

How do child and adolescent mental health problems influence public sector costs?

Inter-individual variations in a nationally representative British sample

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Declaration of interest: None

Acknowledgements: This paper presents independent research funded from Department of Health grant 035/0045, and Wellcome Clinical Fellowship GR056900MA. Views expressed are those of the authors and not necessarily those of the funders.

Abstract

Background: Policy and practice guidelines emphasise that responses to children and young people with poor mental health should be tailored to needs, but little is known about the impact on costs. We investigated variations in service-related public sector costs for a nationally representative sample of children in Britain, focusing on the impact of mental health problems. **Methods:** Analysis of service use data and associated costs for 2461 children aged 5-15 from the British Child and Adolescent Mental Health Surveys. Multivariate statistical analyses, including two-part models, examined factors potentially associated with inter-individual differences in service use related to emotional or behavioural problems and cost. We categorised service use into primary care, specialist mental health services, frontline education, special education and social care. **Results:** Marked inter-individual variations in utilisation and costs were observed. Impairment, reading attainment, child age, gender and ethnicity, maternal age, parental anxiety and depression, social class, family size and functioning were significantly associated with utilisation and/or costs. **Conclusions:** Unexplained variation in costs could indicate poor targeting, inequality and inefficiency in the way that mental health, education and social care systems respond to emotional and behavioural problems.

Introduction

Policy frameworks and practice guidelines emphasise the individuality of children and adolescents with mental health problems, and the need for services and preventive strategies to be responsive to their needs and preferences, and to individual, family and social contexts (Department of Health, 2014). It is therefore likely that costs of care, support and treatment could vary between individuals, as suggested by Snell et al. (2013).

Why do these variations occur? It seems intuitively plausible that the orientation of a particular service might influence who is seen; for example, children with comorbid mental health and learning problems may be more likely to access school or specialist educational resources in relation to poor mental health, and those with difficult psychosocial situations or comorbid health conditions might be more likely to be seen within social services or health services. We might also expect – indeed hope – that more severe needs or impairments would be associated with greater service responses and hence higher costs. However, surprisingly few previous studies have explored such sources of variance, and yet identification of associations (or lack of them) could usefully inform policy, funding and provision decisions.

We used data from a nationally representative sample of children and adolescents aged 5-15 years to explore individual-level variations in the costs of health, education and

social care service contacts related to their mental health, and their associations with a range of child and adolescent, parent and family characteristics.

Methods

Data sources

Service use data were taken from the British Child and Adolescent Mental Health Survey (BCAMHS) of 10,438 children and adolescents aged 5-15 years in Great Britain (Meltzer et al., 2000). Figure 1 summarises the process. The 'baseline' survey (time 1) was in 1999. After two years, those identified with a psychiatric disorder at baseline (n=929) and one-third of those without disorder (n=3074) were posted a follow-up questionnaire (time 2). Those who reported contact with frontline professionals (primary care or teachers) or specialised services (health, education or social care) were invited to participate in a telephone interview (n=439) to collect detailed information on service use. Those who completed the time 2 postal questionnaire were invited to repeat the baseline interview at three years (time 3), with service users followed up in a further round of telephone interviews (n=403). Data on 2461 children were collected on all three occasions.

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Service use

Service use data therefore covered three years. Information was also collected from parents on whether services had been used over a specific period (since baseline at time

2; in the preceding year at time 3), while telephone interviews collected additional data on practitioners involved, frequency and length of contact. Services included primary health care, children's health services, specialist mental health services, paediatric services, teaching staff, specialist education professionals and social care services. Telephone interviews used the Children's Service Interview, which has good validity and test-retest reliability, and achieved response rates among those approached to complete a telephone interview of 88% (time 2) and 85% (time 3) (Ford et al., 2007a, 2007b).

Our analyses include all children reported to receive some response from health or school-based services as a direct result of emotional or behavioural problems, irrespective of whether those problems were sufficient for ICD-10 diagnosis. Most childhood psychiatric disorders represent the extreme end of traits normally distributed across the population; thus, cut-points are essentially arbitrary between those with and without disorder. Impairment and service use are not restricted to children who warrant diagnosis, but also evident among those with lesser difficulties (Scott et al., 2001; Goodman & Goodman, 2009). Thus, previous studies support inclusion of all mental health-related service contacts.

Although parents were asked to register only service contacts relating specifically to concerns about their child's 'emotions, behaviour and concentration', it became apparent during telephone interviews that they were also indicating professional

contacts not strictly related to these difficulties. Interviewers graded service contacts to indicate relevance to emotional and behavioural problems; only those graded as ‘mostly/totally related’ were included. For example, additional educational support related to dyslexia was not seen as mental health-related, while seeing a school doctor for assessment of special educational needs linked to autism *would* be.

Unit costs

Costs were expressed in pounds sterling (£), 2007/08 prices. Health and social care unit costs were derived, where available, from Curtis (2008).

Costs for teachers, teaching support staff and special educational needs officers were derived from salary scales published online by the National Union of Teachers, with additions for salary-related costs (e.g. pension contributions) and overheads incurred by employers. Special school costs were estimated using *Education Cost Statistics* published online by the Chartered Institute for Public Finance and Accountancy, assuming a 40% cost difference between residential placements (where children are resident overnight) and day placements (where they are not), based on the proportional difference in residential and day care costs for older people (Netten & Curtis, 2003).

Costs of special educational needs tribunals – independent judicial bodies charged with settling disputes between parents and local authorities over special educational needs provision – were derived from Lord Chancellor’s Department (2001) figures.

Costs applied to services used by children in London were adjusted to reflect higher costs in the capital (Netten & Curtis, 2003).

Statistical analyses

Statistical analyses investigated patterns of association between measured characteristics of children in contact with services and cost for each of five service groups in turn (primary care, specialist mental health services, frontline (i.e. standard) education, special education (i.e. for children with special needs) and social care contacts). For each, a two-part model separated analysis of processes that drive the likelihood of *any* service use from those that determine *volume* of resource use (cost) for those individuals using at least some services (Duan et al., 1983). Figure 2 lists variables included in the analyses.

(Figure 2 here)

To maximise information available for analysis, and to reduce risk of bias from exclusion of individuals with missing data, we used multiple imputation to replace missing data in explanatory variables (Graham, 2009). Missing data was not a serious problem; it could stem from failure to contact for follow-up interview, non-response (see Figure 1), or incomplete service use reports. (Details available from authors.) Results of the imputation were checked to ensure that nonsensical values were not generated. STATA's 'MIM' command was applied to combine results from the imputed datasets.

Dummy indicators identifying any service receipt for any participant completing time 2 and time 3 telephone follow-ups were constructed. Logit models examined factors associated with service contacts. All individuals with missing service use data who reported use of at least one service within a group at either time point were included.

Given the possibility of non-normality and skewed cost data, we estimated generalised linear models (GLM) with a log-link function (McCullagh & Nelder, 1989), using Manning & Mullahy's (2001) algorithm to inform model selection. If error variances were homoskedastic, we used robust standard errors to calculate test statistics.

For each service group, two sets of GLM cost estimations were generated, one based on the complete estimation sample and the other using a trimmed sample removing observations in the top and bottom 5% of the cost distribution to test for sensitivity to removal of outlying observations, particularly with regard to effect sizes estimated on variables identifying problem severity. This is potentially important when analysing cost variations within relatively small samples.

Results

Characteristics of the follow-up sample were compared with the original sample surveyed at baseline (Table 1). Children and adolescents who participated in both follow-ups showed *greater* likelihood of suffering from emotional, conduct and

hyperkinetic disorders than those who completed baseline only or completed just one follow-up; this was exactly as anticipated given the sample design. However, families at socio-economic disadvantage and children from ethnic minorities were *less* likely to participate at follow-up.

(Table 1 here)

Analyses of variations: distributional form

Using Manning & Mullahy's (2001) algorithm to inform model selection, a gamma distribution best fitted the cost data.

Factors associated with service use

Results of the multivariate analyses are reported in Tables 2 and 3. Taking into account effects of other covariates, some individual and family characteristics were associated with either the binary measure of some service use or cost.

Child characteristics significantly associated with some service use and cost measures over the subsequent three years were: age, gender, ethnicity, SDQ and reading test scores at baseline. In the first-stage analyses, the only significant association was that older children were less likely to use frontline education. In the second stage, this relationship was reversed; age was positively associated with higher primary care costs, but not with other costs. Girls were more likely to use special education (linked to emotional or behavioural problems), and to have higher primary care costs. White

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children had lower special education costs than those from black, Asian or other minority ethnic groups.

Mental health difficulties (SDQ impact score) were positively associated with receipt of any services for all five service groups: greater impairment at baseline was associated with higher subsequent likelihood of using services (Table 2). In the second-stage, however, significant association between cost and SDQ was only observed for specialist mental health services (Table 3).

Higher reading test scores were negatively related to service use for all service groups except specialist mental health. However, when looking at those who accessed services, reading test score was only significantly related to costs for frontline and special education.

Three family indicators were significantly associated with service use or cost. Parental social (occupational) class was significant only once: lower social class was associated with lower likelihood of using frontline education resources. Family size was not linked to likelihood of using services, but was linked to higher costs of mental health services in primary care and lower specialist mental health and special education costs. Greater family discord or dysfunction at baseline (Miller et al., 1985) was associated with greater likelihood of use of specialist mental health services and social care, and – for sample

members with non-zero service use – with *lower* costs of primary care, specialist mental health and special education services.

Maternal age at the time of birth was not linked to whether the child made any use of services, but – for sample members who *did* use services – was positively associated with primary care, specialist mental health and frontline education costs. Parental symptoms of anxiety and depression were related to greater likelihood of use by the child of primary health care, specialist mental health and special education, but not to higher costs.

(Tables 2 and 3 here)

The GLM estimates were sensitive to exclusion of observations in the top and bottom 5% of the cost distribution (Table 4); stronger positive association was observed between SDQ impact score and costs of social services in the trimmed sample.

(Table 4 here)

Discussion

Mental health problems in childhood and adolescence have large, wide-ranging, enduring economic impacts, and those impacts vary considerably between individuals (Snell et al., 2013; Scott et al., 2001; Knapp et al., 2011; D’Amico et al., 2014). We examined whether child and adolescent, mother and family characteristics were associated, in the subsequent three years, with likelihood of using services (primary care, specialist mental health services, frontline education, special education and social

care) and, if so, the public sector costs of those services. We only looked at service use linked to emotional and behavioural problems.

Strengths and limitations

Data came from the first British national epidemiological survey of child and adolescent mental health problems, which included interviewer-administered follow-up collections over a three-year period for a large sample. (A second survey in 2004, with follow-up in 2007, had far less reliable service data; Green et al., 2007; Parry-Langdon, 2008.) This design stands in contrast to previous studies of service use and cost variations which have used smaller, locally drawn samples, and often individuals already in contact with mental health or other specialist services. Most previous studies have employed cross-sectional designs, which suffer from the weakness that costs are measured over time, usually the period *preceding* ratings of symptoms or impairment, making it impossible to interpret any associations between impairment and costs as representing predictive links running from the former to the latter. Indeed, good quality services responding to identified need might be expected to *reduce* impairment, which would lead to a *negative* association between costs and impairment.

Nevertheless, our analyses have limitations. Children looked after by local authorities were excluded, and these tend to have above-average rates of psychiatric disorder and complex needs (Ford et al., 2007c). Children from more disadvantaged social backgrounds were under-represented in the follow-up (Ford et al., 2003). We do not

know whether these exclusions affected our estimated relationships. Despite the large initial sample and imputation of missing values, numbers in some subgroups were low because many children did not use services. Estimated standard errors suggest some imprecision in some estimated regression parameters, including those relating to severity of impact and reading attainment, although precision here was no worse, and probably better, than in studies with considerably smaller samples.

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There is risk of misspecification of functional relationships between costs and the explanatory variables. The GLMs were estimated using a log-link function. In the absence of prior theoretical guidance on appropriate functional form, and in view of the pitfalls of data-mining, we chose a simple log-link specification on the basis of its wider application in other relevant studies (Manning & Mullahy, 2001; Kilian et al., 2002).

Our models were somewhat sensitive to exclusion of outliers, particularly the estimated slope effects and relative predictive power. The mental health service estimations were most sensitive to inclusion or otherwise of a single sample member whose total package of mental health-related care cost more than £25,000 over three years (compared to £5,000 for the next highest individual). While this young person was not described as having any mental disorder at baseline, researchers rated his/her services over follow-up as strongly related to the presence of behavioural and emotional difficulties (a history of special educational needs, social care placement, and contact with police and youth justice services). Psychosocial difficulties are not static, and at the time SDQ

ratings were made there may genuinely have been few problems to report, with more serious difficulties developing later, as suggested in this case in the telephone interview. Either way, including a case with such high costs combined with low baseline SDQ impact score would significantly flatten any underlying slope effect otherwise observed within a less extreme range of costs. Generally, there were few concerns that measurement error among outliers was having such extreme effects.

Summary of findings and comparisons with previous studies

Children and adolescents with higher SDQ impact scores were more likely to use at least some services in each of the five groups, and – for those with non-zero usage – to make greater use of specialist mental health services and perhaps special educational resources, as measured by higher costs. With the trimmed sample, SDQ impact score was additionally a significant predictor of social care costs. These findings clearly show the targeting of mental health-related services on young people with higher levels of impairment. Primary care and frontline education costs were not associated with higher SDQ impact scores in the same way, perhaps less surprising given their gate-keeping roles.

Although some previous studies have examined associations between impairment, symptoms or functioning (using various scales) and costs (using various definitions), few have examined data at more than one time-point. Cross-sectional evidence on such associations cannot be unambiguously interpreted and is not considered here. Hodges &

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Wong (1997) found a functional assessment scale rated at baseline for 590 youths referred for mental health services was a strong predictor of service use and cost 6 and 12 months later. Beecham et al. (2009) looked at 155 consecutive admissions to child and adolescent psychiatric inpatient units: global impairment at admission was a significant predictor of subsequent costs. Clark et al. (2005) looked at 60 young people 'of greatest concern with complex mental health problems' in a one-year prospective design: costs were associated with social factors but not with diagnosis or need. Minnis et al. (2006) found SDQ total score to be associated with cost over the subsequent 9 months for children in foster care.

Reading attainment at school (age-adjusted) was measured at baseline using the British Ability Scales (Elliot et al., 1978). Lower reading test scores predicted higher likelihood of use of all services except specialist mental health, and predicted higher costs for frontline and special education services. While intuitively plausible and suggestive of targeting, this may indicate that emotional distress and/or behavioural disturbance highlights reading difficulties to practitioners in schools or vice versa. Previously, Scott et al. (2001) found that reading attainment at age 10 predicted health and social care costs and criminal justice contacts by early adulthood, pointing to *enduring* links between reading difficulties and antisocial behaviour.

Older children were less likely than younger children to have frontline education contacts linked to mental health problems, and to have higher primary care costs, even

though mental health problems increase with age (Green et al., 2005). Clark et al. (2005) and Beecham et al. (2009) found child age to be negatively linked to overall costs in their respective longitudinal analyses. We found gender generally not to be a predictor of service use, except girls were more likely to use special education (related to emotional or behavioural problems) even though special educational needs are more prevalent in boys (Department for Education and Schools, 2007), suggesting a mismatch between needs and responses. Girls had higher mental health costs in primary care. In contrast, Romeo et al. (2006) found that girls aged 3-8 referred to mental health services with severe antisocial behaviour had *lower* costs than boys. In that same study, ethnicity was not correlated with costs, whereas we found that children from minority ethnic groups had *higher* mental health-related special education costs. These associations of age, gender and ethnicity with costs and service use may reflect differential recognition and targeting, and warrant further investigation.

Parental anxiety and depression at baseline was associated with use (by the child) of mental health services within primary care, specialist mental health and special education, even after adjusting for SDQ score: perhaps more stressed parents are more likely to seek services for their children. Better identification and treatment of parental mental illness health would have benefits for both generations. This mirrors arguments from Bauer et al. (2014), who found high costs associated with child mental health needs linked to maternal perinatal depression. Our findings, coupled with Bauer's, reinforce the economic case for treating parental mental illness. Although likelihood of

service use for mental health-related reasons was not related to maternal age at time of birth, primary care, specialist mental health and frontline education costs were higher for older mothers.

Single parenthood was not linked to probability of service use or costs, a result also found by Romeo et al. (2006), whereas social (occupational) class, family size and family functioning all influenced either service use or costs. Children in families where the head of household had lower occupational status were *less* likely to use frontline education resources, while children in larger families generated higher mental health-related primary care costs, and lower specialist mental health and special education costs. Worse family functioning was a positive predictor of using specialist mental health and social care services, but a *negative* predictor of primary care, specialist mental health and special education costs. Family dysfunction may therefore be an important barrier to service engagement. Again, it is intuitively plausible that poor family function is associated with poor mental health in children, which adds further support to calls for investment in parenting programmes (e.g. Chief Medical Officer, 2013). Previous research has also emphasised the importance of parental concerns in engagement with child mental health treatment (Larson et al., 2011; Ford et al., 2005b).

Although numerous statistically significant associations were found, the pseudo-R² statistics show that high proportions of variation in access to services and costs remain *unexplained* by variables included in the equations. There is therefore either a large

stochastic element or there are important influences on service use and costs not measured in the survey. This could indicate inequality in the way that the health, education and social care systems identify, refer and respond to mental health needs; or it could point to system-wide inefficiencies in use of scarce resources.

Conclusions

We found considerable variability in mental health-related service use and costs between children and adolescents, but also some underlying patterns of association with child, parent and family characteristics. Some inter-individual variability is appropriate in that it reflects perceived differences in needs. For example, positive associations between SDQ and reading attainment on the one hand, and service use and costs on the other suggest that needs are identified and responded to by a range of services. However, poorer family functioning was associated with *lower* primary care, specialist mental health and special education costs, which would certainly not be expected of a well-targeted mental health system. Family dysfunction may itself be a barrier to appropriate service engagement. And parental depression and anxiety pushes up costs associated with *child* mental health problems, demonstrating the importance of better recognition of mental health needs across *all* generations.

Key points

- SDQ and reading score are linked to service use and cost, suggesting modest targeting of services on mental health needs, especially for more severe problems.
- Lower reading attainment was associated with greater likelihood of using most services, but, among service users, only related to higher costs of frontline education and special education.
- Older children were less likely to use frontline education support; girls were more likely to use special education services; and children from minority ethnic groups had higher special education costs (all related to emotional or behavioural problems). There were no other associations with age, gender or ethnicity.
- Lower social class was associated with lower frontline education service use; while children in larger families had higher mental health-related primary care costs, and lower specialist mental health and special education costs.
- Family dysfunction may be a barrier to service engagement: poor family functioning predicted use of specialist mental health and social care services, but also predicted lower primary care, specialist mental health and special education costs.
- Variation in service use and costs highlight potential disparities in health, education and social care responses to needs, implying inequity and/or inefficiency.

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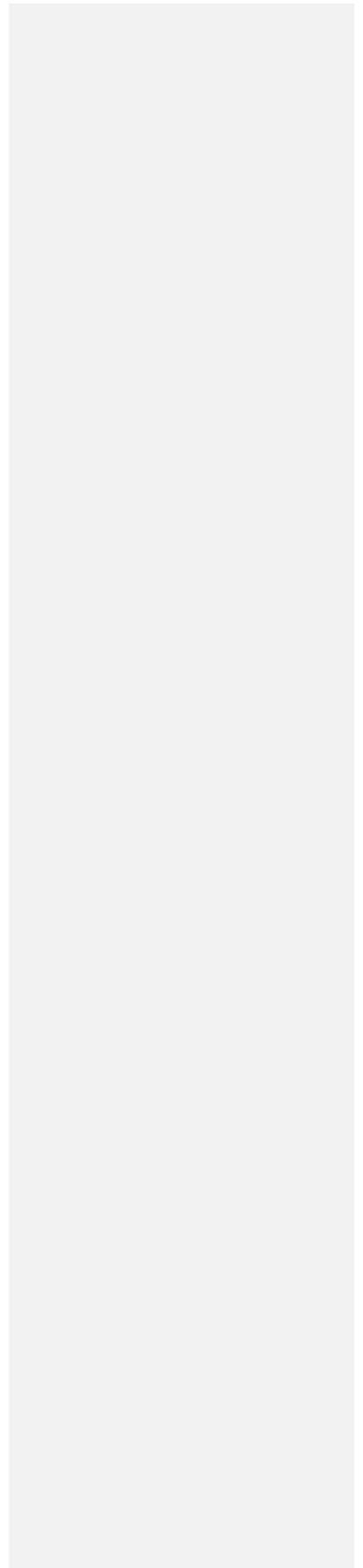


Figure 1. Flow diagram illustrating composition of sample for studying service use

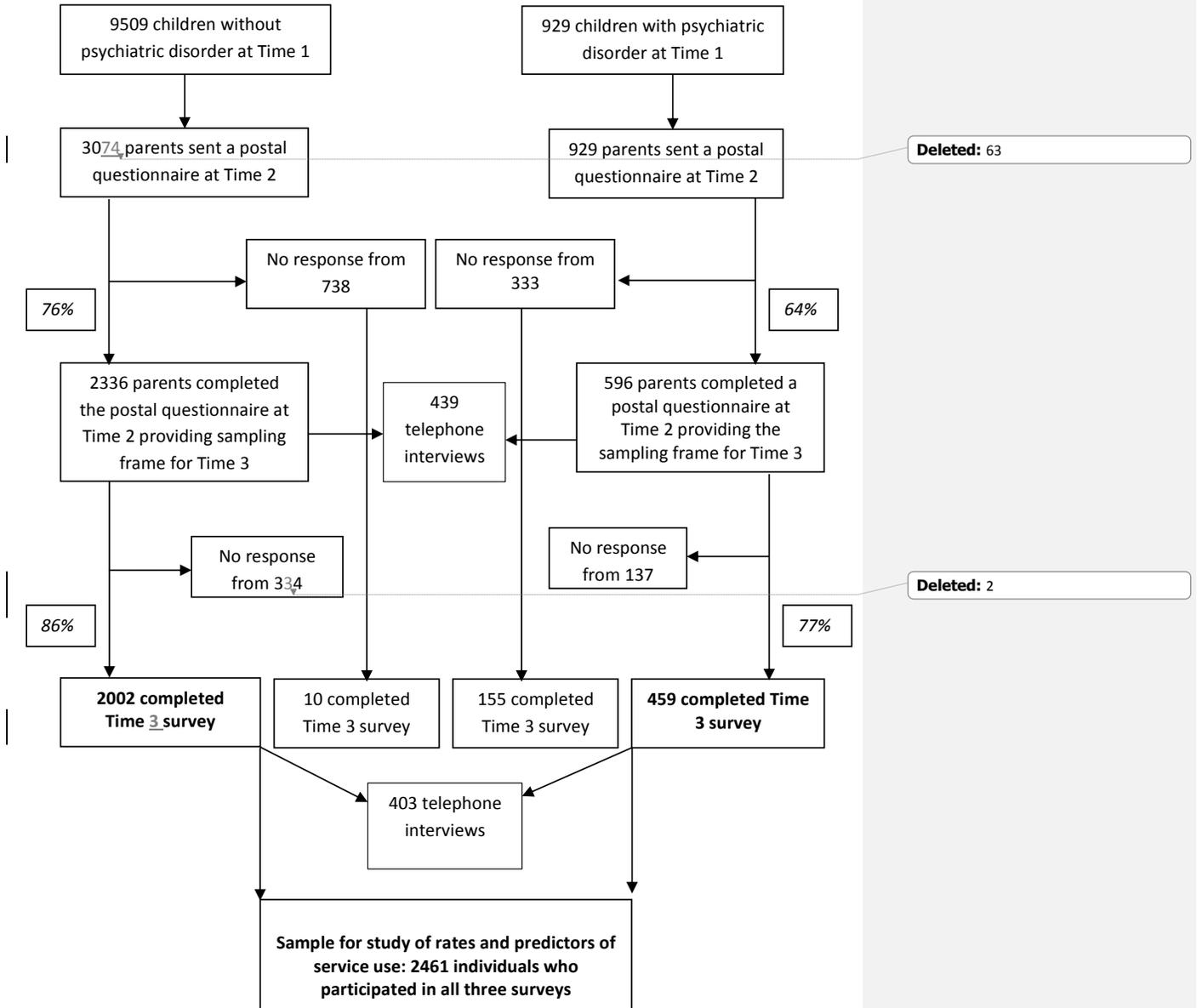


Figure 2. Explanatory variables

CHILD CHARACTERISTICS

Age: Age at baseline of child/adolescent in years.

Gender: Gender of child/adolescent (0 = female; 1 = male).

Ethnicity: Ethnic origin of child/adolescent (0 = black, Asian or other ethnic minority group; 1 = white).

SDQ impact score: Impact of emotional or behavioural problems on child at baseline (parent-rated), using the 10-point Impact scale of the widely used and validated Strengths and Difficulties Questionnaire (SDQ; Goodman, 1999). This measure covers severity of impact on various aspects of day-to-day living; higher scores indicate greater impairment.

Reading test score: Reading attainment at school measured at baseline: Z-transformed, age-adjusted reading test scores based on British Ability Scales (Elliot et al., 1978); higher scores indicate higher ability.

FAMILY CHARACTERISTICS

Large family: Family size at baseline (0 = fewer than 3 siblings; 1 = three or more siblings).

Single parent family: Child/adolescent lived in single-parent household at baseline (0 = conventional or reconstituted family; 1 = single parent family).

Family functioning: General functioning scale of the McMaster Family Assessment Device (Miller et al., 1985) to measure family discord. Focusing on degree of functioning across a range of domains relating to interpersonal relationships within the family environment, it is reported by parent during interview. Scale runs from 21 to 41; higher scores indicate greater dysfunction.

PARENT CHARACTERISTICS

Social class: Occupational class of head of household, identified using Registrar General's classificatory system of occupational status (1 = professional; 2 = managerial/technical; 3 = non-manual/skilled; 4 = manual/skilled; 5 = semi-skilled; 6 = unskilled; 7 = student/never worked).

Age of mother: Age of the child/adolescent's mother at the time when child/adolescent was born.

Parental GHQ: Parent's anxiety- and depression-related symptoms at baseline, measured by the General Health Questionnaire (Goldberg & Williams, 1998). Scale runs from 0 to 12; higher scores represent poorer mental health. Almost all respondents were mothers.

Table 1: Sample characteristics

Baseline characteristics for children with data for these variables	Participated in both follow-ups (n=2461)	Not in both follow-ups (n=7977) ¹	Total sample (n=10438)
Mean age (years)	9.9	9.9	9.9
Male (%)	51.6	49.4	49.9
Verbal intelligence quotient (mean)	102.9	100.6***	101.1
Reading quotient (mean)	104.7	103.4**	103.7
Any psychiatric disorder (%)	18.7	5.9***	8.9
Emotional disorder (%)	9.3	2.7***	4.3
Conduct disorder (%)	8.9	3.4***	4.7
Hyperkinetic disorder (%)	2.8	0.8***	1.3
Ethnicity: White (%)	94.3	90.4***	91.4
Afro-Caribbean (%)	1.7	2.6***	2.4
Asian (%)	2.1	4.4***	3.9
Other (%)	1.9	2.6***	2.4
Family: Traditional (%)	70.4	65.3***	66.5
Lone parent (%)	18.8	23.3***	22.3
Reconstituted (%)	10.7	11.3***	11.2
Parental GHQ score (mean)	1.9	1.8	1.8
Family function score (mean)	24.6	24.7	24.7
Weekly income < £199 (%)	19.3	25.1***	23.7
At least one parent working (%)	86.1	80.3***	81.7
Homeowners (%)	74.8	65.6***	67.8
3 or more siblings (%)	1.7	3.2***	2.8
Non-manual occupation (%)	54.8	50.0***	51.1
No maternal qualifications (%)	19.1	24.6***	23.3
Mean age of mother at birth of child (yrs)	28.2	27.4***	27.6

1. The number in original sample of 10438 that did not participate in both follow-ups.

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

Table 2: Predictors of any service utilisation by service group; logit analyses for full estimation sample

Baseline measures	Primary care services		Mental health services		Frontline education resources		Special education resources		Social care services	
	β	P	β	P	β	P	β	P	β	p
Child characteristics										
Age	0.00	0.99	-0.17	0.62	-0.14	0.00	0.09	0.10	0.01	0.81
Gender (male)	0.08	0.62	0.32	0.16	0.27	0.15	-0.63	0.05	0.18	0.56
Ethnicity (white)	0.11	0.77	-0.40	0.34	0.70	0.20	0.78	0.47	-0.60	0.24
SDQ impact score	0.31	0.00	0.47	0.00	0.59	0.00	0.43	0.00	0.34	0.00
Reading test	-0.30	0.00	-0.10	0.41	-0.32	0.00	-0.83	0.00	-0.52	0.00
Family characteristics										
Large family	-0.80	0.32	-0.19	0.82	-1.27	0.29	-0.35	0.76	0.36	0.64
Single parent family	-0.08	0.71	-0.10	0.73	-0.04	0.90	0.24	0.52	0.37	0.26
Family functioning	0.03	0.47	0.09	0.04	0.04	0.43	0.04	0.57	0.09	0.09
Parent characteristics										
Social class of parents	-0.09	0.14	-0.11	0.16	-0.22	0.00	-0.10	0.40	0.12	0.23
Age of mother	0.00	0.81	0.02	0.37	0.13	0.52	0.03	0.32	0.00	0.97
Parental GHQ	0.11	0.00	0.08	0.02	0.00	1.00	0.10	0.03	-0.02	0.69
Constant term	-3.31	0.01	-5.83	0.00	-3.15	0.04	-7.72	0.00	-6.72	0.00
Proportion using services during 3-year follow-up period	0.085		0.050		0.071		0.024		0.022	
Pseudo-R ²	0.095		0.166		0.137		0.254		0.162	
N	2193		2180		1967		2202		2450	

a. Pseudo-R² is mean value from five imputed datasets

Table 3: Predictors of service costs by service group; generalised linear model results for full estimation sample

Baseline measures	Primary care services		Mental health services		Frontline education resources		Special education resources		Social care services	
	β	P	β	P	β	P	β	P	β	p
Child characteristics										
Age	0.15	0.00	0.06	0.26	-0.06	0.55	0.18	0.20	-0.05	0.36
Gender (male)	-0.38	0.07	0.25	0.39	-0.74	0.12	-0.03	0.96	0.16	0.70
Ethnicity (white)	-0.10	0.74	0.67	0.11	-0.66	0.59	-5.57	0.05	0.28	0.75
SDQ impact score	0.04	0.48	0.11	0.03	0.26	0.16	0.25	0.10	0.09	0.31
Reading test	0.07	0.57	-0.16	0.23	-1.02	0.00	-1.23	0.00	-0.25	0.30
Family characteristics										
Large family	1.88	0.03	-3.24	0.00	-0.06	0.94	-3.43	0.00	0.14	0.88
Single parent family	0.16	0.55	0.24	0.53	-0.69	0.30	-0.19	0.88	0.10	0.79
Family functioning	-0.11	0.00	-0.15	0.01	0.13	0.37	-0.39	0.01	0.09	0.29
Parent characteristics										
Social class of parents	-0.01	0.86	0.03	0.81	0.09	0.64	-0.12	0.70	-0.05	0.66
Age of mother	0.04	0.03	0.05	0.05	0.15	0.00	0.09	0.18	-0.01	0.79
Parental GHQ	0.04	0.25	0.06	0.14	-0.05	0.75	0.09	0.34	0.04	0.42
Constant term	5.23	0.00	6.89	0.00	0.40	0.91	17.5	0.03	5.75	0.04
Mean cost over 3-year follow-up period	£144.71		£824.18		£2,841.10		£10,634.00		£3,135.90	
Pseudo-R ²	0.117		0.092		0.001		0.196		0.107	
N	188		109		140		52		55	

a. Pseudo-R² is mean value from five imputed datasets

Table 4: Predictors of service costs by service group; generalised linear model results for trimmed sample

Baseline measures	Primary care services		Mental health services		Frontline education resources		Special education resources		Social care services	
	β	P	β	P	β	P	β	P	β	p
Child characteristics										
Age	0.08	0.00	0.01	0.89	-0.01	0.87	0.17	0.21	-0.05	0.38
Gender (male)	-0.43	0.01	0.44	0.08	-0.57	0.21	0.13	0.84	-0.13	0.72
Ethnicity (white)	0.10	0.64	0.41	0.28	-1.48	0.15	-5.52	0.06	0.53	0.50
SDQ impact score	0.04	0.38	0.15	0.00	0.20	0.21	0.22	0.13	0.16	0.03
Reading test	0.03	0.72	-0.19	0.06	-0.85	0.01	-1.22	0.00	-0.23	0.29
Family characteristics										
Large family	-0.56	0.06	-2.09	0.00	0.49	0.55	-3.47	0.00	0.04	0.96
Single parent family	0.18	0.42	-0.45	0.08	-0.82	0.18	0.16	0.91	0.39	0.28
Family functioning	-0.04	0.18	-0.12	0.03	-0.13	0.03	-0.37	0.01	-0.02	0.80
Parent characteristics										
Social class of parents	-0.02	0.79	0.07	0.42	0.25	0.17	-0.19	0.62	0.09	0.32
Age of mother	0.02	0.19	0.04	0.14	0.09	0.03	0.08	0.36	-0.01	0.89
Parental GHQ	-0.01	0.66	0.05	0.14	-0.17	0.05	0.08	0.39	0.05	0.27
Constant term	4.45	0.00	6.95	0.00	8.23	0.00	17.7	0.04	7.26	0.00
Mean cost over 3-year follow-up period	£97.51		£672.97		£1,121.08		£9,089.24		£2,669.48	
Pseudo-R ²	0.084		0.274		0.006		0.233		0.067	
N	173		99		131		48		52	

a. Pseudo-R² is mean value from five imputed datasets