

# The Impact of Early Intervention Services on Mental Health Care Costs

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## ***SUMMARY***

This report describes a model developed to estimate the economic impact of early intervention services compared to usual care. Care pathways have been identified and the probabilities of patients moving through particular pathways and the costs of these have been estimated. The expected cost for EI patients over one year was £13,370 whilst for usual care the figure was £29,369. This represents a 53% saving, which is maintained after three years when the respective costs are £41,054 and £88,108. (Under an alternative version of the model, where all EI patients can be admitted, the expected cost associated with EI rises to £57,665.) Three-year costs after discounting are £31,864 for EI and £77,724 for usual care. With one exception, the findings were insensitive to changes in most parameters including the cost of the actual EI service. The exception was the readmission rate. If this increased from 33% to 38% for EI patients then the cost savings would disappear over the three years period. However, these figures only influence the data in the model and should not be seen as applicable to all areas.

## ***1. BACKGROUND***

The NHS Plan and the Policy Implementation Guide 2001 formally introduced a 'functionally differentiated service model' of three specialist (most likely multidisciplinary) teams: (a) an early intervention psychosis service to manage new cases; (b) a crisis resolution and home treatment team to reduce the number of inpatient admissions; and (c) an assertive

outreach team to support service users who would otherwise be poorly engaged with services and probably not taking their medications. The early intervention (EI) approach has its roots in the early psychosis initiatives in the UK, Australia, Canada, New Zealand, Scandinavia, Germany and the Netherlands in the 1990s. The first EI service in the UK, started in Birmingham in 1990. The approach was being encouraged before the 2001 guidance, for example in the 1998 mental health White Paper, the following year's National Service Framework, and the broader 2000 NHS Plan (Department of Health, 1998, 1999, 2000).

As defined by the Policy Implementation Guide, EI teams would 'provide intensive support and help that every young person who develops a first episode of psychosis needs' (Department of Health, 2001, p.10). The Guide strongly encourages services to function as a whole system: guidance concerning the roles of primary care and of mental health promotion lie adjacent to guidance relating to the most challenging groups such as young people in need of EI services who, in contrast to most other client groups, must be anticipated to have contact with and need of a very wide range of services. For the vast majority of these young people, links with specialist services will also need to be sustained.

### **The duration of untreated psychosis**

Central to the development of EI services is the need to reduce the duration of untreated psychosis (DUP). Studies of first episode psychosis have consistently found an average of 1-2 years between the onset of psychotic symptoms and the start of treatment (McGlashan et al, 1999), and long DUP has been linked to male gender, poor pre-morbid functioning, poor psychosocial support (Larsen et al, 1998) and an insidious presentation with predominantly negative symptoms (Drake et al, 2000, Larsen et al, 1996). Long DUP can also be caused by stigma and fear (Lincoln and McGorry, 1995), lack of knowledge about mental illness and the services available to treat it, poorly structured health care systems and the educational system (Lincoln et al, 1998).

Although still disputed (Ho and Andreasen, 2001), it is highly likely that DUP is associated with outcome in first episode psychosis, particularly functional and symptomatic outcome at 12 months, symptom reduction once treatment begins (Harrigan et al, 2003, Larsen et al 2000, Norman and Malla, 2001), increasing behavioural disturbance and family difficulty (often involving multiple failed attempts to access care), life threatening behaviour (Power, 1999) and increased use of the Mental Health Act (Humphreys et al, 1992). Each of these

consequences of long DUP is likely to lead to higher rates of service utilisation, higher costs for the NHS and other service-providing agencies, and higher costs for society more generally.

Work by Birchwood and others demonstrates the complexity of the concept of DUP, which appears to be composed of three distinct intervals: help-seeking delay, referral delay and delay in use of mental health services (Birchwood and Brunet, in submission). Consequently, developing a strategy to reduce DUP will be difficult because we do not yet understand the factors responsible for delay (Marshall et al submitted). Help-seeking delay may be influenced by, among other things, stigma and shame. Referral delay may be influenced by failure to recognise symptoms in primary care. And delays in use of mental health services may arise because of failures to recognise psychosis, to engage with outpatients and other ‘stigmatising’ services, and to engage in initial treatment.

A further rationale for intervening intensively and early in the first episode is the concept of a ‘critical period’ in the early phase of psychosis, with major implications for secondary prevention of impairments and disabilities. Birchwood and Macmillan (1993) and Birchwood et al (1998) argued that deterioration occurs in the pre-psychotic period and early in the course of psychosis, but that this often stabilises after 2-5 years and may even relent. Interventions targeted in the early years after onset, particularly the first three years, could therefore have a disproportionate impact relative to later interventions. Evidence in support of this argument comes from the long-term follow-up studies of first episode psychosis (Harrison et al, 2001).

### **Intervention studies**

The findings from a number of randomised controlled trials of early intervention have been published or are in the process of reporting. The PACE study of the Early Psychosis Prevention and Intervention Centre (EPPIC) in Melbourne showed that it is possible to delay and potentially avert progression to full diagnostic threshold for psychotic disorder from 35% to 10% in a sample of 59 in ‘ultra high-risk’ individuals using low dose neuroleptics and CBT (McGorry et al, 2002). However, this study also showed that the positive effects of intervening early did diminish over time. Morrison et al (2004) demonstrated that almost the same 6% of patients with prodromal symptoms converted to psychosis following CBT, whilst 22% of those receiving did so. The authors did though exclude two patients who received

CBT and who subsequently became psychotic, as it was reported that they had been psychotic at baseline.

In the United States, findings from the PRIME study which assessed the efficacy of providing olanzapine to people with prodromal symptoms of schizophrenia have recently been reported (McGlashan et al, 2006). Although 16.1% of patients receiving olanzapine converted to psychosis compared to 37.9% receiving a placebo the difference was not statistically significant.

The TIPS project evaluated community education about psychosis in an epidemiological 'case-control' study in Norway, finding a reduction in DUP and a concomitant reduction in psychosis symptoms at onset of treatment and 3 months follow-up (Melle et al, 2004).

Two RCTs have focussed on providing intensive assertive outreach-based care to young people (16-30yrs) during the 'critical period'. The OPUS study in Denmark found advantages in terms of readmission, symptoms and quality of life for integrated, sustained treatment over treatment as usual (Nordentoft et al, 2002).

In London, the Lambeth Early Onset (LEO) study is evaluating the effectiveness of an early intervention service which is compliant with the 2001 Policy Implementation Guide recommendations. Services delivered by a team focusing on specialised care for patients with early psychosis have been found to be superior to standard care for maintaining contact with services and reducing readmissions to hospital (Craig et al, 2004).

In general, the clinical studies that have evaluated EI services appear to show promising results. However, further research is required to provide more substantive evidence for policy makers and this evidence should include information on cost-effectiveness.

### **Economic evaluations**

As far as we aware, the only economic study of EI was carried out in Melbourne by Mihalopoulos et al (1999), comparing the community-orientated treatment delivered by the Early Psychosis Prevention and Intervention Centre with standard care. A before-and-after study compared 51 EPPIC patients treated in 1993 and 1994 with 51 matched retrospective controls receiving the pre-EPPIC treatment model between 1989 and 1992. Outcomes

assessed included quality of life and negative symptoms. Cost measures were limited to health services: inpatient stays, outpatient appointments, medication, community mental health team contacts, general practitioner contacts and private therapy and psychiatry. EPPIC was found to cost less than the pre-EPPIC treatment model, although there is no indication in the published paper of the statistical significance of this result. The cost saving arose because reductions in inpatient service outweighed increases in community services. The study has a number of methodological limitations but encourages the view that an EI service can be more cost-effective than standard care.

Recent reviews of the economics literature in relation to the treatment of psychoses and mental health problems of childhood and adolescence revealed no other published studies that examined the cost implications or cost-effectiveness of EI (Knapp et al, 2002, 2005; Romeo et al 2005).

### **Aim of study**

This aim of this study was to produce a model to estimate the impact that EI services have on the costs of mental health care. Initially we had planned to take a societal perspective by including the social costs that occur during the duration of untreated psychosis. However, lack of data led us to focus on healthcare costs.

## **2. METHODS**

### **Structure of decision model**

Decision models are used to show the impact on costs and cost-effectiveness of new and existing interventions as a quick alternative to collecting such data alongside trials. Whilst trial based data may have more internal validity (in that it allows very specific hypotheses to be addressed) decision models by be more generalisable and are certainly more flexible. However, they are clearly a simplification of reality. The decision model here (see Figure 1) was produced following discussions with David Shiers and Jo Smith, who are EI leads for the National Institute for Mental Health in England, and Paddy Power who is a Consultant Psychiatrist with the South London and Maudsley Mental Health Trust. Full variable definitions for the model are shown in the Appendix. The model is divided into two halves, the top half showing care pathways in the presence of EI services and the lower half showing

care pathways with standard care services. We have incorporated two forms of EI into the model – early detection services and EI services once psychosis has developed.

In the EI half of the model patients are assumed to come into contact with an early detection service and following this there will be one of two outcomes – transition to psychosis or no transition. This was a binary outcome (transition or no transition). It may have been preferable to have used more dynamic methods, for example by examining the time to transition. However, data would be limited for this. (It should also be noted that the main results in this report are based on the effect of early intervention services after psychosis has occurred.) If there is a transition to psychosis then we have assumed that the patient will be seen by an EI team. At this point the model goes through a number of ‘cycles’ lasting two months. In the first cycle the patient can: (i) remain with the EI team, (ii) be admitted under a section of the Mental Health Act (or be admitted to an intensive care unit), (iii) be admitted informally, or (iv) be transferred to standard community mental health services. During the second and subsequent cycles patients either remain in their current ‘state’ or move to one of the others. One exception to this is that patients initially seen by the EI team and not admitted are assumed to remain with the EI team throughout the model. The standard care half of the model follows the same structure except that the EI elements are excluded.

### **Sources of data for probabilities and costs**

The above events will each have a particular probability of occurring. To estimate these probabilities we conducted a search of the literature on EI services and also accessed data on the most comprehensive economic evaluation of EI services to date – the LEO study. However, we were unable to estimate some probabilities from these sources and in these cases we had to assume values. Details of the values used are below and also in Tables 1 and 2.

#### *Transition to psychosis*

A recent review identified four studies that have evaluated early detection services and that provide estimates for rates of transition to psychosis (Nordentoft et al, 2006). For patients assessed/treated by early detection services the transition rate ranged between 6% and 19%, whilst the rate for control group patients ranged between 22% and 35%. We used the mid-point of these ranges, i.e. 11% for EI patients and 29% for standard care patients. There is clearly wide variation around the rates of transition to psychosis and by just using average

figures there is an information loss. However, it became clear as the project developed that the emphasis should be on the cost impact of services for people who had already made this transition.

*Formal admission (first cycle)*

The LEO study (Craig et al, 2004) showed that 61% of patients treated by the EI team and 60% of those receiving standard care were admitted in the follow-up period. Of the EI patients 67% had formal admissions whilst the figure for standard care was 72%. The product of these figures was used in the model – 41% of EI patients and 43% of standard care patients receiving formal admissions.

*Informal admission (first cycle)*

From LEO we know that of the 61% of EI patients who were admitted, 33% were informal admissions and of the 60% standard care patients admitted 28% were informal admissions. These figures translate to 20% of EI patients and 17% of standard care patients being informally admitted.

*Discharge to community services (first cycle)*

Data were not available on the discharge rate back to standard community mental health services from EI teams. We have assumed a figure of 10% in the model. Whilst this is rather arbitrary, when combined with the probabilities of admission obtained from the LEO trial it results in a residual 29% of patients remaining with the EI team (see below) and not being admitted. Feedback following circulation of an draft of this report suggests that this 29% is reasonable (which therefore in turn suggests that the 10% discharge rate is not inappropriate).

*Remain with EI team (first cycle)*

By default, and in the absence of data, 29% of patients were assumed to remain treated by the EI team.

*Formal admission (second and subsequent cycles)*

The LEO study reports a readmission rate of 33% for EI patients and 52% for standard care patients. Assuming the same ratio of formal to informal admissions as before suggests a formal admission rate following an admission of 22% for EI patients and 37%.

*Informal admission (second and subsequent cycles)*

Using the same method as above we have estimated that the informal admission rate following a previous admission is 11% for EI patients and 15% for standard care patients.

*Discharge to or remaining with community services (second and subsequent cycles)*

We have continued to estimate discharge rates at 10% for EI patients. Given the probabilities relating to admissions we estimate that 48% of standard care patients will continue to be treated just by community services.

*Remain with EI team (second and subsequent cycles)*

These are the residual probabilities, i.e. 57% for EI patients.

Cost data for the different events were mainly obtained from the LEO study. The details are as follows:

*Contact with early detection team*

This was estimated to be £1000. By comparison a cost of £500 was estimated for an assessment in standard care. These costs were estimates used mainly to allow the model to function – the main cost comparison being made for patients who have already made a transition to psychosis.

*Contact with standard services during two-month cycle*

The LEO study shows that the cost for standard care patients over six months for contacts with psychiatrists, social workers and community mental health nurses comes to £700. Dividing this by three gives a cost of £233 for a two-month cycle (see Table 2 for details).

*Contact with EI team during two-month cycle*

The LEO study shows that the cost for EI patients over six months for contacts with psychiatrists, social workers and community mental health nurses comes to £1163. Dividing this by three gives a cost of £388 for a two-month cycle (see Table 2 for details).

*Formal admission during two-month cycle*

From the LEO study the mean length of stay for patients admitted formally was 84 days. To fit in with the two-month cycles we have assumed a length of stay of 61 days, i.e. the whole cycle. This equates to a cost of £10492.



### *Informal admission plus other services during two-month cycle*

The LEO study gives a mean length of stay of 33 days for those informally admitted. The cost of this is £5716. Because such an admission would not cover the whole cycle we have added one month of community contacts, estimated as the average of community services delivered by the EI team and standard care, i.e. £155.

### *Duration of untreated psychosis*

In a separate economic evaluation of the OASIS prodromal service the costs associated with lost employment during a long DUP of seven months have been estimated at £9075, whilst the lost employment costs during a short DUP of 22 days are estimated to be £674 (Valmaggia et al, in preparation). The LEO study did not find a significant difference in DUP between EI and standard care patients, and in fact the EI patients had a slightly longer DUP. Other studies though have shown that DUP can be reduced by EI services. Because of the lack of robust data we have not been able to include the costs of different DUPs in the model.

### **Analysis of model**

Costs were compared by ‘rolling back’ the model. This allows cost of the two options, EI or standard care, to be estimated at different points in the model. Costs were estimated by running the model for one and three years. We also produced a model which showed three-year costs discounted by 3% to take account of the fact that future costs may have less value than current costs.

### **Sensitivity analyses**

Clearly there is much uncertainty around the estimation of the above parameters and many of the values used relate to specific services. To address uncertainty and generalisability of the model we assessed how the results of the model would be affected by changing individual parameters. In particular we have reduced/increased by 50% the probabilities associated with (i) initial formal admissions, (ii) formal admissions, (iii) readmission rates, (iv) remaining with the EI or community teams and (v) the transition rate to psychosis. There is little data to inform these ranges and therefore we aimed to allow a relatively large reduction/increase in each parameter. In addition, we (vi) increased the two-month cost of EI services from £388 up to £1000 per person. All sensitivity analyses were conducted on the three-year undiscounted costs. The results showed that readmission rates were particularly important

and we therefore also conducted two-way sensitivity analyses around the readmission rates for EI and usual care patients.

### ***3. BASE-CASE RESULTS***

The results of the model after one year are shown in Figure 2. It can be seen from this that patients seen by an EI team after a transition to psychosis are estimated to have service costs of £13,760 compared to £29,369 for standard care patients. After three years the costs are £41,054 and £88,106 respectively (Figure 3). Discounted costs were £31,864 and £77,724 respectively. The main reason for the substantial cost difference is the readmission rate, which is much less for the EI patients. The expected costs are much lower if we also include the early detection services, as most patients do not make a transition to psychosis. Therefore, for most decision makers the estimate of interest is the expected cost once a transition has been made.

In the model we have assumed that 29% initially receive services from the EI team and then do so throughout the remaining cycles of the tree. If we allow these patients to have the possibility of admission then the expected costs for the EI part of the model rise from £41,054 over three years to £57,665.

### ***4. SENSITIVITY ANALYSES***

#### **(i) Reduction/increase in probability of initial formal admission**

In changing the first formal admission rate in EI from 20.5 to 61.5%, the cost of EI ranges between £29,233 and £52,876. Therefore, the high end of this range remains substantially below the cost of standard care over three years (£88,108). Under standard care, even with a 50% reduction in formal admissions the total cost of standard care decreases by only £18,944 to just under £70,000. If the admission rate increased to 64.5% then the costs of standard care increase to £107,050.

**(ii) Reduction/increase in probability of initial informal admission**

Varying the informal admission rate in the EI half of the model between 10% and 30% results in EI costs ranging between £35,288 to £46,821. Under usual care, changing the informal admission rate by 50% varies the overall cost from £80,618 to £95,597.

**(iii) Reduction/increase in readmission rates**

The base values for EI and standard care readmission were 33% and 52% respectively. We have adjusted the model so that by varying the readmission rates, the rates of admission either into formal or informal care also vary. When the EI readmission rate exceeds 38.5%, EI becomes more costly than the standard care. Thus the 38.5% is the threshold value for EI beyond which there is no cost advantage. (If the 29% of patients who initially receive services from the EI team and then remain with the team are ‘allowed’ to be admitted then the threshold value is 35.5%.)

If standard care has to be less costly than early intervention then the readmission rate needs to be below 42.4% - which is the threshold value. Any readmission above this, standard care will be more expensive.

**(iv) Reduction/increase in probability of remaining with EI team/CMHTs**

In our model for early intervention 29% of patients continue to be treated by the EI team, which might differ for other EI programmes. Varying this probability between 14.5 to 43.5% had almost no cost impact on the overall expenditure of EI. Similarly since a significant percentage of patients (40%) under usual care are treated under community mental health services – varying this probability significantly impacted the overall standard care cost. At 20% the cost of usual care was £78486 and at 60% it was £105,729.

**(v) Reduction/increase in rates of transition to psychosis**

Changing the transition rates to psychosis has little effect on the original result with the cost of early intervention being substantially less than standard care.

**(vi) Increase in cost of EI team**

In the base case model the cost of the EI intervention was assumed to be £388 over two months. If this cost rises to £1000 the overall cost for the EI patients only increases to £45,690 – still over £40,000 less than for usual care.

**(vii) Reduction/increase in readmission rates for EI and usual care patients simultaneously**

The two-way sensitivity analyses revealed that for most combinations of rates of readmission the usual care services would result in higher costs than EI (Figure 4).

## **5. DISCUSSION**

### **Main findings**

This report has modelled the cost associated with early EI over a one-year and a three-year period. Over one year we have estimated that the costs for patients where psychosis has been identified and who then receive EI services are £13,760 as compared to £29,369 for usual care – a potential cost saving of 53%. The difference is maintained after three years - £41,054 compared to £88,108. The discounted costs were £31,864 and £77,724 respectively. The cost difference is largely due to a much lower readmission rate for EI patients. We performed a number of sensitivity analyses around key parameters. In most cases increasing or reducing these parameters did not change the finding that EI resulted in lower costs. It was especially noticeable that even if the cost of the EI service (which as it is based on London data is probably relatively high already) were increased by 158% there would remain cost savings for EI patients.

However, the results were highly sensitive to changes in the readmission rate. If this increased from 33% to 38% the cost saving would disappear, on the assumption that the readmission rate remained constant for usual care. In the base case model we have assumed constant readmissions rate for each part of the model. However, it is possible that the readmission rate for EI patients increases over time towards that seen for usual care patients. This means that cost savings would be greatest early on and would gradually be reduced. It should though be emphasised that the impact of different readmission rates relate only to the data in this model – they must not be treated as targets for individual areas.

### **Limitations**

There are a number of limitations to this study. First, the results are based on a model that is - by definition - a simplification of the real world. However, models are useful for focusing on

key parts of the mental health care system and the ability to perform extensive sensitivity analyses is an advantage. Second, whilst the model would ideally be built from data from a variety of sources the most suitable data came from one evaluation - the LEO study – and therefore we need to be cautious about making generalisations based on the findings (although the sensitivity analyses do allow us to alter model parameters to suit other situations). Third, the LEO study included some patients who were in their second episode of psychosis and, although these only accounted for 22% of all included patients, this may also limit the models generalisability. However, as LEO was a randomised study there is no reason to suggest that the relative differences between EI and usual care would be particularly affected. LEO currently has an early detection service and inpatient ward. The latter was introduced during the course of the study and this may be the reason for the relatively high rate of initial admission. (The costs of the admission unit are not though included in the unit costs of the EI intervention *per se* but they are reflected in subsequent inpatient costs.) Fourth, the model is possibly limited in that we have attempted to include early detection services as well as more ‘standard’ EI services. We have focussed very much on the latter as this is where most data were available. Fifth, we have limited the costs to those associated with mental health services. In reality, patients will use a whole variety of services. Social costs have not been included – we had hoped to be able to include costs associated with the duration of untreated psychosis but data were not sufficient for this purpose. Sixth, only a limited number of sensitivity analyses were conducted. However, it was evident that the model was really only sensitive to readmission rates. It would though be helpful to conduct further work, particularly probabilistic sensitivity analyses. Finally, this model only examines costs. The least costly option is appropriate if outcomes are maintained or improved relative to a more expensive option. In the case of EI this is likely to be the case as anecdotal and trial evidence suggests improvements in quality of life and other domains (Garety et al, 2006).

## **6. CONCLUSIONS**

This model has indicated that substantial cost savings can be made by providing EI services for people with psychosis. However, we do need to urge caution as any model is a simplification of how services actually operate. Nevertheless, the results are promising and should encourage the further development and evaluation of these interventions. Future models should include data from a wider range of services, particularly those in rural areas.

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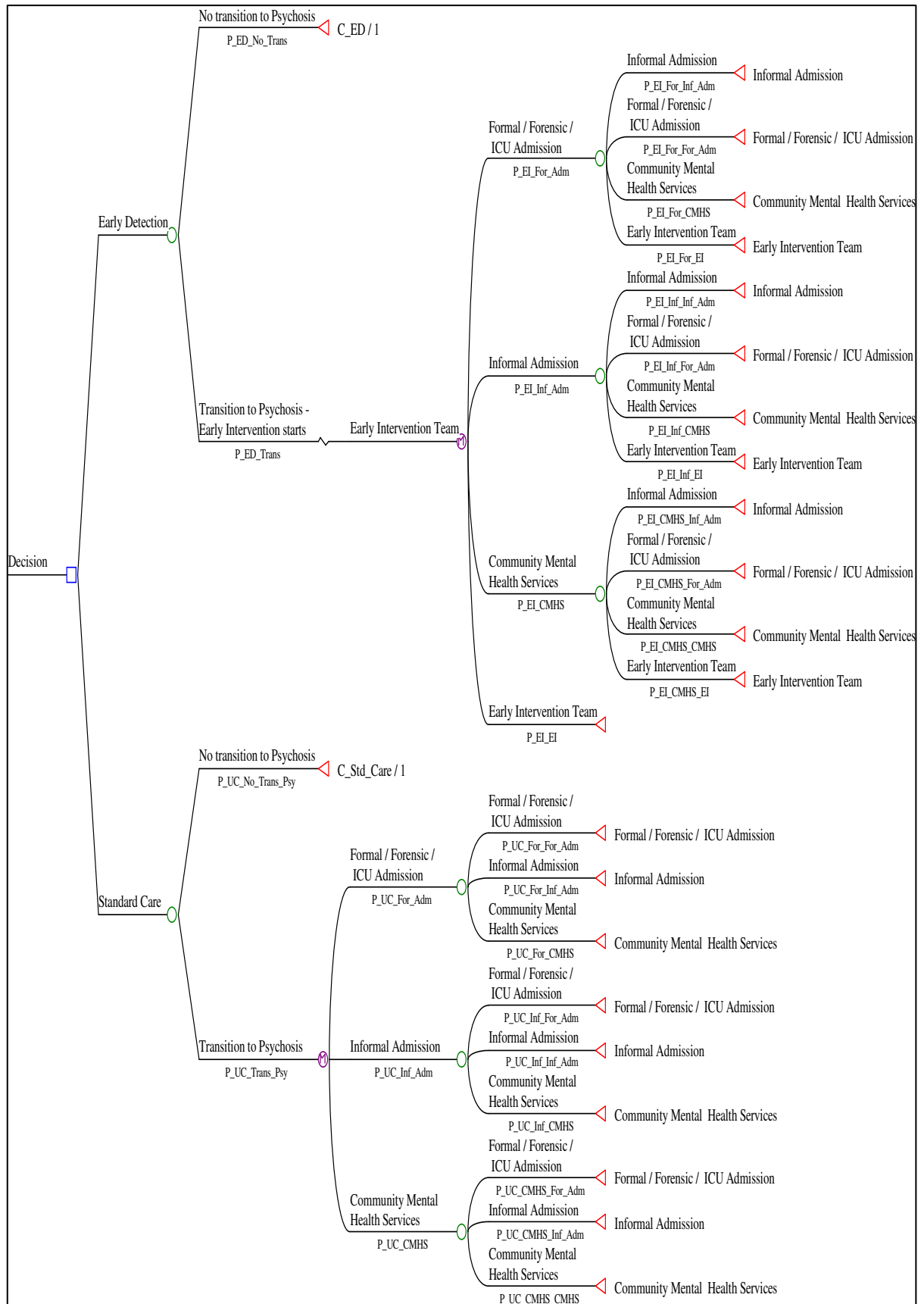
**Table 1. Probabilities used in base-case model.**

<b>Parameter</b>	<b>EI Sub-tree</b>	<b>Standard care sub-tree</b>	<b>Source</b>
Transition to psychosis	11%	29%	Nordentoft et al (2006)
Formal admission (first cycle)	41%	43%	Craig et al (2004)
Informal admission (first cycle)	20%	17%	Craig et al (2004)
Discharge to CMHTs (all cycles)	10%	NA	Best estimate
Remain with EI team (first cycle)	29%	NA	Residual probability <sup>1</sup>
Formal admission (subsequent cycles)	22%	37%	Craig et al (2004)
Informal admission (subsequent cycles)	11%	15%	Craig et al (2004)
CMHT treatment (subsequent cycles)	NA	48%	Residual probability <sup>1</sup>
Remain with EI team (subsequent cycles)	57% (D)	NA	Residual probability <sup>1</sup>

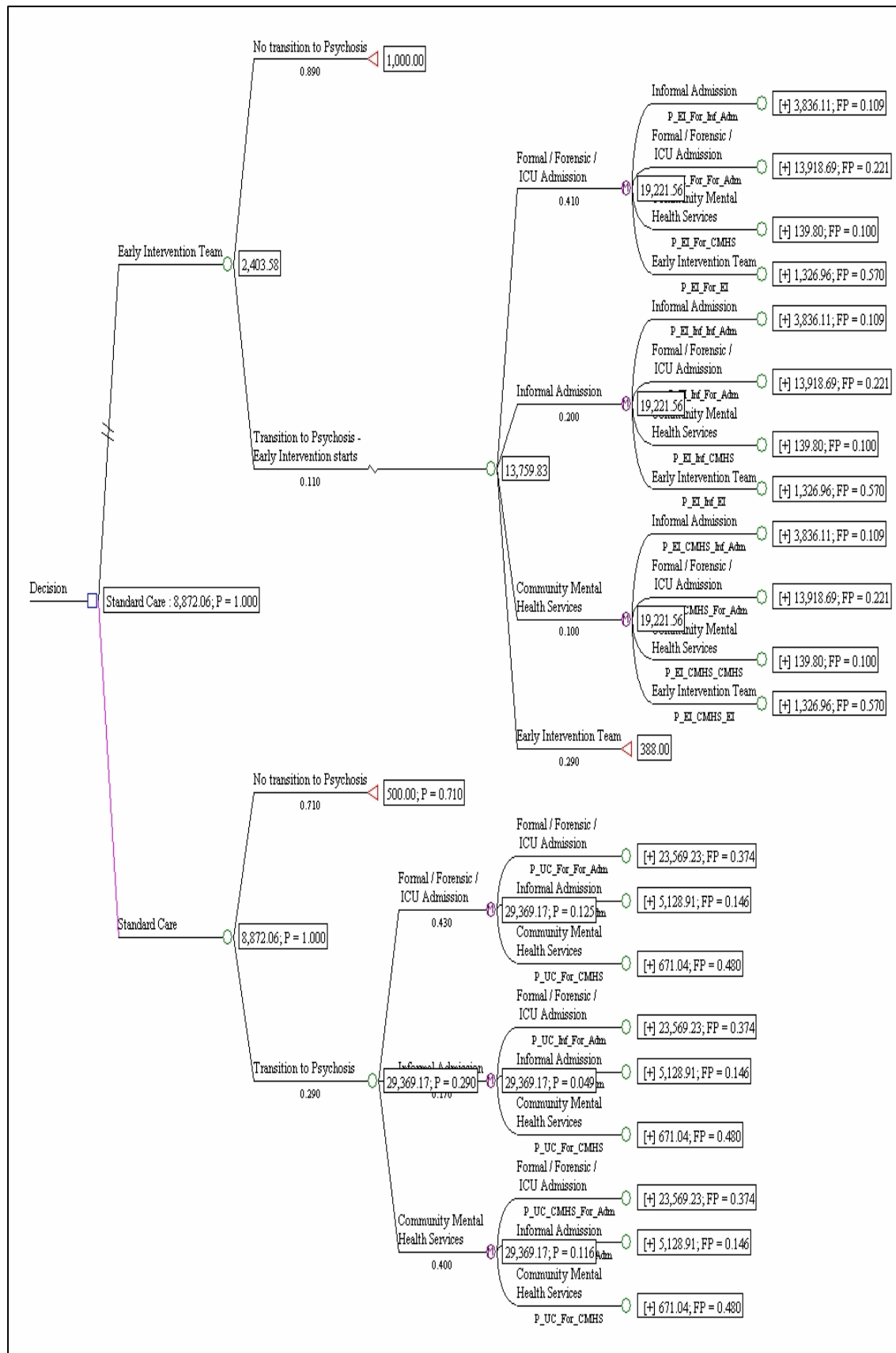
**Table 2. Costs used in base-case model.**

<b>Parameter</b>	<b>Cost</b>	<b>Source</b>
Contact with early detection team	£1000	Best estimate
Care for prodromal symptoms (standard care)	£500	Best estimate
EI input over 2 months	£388	LEO study
<i>Psychiatrist</i>	£600	
<i>Social worker</i>	£116	
<i>Community mental health nurse</i>	£447	
Standard community services over 2 months	£233	LEO study
<i>Psychiatrist</i>	£437	
<i>Social worker</i>	£87	
<i>Community mental health nurse</i>	£176	
Formal admission (61 days)	£10492	LEO study, unit cost from Netten & Curtis (2004)
Informal admission (33 days)	£5716	LEO study, unit cost from Netten & Curtis (2004)

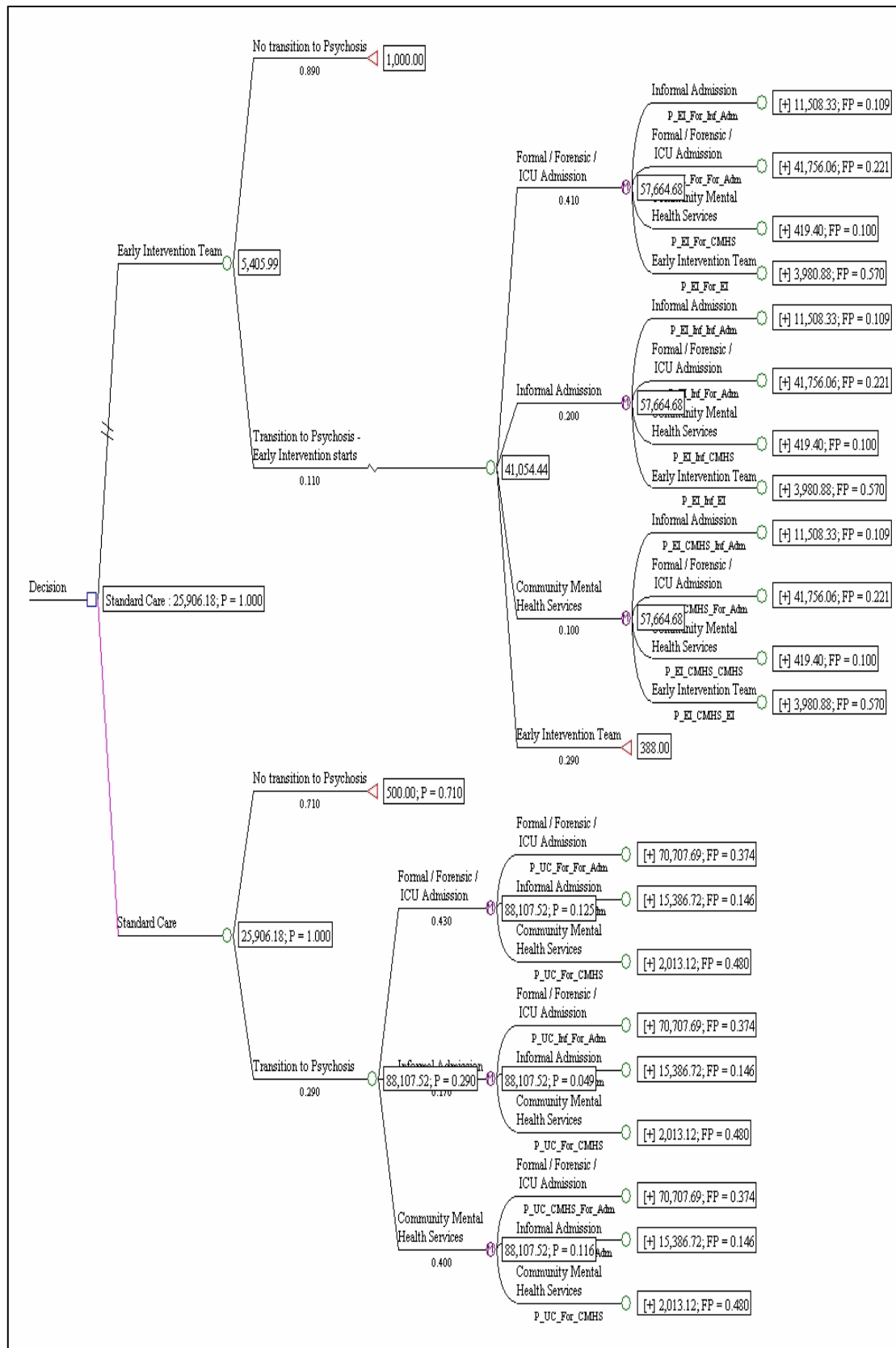
**Figure 1. Structure of EI cost model.**



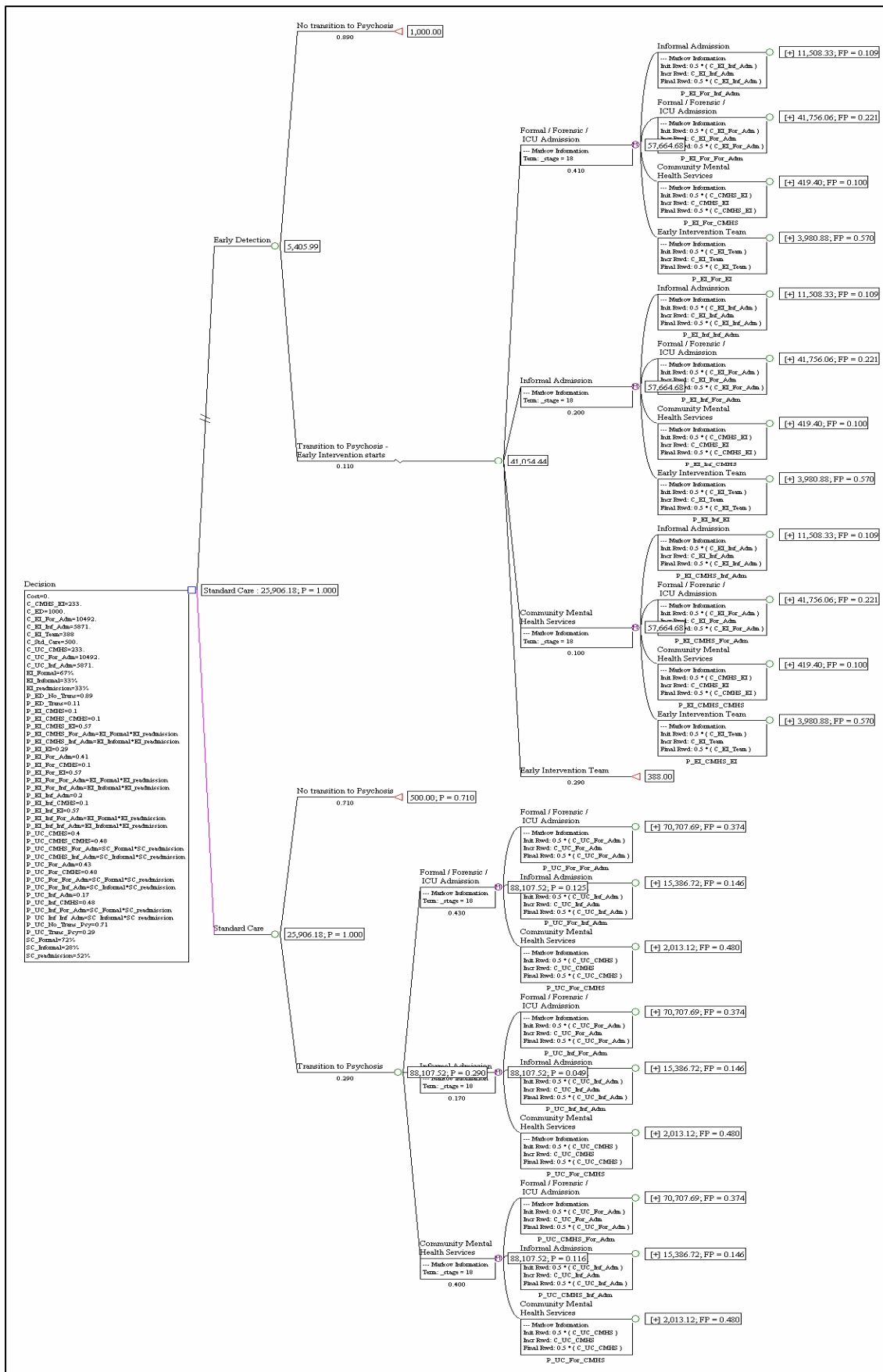
**Figure 2. Cost comparison after one year.**



**Figure 3. Comparison of costs after three years.**



# Appendix. Three-year model with full variable definitions.



**Figure 4. Two-way sensitivity analysis of readmission rates.**

(The area with green squares shows the combination of EI and usual care readmission rates that result in higher costs for usual care.)

