

Maternal Attachment and Child Outcomes

A review of associations using the Millennium Cohort Study data



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Commissioned by the Parent-Infant Foundation

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About the Author – Stephen McKay

Stephen McKay is a social researcher with a career spanning over three decades in academia. He was appointed Professor of Social Research at the University of Birmingham (2007–2013), where he served as Director of the ESRC Doctoral Training Centre from 2010 and played a key role in Birmingham's Third Sector Research Centre. In 2013, he became the inaugural Distinguished Professor of Social Research at the University of Lincoln, where his expertise encompassed social research, inequality, family policy, quantitative methods, social security, and pensions.

McKay's academic output includes co-authoring *Social Security in Britain* (Palgrave Macmillan, 1999) with Karen Rowlingson. His research has shaped policy debates on family and social welfare through notable works such as *Child Maintenance: How Much Should the State Require Fathers to Pay When Families Separate?* (Family Law, 2013), *Child Support Judgments: Comparing Public Policy to the Public's Policy* (University of Cambridge, 2014), and *Levels of Financial Capability in the UK* (Public Money & Management, 2007). More recent contributions include studies on social impacts during the COVID-19 pandemic, such as *Has Lockdown Strengthened Marriages?* (2020) and *Parents in Lockdown* (2020).

Disclaimer

This report has been prepared by Stephen McKay. While every effort has been made to ensure the accuracy and reliability of the information presented, the author accepts full responsibility for any errors, omissions, or inaccuracies that may be contained within this document. The opinions expressed herein are those of the author and do not necessarily reflect the views of any affiliated organisations or partners.

About the Parent-Infant Foundation

We are the Parent-Infant Foundation. Our vision is of a UK in which all parents and carers are supported to create sensitive, nurturing relationships with their babies, to lay the foundation for lifelong mental and physical health.

Not everyone bonds easily with their baby. Parents can be overwhelmed by trauma from their own childhood. Some are struggling with mental or physical health problems.

More than one in ten babies in the UK is thought to be living in fear and distress.

We are the only national charity proactively supporting the growth and quality of parent-infant teams, across the UK. Because every baby deserves a good start in life.

Find out more at [Parent-Infant Foundation](#)

About the Report

In autumn 2024, the Parent-Infant Foundation commissioned Stephen McKay to examine how findings from the Millennium Cohort Study (MCS) could demonstrate connections between early parent-infant relationships and various child outcomes in the UK.

The MCS used a shortened version of the Maternal Postnatal Attachment Scale (MPAS) to assess mother-to-infant attachment in the first 9 months.

The analysis focuses on how mother-to-infant attachment is associated with outcomes such as behavioural difficulties, food-related behaviours, enjoyment of school, and self-reported health.

The study did not collect other parent-infant relationship-related data, so we are unable to explore the impact of relationships with other carers such as dads.

The report also explores an economic valuation and the potential societal monetary benefits of improved mother-to-infant attachment.

Foreword

We'd like to thank all the mothers, and their babies, who kindly took part in the Millennium Cohort Study. Their selfless contributions enabled us to investigate the potential economic value of supporting parent-infant relationships. In summary, this report estimates supporting parent-infant relationships would deliver at least £900m benefit each year. And this doesn't include the estimated additional £8.1bn value that could also be realised by improving perinatal mental health, as previous research has shown.

People who plan and commission parent-infant teams and services understand the fundamental importance of early relationships but have flagged the need for more economic data to justify investing in services. This is what led us to commission this piece of research and is the first step in wider piece of research into the economic value of parent-infant teams. It was made possible by sponsorship from the Barbara and Stanley Fink Foundation and expertly delivered by Stephen McKay. We are grateful to both.

To date, very few studies have used the Millennium Cohort Study data on maternal attachment to identify associations with childhood outcomes. So, this report breaks exciting new ground. Whilst working up an economic value, Steve uncovered several strong statistical relationships, which suggests there is likely to be an effect between maternal attachment and childhood outcomes. It shows the importance of these very early parent-infant relationships, but like many statistical analyses, it leaves us too with many questions. So, while we are excited to be able to add to the current evidence base, we have highlighted too several important future research questions.

For instance, Steve's analysis finds that levels of maternal attachment appear to be associated with; children's behavioural difficulties at age 3, as measured by the Strengths and Difficulties Questionnaire (SDQ); fewer concerns about language development and better potty-training. There were also several beneficial associations as the babies grow up.

However, he did not find associations with other childhood developmental outcomes. And it is important to note Steve's caution that the shortened version of the tool used to determine levels of maternal attachment, with only six questions asked of mothers, reduces its reliability. This may account for the unexpected finding that mothers aged 20-24 years appeared to have the highest maternal attachment scores.

To build on these findings and begin to answer some of the questions that have arisen during this analysis, we plan further research in the years ahead. We look forward to exploring this subject further with parents (not just mums but dads and partners too – everyone has a role to play), carers, babies and the practitioners and professionals who work with families.

With thanks,



Keith Reed
CEO
Parent-Infant Foundation



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Executive summary

This report investigates maternal attachment (also referred to as mother-to-infant attachment) and its association with various child outcomes in the UK, using data from the Millennium Cohort Study (MCS).

The MCS used six questions from the Maternal Postnatal Attachment Scale (MPAS) developed by Condon,¹ to measure mother-to-infant attachment.

It is a different construct to infant attachment. However, there are correlations between the two, in that a stronger score of maternal attachment is linked with the development of a secure attachment style in the infant.

Mother-to-infant attachment describes the bond that develops between a mother and her baby. It is a different construct to infant attachment, which is assessed by behavioural observation of young children.

Key findings are summarised below.

Maternal attachment is significantly associated with children's behavioural difficulties at age 3, as measured by the Strengths and Difficulties Questionnaire (SDQ). Higher maternal attachment scores are correlated with lower SDQ scores, indicating fewer behavioural problems. This association remains robust even after adjusting for socio-economic and demographic factors. Regression analysis reveals that children in the lowest maternal attachment quintile (20%) experience approximately 1.5 more behavioural issues than those with middle-range scores.

Strong maternal attachment is linked to healthier prenatal behaviours, such as higher rates of alcohol abstinence during pregnancy. At age 3, higher maternal attachment scores are associated with fewer parental concerns about language development and better potty-training outcomes. However, no significant associations are observed between maternal attachment and children's weight classifications or hospital admissions, or measles, mumps, and rubella (MMR) vaccination rates.

There is a highly significant association between maternal attachment and the likelihood of parents eating with their child in the evenings. The proportion increases steadily across maternal attachment quintiles, from 79.7% in the lowest quintile compared with an overall average of 81.7%. The proportion of children who eat most things increases with higher maternal attachment, from 43.9% in the lowest quintile to 50.7% in the highest quintile, with an overall average of 47.8%. The proportion of 'fussy eaters' was highest (at 22.3%) where maternal attachment was lowest.

¹ John T. Condon & Carolyn J. Corkindale (1998) The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument, *Journal of Reproductive and Infant Psychology*, 16:1, 57–76, DOI: 10.1080/02646839808404558

By age 11, children of mothers with stronger maternal attachment scores are more likely to enjoy school, have someone ensure homework completion, and follow regular bedtimes on school nights. No significant relationship is observed between maternal attachment and the perceived likelihood of the child attending university.

There was a statistically significant association between maternal attachment and children's self-reported quality of health. The proportion of children reporting 'excellent health' increases with higher maternal attachment, from 60.2% in the lowest quintile to 63.8% in the middle quintile.

Previous research suggests that interventions to improve early child development yield high economic returns, supporting the importance of interventions that support the parent-infant relationship, and in so doing impact positively on child development. Overall, we arrive at valuations of benefits of around £2,500 for having a level of mother-to-infant attachment in the upper half of the spread, compared to the lower half of the distribution. A higher figure of around £5,000 would result from avoiding the lowest levels on just one of the six questions being used to measure maternal to child attachment (the one on annoyance). These figures are likely to be under-estimates.

To better determine the economic impact, some kind of experimental study would be the 'gold standard' of research evidence. That is, randomly assigning parents to an intervention designed to increase mother-to-infant attachment, calculating the difference, and the effect on later outcomes. They would still need to be monetised, but there are established methods for doing so.

Introduction

This report investigates maternal attachment (also referred to as mother-to-infant attachment) and its association with various child outcomes in the UK, using data from the Millennium Cohort Study (MCS).

The MCS is a longitudinal study that follows a large sample of children born in the UK from 2000 to 2002. The study has collected data on a wide range of topics, including maternal attachment, child development, education, health, and well-being.

The MCS used six questions from the Maternal Postnatal Attachment Scale (MPAS) developed by Condon² which measures mother-to-infant attachment. Research comparing adolescent outcomes with this shorter set of questions on maternal attachment using MCS (Reyes, Hargreaves and Creese, 2021), found a high Cronbach's alpha of 0.82. This suggests that the shortened scale is reliable for analyses of this kind.

Mother-to-infant attachment describes the bond that develops between the mother and her baby. It is a different construct to infant attachment which is assessed by behavioural observation of young children. However, there are correlations between the two, in that a stronger score of maternal attachment is linked with the development of a secure attachment style in the infant.

The analysis focuses on how maternal attachment, as measured by the six questions from the Maternal Postnatal Attachment Scale (MPAS), is associated with outcomes such as behavioural difficulties, school readiness, school attendance, mental health, hospital admissions, contact with the police, and academic attainment.

The analysis uses various statistical techniques, including regression analysis, to examine these relationships while controlling for other factors that may influence child outcomes. The piece also discusses the application of cost-benefit analysis (CBA) as an economic framework for evaluating social programmes and interventions related to maternal attachment. To systematically examine the relationship between maternal attachment and potential health outcomes, we employed a quintile-based segmentation approach. Specifically, we divided the maternal attachment measure into five equal groups ('quintiles'), with particular emphasis on the bottom quintiles representing the most vulnerable subgroups.

² John T. Condon & Carolyn J. Corkindale (1998) The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument, *Journal of Reproductive and Infant Psychology*, 16:1, 57–76, DOI: 10.1080/02646839808404558

Methods

Data

Millennium Cohort Study. These children were all born from 2000 to 2002. The parents were surveyed when the child was 9 months old, then at age 3, 5, 7, 11, 14, and 17 (to date).

Statistical methods

Choosing the appropriate statistical regression model depends on the type of dependent variable, in particular whether it is continuous or discrete and the measurement scale of the dependent variable. (e.g. categorical or ordinal). Where the dependent variable is measured on a ratio/interval scale, linear regression is the most appropriate, and in practice is also often used when the dependent variable is categorical but takes on a suitable number of values (such as measures of job satisfaction with perhaps 5, 7, or more outcome codes). Discrete outcome variables take on a small number of distinct values, often representing categories (e.g. yes/no responses or ordinal ranks). The appropriate regression models for the discrete outcomes in this report are ordinal models, as the outcomes are a ranking of options (e.g. how likely to vote).

Control variables. A number of control variables will be used in the analysis. These are to capture variation in the outcome that would be expected, on the basis of past research. While the shortened MPAS does not seem to be some kind of surrogate for an advantaged position, it is important to be sure (or as sure as possible) that any association between maternal attachment and the various key outcomes is not due to some other intervening variables that is causally related to both. For our analysis we include variables to capture: age (plus a squared term to allow for non-linear effects), birth weight of the cohort child, housing tenure (related to longer-term well-being and economic resources), whether a single or multiple birth cohort child, nation of the UK, ethnic identity, highest qualification, and income quintile.

Maternal Postnatal Attachment Scale

The MCS selected six questions to use from the full 19 question from the MPAS developed by Condon as part of the first sweep of MCS. These questions have been used to judge the level of mother-to-infant attachment (Johnson, Atkinson & Rosenberg, 2015). An important caveat is that the questions were only asked of 'natural mothers' within MCS, which means that the analysis must be based on biological mothers giving interviews in sweep 1 of MCS.

The questions begin with this introduction: 'The next questions are about the different sorts of feelings parents might have when caring for young children. For each one please say which is closest to how you feel.' Below, in Table 1, we report the overall proportions and numbers of biological mothers giving each reply. These results suggest that while the majority of respondents feel confident, patient, and rarely resentful when caring for their

child, a smaller group does experience occasional annoyance, mixed feelings, and sadness. Overall, thinking about the child when not together is very common, and care-giving is generally approached with patience and confidence.

Among the respondents, the majority reported infrequent feelings of annoyance or irritation when caring. Specifically, 48.2% stated they 'very rarely' experienced these feelings, while 27% indicated they 'never' felt annoyed or irritated. A significant portion of respondents frequently thought about their child when they were not with him/her – with close to half (45%) reporting thinking about the children 'almost all the time' when not with him/her. When asked about their emotional response when leaving their child, there were mixed emotions. The biggest group (42.9%) had 'mixed feelings of both sadness and relief' but a smaller group (3%) said that they 'often feel rather relieved'. Respondents overwhelmingly felt confident in their ability to care, with 70.4% saying that they felt 'very competent and confident' and only 1.5% reported that they felt 'very incompetent and lacking in confidence'.

The last two questions concerned patience and resentment. Most caregivers described themselves as patient, with 46.9% saying that they are 'extremely patient', with a further 44.4% self-describing as 'fairly patient'. However, small numbers reported impatience – 4% 'a bit impatient' and about the same number (3.6%) being 'very impatient'. The overwhelming majority did not resent having to give up things because of their child (80%). By contrast, 14.6% said they 'resent it a bit'.

Table 1: Questions for the Maternal Attachment Scale in MCS1

First, when I am caring for ^Jack³, I get feelings of annoyance or irritation...	Per cent	Number
1 almost all the time	0.5	116
2 very frequently	0.9	193
3 frequently	1.8	335
4 occasionally	20.8	3521
5 very rarely	48.2	8333
6 never	27.0	5192
7 Can't say	0.8	173
Total	100.0	17863
When I am not with ^Jack, I find myself thinking about ^him...	Per cent	Number
1 almost all the time	45.4	8673
2 very frequently	27.1	4590
3 frequently	17.8	2942
4 occasionally	7.5	1191
5 very rarely	0.8	143
6 never	0.2	50
7 Can't say	1.2	276
Total	100.0	17865
When I have to leave ^Jack...	Per cent	Number
1 I always feel rather sad	19.1	3662
2 I often feel rather sad	25.8	4621
3 I have mixed feelings of both sadness and relief	42.9	7398
4 I often feel rather relieved	3.0	549
5 I always feel rather relieved	0.2	48
6 Can't say	8.9	1574
Total	100.0	17852
When I am caring for ^Jack, I feel...	Per cent	Number
1 very incompetent and lacking in confidence	1.5	370
2 fairly incompetent and lacking in confidence	1.3	259
3 fairly competent and confident	25.4	4445
4 very competent and confident	70.4	12473
5 Can't say	1.4	310
Total	100.0	17857
Usually, when I am with ^Jack...	Per cent	Number
1 I am very impatient	3.6	714
2 I am a bit impatient	4.0	727
3 I am fairly patient	44.4	7791
4 I am extremely patient	46.9	8382
5 Can't say	1.1	244
Total	100.0	17858
Regarding the things that ^we⁴ have had to give up because of ^Jack...	Per cent	Number
1 I find that I resent it quite a lot	0.9	203
2 I find that I resent it a fair amount	1.1	264
3 I find that I resent it a bit	14.6	2503
4 I don't resent it at all	80.0	14213
5 Can't say	3.3	675
Total	100.0	17858

Analysis of MCS1. Weighted by AOVWT2.

³ In the self-completion questionnaire, ^Jack is replaced with the child's name.

⁴ In the self-completion questionnaire, ^we is 'we' if living with a partner or 'I' if not living with a partner.

The measure of maternal attachment used in this report is formed by recoding these six questions and forming a total, following original research by Condon and Corkindale (1998) in the Australian context. The original research used 19 questions rather than the six available in MCS1. Of the six questions in MCS, two are reverse-scored (so lower scores represent higher maternal attachment), while the other four are positively scored (higher scores representing higher maternal attachment). They have a range of different response codes, either 6, 5 or 4. In practice, the questions are coded between 1 and 5, so that 5 represents the highest attachment and 1 the lowest attachment, and then summed. Hence, the MPAS score has a theoretical minimum of 6 (scoring 1 for each question) and a theoretical maximum of 30 (scoring 5 for each question).

When Condon and Corkindale (1988) conducted their research, their scale of 19 questions could therefore give rise to a range from 19 to 95 (i.e. from 19×1 to 19×5). In practice, most respondents have a high level of maternal attachment and the lower scores they found tended to be around 60.

One research choice is how to treat the missing values for each question to which mothers responded with the 'Can't say' option. Analysts may elect to recode them to another value, indicating higher or lower levels of attachment, or to exclude them from the analysis entirely. The more cautious option is to exclude such cases, and that is generally the approach followed here, though with sensitivity testing of this important research decision.

The total scores are compared in Table 2. The first row shows complete data, and the mean of 25.6 suggests generally high maternal attachment scores (given the maximum is 30), with a range from 10.8 and with a sample size of 15,300 cases (natural mothers in MCS1). The second row is where missing values were coded as worst-case scores. This generated only a slightly lower mean (25.2) as expected due to missing values being coded as worst scores, and a lower minimum (9.2). By recording the missing data, there is a larger sample size (17,167), although this additional number may reduce when analysing other data that is also subject to missingness.

Table 2: Overall measures of mother-to-infant attachment

Measure	Mean	Std Dev	Min	Max	N cases (mothers)
Mother-to-infant attachment – complete data	25.6	0.033	10.8	30	15,300
Mother-to-infant attachment – with 'missing' coded as worst outcome	25.2	0.035	9.2	30	17,167

Analysis of MCS1. Weighted by AOVWT2.

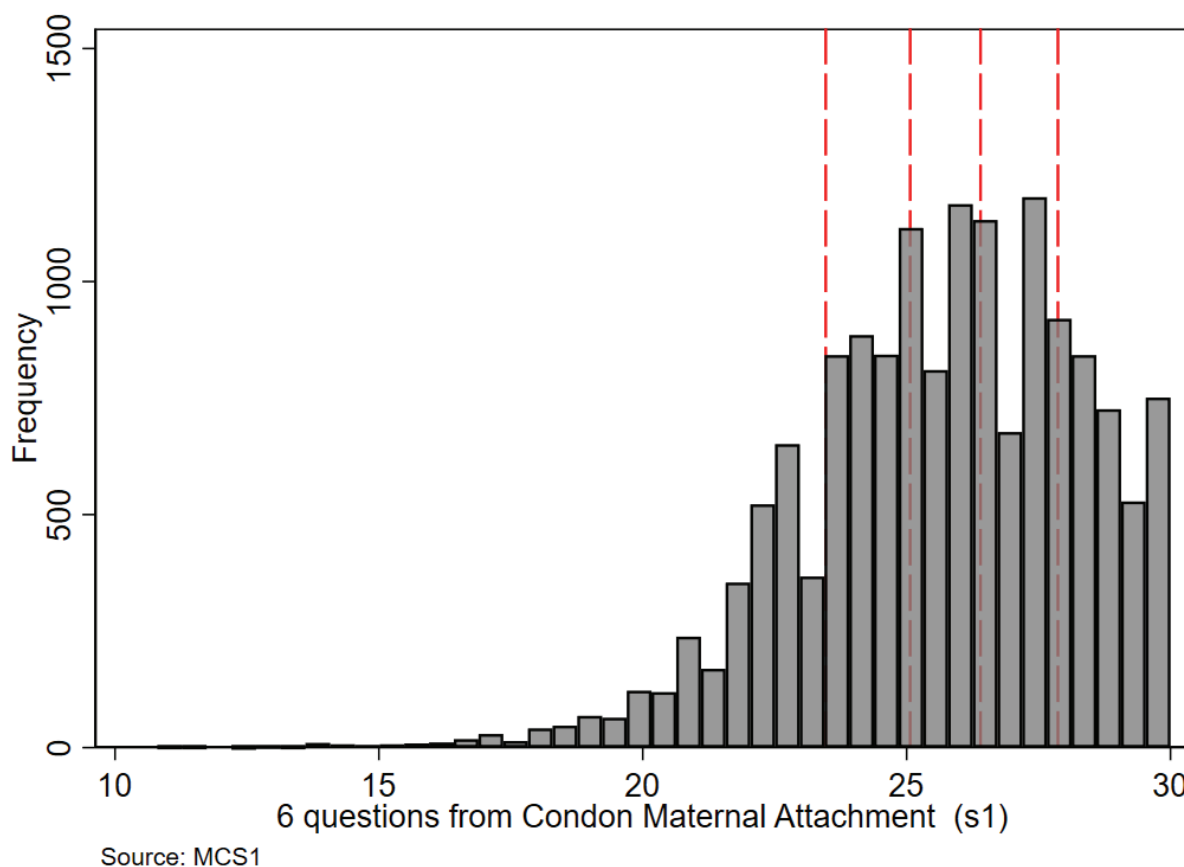
The spread of scores is then shown in **Error! Reference source not found..** The histogram depicts the distribution of the six-question extract from the Condon Maternal Attachment

measure with a range from 10.8 to 30 on the x-axis. The y-axis represents the frequency of occurrences. The distribution shows a clear right skew, with a noticeable concentration of values around the 24 to 28 range, suggesting that most participants scored relatively highly on maternal attachment measure. There were fewer lower scores (below 20). These results are as expected and mirror other work with the MPAS measure (particularly Condon and Corkindale, 1988). The red dashed lines split the distribution into five groups of equal size (quintiles).

To examine the relationship between mother-to-infant attachment and potential health and social outcomes, we employed a quintile-based segmentation approach. Specifically, we divided the maternal attachment style measure into five equal groups (quintiles), which enables analysis of the lower and mid-range of the attachment measure. Our interest is in how outcomes change when maternal attachment becomes more like the middle of the range rather than the lower end of the range.

The range of scores in the lowest quintile group is relatively wide, certainly compared to the other groups. In applied work using this scale, it would be important to use the fixed boundaries, rather than retaining a split into five groups, or to identify important threshold points in the distribution. However, those in the bottom two quintiles are of particular interest, as they would likely be the targets of any interventions.

Figure 1: Distribution of maternal scores



One common means of judging the internal consistency or 'reliability' of a sum of a set of questions is calculating a Cronbach's alpha measure. Scores of 0.7 and higher, and ideally 0.8 and higher, are associated with reliable scales. Condon and Corkindale (1998) claim that the scale is reliable, reporting a Cronbach's alpha of 0.78. For the MCS1 data, the overall scale is rather less reliable, partly reflecting the much smaller number of questions (items) used. Research by Reyes, Hargreaves and Creese, 2021 found a reliable level of Cronbach's alpha for the six questions on mother-to-infant attachment, based on a subset of MCS respondents analysed in their study. However, looking only at MCS1 the alpha level was only 0.49, which suggests that the six items may not be measuring the same underlying construct effectively – although this may become more reliable with attrition from MCS in later waves given the Reyes et al. (2021) result. Using the recoded version (where missing data is regarded as indicating the lowest scoring attachment outcome) makes little difference, with an alpha value of 0.48. Nevertheless, despite these issues, this summary of the six available questions is the key measure available to analysts using the MCS data to look at the effects of mother-to-infant attachment.

Results

Associations with maternal attachment

The six-question measure of mother-to-infant attachment is not a proxy for well-being and does not strongly vary with standard measures of well-being, such as family income. Table 3 presents the mean and standard error of mother-to-infant attachment scores across five quintiles of equivalised family income. A few observations can be made. Overall, the differences in mother-to-infant attachment between income quintiles was small. If anything, there was a pattern where such attachment actually *decreased* with rising income. The lowest income quintile (representing the poorest group) had a mean score of 25.67, while the highest quintile (representing the wealthiest group) has a mean score of 25.25. This suggests that mothers from lower income groups report slightly higher mother-to-infant attachment levels compared to those from higher income groups. The standard errors for all quintiles are relatively low, implying that the sample estimates of mean mother-to-infant attachment scores are relatively precise.

Table 3: Values of mother-to-infant attachment by equivalised family income

Income group	Mean	Std error
Poorest quintile	25.67	0.06
Second quintile	25.81	0.06
Third quintile	25.69	0.06
Fourth quintile	25.50	0.06
Richest quintile	25.25	0.07
Total	25.58	0.03

Analysis of MCS1. Weighted by AOVWT2.

Table 4 presents the distribution of mother-to-infant attachment, as measured by the shortened MPAS, across different age groups of mothers. The proportion of mothers with 'low' scores is relatively consistent across age groups, ranging from 18.7% to 25.5%, with the highest prevalence observed among mothers aged 40 and above (25.5%). Similarly, 'mid' scores are evenly distributed, with slight variations across groups, averaging around 19.7%. Interestingly, 'high' scores are most common among mothers aged 20 to 24 (23.5%), while mothers aged 30 to 34 and 35 to 39 report the lowest proportion of high scores (17.8% and 17.1%, respectively). This suggests a modest variation in mother-to-infant attachment levels based on maternal age, with younger mothers in their early twenties demonstrating slightly stronger attachment scores.

Table 4: Values of shortened MPAS by age group

	Age group						Total
	<19	20–24	25–29	30–34	35–39	40	
Low mother-to-infant attachment	22.7%	18.7%	19.0%	22.0%	23.3%	25.5%	21.0%
2	19.5%	18.4%	20.0%	21.9%	20.9%	21.4%	20.5%
Mid level	17.2%	19.6%	19.6%	19.4%	21.2%	19.6%	19.7%
4	21.6%	19.7%	20.9%	18.9%	17.6%	13.6%	19.3%
High mother-to-infant attachment	19.0%	23.5%	20.5%	17.8%	17.1%	19.9%	19.6%

Analysis of MCS1. Weighted by AOVWT2.

Pregnancy and first year

The results shown in Table 5 highlight significant variations in early child and maternal outcomes associated with mother-to-infant attachment, measured by the shortened version of the Maternal Postnatal Attachment Scale. Five groups of maternal attachment are used to explore differences in immunisation rates, antenatal class attendance, drinking behaviours during pregnancy, and current alcohol consumption.

Child Immunisations: The percentage of children who had received all immunisations was very high across all attachment groups, ranging from 94.5% to 96.2%. While the differences between groups were relatively small, they were statistically significant ($p < 0.05$), suggesting that mother-to-infant attachment may have a subtle influence on compliance with immunisation schedules.

Antenatal Class Attendance: The proportion of mothers attending antenatal classes showed no significant variation across attachment groups, with rates consistently around 38%. This indicates that mother-to-infant attachment level, as measured postnatally, does not appear to have affected antenatal class participation (or the reverse, given the time ordering).

Drinking Behaviour During Pregnancy: A *strong* gradient was observed in the percentage of mothers who refrained from alcohol consumption during pregnancy, increasing significantly with higher mother-to-infant attachment levels. The rates ranged from 57.4% in the low attachment group to 77.5% in the high attachment group ($p < 0.001$). This trend underscores the association between mother-to-infant attachment and healthier prenatal behaviours.

Current Alcohol Consumption: The percentage of mothers who identified as non-drinkers at the time of the survey also showed a statistically significant upward trend with mother-to-infant attachment levels. Non-drinking rates increased from 15.0% in the low attachment group to 23.3% in the high attachment group ($p < 0.001$).

Difference in Non-Drinking Rates: The difference between the proportion of mothers who refrained from drinking during pregnancy and those who refrained at the time of the survey was consistently negative across all groups. The gap was largest in the mid and high attachment groups, suggesting that while higher mother-to-infant attachment is linked to healthier behaviours during pregnancy, sustaining these behaviours after the birth may present challenges.

These findings suggest that mother-to-infant attachment has a significant association with certain health-related behaviours, particularly abstinence from alcohol during and after pregnancy. This supports the hypothesis that stronger mother-to-infant attachment could promote healthier lifestyle choices, both prenatally and postnatally. However, the consistent rates of antenatal class attendance across groups suggest other factors may influence this particular outcome.

Table 5: Values of early outcomes by mother-to-infant attachment

	Had all immunisations	Whether attended antenatal classes	Non-drinker in pregnancy	Non-drinker now	Difference
Low attachment	94.7%	38.6%	57.4%	15.0%	-42.4
2	95.0%	38.4%	62.0%	14.0%	-48.0
Mid attachment	96.1%	37.9%	65.3%	15.4%	-49.9
4	96.2%	38.7%	71.8%	16.9%	-54.9
High attachment	94.5%	35.6%	77.5%	23.3%	-54.2
All	95.3%	37.9%	66.6%	16.9%	-49.7
Stat sig	*		***	***	
(p)	0.0122	ns	$p < 0.001$	$p < 0.001$	

Analysis of MCS1. Weighted by AOVWT2.

Table 6 presents data on food-related behaviours in 3-year-olds. The table shows a significant association between the shortened MPAS levels and the timing of introducing solid foods, as well as the attempt to breastfeed. Notably, children of mothers with lower scores (indicating weaker mother-to-infant attachment) were introduced to solid foods slightly later than those with higher scores. Specifically, 23.2% of children with low attachment mothers received solids before 4 months compared to 26.2% in the high attachment group. Similarly, the attempt to breastfeed decreases with increasing attachment scores, with 74.2% of mothers in the low attachment group trying to breastfeed compared to 67.2% in the high attachment group. These differences are statistically significant ($p < 0.001$).

Table 6: Food-related behaviours at age 3 by mother-to-infant attachment

Feeding	Low attachmen t	2 attachmen t	Mid attachmen t	4 attachment	High attachment	All
Solid food introduced:						
before 4 months	23.2	26.3	25.6	28.3	28.1	26.2
4–5 months	70.3	67.7	67.8	66	64.6	67.1
6 months or later	6.5	6	6.6	5.8	8.3	6.7
(*** $p < 0.001$)						
Ever tried to breastfeed (***)	74.2%	71.8%	71.6%	67.9%	67.2%	70.6%
$p < 0.001$)						

Strengths and Difficulties Questionnaire (SDQ), age 3

Total SDQ score – measured by the total score for the SDQ as reported by mother in MCS2 (and is also available in later waves of the survey). The total SDQ score varies (in principle) from 0 to 33, with a threshold dividing children into those with minor difficulties, definite difficulties and severe difficulties. The histogram represented in Figure 2 displays the distribution of total scores on the SDQ for 3-year-olds. The horizontal axis represents the SDQ total difficulties score, ranging from 0 to 33, while the vertical axis shows the frequency of children obtaining these scores. The distribution is skewed, with most children scoring between 5 and 15, peaking around 8 to 10. The number of children scoring higher decreases steadily, with very few reaching scores near 30.

Figure 2: Distribution of SDQ scores at age 3

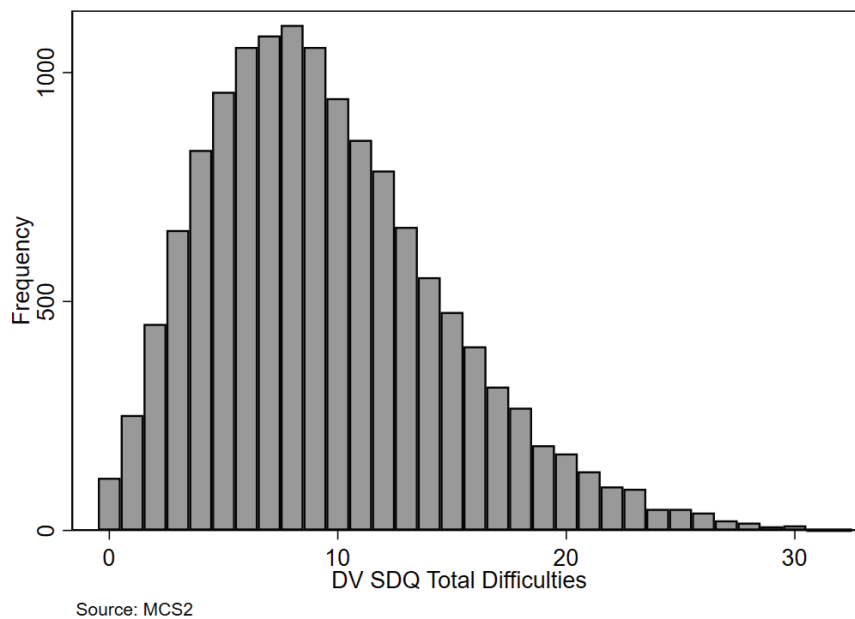
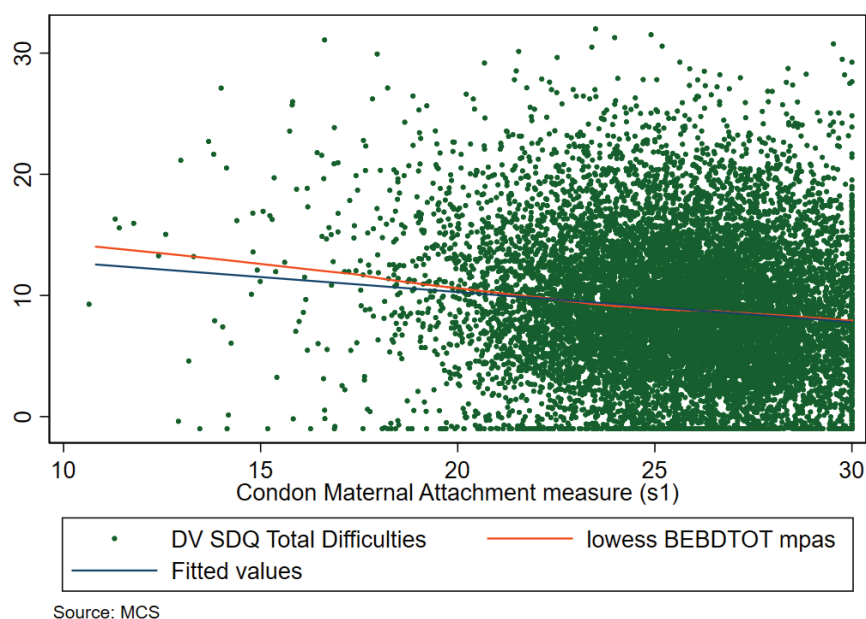


Figure 3: SDQ association with maternal attachment



For our purposes, the interesting question is how the total SDQ score varies with mother-to-infant attachment. The scatterplot in Figure 3 shows the relationship between mother-to-infant attachment scores (measured by six questions from the Condon scale) and children's behavioural difficulties (measured by the SDQ) at age 3. There appears to be a slight negative correlation, suggesting that higher mother-to-infant attachment scores tend to be associated with fewer reported behavioural difficulties in children. The lowest and linear fit lines track quite closely to each other, suggesting the relationship is approximately linear across the range of mother-to-infant attachment scores (10–30).

Another way of showing this information is a table – see below for Table 7. A clear association emerges, where higher levels of mother-to-infant attachment (as indicated by shortened MPAS quintiles) are associated with lower SDQ scores, reflecting fewer difficulties in child behavioural outcomes. Mothers in the lowest attachment quintile reported the highest mean SDQ scores (10.28, SE = 0.136), indicating greater behavioural difficulties among children. In contrast, mothers in the highest attachment quintile had the lowest mean SDQ scores (8.54, SE = 0.140). The overall mean SDQ score across all groups was 9.31 (SE = 0.081). Overall, stronger mother-to-infant attachment was associated with fewer reported behavioural difficulties.

Table 7: Values of SDQ by mother-to-infant attachment group

Attachment group	Mean	Std error
Lowest quintile	10.28	0.136
Second quintile	9.40	0.121
Third quintile	8.96	0.129
Fourth quintile	8.94	0.128
Highest quintile	8.54	0.140
Total	9.31	0.081

Analysis of MCS2.

The next step is to develop a statistical model of the key outcome (SDQ) and consider how it is affected by the mother-to-infant attachment measure, and by a range of other variables. The results from such a model, based on linear regression, are shown in Table 8. The results suggest that mother-to-infant attachment has a significant relationship with child behavioural difficulties. Socio-economic factors also play a substantial role in explaining variation in child behaviour, but without reducing the effect of mother-to-infant attachment. Overall, the negative coefficients for the lower levels of mother-to-infant attachment, both in the simpler and fuller models, indicate that higher mother-to-infant attachment scores are associated with fewer behavioural difficulties. This relationship remains significant even after controlling for numerous socio-demographic factors, and indeed is larger than looking at mother-to-infant attachment alone. The effect is statistically significant at the 0.1% level. In terms of practical application, this would mean that those in the lowest 20% of attachment scores experienced 1.5 more problems than those with a middling score, while the next 20% to 40% had 0.5 more problems. Interestingly the middle and fourth quintiles had quite similar results.

There were, unsurprisingly, also strong associations between several of the socio-economic factors and the degree of behavioural issues as recorded in the SDQ. Renters from local authorities (and housing associations) showed significantly higher difficulties (+1.1 problems) compared to mortgage holders. With education, a clear gradient exists: more highly qualified mother, lower level of SDQ total score. The overall model fit (R^2) increased from 0.014 to 0.15 when adding controls.

Table 8: Regression model of SDQ total difficulties (age 3) and mother-to-infant attachment

	Mother-to-infant attachment only b	Full model b
Six-question measure of mother-to-infant attachment, in five groups		
q1	1.3202***	1.5236***
q2	0.4379**	0.5086***
Mid	0	0
q4	-0.0318	-0.24
q5	-0.4229*	-0.8795***
Respondent age at interview		-0.4297***
Age-squared		0.0057***
Birth weight		-0.2231*
Own outright		-0.1589
Own - mortgage/loan		0
Rent from local authority		1.0619***
Rent privately		0.3661
Living with parents		0.1668
Other		0.8791
One baby		0
Twins		-0.3811
England		0
Wales		-0.2347
Scotland		-0.4107**
NI		-0.7811***
White		0
Mixed		0.6682
Indian		0.6849
Pakistani and Bangladeshi		1.8462***
Black or Black British		-0.2009
Other Ethnic group (inc. Chinese, other)		0.7089
NVQ level 1		1.0662***
NVQ level 2		0.3172
NVQ level 3		0
NVQ level 4		-0.6269***
NVQ level 5		-0.8263**
Overseas qual only		0.597
None of these		1.8127***
Missing		1.3005***
Lowest income quintile		0.7461***
Second quintile		0.4716**
Third quintile		0
Fourth quintile		-0.5186***
Highest income quintile		-0.8461***
Constant	8.9598***	24.4576***
R-squared	0.0142665	0.146478
Observations	11899	11877

* p<0.05, ** p<0.01, *** p<0.001

In Table 9 we show the average number of SDQ difficulties associated with each particular question.

1. Feelings of Annoyance or Irritation While Caring for the Child. The results indicate a strong negative relationship between mother-reported annoyance and SDQ total difficulties. Mothers who report feeling annoyed 'almost all the time' show the highest SDQ score (13.3), while those who report 'never' feeling annoyed have the lowest score (8.6). The coefficients show a clear decreasing trend, with statistically significant negative values ($p < 0.001$), suggesting that lower levels of annoyance are associated with fewer child difficulties. The R^2 value of 2.1% indicates that while this factor has a small explanatory power, it is a meaningful predictor.
2. Thinking About the Child When Apart. The results here exhibit a less clear pattern. Mothers who think about their child 'almost all the time' report a higher SDQ score (10.0), but the coefficients are not statistically significant except for the category 'can't say' ($p < 0.05$). The baseline category ('frequently') shows an SDQ score of 8.8. The R^2 value of 0.9% suggests that this variable explains very little variance in child difficulties.
3. Feelings When Leaving the Child. Mothers who feel sad when leaving their child show lower SDQ scores. Those who 'always feel rather sad' have an SDQ score of 9.8, while those who 'always feel rather relieved' report a slightly higher score (10.1). The significant negative coefficients ($p < 0.001$) for feelings of sadness suggest that a greater emotional connection to the child may be linked to fewer behavioural difficulties. However, the R^2 value of 0.8% indicates relatively low explanatory power.
4. Feelings of Competence While Caring for the Child. A notable pattern emerges in this section, with mothers reporting greater competence ('very competent and confident') having lower SDQ scores (8.9), compared to those feeling 'fairly competent' (10.0) or 'very incompetent' (12.6). The coefficient for the most competent group is significantly negative ($p < 0.001$), reinforcing the idea that higher maternal confidence correlates with fewer child difficulties. The R^2 value of 1.6% suggests a reasonable explanatory contribution.
5. Patience While with the Child. Mothers who report being 'extremely patient' have the lowest SDQ score (8.6), while those feeling 'a bit impatient' report a higher score (12.1). The coefficient analysis shows that greater patience is associated with fewer difficulties, with significant negative effects for the 'very impatient' and 'extremely patient' categories. The R^2 value of 2.1% suggests a moderate contribution of maternal patience to child outcomes.
6. Resentment Over Sacrifices Made for the Child. Mothers who report resenting sacrifices 'a lot' have the highest SDQ score (13.0), while those who 'don't resent it at all' show the lowest score (9.0). The coefficient analysis confirms a significant negative relationship between lower resentment and fewer difficulties ($p < 0.001$). The R^2 value of 1.7% suggests a small but notable contribution.

Overall, the findings suggest that mothers' emotional responses and perceptions of competence are significantly related to child behavioural difficulties. Lower levels of annoyance, higher competence, patience, and lower resentment are associated with fewer difficulties. However, the relatively low R^2 values indicate that while these factors contribute to understanding SDQ scores, other influences are also at play. The questions about becoming annoyed and remaining patient seemed to be most strongly associated with later SDQ outcomes.

Table 9: Average number of SDQ total difficulties (age 3) by individual questions for mother-to-infant attachment

First, when I am caring for ^Jack⁵, I get feelings of annoyance or irritation... Model R² = 2.1%			Mean	Coefficient
1 almost all the time			13.3	-2.606***
2 very frequently			12.9	-0.155***
3 frequently			12.9	baseline
4 occasionally			10.2	-2.629***
5 very rarely			9.0	-3.618***
6 never			8.6	-4.239***
7 Can't say			12.8	-2.163***
When I am not with ^Jack, I find myself thinking about ^him... Model R² = 0.9%			Mean	Coefficient
1 almost all the time			10.0	0.96ns
2 very frequently			8.6	-0.17***
3 frequently			8.8	baseline
4 occasionally			8.8	-0.08***
5 very rarely			10.5	1.287ns
6 never			11.3	0.764ns
7 Can't say			10.4	0.01*
When I have to leave ^Jack... Model R² = 0.8%			Mean	Coefficient
1 I always feel rather sad			9.8	-0.183***
2 I often feel rather sad			8.6	-0.967***
3 I have mixed feelings of both sadness and relief			9.6	baseline
4 I often feel rather relieved			10.3	0.541ns
5 I always feel rather relieved			10.1	0.026*
6 Can't say			8.7	-1.257***
When I am caring for ^Jack, I feel... Model R² = 1.6%			Mean	Coefficient
1 very incompetent and lacking in confidence			12.6	1.17ns
2 fairly incompetent and lacking in confidence			12.9	2.566ns
3 fairly competent and confident			10.0	baseline
4 very competent and confident			8.9	-0.964***
5 Can't say			13.7	2.545ns
Usually when I am with ^Jack... Model R² = 2.1%			Mean	Coefficient
1 I am very impatient			9.9	-0.323***
2 I am a bit impatient			12.1	1.996ns
3 I am fairly patient			9.7	baseline
4 I am extremely patient			8.6	-1.054***
5 Can't say			11.7	1.026ns
Regarding the things that ^we⁶ have had to give up because of ^Jack... Model R² = 1.7%			Mean	Coefficient
1 I find that I resent it quite a lot			13.0	1.016ns
2 I find that I resent it a fair amount			13.2	1.517ns
3 I find that I resent it a bit			10.2	baseline
4 I don't resent it at all			9.0	-1.323***
5 Can't say			11.4	-0.24***

Analysis of MCS1. Weighted by AOVWT2.

⁵ In the self-completion questionnaire, ^Jack is replaced with the child's name.

⁶ In the self-completion questionnaire, ^we is 'we' if living with a partner or 'I' if not living with a partner.

Health of cohort children, age 3

Table 10 below predominantly reports non-significant (ns) findings, which suggests a lack of strong association between the levels of mother-to-infant attachment and the specified child health outcomes. Most health outcomes show consistent percentages across the attachment categories, suggesting limited variability. For example, 'eyesight problems', 'hearing problems', and 'longstanding health condition' exhibit very similar values across all groups, which reinforces the lack of significance. One possible exception was reports of asthma, which had a marginally significant p-value ($p = 0.039$), with higher reports of asthma among those with a higher level of maternal attachment at wave 1. However, the results were not particularly strong.

Table 10: Health of child at age 3

Health	Low attachment	2	Mid attachment	4	High attachment	All
Eyesight problems (ns)	7.2%	5.9%	6.6%	6.3%	6.7%	6.6%
Hearing problems (ns)	4.9%	4.7%	4.4%	4.7%	4.6%	4.7%
Longstanding health condition (ns)	15.4%	16.5%	15.1%	17.3%	15.7%	16.0%
Eczema/hay fever (ns)	38.9%	38.4%	36.7%	36.4%	35.7%	37.3%
Wheezing in the chest (ns)	31.8%	31.5%	30.1%	31.4%	30.0%	31.0%
Asthma (* $p=0.039$)	11.2%	11.6%	11.4%	12.4%	13.3%	12.0%

Table 11 provides summaries of the health-related behaviours of children at age 3 by quintiles of mother-to-infant attachment.

Concerns About Language: There is a statistically significant association between maternal attachment and concerns about language development ($p = 0.0008$). The prevalence of language concerns decreases progressively across the quintiles, from 16.2% in the lowest attachment quintile to 11.8% in the highest quintile. The overall prevalence is 13.5%.

Number of Accidents: The average number of accidents reported does not significantly vary across attachment quintiles (ns). The mean number of accidents ranges narrowly from 0.46 to 0.49, with an overall average of 0.48.

Hospital Admissions: Hospital admissions, both in terms of occurrence and average number, show no significant differences across mother-to-infant attachment levels. Around 18% of children experienced hospital admissions across all quintiles, with an average number of admissions ranging from 0.27 to 0.33.

Potty Training (Daytime Cleanliness): The proportion of children consistently clean during the day shows a significant relationship with mother-to-infant attachment ($p = 0.0013$). This proportion increases steadily from 82.3% in the lowest attachment quintile to 85.7% in the fourth quintile, before slightly declining to 84.4% in the highest quintile. The overall average is 83.8%.

MMR Vaccination: The proportion of children who had received the MMR vaccine was high across all groups, with no significant variation by mother-to-infant attachment quintile. Coverage ranges from 92.7% to 93.9%, with an overall average of 93.4%.

The data suggest that higher mother-to-infant attachment levels are associated with reduced concerns about language development and greater success in daytime potty training. These findings underscore the potential influence of mother-to-infant attachment on developmental milestones in early childhood. Conversely, no significant associations were observed for accidents, hospital admissions, or MMR vaccination uptake, indicating these behaviours may be less influenced by variations in mother-to-infant attachment. The survey also experienced rather higher levels of MMR uptake (though not quite universal levels) than has more recently been the case.

Table 11: Health-related behaviours at age 3

Health	Low attachment	2 attachment	Mid attachment	4 attachment	High attachment	All
Concerns about language (** p=0.0008)	16.2%	13.3%	12.7%	12.9%	11.8%	13.5%
No. of accidents (ns)	0.49	0.47	0.46	0.49	0.47	0.48
Any hospital admissions (ns)	17.0%	18.6%	18.2%	18.5%	17.5%	18.0%
Avg number (ns)	0.28	0.27	0.27	0.27	0.33	0.29
Potty training: always clean during day (** p= 0.0013)	82.3%	82.6%	84.3%	85.7%	84.4%	83.8%
Had MMR (ns)	92.7%	93.6%	93.6%	93.1%	93.9%	93.4%

Maternal mental health

The MCS asks a number of questions about the status of the mother. Table 12 presents the prevalence of depression and anxiety among mothers, stratified by levels of mother-to-infant attachment (measured by the shortened six-question version). The results are shown for two time points: wave 1 (when the baby was 9 months old) and wave 2 (when the child was 3 years old). All cross-tabulations were statistically significant at the 1% level or higher.

Overall, the prevalence of mothers ever diagnosed with depression or serious anxiety decreases with higher levels of maternal attachment. Similarly, the proportion of mothers currently being treated for depression or anxiety decreases with increasing maternal attachment. There is an overall increase in the proportion of mothers reporting a lifetime diagnosis between wave 1 and wave 2, while the proportion currently being treated remains relatively stable.

These findings may highlight a protective effect of strong maternal attachment on maternal mental health outcomes over time. However, parental mental health and parent-infant relationships are generally understood to be bidirectionally linked, meaning that they affect each other. Alternatively, there might be one or other factors that impact on both maternal attachment and mental health (such as socio-economic status).

More research is required that can more precisely explore the causal pathways. However, these associations are consistent with the idea that interventions targeting attachment and parental mental health could yield significant benefits for mothers, children, and families with long-term societal advantages.

Table 12: Depression among mothers, by mother-to-infant attachment
[column percentages]

Health	Low attach- ment	2	Mid attach- ment	4	High attach- ment	All
Wave 1 (baby at 9 months)						
Whether ever diagnosed with depression/ serious anxiety	29.4	25.4	22.4	24.3	21.7	24.7
Currently being treated	10.5	9.3	8.6	8.7	6.8	8.8
Wave 2 (child at 3 years)						
Whether ever diagnosed with depression/ serious anxiety	33.2	30.3	27.0	27.8	25.8	29.0
Currently being treated	9.0	9.0	7.2	6.9	7.0	7.9

All cross-tabulations statistically significant at the 1% level or higher.

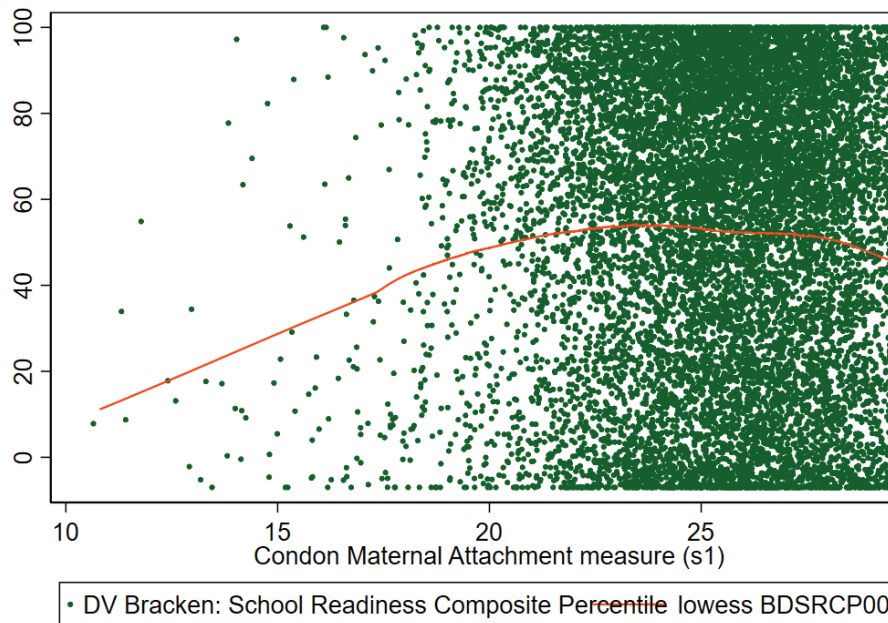
Bracken school readiness measure

The Bracken School Readiness Assessment evaluates children's knowledge of basic concepts considered important for early academic learning. In the Millennium Cohort Study, the assessment was administered when the children were 3 years old (in 2003–2004). The child is shown various pictures and asked to point to or identify specific items that demonstrate their understanding of these basic concepts.

However, there was not a strong or consistent relationship between maternal attachment and the Bracken measure of school readiness (see Figure 4 below) There was, perhaps, some evidence of lower readiness at the lowest levels of maternal attachment. However, in

the denser parts of the distribution the relationship was less clear, and perhaps even negative at higher levels of attachment.

Figure 4: School readiness association with maternal attachment



This was further investigated with regression models. The fuller models tended to find strong associations between socio-economic background and school readiness. However, there was not any statistically significant association with the summary measure of mother-to-infant attachment.

Weight of cohort children

The results in Table 13 examine the relationship between mother-to-infant attachment and children's weight classifications at wave 2 (normal weight, overweight, and obese). Across all levels of mother-to-infant attachment – low, mid, and high – the proportions of children classified as normal weight, overweight, and obese show quite limited variation.

Normal Weight: The majority of children were classified as having normal weight, with percentages ranging narrowly from 76% to 79% across maternal attachment groups.

Overweight and Obesity: The proportion of children classified as overweight fluctuates between 16% and 20%, while the percentage of those classified as obese remains consistently low, between 4% and 6%.

The results are not statistically significant, indicating no meaningful association between

mother-to-infant attachment levels and children's weight classifications at wave 2. This lack of variation

suggests that factors other than mother-to-infant attachment are likely to play a more prominent role in influencing children's weight outcomes.

Table 13: Weight classification at wave 2 (age 3), by mother-to-infant attachment

MPAS	Normal weight	Overweight	Obese	Total
Low attachment	79%	16%	5%	100%
2	76%	20%	4%	100%
Mid attachment	76%	19%	5%	100%
4	76%	18%	5%	100%
High attachment	78%	17%	6%	100%
All	77%	18%	5%	100%

Results not statistically significant.

The data presented in Table 14 shows the distribution of weight classifications among children at age 11 (Wave 5), categorised by levels of mother-to-infant attachment. The percentages reflect the proportion of children within each maternal attachment category who fall into normal weight, overweight, or obese classifications. Notably, there is a pattern suggesting that as maternal attachment scores increase from low to high, the percentage of children classified as normal weight decreases, while the percentages of children classified as overweight or obese generally increase. Children from the lowest maternal attachment group showed the highest percentage of normal weight (77.2%) and the lowest percentage of obesity (4.7%).

Table 14: Weight classification at wave 5 (age 11), by mother-to-infant attachment

MPAS	Normal weight	Overweight	Obese	Total
Low attachment	77.2	18.0	4.7	100%
2	72.3	22.1	5.6	100%
Mid attachment	75.1	20.3	4.6	100%
4	72.7	20.2	7.0	100%
High attachment	70.4	22.4	7.3	100%
All	73.7	20.5	5.8	100%

Results statistically significant at 0.1% level.

Family meals and eating – age 7

Table 15 presents the relationship between levels of mother-to-infant attachment and various food- and eating-related outcomes for children at age 7. There is a highly significant association between mother-to-infant attachment and the likelihood of parents eating with their child in the evenings ($p < 0.001$). The proportion increases steadily with higher levels of mother-to-infant attachment, from 79.7% in the lowest quintile to 86.1% in the highest quintile, with an overall average of 81.7%. There was no significant link with eating breakfast. However, the proportion of children who eat most things increases with higher mother-to-infant attachment, from 43.9% in the lowest group to 50.7% in the highest group, with an overall average of 47.8%. The proportion of fussy eaters was highest (at 22.3%) where mother-to-infant attachment was lowest.

Table 15: Food-related behaviours at age 7

Health	Low attachmen t	2 attachmen t	Mid attachmen t	4 attachment	High attachment	All
Parents eat with child evenings (** $p < 0.001$)	79.7%	79.4%	80.5%	83.7%	86.1%	81.7%
Has breakfast every day (ns)	94.4%	94.6%	94.9%	94.5%	93.7%	94.4%
Child's eating (*** $p < 0.001$)						
eats most things	43.9%	45.6%	50.1%	48.9%	50.7%	47.8%
eats a reasonable variety of things	33.8%	34.5%	30.3%	29.5%	26.8%	31.2%
or is he/she a fussy eater?	22.3%	19.8%	19.6%	21.6%	22.5%	21.1%

Education – age 11

There was a clear association with children with higher levels of mother-to-infant attachment being more likely to enjoy school and have someone ensuring their homework is completed (see Table 16). This pattern is statistically significant, suggesting that mother-

to-infant attachment may play a role in these educational outcomes. However, the expectation of university attendance does not show a significant variation across different levels of mother-to-infant attachment, as indicated by 'ns' (not significant).

There was also a strong association between mother-to-infant attachment and the child observing a regular bedtime, at least on school nights, a connection that was statistically significant.

Table 16: Schooling at age 11 by mother-to-infant attachment

School	Low attachment	2 attachment	Mid attachment	4 attachment	High attachment	All
Child always enjoys school (***) p<0.001)	47.1	46.4	51.2	52.7	57.1	50.6
Very likely to attend university (ns)	35.6	32.8	33.6	33.7	36.6	34.4
Someone makes sure homework always done (***) p<0.001)	52	56	61	64.2	67.7	59.7
Regular bedtime on school nights (** p= 0.0067)	53	54.3	57.6	56.4	60.9	56.2

Health – age 11

As we see in Table 17, two health-related outcomes for children at age 11 are analysed by quintiles of mother-to-infant attachment. The percentage of children who visited a dentist in the past year does not significantly differ across quintiles (ns). Attendance is consistently high, ranging from 91.8% in the highest quintile to 93.8% in the second quintile, with an overall attendance rate of 93%. However, there was a statistically significant association between mother-to-infant attachment and children's self-reported excellent quality of health ($p = 0.011$). The proportion of children reporting excellent health increases with higher mother-to-infant attachment, from 60.2% in the lowest quintile to 63.8% in the middle quintile, with an overall average of 61.9%.

Table 17: Health at age 11 by mother-to-infant attachment

Health question	Low attachment	2 attachment	Mid attachment	4 attachment	High attachment	All
Visited dentist in last year (ns)	92.9	93.8	93.1	93.4	91.8	93
Excellent quality of health (* p=0.011)	60.2	61	63.8	63.2	61.5	61.9

Economic valuation

Background

Cost-benefit analysis (CBA) is an important economic approach to evaluating various social programmes and interventions. The aim of CBA is to evaluate programmes in monetary terms, even when there may not be a market with prices, as there would often be with privately provided goods with a market for buyers and sellers. Given the results found above, there may be particular interest in past research exploring the financial value associated with changes in SDQ. The SDQ is widely used to assess emotional and behavioural issues in children, and studies have aimed to quantify the potential economic benefits of improving SDQ scores by correlating them with future economic outcomes, such as earnings, healthcare costs, and educational attainment.

Influential work by Heckman suggests that the earlier the intervention, the greater the rate of return on investment.

It is also clear that interventions affecting mental health can generate very large returns (Knapp and Wong 2020), with a 2014 study assessing the cost of perinatal depression at over £70,000 (Bauer, et al. 2014), while a review for younger people suggested a cost of around £1,800 for mental health problems (Knapp et al. 2016). More recently, research has tried to link SDQ more directly to estimates of benefit (Boyer et al. 2016).

Monetary benefits of improved maternal attachment

In a report for the Department for Education, Paull and Xu (2017) costed the monetary value of improving SDQ scores at age 3 by one standard deviation as being £6,803. Converting to 2024 terms, that would equate to around £8,880.⁷ With the standard

⁷ CPIH in July 2017 was 103.5 and in December 2024 was 135.1.

deviation of SDQ being around 5.2, that means that the value to society of moving from a bottom to middle quintile improvement in maternal attachment would have a monetary value of £2,562 (calculated as $1.5/5.2 \times 8880$ – with 1.5 the model coefficient taking into account a range of socio-economic and demographic factors). This builds on past research attempting to link SDQ more directly to estimates of benefit (Boyer et al. 2016).

To be clear, the benefits identified by Paull and Xu (2017), and hence part of their calculation, are predominantly based on the longer-term improvements expected for earnings and rates of employment for the child. They are not based on wider measures (such as improved health, other measures of well-being), nor on any measures related to the mother/parents, as the nature of SDQ is that it relates only to the child..

The model using just one attachment question (see Annex, Table 18) also helps to place this in context. If it was possible to influence a person to only experience annoyance 'very rarely', which is the most common response, rather than one of ...'almost all the time' / 'very frequently' / 'frequently', that would be associated with a reduction in SDQ of around 2.94 problems. That, in turn, would have a monetary valuation of £5,040 per child. The same would apply for some of the other individual questions, though generally we have worked with the overall index constructed from all six questions. However, it is worth a reminder that the level of reliability achieved by the maternal attachment scale with this data was relatively low. If a revised measure of maternal attachment was available, it is plausible that the effect on SDQ would be higher, and that the monetary returns from improving maternal attachment would be that much greater. Moreover, this is just one outcome from improving mother-to-infant attachment, and a fuller analysis would be likely to uncover other benefits, such as on the mother's well-being rather than the SDQ measure which is focused on the child.

Overall we arrive at valuations of benefits of around £2,500 for avoiding the lower half of the distribution of maternal attachment, or around £5,000 for avoiding the more extreme replies to just one of the six maternal attachment questions (the one on annoyance). Against this we need to balance the costs of a programme designed to generate such benefits. However, many intensive interventions aimed at mothers and young children tend to show a strong net benefit over their costs. For example, the Nurse-Family Partnership study achieved benefits that were around three times the costs of the programme, rising to 5.7 times for the most disadvantaged members of the sample (see Karoly, Kilburn & Cannon, 2006). In the UK context, Public Health England (2018) makes the case for very strong monetary returns for investments to prevent postnatal depression and to increase rates of breastfeeding. Nevertheless, robust evaluations of child intervention programmes in the UK remain rare (e.g. Wright et al., 2015).

In England & Wales in 2022, there were 605,479 live births – the latest available data^[1]. According to a recent HM Government report, *Family Hubs and Start for Life programme guide*^[2], 'Approximately 50% of babies are likely to develop a secure attachment style, while 40% are likely to develop an insecure attachment style, and 10%, a "disorganised"

attachment style, the later of which is associated with the worst developmental outcomes.' (p.81) Given the total number of births that would mean around 60,000 children with a disorganised attachment style (with the worse outcomes) and some 250,000 with an insecure attachment style. If we apply the above figures for monetary effects, of perhaps £5,000 for the worst and £2,500 for more moderate improvements, that would equate to a total potential benefit of some £900million on an annual basis (£0.9bn).

Other research has sometimes suggested that interventions affecting mental health can generate very large returns indeed (Knapp and Wong 2020), with a 2014 study assessing the cost of perinatal depression at over £70,000 (Bauer, et al. 2014). However, a review for younger people suggested a rather more modest cost of around £1,800 for mental health problems (Knapp et al. 2016). When an intervention is able to affect maternal depression, as well as maternal attachment, clearly the monetary benefits would be considerably increased. As described above, there is certainly a clear association between these two, though the precise mechanism affecting them may require further consideration.

^[1] See <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/livebirths/datasets/birthsummarytables>

^[2] Available at: assets.publishing.service.gov.uk/media/62f0ef83e90e07142da01845/Family_Hubs_and_Start_for_Life_programme_guide.pdf

Conclusions

This report investigates maternal attachment (also referred to as mother-to-infant attachment) and its association with various child outcomes in the UK, using data from the Millennium Cohort Study (MCS).

The MCS used six questions from the Maternal Postnatal Attachment Scale (MPAS) developed by Condon which measures mother-to-infant attachment.⁸

Mother-to-infant attachment describes the bond that develops between the mother and her baby. It is different from, although strongly correlated with, the attachment style which develops in the infant. That is, a secure maternal attachment style is likely to result in a secure attachment style in the infant.

Mother-to-infant attachment was significantly associated with behavioural difficulties at age 3. Higher attachment scores were linked to lower scores on the Strengths and Difficulties Questionnaire (SDQ), suggesting that stronger mother-to-infant attachment may have a protective effect against behavioural problems. This association remained significant even when controlling for various socio-demographic factors.

Strong mother-to-infant attachment was linked to a number of healthier prenatal behaviours, such as higher rates of alcohol abstinence during pregnancy. At age 3, higher attachment scores are associated with fewer parental concerns about language development and better potty-training outcomes. However, no significant associations are observed between mother-to-infant attachment and children's weight classifications, hospital admissions, or MMR vaccination rates.

There is a highly significant association between mother-to-infant attachment and the likelihood of parents eating with their child in the evenings. Moreover, the proportion of children who eat most things increases with higher mother-to-infant attachment. The proportion of fussy eaters was highest (at 22.3%) where mother-to-infant attachment was lowest.

By age 11, children of mothers with stronger attachment scores are more likely to enjoy school, have someone ensure homework completion, and follow regular bedtimes on school nights.

There was a statistically significant association between mother-to-infant attachment and children's self-reported excellent quality of health. The proportion of children reporting excellent health increases with higher mother-to-infant attachment, from 60.2% in the lowest quintile to 63.8% in the middle quintile.

⁸ John T. Condon & Carolyn J. Corkindale (1998) The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument, *Journal of Reproductive and Infant Psychology*, 16:1, 57-76, DOI: 10.1080/02646839808404558

Limitations

The questions used in the MCS is a shortened version of the original Condon MPAS scale. With only six items, and its reliance on the mother's self-reported feelings towards the infant, the reliability of the measure of mother-to-infant attachment is somewhat limited, although other research has found higher values. Moreover, the attachment measure used in the report is only measured once, so the analysis is necessarily cross-sectional. It would be instructive to have information relating to *changes* in the measure of attachment over time.

While the analysis controlled for several socio-demographic factors, it is not possible to definitively establish causality. Other unmeasured factors could be influencing both mother-to-infant attachment and child outcomes.

The findings suggest that mother-to-infant attachment may play a role in early childhood development, particularly in relation to behavioural difficulties. However, the evidence for its impact on later outcomes is less clear. Further research using more robust measures of mother-to-infant attachment and exploring potential causal pathways is needed to inform effective interventions and support programmes.

Cost-benefit analysis (CBA) can be a valuable tool for evaluating the economic impact of social programmes aimed at strengthening maternal-child relationships. Some initial estimates of the likely sizes of effects are discussed above, with a focus on the SDQ given that this is an area where mother-to-infant attachment seems most likely to be making a difference. Moving from the worst expressed levels of maternal attachment towards 'typical' levels is calculated to generate a benefit of between £2,500 and £5,000 for society. And this is calculated on the basis of measures that are not as robust as we would like and may be subject to reporting biases.

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Annex: Model with 'annoy' measure

Table 18: Regression model of SDQ total difficulties (age 3) and mother-to-infant attachment

	Mother-to-infant attachment only b	Full model b
Feelings of annoyance or irritation		
almost all the time / very frequently / frequently	4.310***	3.895***
occasionally	1.550***	2.154***
very rarely	0.431***	0.959***
or never	0	0
Respondent Age at Interview		-0.419***
Age-squared		0.0057***
Birth weight		-0.273**
Own outright		-0.220
Own – mortgage/loan		0
Rent from local authority		1.228***
Rent privately		0.495*
Living with parents		0.1313
Other		0.8492
One baby		0
Twins		-0.5143
England		0
Wales		-0.3105**
Scotland		-0.4010**
NI		-0.6640***
White		0
Mixed		0.2650
Indian		0.6442
Pakistani and Bangladeshi		1.7817***
Black or Black British		-0.3259
Other Ethnic group (inc. Chinese, other)		1.0000*
NVQ level 1		1.1784***
NVQ level 2		0.4700**
NVQ level 3		0
NVQ level 4		-0.5041***
NVQ level 5		-0.7409**
Overseas qual only		0.8341*
None of these		1.9037***
Missing		0.5089**
Lowest income quintile		0.8370***
Second quintile		0.4958**
Third quintile		0
Fourth quintile		-0.5281***
Highest income quintile		-0.7776***
Constant	8.607791***	16.0108***
R-squared	0.0296	0.1653
Observations	13682	13654

* p<0.05, ** p<0.01, *** p<0.001

The table presents an OLS regression analysis examining the relationship between mother-to-infant attachment and child behavioural difficulties (SDQ total difficulties score) at age 3. Two models are reported: one including only mother-to-infant attachment variables (the question about being annoyed) and a full model controlling for various socio-demographic factors.

Frequent maternal feelings of annoyance or irritation are strongly associated with higher SDQ scores. Compared to mothers who 'never' experience such feelings, those who report them 'almost all the time' have children with significantly higher difficulty scores ($b = 4.310$, $p < 0.001$ in the simple model; $b = 3.895$, $p < 0.001$ in the full model).

The mother-to-infant attachment-only model explains about 3% of the variance ($R^2 = 0.0296$), whereas the full model, accounting for additional socio-demographic factors, improves explanatory power to 16.5% ($R^2 = 0.1653$).

Frequent maternal irritation is a key predictor of child behavioural difficulties as measured by the SDQ score, but broader socio-economic and demographic factors also play a significant role in shaping this.



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