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Economic Evaluation of Early Intervention (EI) Services: Phase IV Report

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Economic Evaluation of Early Intervention (EI) Services: Phase IV Report

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Summary

In this report we present findings from Phase IV of a programme of work assessing the economic impact of early intervention (EI) services for people with psychosis. We have focussed on the following areas: (i) the impact of EI on vocational outcomes, (ii) the impact of EI on homicide costs, (iii) the impact of EI on suicide costs, and (iv) the long-term economic impact of EI.

The main findings are as follows:

(i) *EI results in substantially reduced costs of lost employment*. This is due to estimated employment rates of 36% and 27% for EI and standard care respectively. Using a minimum wage rate the *average savings are £2087 in addition to healthcare savings previously demonstrated*.

(ii) The cost of homicide is low for both EI and standard care. However, for *EI the annual costs of homicide (£6 per person) are £80 per person lower than for standard care (£86 per person)*.

(iii) Suicide is assumed to occur for 1.3% of EI patients and 4% of standard care patients. *The estimated annual saving in suicide costs due to EI is £957 per person*.

(iv) The long-term economic impact of EI depends on what happens to readmission rates after a patient is discharged from the EI team. If the readmission rates remain constant then the expected savings over eight years are £36,632. If rates converge immediately after EI team discharge the figure is £17,427. Finally, if the rates converge gradually the expected savings are £27,029.

This paper has reinforced the findings from earlier work that EI is likely to have beneficial impacts. These will be experienced in terms of increased work, decreased suicide and decreased homicide.

Acknowledgements

We would like to thank members of the steering group for their advice and comments, in particular Dr. Michael Clark, Dr David Shiers, Professor Swaran Singh and Dr Jo Smith. We are also grateful for the comments received by attendees at a related seminar on 28 September 2010. Finally, we also thank the DH for funding this work.

1. Introduction

In 2006 a model was produced which examined the economic costs of EI services. This model showed substantial savings in costs over a one- and three-year period, mainly as a result of reduced readmission rates compared to usual care. However, the model was limited because it (i) focussed on psychiatric service costs and excluded the impact on the use of other services and lost employment, (ii) was a general model and did not examine the economic impact of delivering EI to specific patient groups or in specific settings, (iii) did not examine patient outcomes and (iv) used data from one study (the evaluation of the Lambeth Early Onset service). Subsequent to this piece of work we were commissioned to undertake a scoping review to see how the model could be adapted. We aimed to investigate the possibility of using other data sources and to incorporate a broader range of outcomes. Areas to be considered were: suicide, offenders, Black and minority ethnic (BME) groups, children and adolescents, rural issues and the cost of lost opportunities. After embarking on this second phase we decided to re-estimate the original model using more appropriate data and to present a worked out model for BME service users. A third phase of work followed where we (i) conducted further analyses using the Mental Health Minimum Dataset, (ii) refined the model to show the impact of EI for BME patients and reported further data to potentially improve this, (iii) developed and ran a model for children and adolescents and (iv) developed the structure of a model for offenders. The initial results were presented at a seminar on 11 March 2009.

Further discussions led to a proposed fourth phase. This aimed to look at the impact that EI might have on (i) vocational outcomes, (ii) crime costs and (iii) out of area placements for children and adolescents as well as (iv) conducting a scoping exercise and initial modelling work of the long-term impact of EI. We subsequently have included the impact of EI on suicide. The aim of looking at child and adolescent placements has not been achieved and we address some of the issues around that. This report presents the findings for Phase IV.

2. Modelling the impact of EI on vocational outcomes

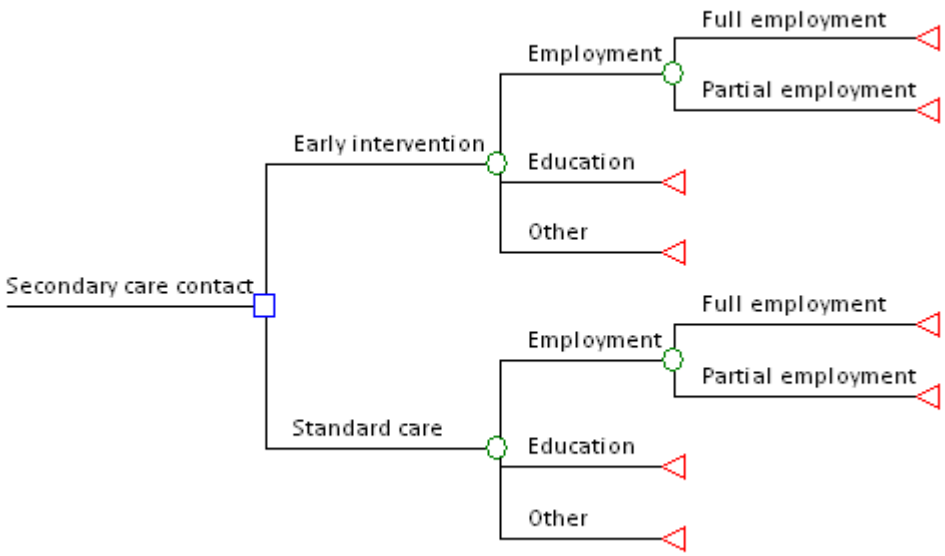
Background

Key aims of many EI services are to maintain people in employment, education or training or to enable recovery in these areas. Clearly there are economic benefits to be attained for individuals themselves from this in terms of increased income, but also to society as a result of increased production.

Model structure

A simple decision model has been used to examine the impact that EI has on the costs of lost employment (Figure 1). Patients are assumed to receive either EI or standard care and then to either be in employment (partial or full), education/training or to be out of work. There are probabilities associated with these events and costs incurred through not being in work.

Figure 1. Model to estimate impact of EI on vocational outcomes.



Parameters

Studies have revealed increased levels of employment following the receipt of EI. In London, the LEO study found that 33% of EI patients made a full vocational recovery compared to 21% for standard care (Garety et al, 2006). Of those EI patients making any vocational

recovery, 58% achieved full employment and 42% partial employment. In Australia, Mihalopoulos et al (2009) report that 7.5 years after receiving EI 56% of patients were in paid employment compared to 33% of those who had received standard care.

In another recent UK study, Major et al (2010) report that following EI 36% of patients were in employment and 20% were in education. Data on standard care have suggested that around 24% of long-term patients are in some form of work/education (including sheltered work) (Perkins & Rinaldi, 2002). We have used this figure for first-onset patients treated in standard care. Given the uncertainty over this, we have conducted sensitivity analyses. The LEO study indicates that of these 52% will be fully employed.

The cost of lost employment has been estimated using the human capital approach. The minimum wage of £5.80 has been used to represent the value of one hours work (Office for National Statistics, 2009), 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 a value of employment of £9744. This probably underestimates production as a proportion of patients would have received in excess of the minimum wage were they in work. We have further assumed that half of this value will be realised if only a partial vocational recovery is attained. A further limitation is that, whilst 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).

Sensitivity analyses

- As the minimum wage may underestimate productivity gains we have also used the median wage of £9.79 (Office for National Statistics, 2009).

- The probability of being employed after EI has been varied between 19% and 36% (Major et al, 2010).

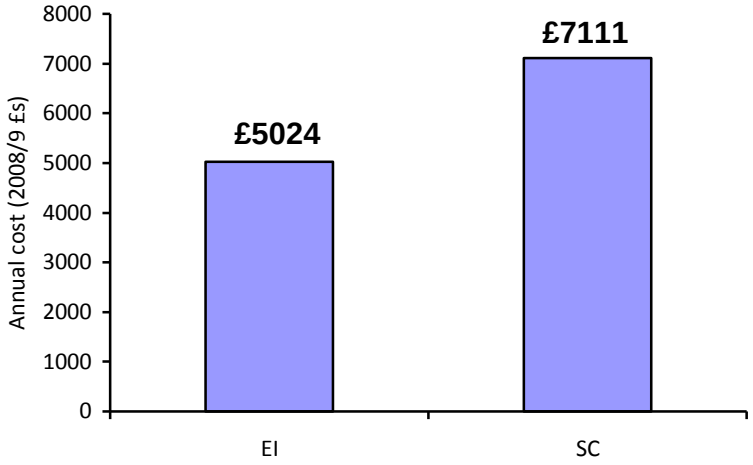
- The probability of being employed after standard care has been varied between 9% and 27% (Perkins & Rinaldi, 2002).

- Costs have been varied upwards and downwards by 50%.

Results of vocational model

Figure 2 reveals that the estimated costs of lost employment are substantially lower for EI – a difference of £2087 per person.

Figure 2. Expected service and lost employment costs associated with EI and standard care.



From Table 1 we can see that if the employment rate following EI is reduced from 36% to 19% the costs associated with EI increase from £5024 to £6333. If the employment rate for standard care falls to 9% the lost employment costs associated with standard care increase to £8481.

Table 1. Impact on costs of varying the employment rate following early intervention and standard care.

Probability of employment with EI	EI cost	Probability of employment with standard care	Standard care cost
0.19	£6333	0.09	£8481
0.23	£6455	0.13	£8139
0.28	£5678	0.18	£7796
0.32	£5351	0.22	£7454
0.36	£5024	0.27	£7111

The above model used the minimum wage of £5.80. If the median wage of £9.79 for a 25-year old is used the difference in lost employment rises from £2087 per person to £3523.

3. Modelling the impact of EI on homicide

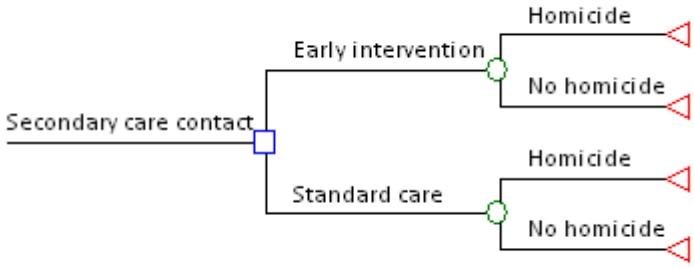
Background

Some people with psychosis will commit offences as a result of their illness. Some offences may be common but have a low cost, whilst high cost offences occur less frequently. Costs can fall on different agencies (health care services and the criminal justice system being the obvious ones) and also occur due to lost productivity if someone is unable to work (due to homicide or injury). In addition, there are the reductions in quality of life for those who are affected by crime and in theory these may also be valued. We have focussed here on homicide which is rare but has high costs. Data on other crimes committed by people with mental health problems are limited, and samples sizes from relevant studies are small. As such we are clearly underestimating the overall costs of crime.

Model structure

The figure below shows a decision model to estimate homicide costs. The structure is uncomplicated; patients are assumed to be treated either by an EI or standard care team and in both cases there is a probability of a homicide being committed.

Figure 3. Decision model to estimate cost of homicide.



Parameters

There are few studies that provide robust estimates of homicide rates among people with mental health problems. We have used a review conducted by Nielssen and Large (2008).

This included ten studies from a number of countries. The review estimated that there is a 0.17% likelihood of someone with untreated psychosis committing homicide. By contrast, the review estimated that 0.011% of those receiving treatment would go on to commit homicide – a ten-fold difference. We have used these estimates in our model. Caution is urged though because comparing treated and untreated psychosis is not necessarily the same as comparing EI and standard care. We have though assumed, in the absence of other data, that the same relative difference applies.

The lifetime cost of homicide has been estimated in an official UK government report (Home Office, 2004) and a summary of the costs are shown in Table 2. Costs result from defensive activities on the part of individuals, as a consequence of the homicide, and as a response to crime. Costs were originally estimated for 2003 and we have inflated these to 2009 prices. The total (discounted) cost per homicide is estimated at £1.72 million. The largest component of cost is due to the physical and emotional impact on victims (i.e. families of the deceased), accounting for 59% of the total. This is followed by lost output/production at 31%. Other costs only account for 10% of the total.

Table 2. Lifetime cost of homicide in the UK (£s).

Year	**Anticipation of crime**		**Consequence of crime**				**Response to crime**	**Total**
	Defensive costs	Insurance costs	Physical & emotional impact on direct victims	Victim services	Lost output	Health services	Criminal justice system	
2003	145	229	860380	2102	451110	770	144239	1458975
2009	171	269	1012134	2473	530677	906	169680	1716309

Source: Adapted from the estimates in the Home Office (2004)

However, it is helpful to examine annual costs of homicide. Using the above figures, we have assumed that defensive costs, insurance costs, victim service costs, and health service costs all occur in the year of the homicide. We have also assumed that criminal justice system

costs occur in the first ten years. Homicide annual costs are estimated at £54,079 in the year of the homicide and £50,260 in each of the following nine years. We do not know when any homicide takes place and in subsequent calculations we have assumed it occurs four years after psychosis develops.

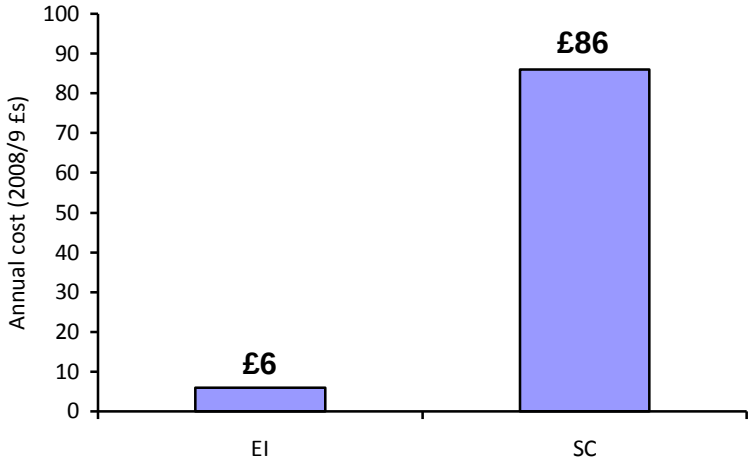
Sensitivity analyses

- The probability of homicide following EI has been varied between 0.00007 and 0.00016 (Nielssen and Large, 2008).
- The probability of homicide following standard care has been varied between 0.00077 and 0.00347 (Nielssen and Large, 2008).
- Cost of homicide has been calculated including:
    - Only health costs
    - Only criminal justice system costs
    - Excluding lost output
    - Excluding the physical and emotional impact on victims

Results of homicide model

From Figure 4 we can see that the estimated annual costs associated with homicide are far higher for standard care than for EI, but the absolute cost in both cases is very low.

Figure 4. Expected service and homicide costs associated with EI and standard care.



Reducing the rate of homicide following EI from 0.011% to 0.007% would only reduce annual costs from £6 to £4 (Table 3). Similarly, increasing homicide rates 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.

Table 3. Impact on annual homicide costs of varying the homicide rate following early intervention and standard care.

Probability of homicide with EI	EI cost	Probability of homicide with standard care	Standard care cost
0.00007	£4	0.00077	£39
0.000093	£5	0.0015	£76
0.00012	£6	0.0021	£106
0.00014	£7	0.0028	£142
0.00016	£8	0.0034	£172

EI was the least expensive option, when the costs of homicide were varied from the lower lifetime limit of £906 (including health services cost only) to the upper limit of £1,185,632 (excluding lost output). In addition, when the cost for criminal justice system only or when the cost for physical and emotional impact on direct victims was considered, the results were still robust.

4. Modelling the impact of EI on suicide

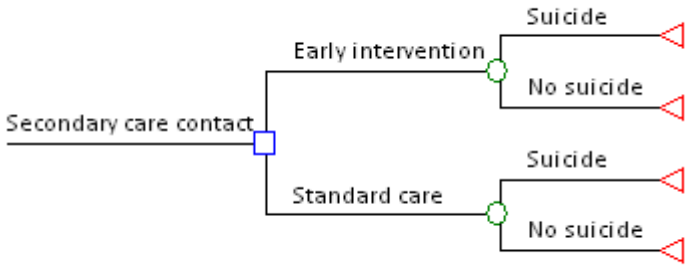
Background

In modelling the economic impact of suicide there are similarities with the previous section on homicide in that key costs are the loss of production and the impact that suicide has on those who are bereaved. However, whereas homicide is a relatively rare event, suicide is by contrast more common in those with mental health problems.

Model structure

From Figure 5 we can see that the structure of the suicide model is very similar to that used for homicide. Patients are assumed to either receive care from an EI team or from standard care services. There is then a probability of suicide occurring or not.

Figure 5. Decision model to estimate cost of suicide.



Parameters

A recent systematic review of studies which report suicide rates in people with schizophrenia has estimated a rate of completed suicide of around 4% with an indication that most occur near the beginning of the illness (Robinson et al, 2010). Another recent study has examined suicide attempts in areas with EI teams and has compared these data with areas without EI teams (Melle et al, 2006). The findings suggest that the number of suicide attempts in areas with EI teams is one-third that in areas without them. We have assumed that completed suicides are also reduced by the same amount 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.

An existing cost model that had been built to calculate the cost of suicide for the Scottish government (Platt et al, 2006) to estimate the average lifetime costs of a suicide for someone between the ages of 15 and 35 was updated and adapted to an English context as part of suicide specific work undertaken for the DH (McDaid & Park, 2010). The estimate in 2009 prices is £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 earning potential. This results in an average lifetime cost per suicide of £1,552,307. Of this figure, 2.8% falls on the NHS,

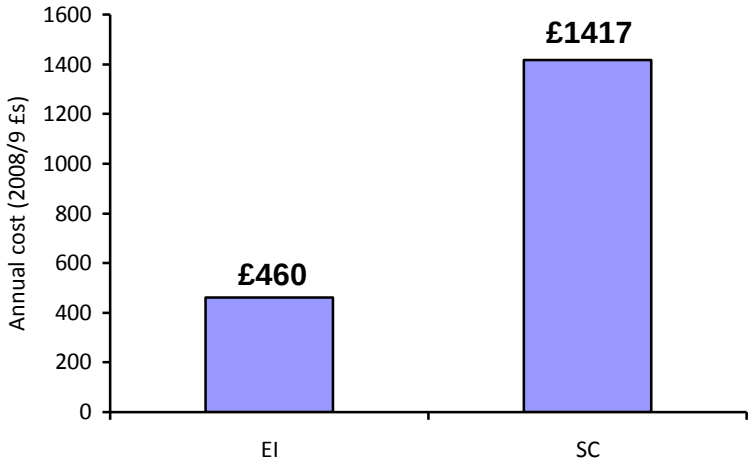
28.7% is due to productivity losses, and 68.5% is due to the monetary valuation of reduced quality of life in those who are bereaved.

Annual suicide costs are estimated at £34,412 in the year of suicide and £33,442 in subsequent years. The human capital approach attaches greater to value to those with higher earnings and this of course introduces a gender bias with the average annual cost per male suicide being £36,096 compared to a cost for women of £32,728. We have used these annual costs in our models (rather than the lifetime costs which were used in the homicide models) but recognise that the gender bias is problematic. To estimate a weighted cost we have assumed that 80% of suicides occur in men and 20% in women.

Results

The annual cost of suicide are shown in Figure 6. The difference in annual suicide costs is £957.

Figure 6. Expected service and suicide costs associated with EI and standard care.



When median wage rates were used instead of minimum wage rates the costs of suicide increase to £627 for EI compared to £1929 for standard care.

5. Combination of vocational, homicide and suicide effects

The table below shows the annual savings compared to standard care due to 100% EI provision. This is based on a one-year cohort of 6900 patients (the estimated incidence of psychosis in England) receiving care. The savings in service costs are based on our earlier work (McCrone et al, 2009). Clearly, more savings will accumulate as EI is used in subsequent years. Savings are reduced beyond the short-term because we have conservatively assumed that admission rates are then the same for EI and standard care. This is addressed in the next section.

Table 5. Potential annual savings from EI compared to standard care services.

	Short-term (<1 year)	**Medium term (2-5 yrs)**	**Long term (6-10 yrs)**
Per person savings	£5777 (all due to reduced service costs)	£4774 (£2408 reduced service costs, £2052 reduced lost productivity, £314 intangible)	£2600 (£60 reduced service costs, £1912 reduced lost productivity, £628 intangible)
Total by sector			
NHS	£39.1 m	£16.0 m	-
Other public sector	£0.8 m	£0.6 m	£0.4 m
Productivity	-	£14.2 m	£13.2 m
Intangible	-	£2.2 m	£4.3 m
Total	**£39.9 m**	**£32.9 m**	**£17.9 m**

6. Long-term economic impact of EI services

Background

There is growing evidence as to the economic benefits of EI but there is limited information about the long-term effects. A small number of studies have though been performed. An early economic evaluation of the EPPIC service in Melbourne reported substantial cost savings for EI (Mihalopoulos et al, 1999). Recently, the same group has reported economic findings approximately 7.5 years later for these patients (Mihalopoulos et al, 2009). The mean annual costs were A$3445 for EI and A$9503 for standard care (difference of 64%).

Inpatients costs were A$1178 for EI and A$3243 for standard care (difference of 64%). During the two years prior to follow-up assessment 56% of EI and 33% of standard care patients had been in paid employment. EI patients also had significantly better clinical outcomes.

A five-year follow-up of the OPUS study in Denmark was performed by Bertelsen et al (2008). The EI intervention 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. After two years of EI treatment patients would receive standard care (which may just be from their GP). At two years there were significant differences in favour of EI for psychotic symptoms and functioning. There were no significant differences at five-year follow-up. 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. The figures were 57% and 54% during the three to five year period. Mean inpatient days during the first two years were 96 for EI and 123 for standard care (EI 22% less than standard care). The figures in the three to five year period were 58 days for EI and 71 days for standard care (18% less for EI), and in the entire five-year follow-up they were 149 days for EI and 193 days for standard care (23% less for EI). During the five-year period 4% of EI patients and 10% of standard care patients lived in residential care. After five years 61% of EI patients and 59% of standard care patients were not working.

In a follow-up to the LEO study in south London, Gafoor et al (2010) examined admissions in the period 3.5-5 years after entry to the study. 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 patent characteristics it was found that EI patients spent on average of 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.

Long-term model

We have focussed on the Markov model we used in our initial model to estimate the short-term economic savings associated with EI. We have extended this by increasing the number of two-month cycles from six to 48 (representing an eight year period). We have also included employment gains into the model.

We have addressed three specific scenarios:

Scenario 1. Readmission rates are constant throughout all the 48 cycles for both EI (12%) and standard care (20%).
Scenario 2. Readmission rates for EI for the first three years are constant, and then suddenly become the same as for standard care.
Scenario 3. Readmission rates for EI after three years *gradually* become similar to those for standard care.

The detailed models are shown in Figures 7, 8 and 9. In Table 6 the expected costs from each model are summarised. As would be expected, the savings per person are greatest in the first scenario and lowest in the second. The third scenario is perhaps the most plausible. If patients are discharged to standard care services after three years then we might expect a convergence of results. If this convergence is gradual then our model still suggests that the eight-year costs for those receiving three years of EI are 25% lower than if patients had only received standard care services. A crucial question – and one that we can not answer here – is what would happen were the same level of support to be maintained for more than three years?

Table 6. Expected costs from long-term (eight year) models (£s).

Scenario	Readmission rates	EI	SC	Savings (£)
1	Maintained	70240	106872	36632
2	Suddenly become equal after three years	89445	106872	17427
3	Gradually become equal after three years	79843	106872	27029

7. Modelling the impact of EI on child and adolescent placements

In a previous report we have developed a model to estimate the economic impact EI services for children and adolescents with psychosis. The model demonstrated large cost savings. We had in Phase IV intended to model the impact that EI services might have on child and adolescent inpatient placements. This has not proved possible due to limitations with data availability. Out of area placements are clearly important and this can be illustrated by Table 7 which shows the number of NHS short-stay beds for children with mental health needs by mental health Trust. It is clear that many Trusts are not represented in these figures and these will therefore rely on other providers (NHS and independent sector) for this type of care. In addition, four Trusts account for over one-quarter of all NHS beds.

To explore out of area placements further we have explored the possibility of obtaining HES data for children with psychosis. However, it is apparently not possible to identify inpatient episodes that have been preceded by EI or standard care input. Further work needs to be done in this area and use should be made of the National Mental Health Minimum Dataset and administrative systems relating to specific Trusts. In addition, we may wish to revisit the possibility of conducting a survey of CAMHS services to see to what extent EI occurs and what the rates of admission and readmission are for young people receiving this type of care.

Figure 7. Eight-year model with readmission rates constant.

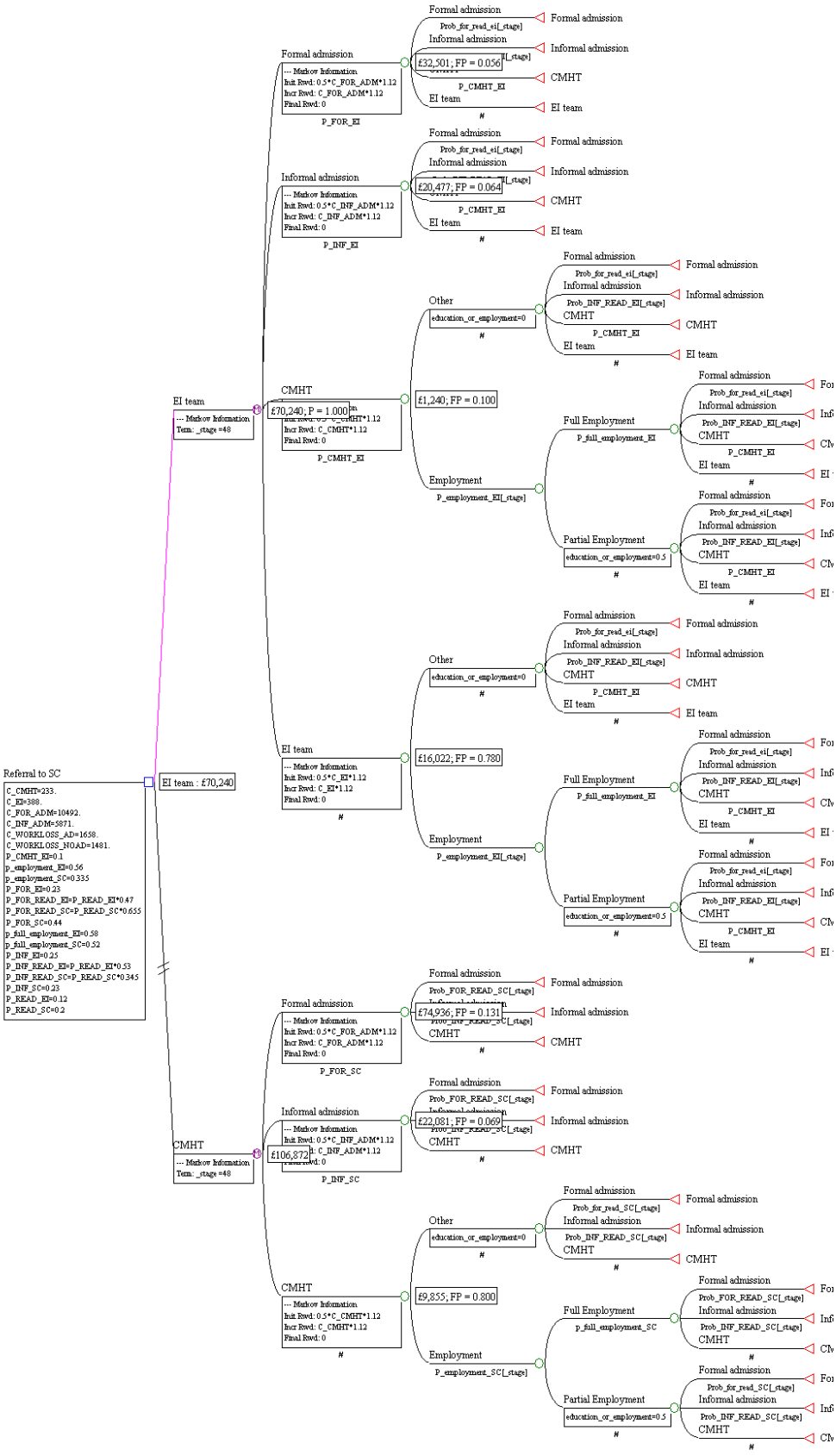


Figure 8. Eight-year model with readmission rates equal after three years.

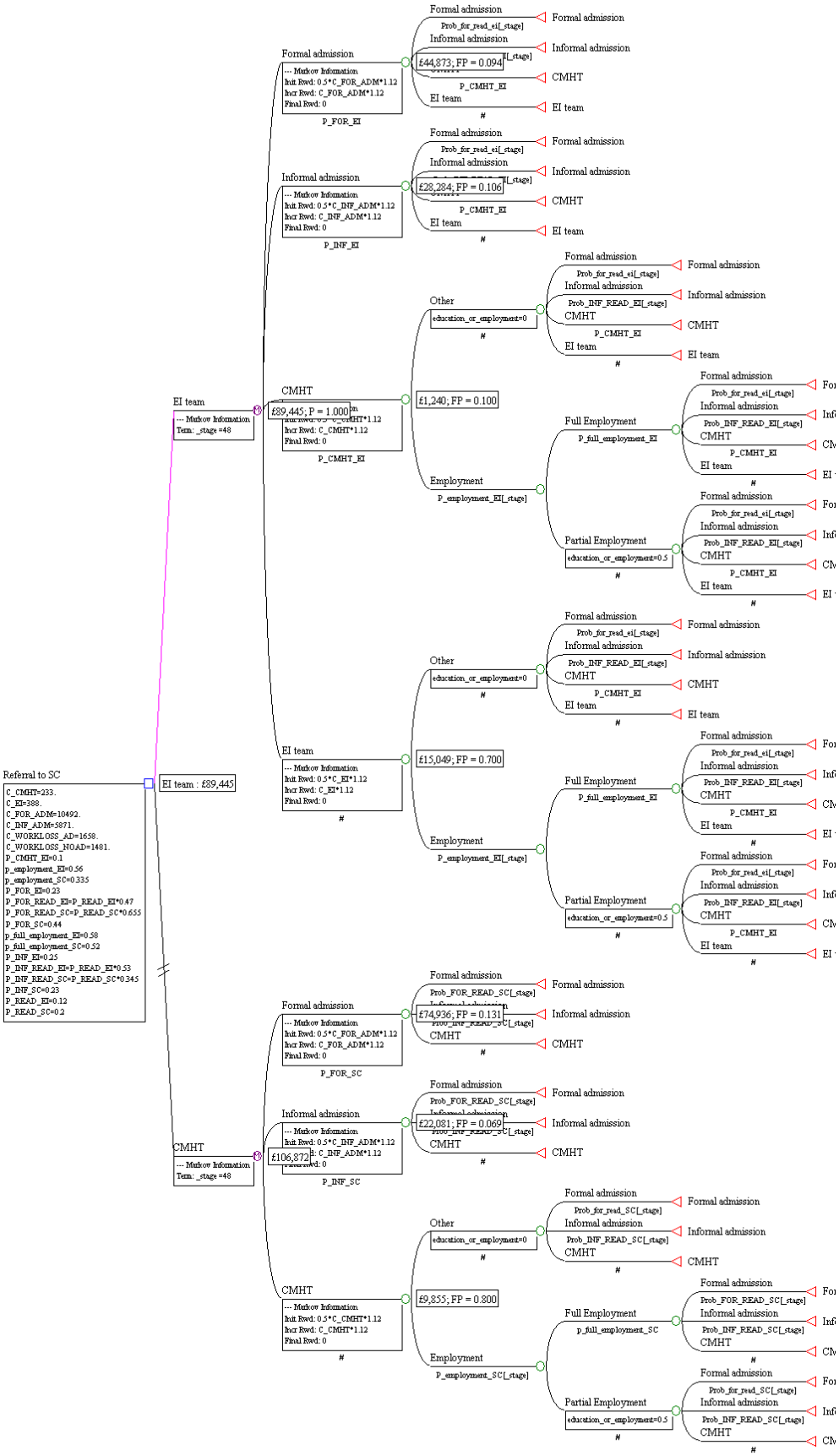


Figure 9. Eight-year model with readmission rates gradually converging after three years.

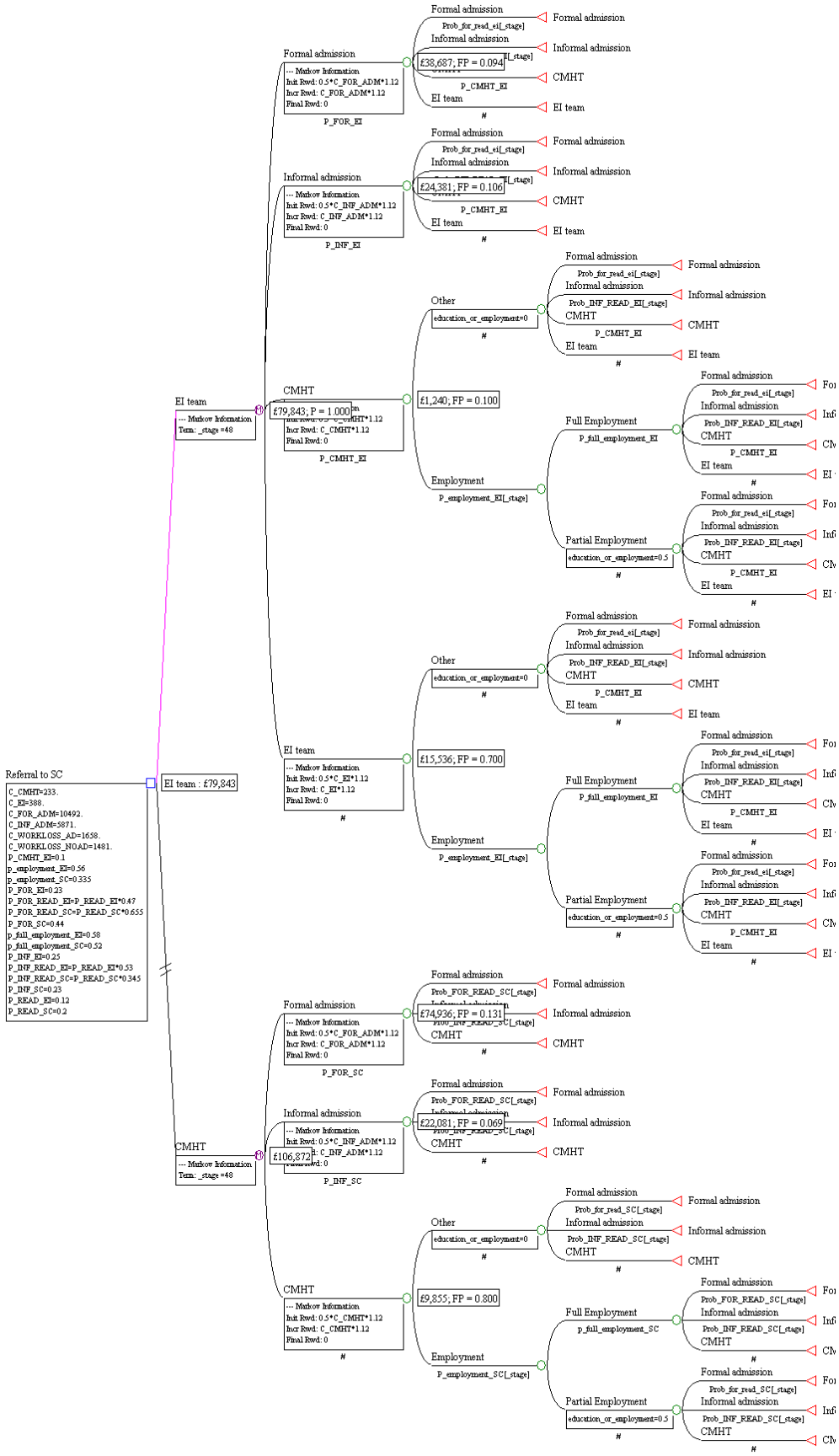


Table 7. Number of NHS short-stay beds for children by mental health Trust.

Trust	Number of beds	% of total
Birmingham Children's Hospital NHS Foundation Trust	44	8.3
South London And Maudsley NHS Foundation Trust	39	7.4
Hampshire Partnership NHS Foundation Trust	38	7.2
Cambridgeshire And Peterborough NHS Foundation Trust	33	6.2
South West London And St George's Mental Health NHS Trust	26	4.9
Barnet, Enfield And Haringey Mental Health NHS Trust	24	4.5
Tees, Esk And Wear Valleys NHS Foundation Trust	22	4.2
Northumberland, Tyne And Wear NHS Trust	20	3.8
North East London NHS Foundation Trust	15	2.9
East London NHS Foundation Trust	15	2.8
Greater Manchester West Mental Health NHS Foundation Trust	15	2.8
Oxfordshire And Bucks Mental Health NHS Foundation Trust	15	2.8
Cheshire And Wirral Partnership NHS Foundation Trust	14	2.7
Hertfordshire Partnership NHS Foundation Trust	14	2.7
North Essex Partnership NHS Foundation Trust	13	2.5
Lincolnshire Partnership NHS Foundation Trust	12	2.3
North Staffordshire Combined Healthcare NHS Trust	12	2.3
Nottinghamshire Healthcare NHS Trust	12	2.3
Sussex Partnership NHS Foundation Trust	12	2.3
Great Western Hospitals NHS Foundation Trust	12	2.3
North Yorkshire And York PCT	11	2.1
Central Manchester University Hospitals NHS Foundation Trust	10	1.9
North Bristol NHS Trust	10	1.9
Central And North West London NHS Foundation Trust	10	1.8
Pennine Care NHS Foundation Trust	9	1.7
Great Ormond Street Hospital For Children NHS Trust	9	1.7
Somerset Partnership NHS Foundation Trust	8	1.5
Lancashire Care NHS Foundation Trust	8	1.5
Leicestershire Partnership NHS Trust	8	1.5
Berkshire Healthcare NHS Foundation Trust	8	1.5
Plymouth Hospitals NHS Trust	8	1.4
Kent and Medway NHS and Social Care Partnership Trust	7	1.3
Humber Mental Health Teaching NHS Trust	6	1.1

8. Conclusions

This report has reinforced the findings from earlier work that shows EI to be a potentially cost-saving way of providing care to those in an early stage of psychosis. Our previous models have focussed on NHS care and have shown lower costs associated with EI. This report shows that savings are also likely in terms of reduced lost production costs and, in the longer-term, in reduced rates of homicide and suicide. There is much uncertainty around costs of suicide and homicide, but the data shown here suggest that the contribution they make to total costs is limited. In addition, we have shown that the healthcare cost savings associated with EI are reduced if the readmission rates following EI and SC converge. However, early savings are not lost. All of this work has relied on modelling and some caution is urged in interpreting the findings. Models rely on assumptions about probabilities and costs and therefore sensitivity analyses need to be conducted to assess the impact of changing these assumptions. These models do though provide flexibility in assessing costs and can be adapted to local circumstances. Future work should build on – and improve – the models we have developed here in order to improve the evidence base regarding these specialist teams.

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