

Who needs AESOP? Predicting long term readmission rates from routine EI team discharge information

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## **Abstract**

**Aim:** Prognosis following early psychosis is highly variable. Long-term prognostic information from research studies is available in only a few areas. We sought to understand how well routine discharge information allows prediction of long-term readmission prognosis.

**Methods:** We reviewed the records of 239 people leaving Early Intervention services, after an average of 2.5 years, and counted the number of relapses. The distribution was modelled and extrapolated to a predicted 10 year outcome. Model predictions were compared with published data.

**Results:** Numbers of relapses varied substantially, with 59% having no relapses before discharge, and 5% having four or more. Model predictions for ten year outcome were close to the observed data.

**Conclusions:** A simple model can describe the distribution of numbers of relapses among people discharged from EI services, and predict longer-term outcomes matching those observed in formal research. This low-cost approach could allow EI services to develop locale-specific prognostic information.

## **Key words (5)**

Psychotic disorders; prognosis; recurrence; statistical models; patient readmission

## Introduction

It is well recognised that prognosis following a first episode of psychosis is highly variable; while most people experience one or more relapses, a proportion (around 20%) remain well for at least ten or twenty years (1–4). Understanding longer term patterns of relapse and readmission allows for informed clinical decision making particularly around preventative treatments, and can guide rational service design.

It has been known for some time that long term outcomes in schizophrenia vary between geographical centres (3,5), and this is likely to be even more the case for the broader group of those with experience of psychosis treated by Early Intervention services. Early Intervention services typically offer treatment for a few years, so are well placed to understand local outcomes following a first episode of psychosis over similar periods. Longer-term data on prognosis are less widely available. Some centres have access to local prognostic information through involvement in substantial long-term research studies such as AESOP (6) or TIPS (7), but this is rare, reflecting the considerable challenges such studies face. An economical approach that allowed local services to estimate longer term prognosis for service users in their locality would therefore have considerable appeal.

We sought to understand how well routine team discharge information might allow prediction of locality-specific long-term readmission prognosis. We chose to consider rates of major relapses, such as those causing hospitalisation, as we expected these would be most clearly recorded in clinical records, and this would be a salient outcome to patients, carers, clinicians and other stakeholders.

## Methods

We reviewed the records of consecutive people discharged from Early Intervention services between October 2012 and October 2013 across three boroughs of London and counted the number of times they had experienced a serious relapse. Serious relapses were defined as needing admission to hospital or involvement of a Crisis Resolution and Home Treatment Team (HTT) (8). The threshold for admission in the UK is high; for many people who would otherwise require hospital admission in a crisis, HTT provides an alternative through intensive community treatment. London boroughs are administrative divisions, with populations around 250000 people. In the UK, there is universal state provision of healthcare with Mental Health Trusts providing specialist mental healthcare to people living in defined geographic catchment areas (9). The Early Intervention services aim to provide care from first presentation with psychosis, which follows an average duration of 10 months untreated psychosis. Some people leaving the care of Early Intervention services remained under specialist services, but the majority, around two thirds, were discharged to primary care. The South London and Maudsley NHS Foundation Trust provides secondary mental healthcare, including Early Intervention, to all three boroughs included. Two of these boroughs had been previously studied in the AESOP study (10), one had not.

The distribution of numbers of relapses for the two boroughs included in AESOP (168 people), was fit with a zero-inflated negative binomial model. A negative binomial distribution can arise as a mixture of Poisson distributions with mean distributed as a gamma distribution. The zero-inflated model indicates that there are a greater number of zero-valued observations than would be expected from the negative binomial distribution alone, and the excess is modelled as a separate

process. Goodness of fit was assessed using the Kolmogorov-Smirnoff test. The best fit negative binomial model was extrapolated forward to a predicted 10 year outcome and summary statistics calculated. These model predictions were compared with published data from the AESOP study (6).

Analyses were performed using R (version 3.2.4). Code available online at <https://github.com/Blether/ei-relapse>

## Results

239 people were discharged from the three Early Intervention services in the period studied; the mean time under the care of EI services was 2.5 years (standard deviation 1.6 years). The numbers of serious relapses experienced before discharge varied substantially between individuals, with 59% having no relapses, and 5% having four or more.

The distribution of relapses for the two boroughs included in AESOP (168 people) was fit by a two component model (Figure 1A) with most of the population following a negative binomial distribution (*size* 1.10, *prob* 0.53, *p* 0.94), and an additional ultra low risk group comprising 18% of the total, or 32% of those without relapse before discharge.

Figure 1 near here

Extrapolating the model forward to ten years generated the estimates that by that point 26% would have had no relapses, and 5% ten or more relapses (Figure 1B). These predictions match well the observed 10 year follow-up data from an earlier cohort of people presenting with a first episode of psychosis in the same geographical region where the proportions were 25% and 6% respectively (6).

In this model those without any relapse at 10 years are largely those identified as the 'ultra low risk' component at the earlier time point (Figure 1B). This makes sense as even with an annual relapse rate as low as .26, 95% would have relapsed by ten years follow-up.

Considering the three teams separately, the proportion with no relapses at discharge showed some variation between 53% and 65%, and the proportion with four or more

relapses varied between 5% and 6%. However, the proportion predicted to be 'ultra low risk' varied much more substantially at 10%, 25%, and 34% of the total. If this approach is correct, that suggests there would be substantial differences in longer term prognosis even between these geographically adjacent areas.

## Conclusion

A simple model can describe the distribution of numbers of relapses among people discharged from EI services, and predict longer-term outcomes matching those observed in formal research. There is considerable variation in outcome between individuals in outcome within teams, but also variation between adjacent sectors of the same city. Model predictions suggest differences in 10 year outcome may be substantial between services, in keeping with differences between geographical centres internationally (3,5), and within the UK (6,11).

Here we identified relapse by readmission or involvement of HTT. This could have been affected by differences in thresholds for referral between teams, although this may have been lessened by studying services operating within the same organisation. However, it is the case that not all those becoming unwell will have been captured by this approach.

This approach needs further validation, for example, by following further cohorts over time, and testing its applicability in other centres. However, this low cost approach could allow EI services to develop locale-specific information on readmission risk for their population.



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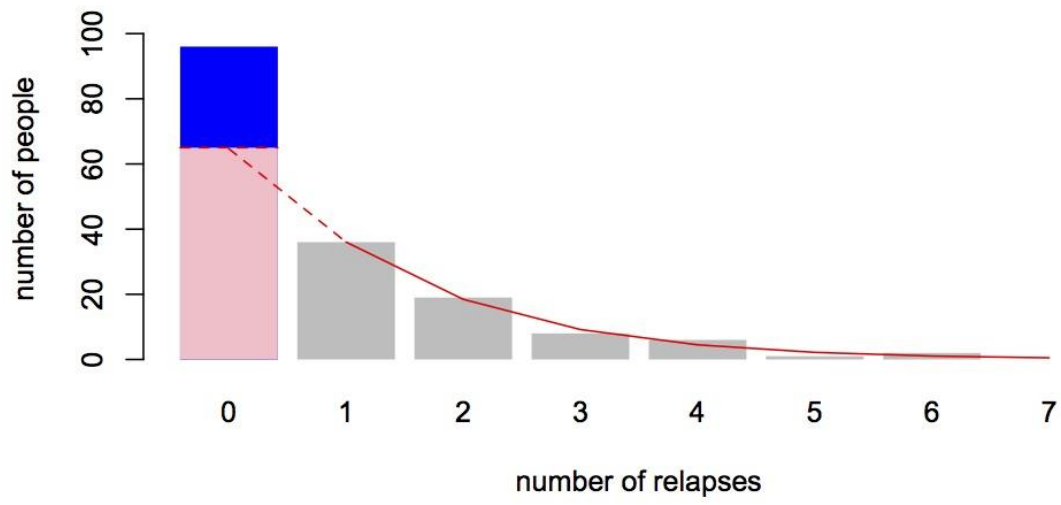
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## Figure Legends

Figure 1.

A. Distribution of number of relapses before discharge from Early Intervention services in 168 people from two services in South London. Line indicates a best fit negative binomial model (*size* 1.10, *prob* 0.53, *p* 0.94). The line extrapolates to divide the group without relapses into the proportion explained by the model (pink) and an additional 'ultra low risk' group (blue). B. Predicted distribution of number of relapses at ten years from the model above.

A



B

