | 0.0562*** (0.0120) | 0.0475*** (0.0117) | 0.0169 (0.0128) |
| Change 5–11: Stayed in poverty | 0.0649*** (0.0118) | 0.0468*** (0.0119) | 0.0202 (0.0150) |
| Age 5 - Poor Emotional Score | | 0.285*** (0.0210) | 0.251*** (0.0207) |
| **Internalizing Age 11 - Peer** | | | |
| | Poverty Cycle | + lag value | + controls |
| Change 5–11: Moved into poverty | 0.0819*** (0.0140) | 0.0585*** (0.0134) | 0.0298* (0.0155) |
| Change 5–11: Moved out of poverty | 0.0640*** (0.0123) | 0.0527*** (0.0121) | 0.0198 (0.0130) |
| Change 5–11: Stayed in poverty | 0.0804*** (0.0122) | 0.0558*** (0.0117) | 0.0183 (0.0149) |
| Age 5 - Poor Peer Score | | 0.290*** (0.0181) | 0.258*** (0.0180) |
| **Externalizing Age 11 - Conduct** | | | |
| | Poverty Cycle | + lag value | + controls |
| Change 5–11: Moved into poverty | 0.126*** (0.0147) | 0.0926*** (0.0143) | 0.0489*** (0.0159) |
| Change 5–11: Moved out of poverty | 0.0619*** (0.0116) | 0.0440*** (0.0110) | −4.15e-06 (0.0119) |
| Change 5–11: Stayed in poverty | 0.113*** (0.0124) | 0.0716*** (0.0119) | 0.0199 (0.0147) |
| Age 5 - Poor Conduct Score | | 0.283*** (0.0154) | 0.254*** (0.0154) |
| **Externalizing Age 11 - Hyperactivity** | | | |
| | Poverty Cycle | + lag value | + controls |
| Change 5–11: Moved into poverty | 0.0777*** (0.0137) | 0.0488*** (0.0128) | 0.0281* (0.0147) |
| Change 5–11: Moved out of poverty | 0.0621*** (0.0121) | 0.0377*** (0.0116) | 0.0109 (0.0122) |
| Change 5–11: Stayed in poverty | 0.0765*** (0.0118) | 0.0371*** (0.0111) | 0.0099 (0.0144) |
| Age 5 - Poor Hyperactivity Score | | 0.354*** (0.0155) | 0.318*** (0.0155) |

In all tables asterisks indicate levels of statistical significance.

*** is significant at the 1% level,

** at the 5% level, and

* at the 10% level.

The omitted reference category is never in poverty. The lag value is ‘poor’ mental health at age 5. Additional controls in model 3 include parents’ movement in and out of poor mental health of that type, gender, UK country of origin, ethnicity, parents’ physical health problem, parents malaise at age 5, age parents left full-time education, type of housing tenure at age 7, parents’ work status, breast feeding during first year, child ‘dry’, speech problem, regular bedtime all at age 3, parents’ smoking behaviour, number of younger and older siblings at age 7, and living arrangements of parents. See supplemental Table 3 for details.

**Table 3**

Age 11 Model for Estimating Effects of Parent's Mental Health Transitions on Probability of Children's Poor Mental Health Outcomes

| | Emotional | Peer | Conduct | Hyperactivity |
|---|---|---|---|---|
| Change 5–7: Mother moved into poor mental health | 0.0673*** (0.0134) | 0.0449*** (0.0131) | 0.0351*** (0.0125) | 0.0524*** (0.0125) |
| Change 5–7: Mother moved out of poor mental health | 0.0348*** (0.0117) | 0.0077 (0.0111) | 0.0063 (0.0111) | 0.0211* (0.0113) |
| Change 5–7: Mother stayed in poor mental health | 0.0994*** (0.0145) | 0.0586*** (0.0136) | 0.0704*** (0.0137) | 0.0538*** (0.0136) |
| Change 5–7: Father moved into poor mental health | 0.0135 (0.0148) | −0.0081 (0.0140) | 0.0179 (0.0133) | 0.0257* (0.0135) |
| Change 5–7: Father moved out of poor mental health | 0.0030 (0.0138) | −0.0058 (0.0138) | 0.0040 (0.0129) | 0.0073 (0.0129) |
| Change 5–7: Father stayed in poor mental health | 0.0380* (0.0187) | 0.0070 (0.0172) | 0.0215 (0.0165) | 0.0130 (0.0165) |
| Mother: Long Standing Physical Health Prob | 0.0177** (0.0084) | 0.0357*** (0.0087) | 0.0101 (0.0078) | 0.0150* (0.0079) |
| Father: Long Standing Physical Health Prob | 0.0115 (0.0091) | −0.0012 (0.0091) | −0.0036 (0.0081) | 0.0116 (0.0087) |
| Mother high malaise at 9 months | 0.0374*** (0.0109) | 0.0115 (0.0105) | 0.0167* (0.0103) | 0.0219** (0.0103) |
| Father high malaise at 9 months | 0.0085 (0.0137) | 0.0143 (0.0138) | 0.0044 (0.0129) | 0.0077 (0.0129) |

Models include all the other covariates in the model iIncluding the poverty transition variables, lag value is 'poor' mental health of that type at age 5 and the other variables listed in the legend to table 2 See supplemental Appendix Table 3 for details.

**Table 4**

Model for Estimating Probability of Poor Mental Health at Age 5, Poverty and Mental Health Changes

| | | | | | ( with all controls) | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Emotional | Peer | Conduct | Hyperactivity | Emotional | Peer | Conduct | Hyperactivity |
| Change 9mo-5: Moved into poverty | 0.0299*** (0.0093) | 0.0296*** (0.0105) | 0.0704*** (0.0127) | 0.0676*** (0.0129) | 0.0010 (0.0102) | −0.0105 (0.0112) | 0.0061 (0.0134) | 0.0204 (0.0134) |
| Change 9mo-5: Moved out of poverty | 0.0380*** (0.0096) | 0.0581*** (0.0108) | 0.0821*** (0.0124) | 0.0657*** (0.0121) | 0.0115 (0.0108) | 0.0166 (0.0126) | 0.0068 (0.0140) | 0.0076 (0.0133) |
| Change 9mo-5: stayed in poverty | 0.0625*** (0.0095) | 0.0903*** (0.0111) | 0.1290*** (0.0122) | 0.1050*** (0.0120) | 0.0277** (0.0119) | 0.0322** (0.0138) | 0.0302** (0.0153) | 0.0293** (0.0146) |
| Mother no malaise 9 months, Poor Kessler age 3 | | | | | 0.0243*** (0.0085) | 0.0390*** (0.0100) | 0.0426*** (0.0111) | 0.0388*** (0.0113) |
| Mother malaise 9 months, Good Kessler age 3 | | | | | 0.0679*** (0.0119) | 0.0533*** (0.0122) | 0.0696*** (0.0137) | 0.0376*** (0.0130) |
| Mother malaise 9 months, Poor Kessler age 3 | | | | | 0.0650*** (0.0133) | 0.0980*** (0.0156) | 0.0946*** (0.0168) | 0.0759*** (0.0163) |
| Father no malaise 9 months, Poor Kessler age 3 | | | | | 0.0084 (0.0097) | 0.0287** (0.0124) | 0.0165 (0.0128) | 0.0107 (0.0130) |
| Father malaise 9 months, Good Kessler age 3 | | | | | 0.0106 (0.0122) | 0.0232* (0.0139) | 0.0219 (0.0158) | 0.0115 (0.0157) |
| Father malaise 9 months, Poor Kessler age 3 | | | | | 0.0331* (0.0195) | 0.0308 (0.0205) | 0.0322 (0.0245) | 0.0367 (0.0245) |
| Mother: LS Physical Health Prob | | | | | 0.0107* (0.0063) | 0.0083 (0.0069) | 0.0057 (0.0079) | 0.0047 (0.0080) |
| Father: LS Physical Health Prob | | | | | −0.0063 (0.0060) | −0.0065 (0.0074) | 0.0035 (0.0084) | −0.0095 (0.0086) |

These models include all the other covariates in the model. Additional controls added in model 3 include the poverty transition variables, lag value is ‘poor’ mental health at age 5 (see Table 3), gender, UK for country of origin, ethnicity, parents’ long-term physical health problem, age parents left full time education, type of housing tenure at age 7, parents’ work status, breast feeding during first year, child

'dry', speech problem, regular bedtime all at age 3, parents' smoking behaviour , number of younger and older siblings at age 7, and living arrangements of parents. See supplemental Appendix Table 4 for details.

## Table 5

Moving into Poor mental health at age 11 from good mental health on same domain at age 5

| | Emotional | Peer | Conduct | Hyperactivity |
|---|---|---|---|---|
| Change 5–11: Moved into poverty | 0.0319** (0.0130) | 0.0440*** (0.0135) | 0.0721*** (0.0142) | 0.0274** (0.0123) |
| Change 5–11: Moved out of poverty | 0.0209* (0.0124) | 0.0401*** (0.0128) | 0.00424 (0.0107 | 0.0150 (0.0117) |
| Change 5–11: stayed in poverty | 0.0408*** (0.0126) | 0.0386*** (0.0124) | 0.0474*** (0.0126) | 0.0149 (0.0115) |
| Change 5–7: Mother moved into poor mental health | 0.0693*** (0.0133) | 0.0549*** (0.0132) | 0.0372*** (0.0120) | 0.0458*** (0.0119) |
| Change 5–7: Mother moved out of poor mental health | 0.0407*** (0.0115) | 0.0119 (0.0108) | 0.0134 (0.0105) | 0.0275** (0.0107) |
| Change 5–7: Mother stayed in poor mental health | 0.105*** (0.0144) | 0.0593*** (0.0133) | 0.0670*** (0.0136) | 0.0590*** (0.0131) |
| Change 5–7: Father moved into poor mental health | 0.0295** (0.0148) | 0.0107 (0.0136) | 0.0181 (0.0125) | 0.0224* (0.0127) |
| Change 5–7: Father moved out of poor mental health | 0.0178 (0.0136) | 0.0181 (0.0137) | 0.0211* (0.0127) | 0.0129 (0.0120) |
| Change 5–7: Father stayed in p mental health | 0.0429** (0.0184) | 0.0080 (0.0161) | 0.0177 (0.0155) | 0.0189 (0.0150) |
| Age 5yrs-11yrs: Parents split | 0.0246** (0.0101) | 0.0088 (0.0096) | 0.0528*** (0.0100) | 0.0394*** (0.009) |
| Age 5yrs-11yrs: Parents joined | 0.0275 (0.0325) | −0.0600*** (0.0231) | −0.0392** (0.0198) | 0.0497 (0.0328) |
| Age 5yrs-11yrs: Lone parent both waves | 0.0334*** (0.0088) | 0.0344*** (0.0091) | 0.0624*** (0.0087) | 0.0604*** (0.0087) |
| Observations | 10,391 | 10,192 | 9,912 | 9,872 |
| R-squared | 0.026 | 0.017 | 0.035 | 0.024 |

*** p<0.01,

** p<0.05,

* p<0.1