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The Economic Impact of Early Intervention in Psychosis Services for Children and Adolescents

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Abstract

Aims: To develop and populate a plausible model of the impact of EI for children and adolescents with psychosis to estimate potential short-term health-related cost savings compared to generic Child and Adolescent Mental health Services (CAMHS). **Method:** A decision-tree based model for EI in CAMHS was developed. The model was populated using data relating to the use of in-patient care and EI service activity for people aged under 18 from an area of North-East England. Data were abstracted from NHS clinical reporting systems for 2001-08. Sensitivity analyses were performed to examine costs associated with the model under differing assumptions. **Results:** EI delivered cost savings of £4814 per patient compared to care provided by generic CAMHS. Cost savings were predominantly a consequence of reduced length of hospital admissions for patients served by the EI team. The findings were robust to sensitivity analyses. **Conclusions:** These findings suggest that EI services for children and adolescents with psychosis provide potential direct health cost savings comparable to those observed for working-age adults.

Declaration of Interest: None.

Keywords: Child and Adolescent Mental Health Services, Economic Modelling, Early Intervention, Psychosis, Cost Effectiveness

Suggested short running title: The economic impact of EI in under 18s

INTRODUCTION

Early Intervention (EI) services have been developed in many countries with the aim of improving the care and long-term outcomes for individuals developing psychosis. Although the specification for EI teams for the English health service included an age-range of 14-35 years,[1] in practice most of these services have been orientated around the needs of working-age adults; a national audit of EI services in 2005 reported that, of 117 EI teams operating, only 1 in 6 received any dedicated input from Child and Adolescent Mental Health Services (CAMHS). [2] When this audit was repeated in 2007 this figure had risen to around 75% of EI teams. [3] However, in practice CAMHS input may mean as little as one session per week from a mental health professional specialising in the care of young people. Indeed, access to key forms of care for under 18s affected by severe mental illness can be extremely limited as revealed in a recent report examining the interface between child and adolescent and adult services.[4] Nevertheless, examples of EI teams specifically serving children and adolescents exist, and the service model of one such team operating in Teesside in the north of England has previously been described.[5] This service utilises CAMHS-specific care-coordinators and provides mental health care to those under 18 affected by psychosis or deemed to be at high risk of impending psychotic illness.

Previous attempts to model the economic consequences of EI services have suggested that over the short to medium term (one to three years) these services are likely to provide direct healthcare savings for both individuals with psychosis [6 7] and also for at-risk individuals. [8] Such cost savings would be in addition to the wider economic benefits and decreased morbidity that EI may offer service users. [9] These potentially include improvements in quality of life, enhanced concordance with medication prescribing and aspects of social and vocational functioning. [10 11] However, previous studies have

populated their models using data almost exclusively from those over 18 years and associated adult mental health services. This is understandable given that policy documents recommending the use of EI focussed on the mental health care of those of working-age. [1 12]

There is evidence, though, that many affected individuals experience their first symptoms of psychosis during adolescence or even childhood, and that earlier onset of illness may be associated with poorer outcome. [13] In England, data reveal that in 2006/7 there were 227 hospital admissions due to schizophrenia or bipolar disorder where the patient was under 15 years of age and 1716 where the age was 15-19, representing 3.6% of all mental health admissions for that year.[14] Providing appropriate and prompt treatment is important, but interventions require investments that could divert resources from other uses, and so the economic impacts of EI should be considered.

To date there have been no published studies of the economic impact of EI in the younger age group. Moreover, the models will need to differ from those for working-age adults as the costs associated with both in-patient and generic out-patient care are higher for CAMHS in comparison with adult mental health services.

METHODS

A decision model was developed to estimate the economic impact of EI for children and adolescents. Such models can be helpful in investigating the impact on costs and cost-effectiveness of interventions when it is not feasible to collect data in a trial or observational study. Trial-based approaches may have advantages in terms of internal validity, but decision models can be more generalisable and flexible. They are also produced in a substantially shorter time with appreciably fewer research resources. However, like trials, decision models represent simplifications of reality.

In the model developed here (Figure 1) a mental health perspective is adopted, with impacts on other health services, social care and society not included. The time horizon was 6 months. This is relatively short but data availability did not provide confidence in estimating longer-term impacts. It is assumed that young people with signs of psychosis are initially referred to CAMHS. Following referral, a decision is made to refer on to a specialist EI team or to continue to provide care from 'usual' services. Patients may have a psychotic illness, be in an 'at-risk mental state' (ARMS) or they may have another mental health problem. If psychosis has developed then the treatment options are to admit the patient to in-patient care or to provide community-based support. If the patient is in an at-risk state then either psychosocial intervention, medical intervention, a combination of these, or no treatment is provided. Figure 1 shows just the EI part of the model; the standard care part is identical in structure.

INSERT FIGURE 1 ABOUT HERE

The probabilities of different events occurring are shown in Table 1. Data to inform these were limited, but unpublished data from the Transitions from CAMHS to Adult Mental Health Services (TRACK) study and a report by Tiffin and Hudson [3] with details of 42 patients does enable probabilities of many to be estimated. In some cases best estimates were made by the authors and uncertainty addressed using sensitivity analyses. Probabilities of the following events were assumed to be the same for both parts of the model: occurrence of psychosis, ARMS and other conditions; and admissions or community services for those with psychosis. The main differences were for care provided to those in an at-risk state. It is assumed that an at-risk state will be recognised by an EI team and treatment will be provided accordingly. We derived probabilities for such care

from Tiffin & Hudson.[3] Data were not available for those in the control group and therefore we assumed the probability of different care options for that part of the model were half the probabilities for the EI part.

Based on the paper by Tiffin and Hudson,[3] it was assumed that medical interventions following ARMS consist of six months of atypical antipsychotics plus ten outpatient appointments with a psychiatrist. Tiffin and Hudson suggest treatment with quetiapine (25-75 mg twice daily) or risperidone (0.5-1 mg twice daily). Using the mid-points of these ranges, the 2011 UK cost of these drugs [15] and an equal likelihood of using quetiapine or risperidone, suggests six-month medication cost of £218. The unit costs for psychiatrist contacts are £393 for the first contact and £210 for each of the subsequent contacts.[16] Psychosocial interventions are assumed to last for six months and consist of weekly contacts with a psychologist at £81 per contact. [17] The costs of combined care following ARMS is assumed to be equal to the sum of the costs of medical and psychosocial interventions. It is assumed that under EI all patients receiving treatment for ARMS will have six nurse/care coordinator contacts during the six month period.

We assumed that the length of stay for patients admitted may differ between EI and SC. To investigate this possibility we analysed data from one mental health trust in the North-East of England. Data were available on lengths of stay for children/adolescents admitted with a diagnosis of psychosis between 2001 and 2008. The number of new cases seen by the EI team was also available. Between 2001 and 2003 there were no new EI cases; between 2004 and 2008 there were between 8 and 56 new cases per year. We created a variable for each year to indicate how ‘operational’ the team was. This was based on the assumption that the team started off slowly and eventually reached a fully operational level. By 2008 it had 56 referrals and we assumed it was 100% operational; in 2004 it had eight referrals and therefore we assumed it to be 14% operational (8 divided

by 56 multiplied by 100). This operational variable (expressed as a proportion rather than percentage) was used as an independent variable in regression analyses of length of stay. The coefficient of the variable indicates the difference in length of stay when the service has operational levels of 0% and 100% (i.e. no EI compared to 'full' EI). The operational variable had a coefficient of -33.3 indicating that length of stay was reduced by this much for a fully operational EI service compared to absence of EI. From this we assumed that length of stay for EI patients is 66% that of standard care patients (i.e. 64 divided by 97.3). However, the variable was not statistically significant (p=0.123) but the 95% confidence interval (-76 to 9) suggested a trend towards lower length of stay for EI. The mean length of stay for SC (97 days) was based on the years 2001-3 (when there was no EI) whilst the mean length of stay for EI was this figure minus the coefficient from the regression model i.e. 64 days. Length of stay was multiplied by the NHS Reference cost for 2009/10 of £594 for a night in a child/adolescent psychiatric inpatient bed. [16] The costs of community interventions following psychosis are assumed to be the same as for psychosocial interventions following ARMS.

Data sources

Data relating to EI activity for under 18s (in terms of staffing and caseloads) were abstracted from service monitoring records for the Teesside and Durham area covered by the team. Information relating to hospital admissions was also abstracted and collated using the Clinical Reporting System within Tees, Esk and Wear Valleys NHS Foundation Trust. This database is used to record hospital episodes of care. Data related to all in-patient admissions for the period 2001-2008 for those age under 18 years at the time were abstracted. As primary ICD-10 diagnostic codes are included in the database it was possible to establish that the hospital admission episode involved a young person who

would have been eligible for EI service input. This included brief admissions to adult wards (in the case where a CAMHS bed was unavailable) and to low-security care. Five admissions involved out-of area in-patient care episodes in a neighbouring NHS Trust and the related data were traced and abstracted using the equivalent Clinical Reporting System. Data abstracted from the electronic databases were checked and verified against the paper admissions logbooks kept at the adolescent mental health units within Tees, Esk and Wear Valleys NHS Foundation Trust.

Analysis

In decision models the model is 'rolled back' so that the weighted cost for each option being considered (here EI and standard care) can be calculated. Assumptions have been made about each of the parameters in the model and the level of uncertainty around these parameter estimates varies. To investigate the influence of these assumptions we have conducted a series of sensitivity analyses where the parameter value is changed by 50% in either direction and we report whether this changes the overall base-case result. Some probabilities could not be changed by 50% as this would make the overall probability greater than unity. In such cases these probabilities were changed by the maximum amount. We did not conduct probabilistic sensitivity analyses due to a lack of data to inform the distributions around the base-case parameters.

RESULTS

The base-case costs over a six-month period estimated from the model are £13,186 for EI and £18,000 for standard care. This represents a cost savings of £4814 for EI. Even though patients with ARMS are more likely to receive interventions if they are seen by an

EI team, the EI costs are lower due to the reduced length of stay for those with psychosis who are admitted.

Changing the probability of admission following psychosis for EI patients had little influence on the results as this maintained the result that standard care was more expensive and it would need to be increased from 0.58 to 0.86 before EI becomes more expensive. Similarly, if the probability of standard care patients with psychosis being admitted was between 0.29 and 0.4 rather than 0.58 then again EI would become more expensive. Changing the assumption that length of stay for EI patients is 66% that of standard care patients only reversed the result to EI being more expensive if the length of stay for EI patients was in excess of 97% that of standard care patients. In both halves of the model it is assumed that 48% of patients have psychosis. If in excess of 67% of patients referred to EI have psychosis, or less than 36% of those referred to standard care have psychosis then EI becomes more expensive. Changing other parameters by 50% did not reverse the findings of the model.

DISCUSSION

This model has demonstrated potential cost savings from delivering early intervention to children and adolescents with psychosis. Detecting at-risk states has a cost increasing effect but this is more than offset by shorter lengths of stay for those admitted following the onset of psychosis. The model was robust to changes in most parameters. Changing the likelihood of admission had some effect as did increasing length of stay for EI patients, but these changes would need to be relatively high. If EI services receive more cases of psychosis then costs would increase but the model is aiming to compare like-with-like patients.

These findings are comparable to those for working-age adults.[6] Since in-patient care for children and adolescents is more expensive than equivalent care for adults (due to the higher staffing levels), the potential savings due to decreased admission durations may be higher in under 18s. It is very likely that all data relating to admissions for under 18s affected by psychosis within Durham and Tees was captured. However, whilst the model assumes that the trend toward reduced admission duration was due to EI service activity the potential role of other factors, such as improved in-patient care, cannot be ruled out. Also, there are currently few data relating to the ARMS concept in under 18s and it is thus uncertain to what degree these individuals will be referred to EI, and what impact such specialist input will have.

There are limitations to the study. First, we have constructed a model to assess the impact of EI for children and adolescents over a six-month period. This is a relatively short timeframe and given data availability it would be preferable to examine the impact on costs, and indeed outcomes, over a longer duration. EI patients are not a homogenous group and further studies may identify sub-populations of individuals most likely to experience lasting benefit from the EI model. However, even if the benefits are not maintained, a short-term 'gain' (through reduced costs and/or improved outcomes) is still worth aiming for unless by so doing there are future negative consequences. Second, even though this is a short-term model we have had to make assumptions about parameters and clearly there is uncertainty around these values. Data were primarily taken from services and there may be issues therefore of generalisability. However, we have conducted sensitivity analyses and the overall results of the model, that EI is less expensive than standard care, seem robust. Ideally we would conduct probabilistic sensitivity analyses, but data were not available to inform the distributions around the parameters. Third, we have not addressed effectiveness. While this was not an aim of the

study (which was to compare costs) the aim of future work should be to combine cost and outcome data in order to fully address cost-effectiveness. It could be argued that the finding of cost savings indicates cost-effectiveness if we assume that intervening early at worst causes no harm. The evidence from EI studies elsewhere suggests that this is indeed the case. [11 18] However, some might argue that such interventions can have possible negative impacts such as increasing stigma and discrimination that result from a diagnosis of psychosis. These may affect employment and education possibilities, use of services and social/recreational activities. Another negative consequence could be side effects of medication which some would experience, even though antipsychotic dosages are relatively low in this model. If we had shown that EI results in higher costs then it would become even more important to measure effectiveness in order to see whether clinical improvements (if there are any) justify extra investment. Fourth, we have adopted a mental health perspective in the model. It is likely that there will be an impact on the costs of other services and to society in general, and therefore this restriction needs considering when assessing the findings. Fifth, the impact on length of stay of EI was based on a simple regression model that examined the relationship between the extent to which the EI service was operational and bed days. This suggested that he more operational the service was the lower the length of stay but this was not statistically significant. Furthermore, the extent to which the service was operational may simply reflect time and …. Finally, this model is, to some extent, idealistic in that it assumes that patients can be referred to EI services and that once psychosis is identified that appropriate care can be delivered. In real life there are may be delays before psychosis is accurately diagnosed and appropriate referral made to EI services. Some areas may also have a shortage of beds for under 18s and this could increase reliance on the (more expensive) independent sector, which provides around 40% of in-patient mental health provision for adolescents. [19]

The sensitivity analyses included increasing the unit cost of an inpatient bed by 50% which would reflect the use of beds in the independent sector; this did not have a large impact on the results. This issue could lead to an underestimate of the potential savings through reduced bed-utilisation in the EI arm of the model.

Conclusions

Early Intervention services are likely to provide at least the same economic benefits in terms of direct healthcare costs in children and adolescents as have been found for working-age adults. As in the latter case, savings are mainly made through a reduction in length of stay in hospital.

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FIGURE 1. Model of economic impact of EI for children and adolescents.

[see attached JPEG file]

TABLE 1. Probability values for child and adolescent model.

Probability	**Early Intervention**	**Standard Care**	**Source**
Psychosis	0.48	0.48	Tiffin & Hudson
At risk mental state (ARMS)	0.21	0.21	Tiffin & Hudson
Other	0.31	0.31	Tiffin & Hudson
Admission following psychosis	0.58	0.58	TRACK study (personal communication)
Community-based care following admission	0.42	0.42	TRACK study (personal communication)
Psychosocial intervention following ARMS	0.60	0.30	Tiffin & Hudson, estimate
Medical interventions following ARMS	0.20	0.10	Tiffin & Hudson, estimate
Combined treatment following ARMS	0.20	0.10	Tiffin & Hudson, estimate
No treatment following ARMS	0.00	0.50	Tiffin & Hudson, estimate