

# Factors that Influence the Cost of Deliberate Self-poisoning in Children and Adolescents

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## Abstract

**Background:** Ideally, the type and quantity of services received by young people with mental health problems would be determined by need alone. In reality, however, a number of factors will influence resource-use, and thus the total cost of care.

**Aims of the study:** The aim of this study was to evaluate the impact of baseline patient and family characteristics on the total cost of caring for children and adolescents who have deliberately poisoned themselves. It was hypothesised that the cost of this patient group would be associated with severity of suicidality and other psychiatric characteristics, the existence of current problems and demographic and socio-economic characteristics.

**Methods:** Univariate and multivariate regression analyses were used to examine the associations between baseline characteristics and both total statutory service costs and total NHS costs in 149 young people aged 16 years and under, referred to child mental health teams with a diagnosis of deliberate self-poisoning.

**Results:** Baseline variables found to be significantly associated with relatively more expensive care packages included a definite intention to die, the existence of current problems, being in foster care, poorer parental well being and not having a diagnosis of conduct disorder. No significant relationships were found between cost and measures of illness severity, including suicidal ideation, hopelessness and severity of depression.

**Discussion:** Although costs are not influenced by clinical measures of severity, service provision does appear to respond to more 'practical' notions of severity, such as intent to die and the existence of current problems. Some high-risk sub-groups, such as those with a conduct disorder and those who have experienced episodes of local authority care or accommodation, appear to be slipping through the health services net, although this may be due more to the demand-side problem of non-compliance than to issues of supply.

**Implications for Health Care Provision and Use:** The evidence presented suggests that health care providers are directing more services towards those who are more in need, where need is defined in a practical rather than a clinical sense. More targeting of certain high-risk sub-groups may be needed, however, particularly those who are traditionally poor attenders and prone to drop-out.

**Implications for Health Policy Formulation:** Interventions for young

people who have attempted suicide should be better targeted towards high-risk groups, such as those with a diagnosis of conduct disorder. In addition, prevention schemes that target high-risk groups before a suicide attempt is made should be encouraged.

**Implications for Further Research:** This study is limited by small sample sizes. Research that focuses directly on the care of young people at high-risk for repeat suicide attempts is needed, since the results presented here can be viewed only as exploratory and not explanatory.

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## Introduction

Limited resources are a feature of the National Health Service (NHS) that will not disappear. Evidence of the costs associated with alternative treatment interventions can help to determine the distribution of individual budgets that would maximise the benefits gained by patients, but such evidence is sparse. In the field of child and adolescent psychiatry, little research has been carried out which incorporates an economic component<sup>1</sup> and thus it is almost impossible for clinicians to determine the most efficient distribution of available resources.

Ideally, the type and quantity of services received by young people with mental health problems would be determined by need alone. In reality, however, a number of factors will influence resource-use, and thus the total cost of care. Knowledge of these factors, which might include such things as co-morbidity or socio-economic characteristics, would help to predict which young people are likely to be intensive service users and to assess the appropriateness of this intensity.

An economic evaluation was carried out alongside a randomised controlled trial of a brief, home-based social work intervention for the treatment of children and adolescents who have deliberately poisoned themselves.<sup>2,3</sup> The aim of this paper is to assess the associations between baseline characteristics of the young people and their families and the total cost of care provided, in an attempt to determine factors that predict high and low cost. It was hypothesised that the cost of caring for young people who have deliberately poisoned themselves, would be associated with the type of intervention received, the

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severity of suicidality and other psychiatric characteristics, demographic and socio-economic family characteristics, and the existence of current problems.

## Methods

The methods of the randomised, controlled trial and economic evaluation have been described in detail elsewhere.<sup>2,3</sup> A summary is provided here.

### *Patients*

Children and adolescents referred to child mental health teams based in four hospitals in Manchester were eligible for inclusion in the trial if they were aged 16 years or under and had a diagnosis of deliberate self-poisoning. Young people were excluded if the overdose was accidental, if their social situation precluded a family intervention (e.g., not living in a family, or abuse suspected), or if there was a clinical or psychiatric contra-indication (e.g., severe mental illness, current psychiatric patient, or severely suicidal). One hundred and sixty two patients entered the trial and were randomly allocated to routine care or routine care plus the social work intervention. More detailed description of the interventions can be found elsewhere.<sup>2,4</sup> Clinical and resource use data were assessed over six months from the date of trial entry.

### *Measurement of Outcome*

The primary outcome measures of the clinical trial, assessed at baseline, two and six months, were the Suicidal Ideation Questionnaire (SIQ),<sup>5</sup> the Hopelessness Scale (HSC)<sup>6</sup> and the Family Assessment Device (FAD), a measure of family functioning.<sup>7</sup> Diagnosis was determined using the children's version of the Schedule for Affective Disorders and Schizophrenia (K-SADS)<sup>8</sup> and the Deliberate Self-Harm Interview Schedule (DSHIS)<sup>9</sup> was used to establish current family circumstances and school performance. Secondary outcome measures included the generation of alternative solutions sub-scale of the Social Problem Solving Inventory (SPSI)<sup>10</sup> and the 28-item version of the General Health Questionnaire (GHQ) to measure parental well-being.<sup>11</sup>

### *Measurement of Costs*

Information on the use of all NHS, education and social services over the study period were collected from the parents at the six-month follow-up interview, using a questionnaire designed for the purpose of the study. One hundred and forty nine patients completed the resource use questionnaire and were included in the economic evaluation. An audit of medical records was carried out to verify the data on NHS clinical contacts. It was assumed that the medical records would be more accurate than patient recall over the six-month period

thus, where the figures differed, data from the medical records was used.

Health services included the social work intervention, in-patient and day-patient stays, out-patient appointments, attendance at accident and emergency departments, and contacts with general practitioners, practice nurses, community psychiatric nurses, clinical psychologists, school doctors and school nurses. Social services included contacts with social workers and time spent in foster and residential care. Education services included contacts with education welfare officers, educational psychologists and school counsellors. All unit costs were for the financial year 1997/98 and these were collected from local providers or calculated directly from salary scales where possible.<sup>3</sup> For services that added little to the total cost of care, unit costs were taken from national publications.<sup>12</sup>

### *Data Analytic Procedures*

Information on a large number of patient and family characteristics was collected during the trial. To avoid finding associations with costs purely by chance, only a limited number of possible predictors of cost were selected from the available baseline information before statistical analysis began, on the basis of hypotheses generated by the clinical team. Univariate associations between each of the specified predictors and both NHS and total costs to all provider sectors were investigated to explore the relationships within the health service and the wider statutory sector. Results for continuous variables are presented in two groups split at the median value, but analyses were actually carried out on the continuous data.

Multiple regression was used to reduce the variable set to those independently associated with costs. Variables were selected using an approach similar to that outlined by Collett for survival data.<sup>13</sup> This involved, in the first instance, fitting a multiple regression model which included all variables that had important univariate associations with costs and discarding from this model all variables that ceased to be important. Secondly, each variable that did not have a univariate association with costs was added, one at a time, and retained if it added significantly to the model or otherwise discarded. The model finally arrived at was checked to ensure that none of the terms currently excluded would add significantly to it. In carrying out this procedure a significance level of around 10% was used, but this was not rigidly applied.

For all analyses, generalised linear models (GLM) with an identity link and a quartic variance function (where the variance of costs is assumed proportional to the mean, raised to the power of 4) were used. These were fitted using quasi log likelihood methods.<sup>14</sup> Such generalised linear models are appropriate for analyses of cost data because they allow inferences about arithmetic means while also modelling the skewed distribution typical of cost data.<sup>15,16</sup> A quartic variance function was found to be the most appropriate for both total and NHS cost data in this study. This was assessed by comparisons of full log likelihoods and residual plots for models with different variance functions.<sup>14,17</sup>

## Results

### Total Costs

**Table 1** details the total cost per patient of individual service items. On average, the total costs of care for this patient group were found to be £1,600 over the six-month period of the trial. The most significant contributor was inpatient care, which accounted for over 40% of total costs. Other key cost drivers included outpatient services (20% of total costs), foster care (14%) and the social work intervention (9%). The greatest proportion of the costs of care was thus borne by the health service. Foster and residential care were fairly significant costs to local authority social services, whilst use of education services was limited.

### Univariate Analyses

**Table 2** and **Table 3** detail the univariate associations with total statutory service costs and with total NHS costs, respectively. Higher total costs to all statutory providers were significantly associated with having a definite intention to die, the existence of current problems and being in foster care at the time of entry into the trial. Higher NHS costs were found to be significantly associated with a definite intention to die, having attempted suicide at least once in the previous year, the existence of current problems, poorer parental well being, as measured by the GHQ, and not having a diagnosis of conduct disorder at entry into the trial.

### Multivariate Analyses

**Table 4** and **Table 5** detail the final multiple regression models for total statutory service costs and total NHS costs, respectively. For total costs of packages of care, multivariate associations differed little from the univariate associations found. On average, costs were significantly higher for young people in foster care, those with a definite intention to die and those with current problems at entry into the trial. In addition, poorer parental well-being became significantly associated with higher total costs in multiple regression whilst a diagnosis of conduct disorder became significantly associated with lower total costs, on average.

For NHS costs alone, higher costs were most strongly associated with a definite intention to die, the existence of current problems, not having been in local authority care or accommodation and not having a diagnosis of conduct disorder at entry into the trial.

### Model Adequacy

The curves given in **Figure 1** illustrate the adequacy of the final models in describing the observed cost data. These show

Table 1. Total cost by service type

Service	Mean cost (standard deviation)	% of total cost
National health services:		
Social work intervention	138 (150)	9
Inpatient	653 (804)	41
Day patient	61 (740)	4
Outpatient	315 (395)	20
Accident & emergency	50 (28)	3
General practitioner	10 (22)	1
Community psychiatric nurse	51 (162)	3
Counselling	3 (22)	0
School doctor or nurse	5 (31)	0
Social services:		
Social worker	22 (76)	1
Foster care	222 (1347)	14
Residential care	68 (524)	4
Education services:		
Education welfare officer	5 (17)	0
Educational psychologist	1 (7)	0
Total cost	1604 (2114)	100

the proportions of patients that are predicted to account for different percentages of the total costs. A bad predictive model is illustrated by a line close to the line of identity, which illustrates the case where covariates have no discriminatory ability. A more appropriate model is given by curves closer to the upper line shown in the figure, which represents the case where the model predicts the observed data perfectly. The graph for total costs, for example, shows that the 50% of patients with the highest observed costs incurred about 75% of total costs, whereas the model predicts that these patients will incur about 60% of the total costs. Overall the curves for total and NHS costs indicate that the final models are reasonable for the data.

## Discussion

A number of factors were found to influence the total cost of caring for young people who have deliberately poisoned themselves. In particular, severity of intention to die and the existence of current problems at the time of entry into the trial were found to be strongly associated with total statutory service costs and total NHS costs alone, both univariately and in multiple regression. These relationships are intuitive and positive findings. Given that suicide attempters are at greater risk for completed suicide, it is logical that relatively more services should be directed towards more serious suicide attempters.<sup>18,19</sup> Similarly, the more serious and persistent the current problems experienced, the greater the risk of repeat suicide attempts. Both the suppliers and the users of health care will influence the selection of services for young people with such characteristics, and thus the total costs of their care.

Table 2. Univariate associations with total cost

Variables	N	Mean cost (standard deviation)	P-value (likelihood ratio test)
<b>Intervention</b>			
Case	74	1455 (1586)	0.37
Control	75	1751 (2531)	
<b>Family Characteristics</b>			
Sex			
Female	134	1591 (2094)	0.83
Male	15	1720 (2349)	
Ethnic group			
Caucasian	135	1642 (2206)	0.42
Other	14	1244 (738)	
In foster care			
Yes	2	10681 (667)	0.04
No	147	1481 (1839)	
Living with both natural parents			
Yes	50	1535 (1820)	0.77
No	99	1639 (2255)	
No of times in local authority care			
None	139	1503 (1875)	0.12
Once or more	10	3011 (4144)	
Social class			
Non manual	46	1631 (2164)	0.92
Manual	103	1592 (2101)	
Parental well being (GHQ)*			
≤8	75	1375 (1674)	0.70
>8	74	1836 (2471)	
<b>Severity of Suicidality and other Psychiatric Characteristics</b>			
Definite intention to die			
Yes	46	2160 (2746)	0.05
No	103	1356 (1718)	
Number of suicide attempts in past year			
None	131	1527 (1922)	0.30
One or more	18	2169 (3204)	
Suicide ideation score*			
≤64	75	1454 (1670)	0.45
>64	74	1756 (2487)	
Hopelessness score*			
≤6	84	1487 (2169)	0.60
>6	65	1756 (2046)	
Diagnosis of Major depression			
Yes	84	1578 (1861)	0.86
No	65	1639 (2416)	
Diagnosis of conduct disorder			
Yes	14	1937 (2788)	0.58
No	135	1570 (2041)	
Existence of Current Problems			
No problems	22	881 (573)	0.002
For < month	16	1016 (642)	
For > month	111	1832 (2384)	

\* summarised in the table as two groups split at the median, but p-values relate to analysis on a continuous scale

Table 3. Univariate associations with NHS cost

Variables	N	Mean cost (standard deviation)	P-value (likelihood ratio test)
<b>Intervention</b>			
Case	74	1296 (1097)	
Control	75	1276 (1556)	0.93
<b>Family Characteristics</b>			
<b>Sex</b>			
Female	134	1304 (1401)	
Male	15	1128 (637)	0.60
<b>Ethnic group</b>			
Caucasian	135	1292 (1394)	
Other	14	1230 (710)	0.87
<b>In foster care</b>			
Yes	2	1019 (698)	
No	147	1290 (1351)	0.74
<b>Living with both natural parents</b>			
Yes	50	1336 (1371)	
No	99	1261 (1336)	0.75
<b>No of times in local authority care</b>			
None	139	1313 (1375)	
Once or more	10	903 (711)	0.23
<b>Social class</b>			
Non manual	46	1549 (1855)	
Manual	103	1169 (1027)	0.11
<b>Parental well being (GHQ)*</b>			
≤8	75	1078 (583)	
>8	74	1497 (1796)	0.06
<b>Severity of Suicidality and other Psychiatric Characteristics</b>			
<b>Definite intention to die</b>			
Yes	46	1757 (2155)	
No	103	1075 (652)	0.0004
<b>No. of suicide attempts in past year</b>			
None	131	1185 (1011)	
One or more	18	2024 (2691)	0.03
<b>Suicide ideation score*</b>			
≤64	75	1183 (678)	
>64	74	1391 (1781)	0.73
<b>Hopelessness score*</b>			
≤6	84	1221 (1396)	
>6	65	1371 (1279)	0.29
<b>Diagnosis of Major depression</b>			
Yes	84	1284 (1180)	
No	65	1289 (1539)	0.98
<b>Diagnosis of conduct disorder</b>			
Yes	14	825 (514)	
No	135	1334 (1394)	0.06
<b>Existence of Current Problems</b>			
No problems	22	866 (573)	
For < month	16	1009 (644)	
For > month	111	1409 (1499)	0.04

\* summarised in the table as two groups split at the median, but p-values relate to analysis on a continuous scale

Table 4. Multiple regression for total cost

Variables	Coefficient (95% confidence interval*)		p-value** (likelihood ratio test)
In foster care			
Yes Vs No	9654	(9215 to 10094)	<0.0001
Intention to die			
Yes Vs No	679	(12 to 1345)	0.03
Existence of current problems			
For < 1 month Vs No problems	52	(-183 to 286)	
For > 1 month Vs No problems	488	(204 to 773)	0.006
Diagnosis of conduct disorder			
Yes Vs No	- 415	(-608 to -221)	0.03
Parental well being (GHQ)***	21	(-2 to 43)	0.04

\* Confidence intervals are from Wald methods using robust estimates of standard error <sup>33</sup>

\*\* Likelihood ratio p-value could not be obtained for the 'In foster care' variable due to convergence problems. Reported for this variable is the p-value from a Wald test using a robust estimate of the standard error <sup>33</sup>

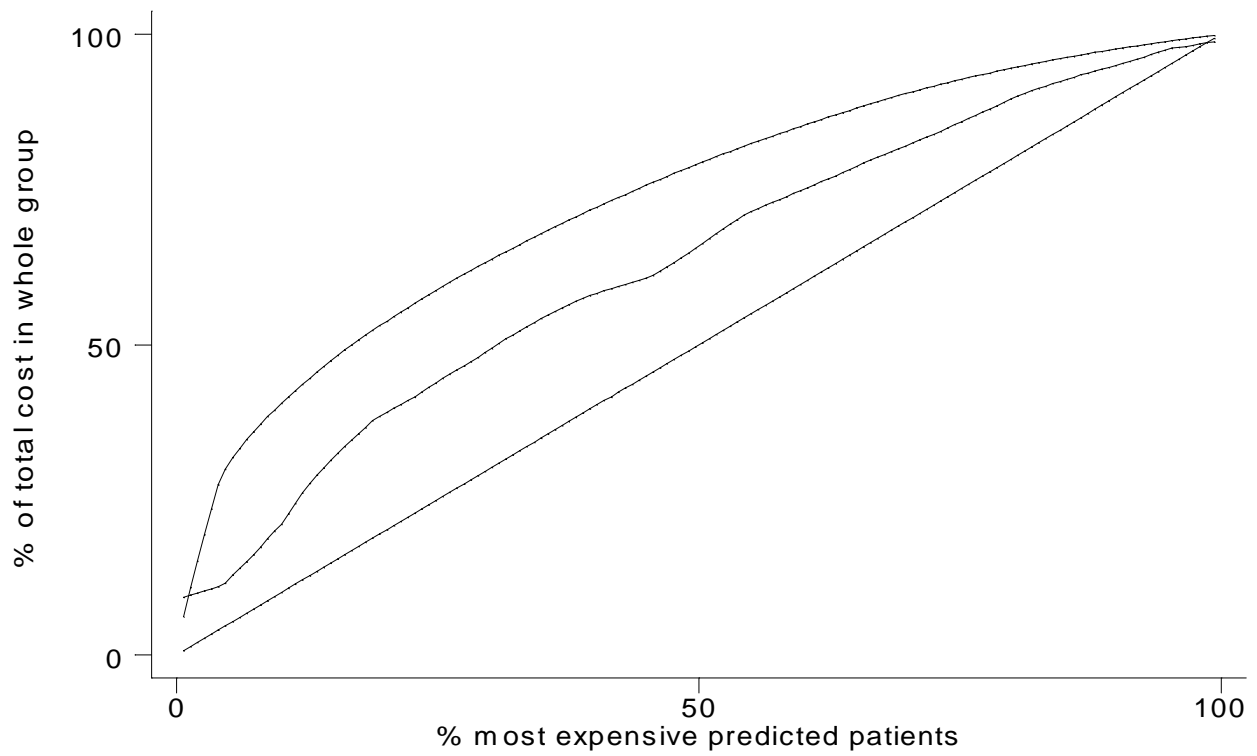
\*\*\* Coefficient interpreted as increase in total cost per unit increase in GHQ score.

Table 5. Multiple regression for NHS cost

Variables	Coefficient (95% confidence interval*)		p-value (likelihood ratio test)
In foster care			
Yes Vs No	399	(5 to 793)	0.03
Existence of current problems			
For < 1 month Vs No problems	253	(103 to 404)	
For > 1 month Vs No problems	486	(308 to 663)	0.002
No of times ever in local authority care			
None Vs once or more	314	(174 to 454)	0.02
Diagnosis of conduct disorder			
Yes Vs No	-446	(-586 to -305)	0.002

\* Confidence intervals are from Wald methods using robust estimates of standard error <sup>33</sup>

### Total costs



### NHS costs

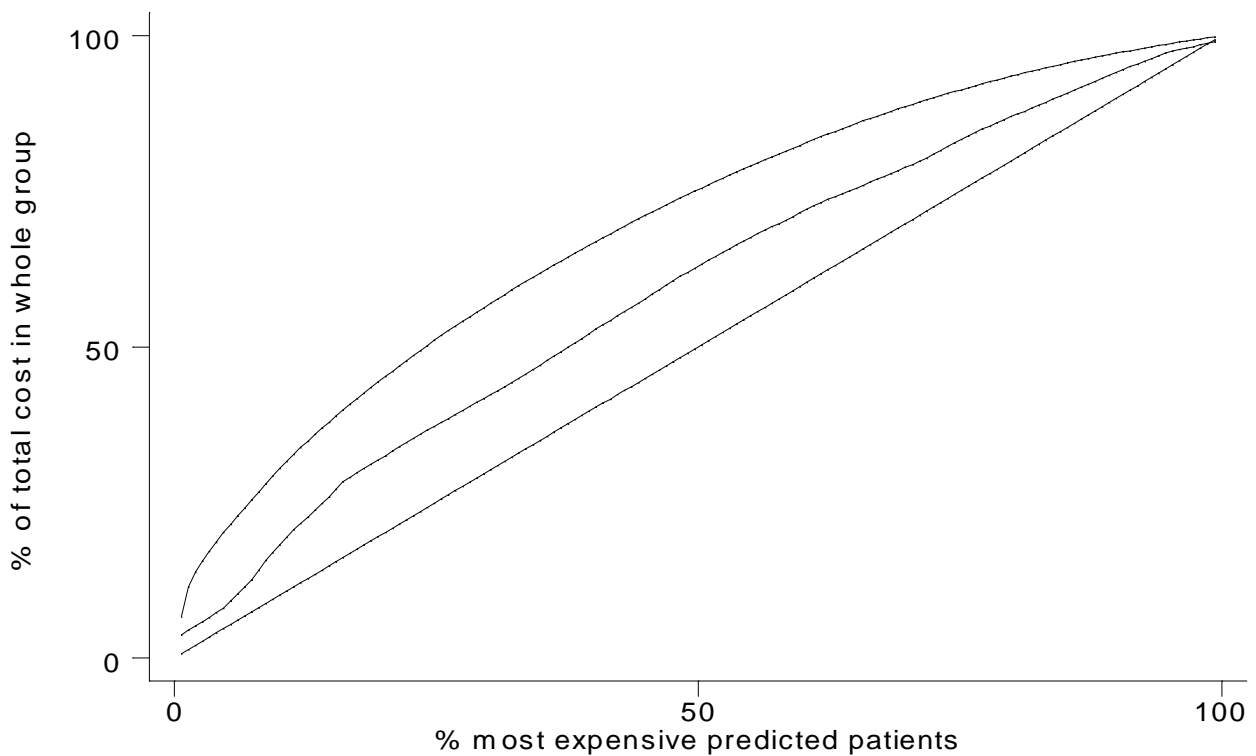


Figure 1. Curve illustrating predictive validity of final multivariate models

Top line: perfect prediction (based on observed values); middle line: smoothed curve based on predictions from the final model;  
bottom line: line of identity illustrating model with no predictive capacity

As intent and current problems increase, both clinicians and parents/carers are likely to become increasingly concerned by the seriousness of the young person's actions, and thus the supply of and demand for services would be expected to rise. This conclusion is supported by a US study that found a relationship between parental perception of a child's mental health service need and receipt of professional help in young people with depression.<sup>20</sup>

Also intuitive was the significant relationship found between the total costs of care to all provider sectors and young people in foster care at baseline. Since being in foster care at the time of entry into the trial was not found to have a significant impact on the total cost to the NHS alone, this finding is likely to be due mainly to the high cost of foster care to the social services sector, estimated to be over £400 per week.<sup>12</sup> Exploration of the data supports this argument. Being in foster care at baseline was predictive of remaining in or returning to foster care during the trial period, hence the relatively greater expense for these young people. The use of all other services accounted for only a relatively small proportion of the total cost of caring for these young people (approximately 8% on average). It is important to note, however, that only two young people were in foster care at the start of the trial, thus the sample is unlikely to be representative. Statistical tests are infeasible with such small numbers and the evidence presented here should be seen as exploratory not explanatory.

From the point of view of the NHS alone, costs were found to be significantly lower for young people who had been in local authority care or accommodation at least once over their lifetime. This may be due to a better health status in this group, but given much evidence to suggest otherwise,<sup>21-24</sup> alternative explanations are more likely. It is possible that this group of young people maintain a greater reliance on social services or an unwillingness to voluntarily access statutory services, such as health services. Although an adequate explanation is beyond the scope of this study, previous authors have suggested that the health needs of this population have been neglected<sup>21,25</sup> and more focused research is needed in the future. Ten young people had been in local authority care at least once in their lifetime so again the sample size was relatively small and these findings should be treated with caution.

Parental well-being was found to be significantly related to total statutory sector costs, with costs increasing as well-being falls. Thus, the well-being of parents and carers appears, unsurprisingly, to have a positive influence on the health and well being of their children. Two related factors are likely to contribute to higher costs in families demonstrating relatively poorer parental well-being. First, family difficulties may have been a factor in the initial suicide attempt and the severity of the attempt, thus having an impact on the initial treatment received for the attempt itself. Indeed, many studies have demonstrated that family difficulties are a significant risk factor for suicide attempts.<sup>19,26,27</sup> Second, service providers may be inclined to provide more intensive follow-on support to young people where family difficulties are observed, in the knowledge that this important risk factor may be predictive of future attempts and ill health.

A more surprising finding is the relationship between cost

and a diagnosis of conduct disorder. Young people diagnosed with conduct disorder were, on average, found to cost the NHS less than those without such a diagnosis. This finding is of particular concern given evidence to suggest that antisocial behaviour and conduct disorders are strong risk factors for suicide in young people and thus should be priorities for intervention.<sup>19,28-30</sup> Although young people with a diagnosis of conduct disorder receive more expensive packages of care overall than those without (mean cost £1937 vs. £1570, respectively) (see **Table 2**), **Table 3** demonstrates that NHS costs are lower on average (mean cost £825 vs. £1334, respectively;  $p=0.06$ ). In multiple regression, this difference reaches conventional levels of statistical significance ( $p=0.002$ ) (see **Table 5**). The same relationship is seen in multiple regression of total costs (see **Table 4**), even though the opposite was found in univariate analysis. This is likely to be due to the inclusion of the variable 'In foster care' which effectively controls for the cost of local authority care and accommodation thus giving the impact of conduct disorder on other costs alone. Examination of the data bears out this argument, since the higher total costs of young people with conduct disorder are largely due to their use of foster care, an expensive resource.

It is difficult to know precisely why NHS expenditure on young people with a diagnosis of conduct disorder was found to be relatively lower than for young people without. A number of possible explanations exist. Perhaps the most likely explanation is the tendency for low attendance and drop-out in this group of young people.<sup>31,32</sup> Although we do not have data on attendance for treatment of conduct disorder, compliance rates with the social work intervention were indeed lower in the conduct disorder group, thus contributing to the lower NHS costs. 71% of cases with conduct disorder attended all sessions as compared to 82% of young people without a diagnosis of conduct disorder; 14% of cases with conduct disorder attended no sessions at all as compared to only 5% in the cases without.

It may be the case that efforts were concentrated on the more immediate, and life threatening, issue of suicidal ideation with treatment being determined more by the severity of the suicide attempt than the existence of a co-morbid diagnosis. The data, however, do not support this hypothesis. Although similar numbers in each group had a definite intention to die (29% in the conduct disorder group vs. 31% in the rest of the sample), suicidal ideation was found to be higher for those with a diagnosis of conduct disorder (SIQ score 83 vs. 62, respectively). The conduct disorder group also demonstrated greater severity in terms of the existence of problems that had endured for more than a month (86% vs. 73%), the existence of major depression (64% vs. 56%), the number of times they had run away (average 1.4 vs. 0.6) and whether or not they had ever been in care (21% vs. 5%). The two groups were similar on other measures, including hopelessness and parental well-being. These findings help to support the hypothesis that compliance is driving the cost differences found, although the number of young people with conduct disorder was small ( $n=14$ ) thus the sample may not accurately represent the broader population with conduct disorder and further research is needed.

A further finding relates not to the variables that have been



found to be significant predictors of cost, but to those that have not. No relationship was found between total costs and the majority of measures of severity of illness at baseline, including suicidal ideation, hopelessness and major depression. Costs were thus influenced more by 'practical' notions of severity, such as the severity of intent to die, the existence of current problems and poor parental well-being, than by clinical measures.

The main findings of this study are twofold. First, although costs are not predicted by clinical measures of severity, service provision does tend to respond to more 'practical' notions of severity, such as severity of intent to die and existence of current problems. Second, some high-risk groups, including young people with a diagnosis of conduct disorder and young people who have experienced episodes of local authority care or accommodation, appear to be slipping through the health service net. This latter finding may well be driven more by the demand-side (service users and their families), through non-compliance and drop-out, than by the supply-side (service providers), but clinicians and policy makers should be aware of these potential problems. Further research is needed and attempts made to increase the treatment participation of such youngsters and their families.

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