Economic costs and preference-based health-related quality of life outcomes associated with childhood psychiatric disorders

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Background
Childhood psychiatric disorders may have deleterious consequences through childhood and into adulthood.

Aims
To estimate costs and preference-based health-related quality of life outcomes (health utilities) associated with a broad range of childhood psychiatric disorders during the eleventh year of life.

Method
Participants in a whole-population study of extremely preterm children and term-born controls (EPICure) undertook psychiatric assessment using the Development and Well Being Assessment (DAWBA) and the Kaufman-Assessment Battery for Children. Questionnaires completed by parents and teachers described the children’s utilisation of health, social and education services during the eleventh year of life. Parents also described their child’s health status using the Health Utilities Index Mark 2 and Mark 3 health status classification systems. Descriptive and multiple regression techniques were used to explore the association between psychiatric disorders and economic outcomes.

Results
The study presents detailed costs and health utilities associated with psychiatric disorders for the preterm population, term-born population and pooled study population, following appropriate controls.

Conclusions
The results of this study should be used to inform future economic evaluations of interventions aimed at preventing childhood psychiatric disorders or alleviating their effects. Further research is required that identifies, measures and values the longer-term economic impacts of these disorders in a valid and reliable manner.

Declaration of interest
None.

The median prevalence of childhood psychiatric disorders has been reported as 12% for prepubescent school-age children and 15% among adolescents. Among British children aged 5–15 years, it has been estimated that 10% have a psychiatric disorder, with 5% having conduct disorder and 4% having emotional disorders. A longitudinal community study of children aged 9–13 years from the American state of North Carolina estimated that the 3-month prevalence of any psychiatric disorder averaged 13.3% (95% CI 11.7–15.0%). There is increasing evidence from longitudinal studies and retrospective reports that childhood psychiatric disorders may have significant adverse consequences for mental health, educational outcomes and substance misuse through childhood and into adulthood. However, relatively little is known about their consequences in terms of costs or health utilities (preference-based measures of health outcome developed from economic theory), which can directly or indirectly inform resource-allocation decisions. Cost of illness studies have been conducted for a relatively small number of childhood psychiatric disorders, including childhood depression, separation anxiety and attention-deficit hyper-activity disorder (ADHD), and health utilities have been estimated for ADHD and autism-spectrum disorders. The purpose of this research is to augment the limited economic evidence in this area by estimating costs and health utilities associated with childhood psychiatric disorders during mid-childhood. This will provide a significant new resource for clinical decision-makers and budgetary and service planners and to analysts estimating the cost-effectiveness of preventive or treatment interventions for these disorders.

Study population
Children who participated in the EPICure study represented the study population for this empirical investigation. The EPICure study is a whole-population longitudinal study of all infants born at 20 to 25 completed weeks of gestation in all 276 maternity units in the UK and Republic of Ireland from March to December 1995. Participants in the EPICure study were selected for this investigation as previous research had indicated higher prevalence rates of psychiatric disorders among children born preterm or with a low birth weight compared with general population samples. Of the 367 surviving extremely preterm infants in the EPICure study, 241 (78.2%) were assessed at a median age of 6 years 4 months (range: 5 years 2 months to 7 years 3 months) and 219 (71.3%) again at a median age of 10 years 11 months (range: 10 years 1 month to 12 years 1 month). A control group of 153 mainstream school classmates who were born at full term and matched for age, gender and ethnic group was also evaluated at a median age of 10 years 11 months (range: 9 years 9 months to 12 years 3 months). A full description of the EPICure study is available elsewhere. The extremely preterm children and their classmate controls were analysed separately for the purposes of the empirical investigation reported in this paper. Additionally, we analysed the pooled study population controlled for clinical and sociodemographic confounders, including gestational age at birth and a measure of neurosensory or motor impairment. Ethical approval for the study was obtained...
Psychiatric assessments
Childhood psychiatric disorders were diagnosed using the Development and Well Being Assessment (DAWBA), a semi-structured interview conducted with the main parent (usually the mother) or completed online by the main parent around the child’s eleventh birthday. Information obtained from the DAWBA was used to assign ICD–10 and DSM–IV–TR diagnoses. Supplemental information was provided by teachers who completed a questionnaire-based version of the DAWBA. Multi-informant data were collated and potential diagnoses were computer-generated using scoring algorithms. These were reviewed by two child and adolescent psychiatrists (C.H. and P.K.) masked to group allocation who assigned final DSM–IV diagnoses. 

Estimation of costs
As part of the battery of assessments performed at 11 years, the main parent was asked to complete a detailed postal questionnaire about their child’s resource utilisation over the previous year of life. The questionnaire was piloted to ascertain its acceptability, comprehension and reliability and reminder letters were sent to parents to increase the response and completion rates. The data collected from the main parent included their child’s use of hospital in-patient and day care services, community health services, prescribed medications, social services and education services. The components of resource utilisation and the units in which they were measured are summarised in online Table DS1. Estimates of service provision were derived from these data and usually expressed in terms of contact hours. For all hospital admissions, estimates of service provision were expressed in terms of patient days with part of a day at each level of care counted as a 24-hour period. For education services, estimates of service provision reflected the level of educational assistance within each type of educational establishment (mainstream school, main-stream school with special unit attached, special school for the physically disabled and special school for children with intellectual disability or learning difficulties). In addition to information provided by parents, teachers were asked to identify children with special educational needs, defined in the educational context as those with intellectual disability or learning difficulties that make it harder for them to learn or access education than most children of the same age, and they were also asked to detail any special educational needs support the child received. 

This included information on the type and duration of individual education or behavioural plans, one-to-one special needs provision, small group special needs provision, outreach support and support from educational psychologists, clinical psychologists, physiotherapists, speech therapists and occupational therapists. All resource-use data were entered directly from the research instruments into a purpose-built data-collection program with in-built safeguards against inconsistent entries and then verified by dual coding.

Estimation of health utilities
The postal questionnaire completed by the main parent around the child’s eleventh birthday included the Health Utilities Index (HUI), which can be described as a family of health status classification systems with preference weights (or multi-attribute utility scores) attached to each permutation of responses. 

The main parent considered the appropriate subject for completing the HUI as related research had indicated that the comprehension level required for successful completion is somewhat higher for a paediatric sample where a number of children have developmental disabilities.

The main parent completed the unedited 15-item questionnaire for proxy-assessed usual health status assessment, which was obtained from the HUI developers and covers both Mark 2 (HUI2) and Mark 3 (HUI3) health status classification systems. The ‘usual’ health focus of the questions has previously been applied in population health surveys, where short-term illnesses such as influenza are not the major concern. The HUI2 health status classification system covers seven attributes: sensation, mobility, emotion, cognition, self-care, pain and fertility. The HUI3 health status classification system covers eight attributes: cognition, vision, hearing, speech, ambulation, dexterity, emotion and pain. The HUI3 health status classification system is now recommended by the HUI developers as the preferred measure of primary analyses because of its broad applicability in both clinical and general population health studies, improvements in a number of definitions, and an increased orthogonality of its attributes for structural independence. Consequently, our primarily analyses of preference-based health-related quality of life outcomes were based on the HUI3 health status classification system. Function within each HUI3 attribute is graded on a five- or six-point scale corresponding to the level of severity, ranging from normal function (level 1) to severe impairment (level 5 or 6). Responses to the HUI3 health status classification system were converted into multiplicative multi-attribute utility scores using a published utility function.
expressed on an interval scale ranging from $-0.36$ (representing the health state with the lowest level of function for all attributes) to $1.00$ (representing the health state with the highest level of function for all attributes). The multi-attribute utility scoring algorithm for the HUI3 can be summarised as

$$u^* = 1.371b_1 + b_2 + b_3 + b_4 + b_5 + b_6 + b_7 + b_8 - 0.371$$

where $u^*$ is the utility score for the overall health state being measured and the $b_i$'s are substituted for a table of coefficients provided by the HUI developers for the appropriate attribute and level.\(^{45}\) To develop the multi-attribute utility scoring algorithm a random sample of 504 general population adults living in the city of Hamilton, Canada had previously been asked to value selected health states using both a visual analogue scaling technique and a standard gamble instrument.\(^{45}\) Analyses of preference-based health-related quality of life outcomes in our study were repeated using the HUI2 health status classification system and an underpinning multi-attribute utility scoring algorithm recently estimated on the basis of the preferences of 198 members of the UK general population.\(^{40}\) The latter measure and underpinning multi-attribute utility scoring algorithm might be considered to generate relevant values for UK policy purposes.\(^{45}\)

**Statistical methods**

Differences in baseline sociodemographic and clinical characteristics between children with and without a psychiatric disorder, as defined by DSM–IV–TR criteria, were tested using the Pearson chi-squared test. A number of statistical approaches were tested in order to impute costs for children with some missing data. Given the negligible level of missing cost data ($<2\%$) in the final study sample, simple linear regression and simulation-based multiple imputation\(^{47}\) for each psychiatric group produced similar results. Therefore, it was considered appropriate to use the estimates generated by the simple linear regression in this analysis.\(^{37–49}\)

For the preterm population, term-born population and pooled study population, comparisons of each category of public sector costs and of total public sector costs were made between children with and without a psychiatric disorder as defined by DSM–IV–TR criteria. Similarly, for the preterm, term-born and pooled populations, comparisons of total public sector costs were made between children with and without varying levels of cognitive impairment. Comparisons of total public sector costs between children with and without individual psychiatric disorders (emotional, ADHD, conduct, autistic, tic) as defined by DSM–IV–TR criteria were restricted to the pooled population because of the relatively small sample sizes for some disorders (e.g. $n = 4$ for tic disorders). Comparisons of costs are reported as mean values with standard deviations and mean differences in costs between the comparison groups with $95\%$ confidence intervals. As the data for costs were skewed, in addition to Student $t$-tests for cost differences, non-parametric bootstrap estimation was used to derive $95\%$ confidence intervals for mean cost differences between the comparison groups.\(^{50}\) The bootstrap method does not rely on parametric assumptions concerning the underlying distribution of data, hence its usefulness for generating confidence intervals for skewed data.\(^{51}\) Using a large number of simulations, and based on sampling with replacement from the original data, the bootstrap method estimates the distribution of a sampling statistic.\(^{51}\) Each of the confidence intervals surrounding mean cost differences was calculated using 10,000 bias-corrected bootstrap replications.

In addition, generalised linear regressions\(^{51}\) were performed for the preterm, term-born and pooled populations with total public sector costs over the previous year of life representing the dependent variable in the analyses. Three regression models were constructed for each population group. In the first model, the main independent variable was a dichotomous variable of whether or not the child had a psychiatric disorder as defined by DSM–IV–TR criteria. In the second model, the main independent variable was a dichotomous variable of whether or not the child had moderate cognitive impairment, whereas in the third model it was a dichotomous variable of whether or not the child had severe cognitive impairment. For each generalised linear regression model, a gamma distribution and linear (identity) link function for costs was selected on the basis of its low Akaike information criterion (AIC) statistic (AIC statistics of 19.24, 19.24 and 19.23 for models 1, 2 and 3 respectively for the pooled population) compared with alternative distributional forms (e.g. Gaussian, inverse Gaussian and Poisson distributional families) and link functions (e.g. log link function). For the preterm and term-born populations, covariates included in the generalised linear regressions were gender (male, female), maternal marital status (married, single, cohabiting, widowed, separated or divorced), respondent parent's current age (20, 30–39, 40–49, $\geq 50$ years), type of accommodation (owner occupied, rented, other), access to car (yes, no), highest parental qualification (vocational or equivalent, ordinary level or equivalent, advanced level or equivalent, diploma or equivalent, university degree, postgraduate qualification, other, none), highest parental occupational status (professional or managerial, intermediate, routine and manual, long-term unemployed), language spoken at home (English only, English and other language(s)), number of smokers at home ($0, 1, \geq 2$) and a measure of neurosensory or motor impairment (no, yes).\(^{52}\) For the pooled population, covariates includes in the generalised linear regressions additionally included gestational age at birth ($\leq 23$ weeks, 24 weeks, 25 weeks, term). In sensitivity analyses, the measure of neurosensory or motor impairment was replaced by an interaction term between gestational age at birth and psychiatric disorder for the pooled population.

For the preterm population, term-born population and pooled study population, we used Fisher's exact test for equality of proportions to compare the proportion of children with suboptimal levels of function (defined as below level 1 function) within each of the eight attributes of the HUI3 health status classification system between children with and without a psychiatric disorder as defined by DSM–IV–TR criteria. The same comparison groups used as a basis for analysing total public sector costs were also used as a basis for analysing health utilities. Differences in the HUI3 and UK HUI2 multi-attribute utility scores between the comparison groups were tested using two-sample $t$-tests for unequal variance. Finally, we performed Tobit regressions to explore the effects of psychiatric disorders on the HUI3 and UK HUI2 multi-attribute utility scores for the preterm, term-born and pooled populations. Tobit regression was required to account for the censoring of the dependent variable, the multi-attribute utility score, which has an upper value of 1.0.\(^{53}\) As with costs, three regression models were constructed for each population group, which differed in terms of the main psychiatric independent variable. The same covariates incorporated into the generalised linear regressions on costs were incorporated into the Tobit regressions on health utilities.

All analyses were performed with a microcomputer using the Statistical Package for the Social Sciences (SPSS) (version 15.0) software and STATA (version 10.0) software for Windows XP. $P$-values of 0.05 or less were considered statistically significant.
Postal questionnaires reporting costs and health utilities were returned for a total of 331 study children, including 190 extremely preterm children (representing 86.8% of extremely preterm children undergoing neurodevelopmental assessments at a median age of 10 years 11 months) and 141 term-born classmates (representing 92.2% of term-born classmates undergoing neurodevelopmental assessments at this time point). Multi-informant psychiatric assessments were performed on 321 (97.0%) of these 331 study children, with multiple imputation techniques used to estimate psychiatric diagnoses for the remaining 10 children.25 Children for whom postal questionnaires were not returned were more likely to be born at between 25 weeks exactly and 25 weeks 6 days, be of Black and minority ethnic origin, have had an operation for necrotising enterocolitis, to have unemployed parents and to have had lower cognitive scores or cognitive impairment at 2.5 and 6 years (P > 0.05). There were a number of significant differences between the 50 children with and 281 without a DSM–IV–TR clinical diagnosis, for whom postal questionnaires were returned, in terms of sociodemographic and clinical characteristics. Notably, children with a DSM–IV–TR clinical diagnosis were more likely to be male, less likely to have married parents, less likely to live in owner-occupied accommodation, more likely to live with smokers and more likely to have been born preterm (online Table DS2).

Resource-use values for children with and without a psychiatric disorder as defined by DSM–IV–TR criteria are summarised in Table 1 for the preterm population, term-born population and pooled study population. Of particular note are the additional £3170 (P = 0.001) and £8877 (P < 0.0001) annual public sector costs associated with moderate cognitive impairment and severe cognitive impairment, respectively, in the preterm population; and for children with a DSM–IV–TR clinical diagnosis was estimated at £1998 (bootstrap 95% CI £164 to £4160, P = 0.076). Among the preterm population, the respective public sector cost difference between the 11 children with and 130 children without a psychiatric disorder, as defined by DSM–IV–TR criteria, was estimated at £51 (bootstrap 95% CI £752 to £854, P = 0.903). When the data were analysed by cost category, a DSM–IV–TR clinical diagnosis was associated with significantly higher community health and social care costs in all population groups and significantly higher total health and social care costs in the preterm population and pooled study population.

Mean public sector costs over the previous year of life and mean cost differences between children with and without individual psychiatric disorders are summarised in Table 1 for the preterm population, term-born population and pooled study population. Of particular note are the additional £3170 (P = 0.001) and £8877 (P < 0.0001) annual public sector costs associated with moderate cognitive impairment and severe cognitive impairment, respectively, in the preterm population; and the additional £6745 (P = 0.014), £3375 (P < 0.0001) and £8530 (P < 0.0001) annual public sector costs associated with a diagnosis of an autistic disorder, moderate cognitive impairment and severe cognitive impairment, respectively, in the pooled study population.

The results of generalised linear regressions exploring the relationship between psychiatric disorders and total public sector

### Table 1: Mean public sector costs over the previous year of life and mean cost differences between children with and without psychiatric disorders (UK £ sterling, 2006–7 prices)

<table>
<thead>
<tr>
<th>Psychiatric disorder</th>
<th>With disorder</th>
<th>Without disorder</th>
<th>Cost difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>s.d.</td>
</tr>
<tr>
<td>Preterm sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV–TR clinical diagnosis</td>
<td>39</td>
<td>8071.8</td>
<td>6358.5</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>67</td>
<td>8536.1</td>
<td>6665.3</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
<td>14519.4</td>
<td>6187.6</td>
</tr>
<tr>
<td>Term sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV–TR clinical diagnosis</td>
<td>11</td>
<td>4053.9</td>
<td>1127.7</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>2</td>
<td>3333.0</td>
<td>121.6</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>0</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Total sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any emotional disorder</td>
<td>16</td>
<td>6860.1</td>
<td>5259.2</td>
</tr>
<tr>
<td>Any ADHD diagnosis</td>
<td>17</td>
<td>5812.0</td>
<td>3832.6</td>
</tr>
<tr>
<td>Any conduct disorder</td>
<td>17</td>
<td>7033.5</td>
<td>5700.1</td>
</tr>
<tr>
<td>Any autistic disorder</td>
<td>11</td>
<td>12016.1</td>
<td>7568.1</td>
</tr>
<tr>
<td>Tic disorder</td>
<td>4</td>
<td>7022.4</td>
<td>6474.7</td>
</tr>
<tr>
<td>Any DSM–IV–TR clinical diagnosis</td>
<td>50</td>
<td>7187.8</td>
<td>5868.6</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>69</td>
<td>8385.3</td>
<td>6625.2</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
<td>14343.3</td>
<td>6725.1</td>
</tr>
</tbody>
</table>

ADHD, attention-deficit hyperactivity disorder.

a. Bootstrap estimation using 10000 replications, bias corrected.
b. P calculated using Student’s t-test.
c. IQ score: –3 standard deviations to –2 standard deviations against classmate reference norms.
d. IQ score: less than –3 standard deviations against classmate reference norms.
e. Not calculated because of insufficient cases.
f. Encompasses separation anxiety, specific phobia, social phobia, post-traumatic stress disorder, generalised anxiety disorder, childhood emotional disorder (not otherwise specified) and major depression.
g. Encompasses ADHD inattentive subtype and ADHD combined subtype.
h. Encompasses conduct disorder and oppositional defiant disorder.
i. Encompasses childhood autism and atypical autism.
costs over the previous year of life are shown in Table 2 for the preterm population, term-born population and pooled study population. After controlling for clinical and sociodemographic confounders, a DSM–IV–TR clinical diagnosis was associated with increases of £1499 (95% CI £758 to £2355, \( P = 0.193 \)) and £1505 (95% CI £40 to £3049, \( P = 0.056 \)) in annual public sector costs for the preterm and pooled study populations, respectively. Moderate cognitive impairment and severe cognitive impairment were associated with increases in annual public sector costs of £915 (95% CI £238 to £1591, \( P = 0.041 \)) for the preterm population and £2891.2 (95% CI £188 to £3755, \( P = 0.095 \)) for the pooled study population. The only other factor associated with statistically significant utility decrements were also generated for a psychiatric disorder as defined by DSM–IV–TR criteria, moderate cognitive impairment and severe cognitive impairment, respectively, in the preterm population; and the 0.198 (\( P = 0.027 \)), 0.250 (\( P = 0.005 \)), 0.261 (\( P = 0.011 \)), 0.192 (\( P < 0.0001 \)), 0.273 (\( P < 0.0001 \)) and 0.571 (\( P < 0.0001 \)) mean utility decrements associated with an emotional disorder, an ADHD diagnosis, an autistic disorder, a psychiatric disorder as defined by DSM–IV–TR criteria, moderate cognitive impairment and severe cognitive impairment, respectively, in the preterm population; and the

### Table 2: Relationship between psychiatric disorders and public sector costs (UK £ sterling, 2006–7 prices) over the previous year of life, generalised linear models with gamma distribution and linear (identity) link function

<table>
<thead>
<tr>
<th>Psychiatric disorder</th>
<th>Adjusted regression coefficient</th>
<th>Robust standard error</th>
<th>95% CI</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preterm sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td>1.498.7</td>
<td>11.512</td>
<td>-757.7 to 3755.0</td>
<td>0.193</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>915.1</td>
<td>817.2</td>
<td>-686.6 to 2516.8</td>
<td>0.263</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>4851.5</td>
<td>2903.5</td>
<td>-839.3 to 10542.2</td>
<td>0.095</td>
</tr>
<tr>
<td><strong>Term sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td>-33.8</td>
<td>829.1</td>
<td>-1658.8 to 1591.2</td>
<td>0.967</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>1401.6</td>
<td>760.1</td>
<td>-88.1 to 2891.2</td>
<td>0.065</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>5662.2</td>
<td>2767.4</td>
<td>238.2 to 11086.3</td>
<td>0.041</td>
</tr>
<tr>
<td><strong>Total sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td>1504.5</td>
<td>788.2</td>
<td>-40.3 to 3049.3</td>
<td>0.056</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>1401.6</td>
<td>760.1</td>
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</tr>
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<td>5662.2</td>
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<td>238.2 to 11086.3</td>
<td>0.041</td>
</tr>
</tbody>
</table>

a. Interpreted as the additional costs over and above the reference group after adjustment for covariates.
b. Adjusted for gender, maternal marital status, respondents parents current age, type of accommodation, access to car, highest parental qualification, highest parental occupational status, language spoken at home, number of siblings at home and neurosensory or motor impairment.
c. IQ score: –3 standard deviations against classmate reference norms.
d. IQ score: less than –2 standard deviations against classmate reference norms.
e. Not calculated because of insufficient cases.
f. Adjusted as per footnote b plus adjustment for gestational age at birth.

Finally, the separate Tobit regressions revealed that, even after controlling for clinical and sociodemographic confounders, a psychiatric disorder as defined by DSM–IV–TR criteria, moderate cognitive impairment and severe cognitive impairment, respectively, in the preterm population; and the

### Table 3: Comparison of the frequency and proportion of suboptimal levels of function among the children with and without a DSM–IV–TR clinical diagnosis for each of the eight attributes of the HUI3.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Preterm</th>
<th>Term</th>
<th>Pooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>emotion</td>
<td>0.165</td>
<td>0.263</td>
<td>0.0001</td>
</tr>
<tr>
<td>pain</td>
<td>0.273</td>
<td>0.261</td>
<td>0.0001</td>
</tr>
<tr>
<td>dexterity</td>
<td>0.571</td>
<td>0.512</td>
<td>0.0001</td>
</tr>
<tr>
<td>cognition</td>
<td>0.571</td>
<td>0.512</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

The analyses revealed significantly higher proportions of suboptimal levels of function among the children with a DSM–IV–TR clinical diagnosis for four attributes (emotion, pain, dexterity and cognition) for the preterm population, three attributes (speech, emotion and dexterity) for the term population and five attributes (speech, emotion, pain, dexterity and cognition) for the pooled study population (\( P \leq 0.05 \)).
cognitive impairment and severe cognitive impairment were associated with significant decrements in the HUI3 multi-attribute utility score of 0.226 (P < 0.0001), 0.205 (P < 0.0001) and 0.342 (P < 0.0001), respectively, for the preterm population, and 0.213 (P < 0.0001), 0.198 (P < 0.0001) and 0.324 (P < 0.0001), respectively, for the pooled study population (Table 5). Analogous results were generated using the alternative UK HUI2 multi-attribute utility measure (Table 6); the decrements in these utility scores were smaller in magnitude, but remained statistically significant. The only other factor associated with statistically significant decrements in utility scores across the regression models was extremely preterm birth for the pooled study

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Health Utilities Index Mark 3 multi-attribute utility scores for children with and without psychiatric disorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychiatric disorder</td>
<td>With disorder</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Preterm sample</td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>39</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>67</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
</tr>
<tr>
<td>Term sample</td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>11</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>2</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>0</td>
</tr>
<tr>
<td>Total sample</td>
<td></td>
</tr>
<tr>
<td>Any emotional disorder</td>
<td>16</td>
</tr>
<tr>
<td>Any ADHD diagnosis</td>
<td>17</td>
</tr>
<tr>
<td>Any conduct disorder</td>
<td>17</td>
</tr>
<tr>
<td>Any autistic disorder</td>
<td>11</td>
</tr>
<tr>
<td>Tic disorder</td>
<td>4</td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>50</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>69</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
</tr>
</tbody>
</table>

ADHD, attention-deficit hyperactivity disorder.

Table 4 | Health Utilities Index UK Mark 2 multi-attribute utility scores for children with and without psychiatric disorders |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychiatric disorder</td>
<td>With disorder</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Preterm sample</td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>39</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>67</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
</tr>
<tr>
<td>Term sample</td>
<td></td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>11</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>2</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>0</td>
</tr>
<tr>
<td>Total sample</td>
<td></td>
</tr>
<tr>
<td>Any emotional disorder</td>
<td>16</td>
</tr>
<tr>
<td>Any ADHD diagnosis</td>
<td>17</td>
</tr>
<tr>
<td>Any conduct disorder</td>
<td>17</td>
</tr>
<tr>
<td>Any autistic disorder</td>
<td>11</td>
</tr>
<tr>
<td>Tic disorder</td>
<td>4</td>
</tr>
<tr>
<td>Any DSM–IV clinical diagnosis</td>
<td>50</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td>69</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td>18</td>
</tr>
</tbody>
</table>

ADHD, attention-deficit hyperactivity disorder.

a. Calculated using Student’s t-test.
b. IQ score: −3 standard deviations against classmate reference norms.
c. IQ score: less than −3 standard deviations against classmate reference norms.
d. Not calculated because of insufficient cases.
e. Encompasses separation anxiety, specific phobia, social phobia, post-traumatic stress disorder, generalised anxiety disorder, childhood emotional disorder (not otherwise specified) and major depression.
f. Encompasses ADHD inattentive subtype and ADHD combined subtype.
g. Encompasses conduct disorder and oppositional defiant disorder.
h. Encompasses childhood autism and atypical autism.
population. Replacing the measure of neurosensory or motor impairment by an interaction term between gestational age at birth and psychiatric disorder had no discernible effects on the results of the Tobit regression.

### Discussion

**Main findings**

This paper augments the limited published evidence on the economic consequences of childhood psychiatric disorders.\textsuperscript{16–20} Its unique contribution is twofold. First, it focuses on a broader range of childhood psychiatric disorders than has hitherto been studied by health economists within one sample, from relatively rare tic disorders to more common emotional and behavioural disorders, such as ADHD. Second, it reports both cost and preference-based health-related quality of life (or health utility) outcomes for these disorders. In the process, it provides a broader set of data inputs for directly or indirectly informing resource-allocation decisions than has hitherto been provided.

The study revealed an average annual cost difference of over £2000 across the pooled study population between children with and without a psychiatric disorder as defined by DSM–IV–TR criteria. This exceeds that identified for several other childhood disorders, such as ADHD.\textsuperscript{18} The study also revealed mean differences in the HUI3 and UK HUI2 multi-attribute utility scores of 0.192 and 0.118, respectively, across the pooled study population between these comparison groups, which far exceeds the 0.03 minimally important difference in utility score postulated in the literature as clinically important for evaluative purposes.\textsuperscript{57} Notably, the difference in the mean HUI3 multi-attribute utility scores between children with (0.698) and without (0.890) a psychiatric disorder can be interpreted as a difference between being in a state of severe overall disability rather than a mild overall disability according to the classification of HUI3 multi-attribute utility scores published by the HUI developers.\textsuperscript{58}

### Strengths and limitations

The study population was drawn from participants in the EPICure study, a whole-population longitudinal study of all infants born extremely preterm in the UK and Republic of Ireland over a 10-month period and a contemporaneous classroom control group born at full term and matched for age, gender and ethnic group. As such, the study population consists of two distinct groups of children: one that can be characterised as at high risk for psychiatric disorders and a more representative general population sample. The two groups were analysed separately for the purposes of our empirical investigation. Of particular note

<table>
<thead>
<tr>
<th>Psychiatric disorder</th>
<th>Adjusted regression coefficient</th>
<th>Robust standard error</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preterm sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.226</td>
<td>0.053</td>
<td>−0.332 to −0.120</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.205</td>
<td>0.046</td>
<td>−0.297 to −0.113</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.342</td>
<td>0.093</td>
<td>−0.526 to −0.158</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Term sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
<td>−0.144</td>
<td>0.088</td>
<td>−0.317 to 0.030</td>
<td>0.104</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
<td>−0.213</td>
<td>0.045</td>
<td>−0.302 to −0.124</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
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<tr>
<td>Yes</td>
<td>−0.198</td>
<td>0.043</td>
<td>−0.282 to −0.113</td>
<td>&lt;0.0001</td>
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<tr>
<td>Severe cognitive impairment</td>
<td></td>
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<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.324</td>
<td>0.090</td>
<td>−0.501 to −0.146</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

a. Interpreted as the additional utility over and above the reference group after adjustment for covariates.

b. Adjusted for gender, maternal marital status, respondent parent’s current age, type of accommodation, access to car, highest parental qualification, highest parental occupational status, language spoken at home, number of smokers at home and neurosensory or motor impairment.

c. IQ score: −3 standard deviations to −2 standard deviations against classmate reference norms.

d. IQ score: less than −3 standard deviations against classmate reference norms.

e. Not calculated because of insufficient cases.

f. Adjusted as per footnote b plus adjustment for gestational age at birth.

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were the mean adjusted additional costs of £915 and £4852, the mean adjusted HUI3 utility decrements of 0.205 and 0.342 and the mean adjusted UK HUI2 utility decrements of 0.124 and 0.177 associated with cognitive impairment and severe cognitive impairment, respectively, in the extremely preterm children. Analyses of the term-born children were restricted by the limited number of children in this population who were diagnosed with a psychiatric disorder ($n = 11$). Nevertheless, separate economic results for this population are presented for completeness. Additionally, analyses of the pooled study population controlled for clinical and sociodemographic confounders, including gestational age at birth and, alternatively, either a measure of neurosensory or motor impairment or an interaction term between gestational age at birth and psychiatric disorder. Consequently, we adopted a strategy that disentangled the effects of psychiatric disorders on economic outcomes from those that might be attributable to comorbidities. The study has a number of other strengths. Multi-informant psychiatric data were collected using the DAWBA for all children, rather than a subset identified at high risk, and diagnoses were made by consensus between two expert clinical raters who were masked to group allocation. The DAWBA has excellent reliability and validity and was the principal measure of psychopathology in the British mental health surveys. Cognitive ability was assessed by experienced paediatricians. As loss to follow-up was more common among high-risk children, multiple imputation was used to estimate psychiatric diagnoses for 10 of the 331 study children for whom multi-informant psychiatric diagnoses were not performed. Other strengths of the study include validated and reliable approaches to measuring and valuing costs and preference-based health-related quality of life outcomes during childhood and a comprehensive analytical strategy.

There are a number of caveats to the study findings. First, the children included in the EPICure study, but excluded from our analyses because of loss to follow-up, were more likely to have had lower cognitive scores or cognitive impairment at 2.5 and 6 years. This suggests that we might have underestimated the true extent of psychiatric disorders in the study population. Second, the study population was too small to present cost and utility estimates at a granulated level for all childhood psychiatric disorders. A number of disorders, such as panic disorder, agoraphobia, obsessive–compulsive disorder, elective mutism, disinhibited attachment disorder of childhood, reactive attachment disorder, eating disorder, schizophrenia, manic episodes, ADHD hyperactive–impulsive subtype and Asperger syndrome, were not diagnosed in our study population. In addition, individual disorders had to be grouped into relatively broad categories, which might reflect disparate experiences in terms of resource utilisation and health-related quality of life. A

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**Table 6** Relationship between psychiatric disorders and UK Health Utilities Index Mark 2 multi-attribute utility scores, Tobit regressions

<table>
<thead>
<tr>
<th>Psychiatric disorder</th>
<th>Adjusted regression coefficient</th>
<th>Robust standard error</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preterm sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.130</td>
<td>0.033</td>
<td>−0.196 to −0.064</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.124</td>
<td>0.029</td>
<td>−0.181 to −0.067</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td></td>
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<tr>
<td>No (reference group)</td>
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<tr>
<td>Yes</td>
<td>−0.177</td>
<td>0.057</td>
<td>−0.290 to −0.065</td>
<td>0.002</td>
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<tr>
<td><strong>Term sample</strong></td>
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</tr>
<tr>
<td>No (reference group)</td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.103</td>
<td>0.067</td>
<td>−0.237 to 0.030</td>
<td>0.128</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>No (reference group)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM–IV clinical diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.121</td>
<td>0.030</td>
<td>−0.180 to −0.063</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Moderate cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (reference group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.123</td>
<td>0.028</td>
<td>−0.178 to −0.068</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Severe cognitive impairment</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>No (reference group)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.171</td>
<td>0.058</td>
<td>−0.285 to −0.057</td>
<td>0.004</td>
</tr>
</tbody>
</table>

a. Interpreted as the additional utility over and above the reference group after adjustment for covariates.
b. Adjusted for gender, maternal marital status, respondent parent’s current age, type of accommodation, access to car, highest parental qualification, highest parental occupational status, language spoken at home, number of smokers at home and neurosensory or motor impairment.
c. IQ score: −3 standard deviations to −2 standard deviations against classmate reference norms.
d. IQ score: less than −3 standard deviations against classmate reference norms.
e. Not calculated because of insufficient cases.
f. Adjusted as per footnote b plus adjustment for gestational age at birth.
much larger study population would be required to estimate costs and health utilities with sufficient statistical power for all childhood psychiatric disorders. Indeed, McClellan and colleagues have argued that a longitudinal study of 10,000 children, consisting of 5000 characterised as at high risk of neurodevelopmental disabilities and 5000 randomly selected from the entire childhood population, is required to generate subtle information for the broad spectrum of conditions.60 A third caveat to the study findings is that the analysis of cost differences was conducted from a public sector perspective and encompassed costs of health, social and education services. It is likely that many psychiatric disorders have an impact on other sectors of the economy and on families and carers,16 suggesting that adopting a broader perspective would increase the cost differences between the study groups. A fourth caveat is that our cost estimates are based on parental reports of their child’s resource utilisation over the previous year of life. Previous research has indicated that parents accurately recall their child’s hospital service utilisation over extended periods when validated against medical records, but tend to underreport their child’s community service utilisation.61 If this were the case for our study our absolute costs for community service utilisation may be underestimates. A fifth caveat is that, given the large number of children in our study with serious cognitive impairment and learning difficulties, the main parent rather than the child was considered the appropriate person to complete the HUI3. Empirical evidence of the concordance between child and parent ratings of attributes of children’s health-related quality of life suggests that parents are able to accurately rate observable behaviours, such as physical functioning and physical symptoms, but are less successful at identifying social or emotional impairments.62,63 However, there is no consistent evidence to suggest that parents consistently either underreport or overreport social or emotional impairments,64 which suggests that there are unlikely to be systematic biases in the measurement of health-related quality of life in our study. A final caveat is that the underlying preference weights for the HU13 and UK HU12 multi-attribute utility measures have been derived from surveys of adults rather than of children.44–46 The cognitive requirements entailed in directly estimating preference weights among our study population, many of whom had developmental disabilities, was considered too burdensome. Nevertheless, our approach of valuing health outcomes using population-based preferences is in line with the recommendations of many decision-making bodies, such as the National Institute for Health and Clinical Excellence in England and Wales.36

Implications
How might the results of our study be used? Given recent evidence of the increasing incidence of some childhood psychiatric disorders,65 it is imperative that clinical decision-makers and budgetary and service planners recognise the overall economic impact of each condition in their service planning, as well as the potential contribution of clinical and sociodemographic factors to economic outcomes. More pertinently, in our opinion, our mean cost and utility estimates and their associated distributions can act as data inputs for cost-effective-ness models of preventive or treatment interventions for childhood psychiatric disorders. Economic analysts who construct decision-analytic models are often faced with estimating costs and health utilities for a large number of health conditions or states with limited resources or time. Under these circumstances our catalogue can be viewed as a significant new resource that can act as data inputs or be pooled with the totality of the existing evidence base. It should be noted, however, that analysts may face a particular methodological challenge when the time horizon for the cost-effectiveness model spans the entire period of childhood or further into adulthood. Under these circumstances, the impact of age on costs and health utilities should be estimated from data gathered in large-scale longitudinal studies as they become available. When such data are not available, techniques such as meta-regression of data across a number of studies should be considered as a means of disentangling the impact of age.

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Acknowledgements
We are indebted to the EPICure Study Group, which includes paediatricians in 2% maternity units in the UK and Republic of Ireland who identified the original cohort, contributed perinatal data and whose help was invaluable. We would also like to thank the children who participated in the EPICure Study and the parents who completed the relevant research instruments.

References
Table DS1  Annual resource use for children with and without DSM–IV clinical diagnosis

<table>
<thead>
<tr>
<th>Resource-use variable, unit</th>
<th>Children with DSM–IV clinical diagnosis (n = 50)</th>
<th>Children without DSM–IV clinical diagnosis (n = 281)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community and social care services: contacts, mean (s.d.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General practitioner</td>
<td>3.18 (5.56)</td>
<td>1.30 (1.60)</td>
<td>0.021</td>
</tr>
<tr>
<td>Practice nurse</td>
<td>0.68 (1.71)</td>
<td>0.26 (0.74)</td>
<td>0.076</td>
</tr>
<tr>
<td>Community nurse</td>
<td>0.00 (0.00)</td>
<td>0.03 (0.19)</td>
<td>0.011</td>
</tr>
<tr>
<td>Community paediatrician</td>
<td>0.36 (0.92)</td>
<td>0.09 (0.38)</td>
<td>0.048</td>
</tr>
<tr>
<td>Dentist</td>
<td>1.64 (1.08)</td>
<td>1.68 (1.15)</td>
<td>0.830</td>
</tr>
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<td>Orthodontist</td>
<td>0.22 (0.91)</td>
<td>0.26 (0.89)</td>
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<td>0.63 (1.30)</td>
<td>0.017</td>
</tr>
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<td>Chiropractor</td>
<td>0.06 (0.31)</td>
<td>0.04 (0.43)</td>
<td>0.635</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>2.96 (9.61)</td>
<td>0.41 (2.89)</td>
<td>0.048</td>
</tr>
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<td>Speech therapist</td>
<td>1.42 (4.33)</td>
<td>0.55 (3.34)</td>
<td>0.183</td>
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<td>Audiologist</td>
<td>0.26 (0.92)</td>
<td>0.13 (0.53)</td>
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<td>Social worker</td>
<td>0.74 (2.47)</td>
<td>0.10 (0.67)</td>
<td>0.073</td>
</tr>
<tr>
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<td>0.03 (0.42)</td>
<td>0.259</td>
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<td>Counsellor</td>
<td>0.88 (4.47)</td>
<td>0.04 (0.66)</td>
<td>0.188</td>
</tr>
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<td>Psychologist</td>
<td>0.38 (1.03)</td>
<td>0.07 (0.63)</td>
<td>0.047</td>
</tr>
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<td>Psychiatrist</td>
<td>0.16 (0.47)</td>
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</tr>
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<td>Home teacher (portage)</td>
<td>0.00 (0.00)</td>
<td>0.07 (1.19)</td>
<td>0.318</td>
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<tr>
<td>Home teacher (other)</td>
<td>7.58 (20.28)</td>
<td>0.57 (4.96)</td>
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<tr>
<td>Orthoptist</td>
<td>0.12 (0.72)</td>
<td>0.03 (0.23)</td>
<td>0.395</td>
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<tr>
<td>Orthotist</td>
<td>0.42 (1.81)</td>
<td>0.02 (0.26)</td>
<td>0.129</td>
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<tr>
<td>Other community healthcare professionals</td>
<td>0.26 (0.99)</td>
<td>0.18 (1.20)</td>
<td>0.618</td>
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<tr>
<td>Hospital outpatient and day care services: attendances, mean (s.d.)</td>
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<td></td>
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<tr>
<td>Accident and emergency care</td>
<td>0.22 (0.58)</td>
<td>0.22 (0.77)</td>
<td>0.995</td>
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<tr>
<td>Hospital day unit</td>
<td>0.26 (1.47)</td>
<td>0.02 (0.15)</td>
<td>0.256</td>
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<td>Other out-patient care</td>
<td>1.46 (2.42)</td>
<td>0.42 (1.28)</td>
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<tr>
<td>Hospital in-patient services, mean (s.d.)</td>
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<tr>
<td>In-patient stays, days</td>
<td>0.84 (2.76)</td>
<td>0.56 (5.74)</td>
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<tr>
<td>Education services, n (%)</td>
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<td>0.091</td>
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<td>Mainstream school</td>
<td>41 (82.0)</td>
<td>253 (90.0)</td>
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<tr>
<td>Mainstream school with special unit attached</td>
<td>3 (6.0)</td>
<td>17 (6.0)</td>
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<tr>
<td>Special school for physically disabled</td>
<td>2 (4.0)</td>
<td>2 (0.7)</td>
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<tr>
<td>Special school for learning disabled</td>
<td>4 (8.0)</td>
<td>9 (3.2)</td>
<td></td>
</tr>
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</table>

* P calculated using two-tailed Student’s t-test assuming unequal variance for continuous variables or χ²-test for categorical variables.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Children with DSM-IV clinical diagnosis, n (%) (n = 50)</th>
<th>Children without DSM-IV clinical diagnosis, n (%) (n = 281)</th>
<th>(p^a)</th>
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<tbody>
<tr>
<td>Gender</td>
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<td>Male</td>
<td>29 (58.0)</td>
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<td>Female</td>
<td>21 (42.0)</td>
<td>165 (58.7)</td>
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<td>Maternal marital status</td>
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<tr>
<td>Married</td>
<td>26 (52.0)</td>
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<tr>
<td>Single</td>
<td>9 (18.0)</td>
<td>12 (4.2)</td>
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<tr>
<td>Cohabiting</td>
<td>6 (12.0)</td>
<td>27 (9.6)</td>
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<td>1 (2.0)</td>
<td>3 (1.1)</td>
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<td>8 (16.0)</td>
<td>40 (14.2)</td>
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<td>2 (0.7)</td>
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<td>Respondent parent’s age</td>
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<td>&lt;30</td>
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<td>3 (1.1)</td>
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<tr>
<td>30–39</td>
<td>23 (46.0)</td>
<td>107 (38.1)</td>
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<td>40–49</td>
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<td>147 (52.3)</td>
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<td>≥50</td>
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<td>Missing</td>
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<td>13 (4.6)</td>
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<td>Type of accommodation</td>
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<td>Owner occupied</td>
<td>26 (52.0)</td>
<td>216 (76.9)</td>
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<td>Rented</td>
<td>18 (36.0)</td>
<td>42 (14.9)</td>
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<td>5 (1.8)</td>
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<td>Access to car</td>
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<td>0.137</td>
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<td>44 (88.0)</td>
<td>267 (95.0)</td>
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<tr>
<td>No</td>
<td>4 (8.0)</td>
<td>10 (3.6)</td>
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<td>Missing</td>
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<td>Highest parental qualification</td>
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<td>Vocational/NVQ/CSE</td>
<td>7 (14.0)</td>
<td>39 (13.9)</td>
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<td>79 (28.1)</td>
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<td>Diploma or HND</td>
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<td>University degree</td>
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<td>Postgraduate qualification</td>
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<td>14 (5.0)</td>
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<td>Missing</td>
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<td>Highest household occupational status</td>
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<td>Professional/managerial</td>
<td>15 (30.0)</td>
<td>141 (50.2)</td>
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<td>Intermediate occupation</td>
<td>11 (22.0)</td>
<td>56 (19.9)</td>
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<td>Routine and manual occupation</td>
<td>15 (30.0)</td>
<td>66 (23.5)</td>
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<td>Long-term unemployed</td>
<td>3 (6.0)</td>
<td>11 (3.9)</td>
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<td>6 (12.0)</td>
<td>7 (2.5)</td>
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<tr>
<td>Language spoken at home(b)</td>
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<td>0.594</td>
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<tr>
<td>English only</td>
<td>46 (92.0)</td>
<td>248 (88.3)</td>
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<tr>
<td>English and other language(s)</td>
<td>4 (8.0)</td>
<td>29 (10.3)</td>
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<tr>
<td>Missing</td>
<td>0 (0.0)</td>
<td>4 (1.4)</td>
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<tr>
<td>Number of smokers in home</td>
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<tr>
<td>0</td>
<td>24 (48.0)</td>
<td>182 (64.8)</td>
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<td>1</td>
<td>12 (24.0)</td>
<td>54 (19.2)</td>
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<tr>
<td>≥2</td>
<td>13 (26.0)</td>
<td>34 (12.1)</td>
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<tr>
<td>Missing</td>
<td>1 (2.0)</td>
<td>11 (3.9)</td>
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<tr>
<td>Gestational age at birth (weeks)</td>
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<td>&lt;23 weeks</td>
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<tr>
<td>24 weeks</td>
<td>14 (28.0)</td>
<td>45 (16.0)</td>
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<td>25 weeks</td>
<td>21 (42.0)</td>
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<td>Term</td>
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<td>130 (46.3)</td>
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<td>Neurosensory or motor impairment</td>
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<tr>
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<tr>
<td>No</td>
<td>44 (88.0)</td>
<td>262 (93.2)</td>
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</tbody>
</table>

\(\text{NVQ, national vocational qualification; CSE, certificate of secondary education; O level, ordinary level; GCSE, general certificate of secondary education; BTEC, Business and Technology Education Council; A level, advanced level; HND, higher national diploma.}\)

\(a. \chi^2\)-test.

\(b. \) Distinguished from ethnicity for which the comparison groups were matched. To our knowledge, all study children spoke English with varying levels of proficiency.
Table DS3  Mean costs over the previous year of life and mean cost differences between children with and without DSM–IV clinical diagnosis by cost category (UK £ sterling, 2006–7 prices)

<table>
<thead>
<tr>
<th>Cost category</th>
<th>With diagnosis</th>
<th>Without diagnosis</th>
<th>Mean difference</th>
<th>95% CI a</th>
<th>( p^b )</th>
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</thead>
<tbody>
<tr>
<td>Preterm sample, n</td>
<td>39</td>
<td>151</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs, mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital in-patient care</td>
<td>343.1</td>
<td>346.6</td>
<td>–3.5</td>
<td>–371.5 to 364.5</td>
<td>0.985</td>
</tr>
<tr>
<td>Hospital out-patient and day care</td>
<td>262.7</td>
<td>131.0</td>
<td>131.7</td>
<td>–19.7 to 283.0</td>
<td>0.096</td>
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<tr>
<td>Total hospital</td>
<td>605.8</td>
<td>477.6</td>
<td>128.2</td>
<td>–326.5 to 582.9</td>
<td>0.579</td>
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<tr>
<td>Community health and social care</td>
<td>1216.7</td>
<td>462.2</td>
<td>754.5</td>
<td>382.8 to 1126.2</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Drugs/medications</td>
<td>32.2</td>
<td>21.5</td>
<td>10.7</td>
<td>–15.7 to 37.1</td>
<td>0.437</td>
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<tr>
<td>Total health and social care</td>
<td>1854.7</td>
<td>961.3</td>
<td>893.4</td>
<td>224.7 to 1562.0</td>
<td>0.010</td>
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<tr>
<td>Education</td>
<td>6217.1</td>
<td>5112.5</td>
<td>1104.6</td>
<td>–828.7 to 3037.9</td>
<td>0.269</td>
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<tr>
<td>Total public sector</td>
<td>8071.8</td>
<td>6073.8</td>
<td>1998.0</td>
<td>–164.4 to 4160.4</td>
<td>0.076</td>
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<tr>
<td>Term sample, n</td>
<td>11</td>
<td>130</td>
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<td></td>
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<tr>
<td>Costs, mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hospital in-patient care</td>
<td>123.7</td>
<td>42.5</td>
<td>81.2</td>
<td>–162.1 to 324.5</td>
<td>0.531</td>
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<tr>
<td>Hospital out-patient and day care</td>
<td>213.8</td>
<td>36.3</td>
<td>177.5</td>
<td>–199.0 to 554.0</td>
<td>0.371</td>
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<tr>
<td>Total hospital</td>
<td>337.5</td>
<td>78.8</td>
<td>258.7</td>
<td>–161.7 to 679.1</td>
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<td>523.9</td>
<td>252.3</td>
<td>271.6</td>
<td>31.5 to 511.8</td>
<td>0.050</td>
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<td>Drugs/medications</td>
<td>40.5</td>
<td>9.3</td>
<td>31.1</td>
<td>–43.8 to 106.1</td>
<td>0.433</td>
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<td>901.9</td>
<td>340.4</td>
<td>561.5</td>
<td>–105.3 to 1228.3</td>
<td>0.131</td>
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<tr>
<td>Education</td>
<td>3152.0</td>
<td>3662.9</td>
<td>–510.9</td>
<td>–948.1 to –73.6</td>
<td>0.025</td>
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<tr>
<td>Total public sector</td>
<td>4053.9</td>
<td>4003.3</td>
<td>50.6</td>
<td>–752.3 to 853.6</td>
<td>0.903</td>
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<tr>
<td>Total sample, n</td>
<td>50</td>
<td>281</td>
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<td>Costs, n</td>
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<tr>
<td>Hospital in-patient care</td>
<td>294.9</td>
<td>205.9</td>
<td>89.0</td>
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<td>87.2</td>
<td>164.7</td>
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<td>Total hospital</td>
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<td>253.7</td>
<td>–80.5 to 587.9</td>
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<td>365.1</td>
<td>699.2</td>
<td>398.9 to 999.4</td>
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<td>15.9</td>
<td>18.1</td>
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<td>971.0</td>
<td>448.1 to 1493.9</td>
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<td>–1101.0</td>
<td>–411.0 to 2612.9</td>
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<tr>
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<td>2071.9</td>
<td>348.7 to 3795.2</td>
<td>0.020</td>
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</tbody>
</table>

a. Bootstrap estimation using 10,000 replications, bias corrected.

b. \( p \)-values calculated using Student’s \( t \)-test.
Economic costs and preference-based health-related quality of life outcomes associated with childhood psychiatric disorders
Stavros Petrou, Samantha Johnson, Dieter Wolke, Chris Hollis, Puja Kochhar and Neil Marlow
Access the most recent version at DOI: 10.1192/bjp.bp.110.081307

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