A-La Park, Paul McCrone, Martin Knapp

Early intervention for first-episode psychosis: broadening the scope of economic estimates

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Title: Early intervention for first-episode psychosis: broadening the scope of economic

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Authors: A-La Park,[1] Paul McCrone,[2] Martin Knapp [1,2]

Affiliations: [1] Personal Social Services Research Unit, London School of Economics and Political

Science,[2] Centre for the Economics of Mental and Physical Health, Institute of Psychiatry,

King's College London

Corresponding author: A-La Park, Personal Social Services Research Unit, LSE Health and Social

Care, London School of Economics and Political Science, Houghton Street, London, UK, WC2A

2AE

 E-mail: A.Park@lse.ac.uk

Fax: +44 (0)20 7955 6131

Telephone: +44 (0)20 7955 6598

Abstract (176 words)

Aim: To explore the economic impacts of early intervention in England on outcomes and costs for people with first-episode psychosis.

Methods: Three decision analytical models were constructed to compare treatment by early intervention for first-episode psychosis with standard care in relation to employment, education, homicide and suicide. Data on effectiveness and costs were taken from previous studies and expert opinion. Sensitivity analyses tested the robustness of assumptions.

Results: Our models indicate that early intervention demonstrates savings of £ 2,087 per person over three years from improved employment and education outcomes. In addition, the annual costs over ten years related to homicide after early intervention were £80 lower than for standard care. There were also annual savings of £957 per person for early intervention over four years compared to standard care as a result of suicides averted.

Conclusions: Not only can investment in early intervention help reduce some of the long-term costs and consequences of mental disorders to the health care system, in addition there are broader economic benefits, which strengthen the potential cost savings to society.

Key words: decision modelling, economics, employment, psychotic disorders, suicide.

INTRODUCTION

The first early-intervention (EI) service for psychosis in the UK was initiated in Birmingham in 1990, since when there has been growing support from national policy makers. This was cemented with the publication of a 'Policy Implementation Guide' which mandated the provision of EI services (and also assertive community treatment and crisis resolution teams) across England in 2001 (1). Recently, the new national mental health strategy for England, "No Health without Mental Health", has added further weight to mental health promotion and early intervention for people with severe mental illness, emphasising the interconnections between mental health and domains such as housing, employment and crime(2).

Although there are numerous studies examining the effectiveness of EI(3-6), there have been relatively few studies which have looked at economic impacts and fewer still that have looked at impacts beyond the health and social care sectors. The aim of the work reported in this paper was to examine a wider range of potential economic impacts than has previously been attempted, and in particular to look at the possible impacts of EI on employment, education, risk of suicide and risk of homicide.

METHODS

Three decision analytical models were constructed to compare the costs and outcomes of EI services with standard care, using TreeAge Data Pro 4.0 software(7). Such models can be helpful when it is not plausible to obtain data from empirical studies such as a trial or observational study. Although trial-based approaches can have better internal validity, they tend to take a longer time to obtain meaningful results. Decision analytical models can be produced in a relatively shorter time than trial-based approaches and have some advantages in terms of transferability of study findings from one setting to another(8).

Our models were developed through discussions with clinical experts in the mental health field, some of whom have been actively involved in the initiation, implementation and monitoring of EI services in England for some years. The time horizon for each model was dependent on the effectiveness data available: two years in the employment and education model, ten years in the homicide model, and four years in suicide model. Costs were all reported in UK pounds, standardised to 2009 prices. Future costs were discounted at a rate of 3.5%, in line with guidance from the UK Treasury green book. Discounting is used in the economic analysis to estimate the value today of income or costs incurred in future years(9).

Our definition of EI was based on that of the Lambeth Early Onset (LEO) team in London. This consists of ten mental health professionals including a consultant psychiatrist, trainee psychiatrist, clinical psychologist, community psychiatric nurses, occupational therapists and health care assistants. Individuals have access to services 365 days of the year, with care including low dose atypical antipsychotics, cognitive behavioural therapy, family counselling and vocational therapies(10). Standard care was assumed to be a specialised community mental health service which did not include any component particularly targeted at people with early psychosis (10, 11).

Model structure and assumptions

Employment and education model

As Figure 1 illustrates patients are assumed to receive either EI or standard care. They then have a probability of being in employment (partial or full), or in education/training or out of work. Probabilities associated with these events, as well as costs incurred, are reported in Tables 1 and 2.

Previous studies have revealed increased levels of employment following EI. The probabilities of being in full-time employment (36%) or education/training (20%) following EI were taken

from a recent UK study, which focused on vocational support as part of EI (5).Data from the LEO study which found that 33% of EI patients made a full vocational recovery compared to 21% for standard care were used in sensitivity analysis. Data from LEO were also used to estimate for those EI patients making any vocational recovery, that 58% would be in full employment and 42% in partial employment(12).Data on standard care in England suggest that around 24% of long-term patients are in some form of work/education (including sheltered work)(13). We used this figure for first-onset patients treated in standard care. The LEO study indicates that 52% of those people who obtained work after receiving standard care were in full-time employment.

The cost of lost employment was estimated using the human capital approach, which values time in terms of potential wages lost. The minimum wage in 2009 of £5.80 was used to represent the value of one hour of work (14), and we have assumed that a working week consists of 35 hours and that there are 48 working weeks in one year. This results in annual value of employment of £9,744. This probably underestimates productivity as a proportion of patients would have received in excess of the minimum wage were they in work. We have further assumed that only half of this value will be realised if only a partial vocational recovery is attained. We have not attached any economic value to education even though it may reasonably be expected to increase future productivity(15)

Homicide model

The second decision model looked at the costs of homicide. We focused on homicide because of a lack of data on other crimes committed by people with psychosis. A few studies have estimated homicide rates among people with mental health problems. These figures suggest that the risk of homicide is low. However, the economic impacts of homicide are substantial with lifetime costs of one homicide estimated in the UK to be £1.72 million(16)(Table 2).

We used data from a systematic review by Nielssen and Large(17) that included ten studies from eight countries and estimated that there was a 0.17% likelihood of someone with untreated psychosis committing homicide in any one year. By contrast, the review estimated that a smaller percentage, 0.011%, of those receiving treatment would go on to commit homicide – a ten-fold difference.

In the model patients were assumed to enter the secondary care system and to be treated either by EI or by a standard care team, with probabilities of homicide taken from the Nielssen and Large study(17).While the homicide model covers a ten year period, in light of limited data on when any homicide may take place we have assumed that on average homicide will not occur until four years after psychosis develops. The study by Nielssen and colleagues indicated that violent crime rates peak four years after the onset of a first-episode of psychotic disorder (18). Home Office data are then used to estimate that homicide annual costs are £54,079 in the year of homicide and £50,260 in each of the following six years(16).We have assumed that legal system, insurance, victim service and health service costs all occur in the year of the homicide. The largest component of cost is due to the physical and emotional impact on the families of the deceased, accounting for 59% of total costs. The second highest component is lost output/productivity due to premature death (31%).

Suicide model

The structure of the third model, investigating the costs associated with suicide over a four-year period, was very similar to that used for homicide. Different probabilities of suicide were assigned to patients depending on whether or not they received care from an EI team or from standard care services.

A recent systematic review of studies reporting suicide rates in people with schizophrenia estimated a rate of completed suicide of around 4%, with an indication that most occur near

the beginning of the illness (19). A recent study from Norway compared suicide attempts in areas with and without EI teams (20). The findings suggest that the number of suicide attempts in areas with EI teams is about one-third of that in areas without them. We have assumed that completed suicides are also reduced by the same amount in England, and therefore have used a rate of 4% for standard care and 1.3% for EI. We have also assumed that suicide takes places four years after the psychosis begins drawing on data from a study in Ireland which followed up for risk of suicide in 166 people with untreated psychosis over four years (21).

A previous economic model that had been built to calculate the average lifetime costs of suicide in Scotland(22)for an individual aged between 15 and 35 was updated and adapted to the English context. The estimate of lifetime suicide costs in 2009 prices was £2,171,964. However, this cost is for the general population and does not assume that people have psychosis. We have recalculated the cost by using minimum wage rates instead of average wage rates to take account of lower likely earning levels. This results in an average lifetime cost per suicide of £1.4 million. Of this figure, 2.8% falls on the NHS, 28.7% is due to productivity losses, and 68.5% is due to (the monetary valuation of) reduced quality of life for those who are bereaved. Annual amortised suicide costs, assuming potential average remaining life expectancy for this population of 46 years are estimated at £34,412 in the year of suicide and £33,442 in subsequent years. This takes account of costs that are higher for men than women due to higher rates of participation in full-time rather than part-time work for men. To estimate a weighted cost we have assumed that 80% of suicides occur in men and 20% in women, broadly in line with long term gender differences in completed suicides reported in the UK(23).

Sensitivity analyses

To test the robustness of the findings, a series of one-way and two-way sensitivity analyses were performed. We initially increased and decreased key parameters by 50% individually to

see how costs changed. In the employment and education model, we examined the impact of using an average rather than minimum wage. The probabilities of being employed, in education and risk of homicide were also varied. Costs for homicide from a NHS perspective only were also estimated. For costs of suicide, average wage rates were used for men and women respectively in sensitivity analysis.

RESULTS

Tables 1 and 2 provide detailed information on assumptions on probabilities and costs used in the different models.

Our first model suggests that the estimated costs of lost employment and education are on average £2,087 lower for people receiving EI (£5,024 vs. £7,111). The estimated annual costs associated with homicide are far higher for standard care (£86) than for EI (£6), although the absolute cost in both cases is very low. The annual costs of suicide are £460 for EI and £1417 for standard care, a difference of £957 per person.

Table 3 shows that cost-savings per person over one to three years were estimated to be £7,447, which consisted of £5,360 from reduced health service costs and £2,087 from reduced lost productivity. In addition over the next four to ten years, further potential cost-savings per person were estimated to be £6,222 consisting of £ 957 per annum for reduced suicides, and £80 per annum for reduced homicide). This analysis is conservative as we did not include additional cost-savings to the health care system over years 2 and 3. Moreover, further savings may accumulate as EI is used by subsequent cohorts of people with first-episode psychosis. Assuming that there would be a new cohort of 6,900 patients with first- episode psychosis in England, based on incidence rates in year 2009(11), it would be possible to estimate the cost savings associated with use of EI services by all of the groups. Combining non-health system savings of EI with previous estimates of health care system savings (11), relative to standard

care, overall cost savings of £51.4 million in the short-term (1 -3 years) and £21.6 million in the long-term (4-10 years) could be realised.

Sensitivity analyses

The parameters tested in sensitivity analyses are shown in Table 4. For the employment and educational model, if the employment rate following EI is reduced from 36% to just 19%, as observed in one small study in London (5), the costs associated with EI increase from £5024 to £6333. If the employment rate for standard care falls from 27% to 9% as seen in one review (24) the lost employment costs associated with standard care increase from £7122 to £8481. If the median wage of £9.79 for a 25-year old, instead of the minimum wage of £5.80 is used, the difference in lost employment rises from £2087 per person to £3523.

For the homicide model, reducing the rate of homicide following EI from 0.011% to 0.007% would only reduce annual costs from £6 to £4. Similarly, increasing the homicide rate to 0.016% would have a negligible effect on costs. If homicide rates following standard care are reduced or increased there is far more impact on total costs.

EI was the least expensive option, when the costs of homicide were varied from the lower lifetime limit of £906 (including health services costs only) to the upper limit of £1,185,632 (excluding lost output). In addition, when the costs for criminal justice system only or when the costs for physical and emotional impacts on direct victims were considered, the results were still robust. For the suicide model, when average wage rates were used instead of minimum wage rates the costs of suicide increase to £627 for EI compared to £1929 for standard care.

DISCUSSION

The estimated costs for people receiving EI services are much lower than those for people receiving standard care. The estimated costs associated with lost employment and education are £2,087 lower for people receiving EI than for SC. The estimated annual costs related to homicide and suicide are lower for EI by £80 and £957 respectively. In the three models, what is clear is that within the ranges where sensitivity analyses have been conducted, there is no fundamental change in the findings from our base-case analyses, showing that EI costs are substantially lower than those for standard care.

Our findings add to a mixed picture in the existing literature. A five-year follow-up of EI in Denmark was performed as part of the OPUS study (3). EI lasted for two years and consisted of assertive community treatment, family involvement and social skills training for 275 patients. A control group included 272 patients. Thereafter patients would receive standard care (which may just be from their GP). While there were significant differences in favour of EI with regard to reduced symptoms and improved functioning at two years, these were not seen at five-year follow-up. The study showed that although the Global Assessment Function (GAF) for people in the EI group showed a significantly higher score at two years (55.16 vs. 51.13, p=0.03, 95% CI), the beneficial effect from EI could not be seen at five years (55.36 vs. 54.16, p=0.51, 95% CI). There was no impact on suicidal behaviour at either follow-up. The proportion not hospitalised during the two-year follow-up was 32% EI and 27% standard care. After five years, 61% of EI patients and 59% of standard care patients were not working.

A recent Italian study, which followed 46 patients for a five-year period, reported that people receiving EI showed lower use of services and costs, relative to standard care (€ 4802 vs. € 9871), while achieving a reduction in symptom severity scores on the Health of the Nation Outcome Scale(25). In addition, the EPPIC study in Australia did report significantly lower costs of care: A$3445 for EI vs. A$9503 for standard care (P<0.01)(26). They also reported substantially higher rates of employment at 7.5 year follow up.

In a follow-up to the LEO study in south London, admissions were examined between 3.5-5 years after entry to the study (4). They found that that 33% of EI patients and 39% of standard care patients had admissions. The mean number of bed days was 45.3 days and 51.4 days respectively. After controlling for patient characteristics it was found that EI patients spent on average two more days in hospital than standard care patients. This study either suggests that EI does not have a long-term effect or that when patients are discharged back to standard care they have similar outcomes to others. Of course, what must be borne in mind is that the initial savings are not lost.

In the more recent OPUS study, although there was no significant difference in the average costs of EI and SC for 5 years (€123,683 vs. €148,751), the mean Global Assessment of Functioning score for EI was significantly higher than SC (55.35 and 54.16), showing the chance of EI being cost-effective was 95.3%(27). A study from Hong Kong also showed EI to be more cost-effective than SC with improved functioning, lower rates of hospitalisations and suicides(28). Therefore our results from this modelling study for England appear to be consistent with findings from recently published studies from other countries.

Strengths and limitations of approach

One strength of our work is the use of decision analytic modelling techniques .These can be particularly useful in economic analyses by synthesising evidence from a variety of sources such as clinical trials, literature reviews, routine databases and expert opinion. In addition, a decision modelling approach can improve the external validity of findings by facilitating the transferability of study findings from one setting to another. A further advantage of using a decision model approach is to enable us to estimate values in the absence or lack of data on specific key parameters of interest. The robustness and uncertainty of models can be tested though a wide range of sensitivity analyses given the best available data. Decision analytical

model approaches are useful particularly when there is a lack of data, which can be obtained from clinical trials or observational studies.

There are however a number of limitations that must be kept in mind. Like trial-based approaches, decision models are simplifications of reality. The cost of lost employment in our models was estimated using the minimum wage rate, which probably underestimates production as a proportion of patients would have received in excess of the minimum wage if they were in work. Furthermore, while we have data on the proportion of patients in education or training, we have not attached an economic value to this even though it is unlikely to be zero. However, using this conservative approach, there are still cost-savings in favour of EI.

In the model for homicide costs, caution is needed in our assumption about the ten-fold difference in effectiveness in terms of homicide events, because comparing treated and untreated psychosis is not necessarily the same as comparing EI and standard care. Although we focused on homicide, which is a rare event with very high costs, the overall costs of crime will be underestimated. Less severe crimes are more frequent in the general population, but data on any other crimes committed by people with mental health problems are very limited and study samples are too small to detect statistically significant differences between those receiving EI and SC.

Another limitation is that only completed suicide outcomes were included in our model, more studies are needed to explore non-fatal/attempted suicide events by people with early psychosis and their economic consequences at work and home as previous suicide attempts are strong predictors of completed suicide. If we were to consider the economic costs of these non-fatal events, the economic burden may be much greater. Given the lack of data on reliable attempted suicide events by people with early psychosis, the cost difference in our model is conservative.

While this study has looked at broad economic impacts beyond health systems and their impacts on service use, it will be important in future work to assess impacts on health-related quality of life, and for the purposes of resource allocation decisions to do so using quality adjusted life years. It would help decision makers if the impacts on the subjective and objective burden associated with unpaid caregiving could be incorporated into future economic evaluations.

Implications for policy and practice

Our analysis supports the economic case for investing in EI services, particularly when impacts beyond the health care service use such as employment, education, homicide and suicide are considered. There are potentially both short- and long-term savings to be gained compared to standard care.

Early intervention to treat symptoms of psychosis might also generate more substantial cost-savings for the economy with more coordinated approaches among relevant public sector organisations. This is another area for careful evaluation. It could look at impacts also on housing, homelessness and adherence to intervention.

A recent study by While and his colleagues showed that implementation of mental health policy recommendations had positive impacts on suicide rates. The greatest decrease in suicide rates were related with the provision of 24 hour crisis, multidisciplinary review after fatal events, and the implementation of mental health services with the most deprived catchment areas (incidence rate ratio 0.90; 95% CI 0.88-0.92)(30). Although this study did not particularly look at EI, given that some of the key principles of EI are consistent with the policy recommendations made, EI may also have great potential benefits for effective suicide prevention strategies in the future.

Finally, in England, EI services are usually provided for up to three years. Given the lack of empirical data on long-term follow-up, there remain questions about costs and outcomes if EI support could be maintained for more than three years in future practice.

Acknowledgements

Declaration of Interest

None

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