

Institution: University of Cambridge		
Unit of Assessment: 4		
Title of case study:		
PsyMaptic: a population prediction tool used by all NHS commissioners to design and provide early intervention services for people with psychotic illnesses according to population need		
Period when the underpinning research was undertaken: 2002 - present		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Professor Peter Jones Dr James Kirkbride	Professor of Psychiatry Sir Henry Wellcome Postdoctoral Fellow	Oct 2000 – present Dec 2006 – Dec 2013
Period when the claimed impact occurred: 2013 to date		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words)		
Schizophrenia and other psychotic disorders have massive personal and societal cost, but early treatment improves outcomes. In England, specialist NHS early intervention services (EIS) were set up in the 2000s to address this but resources were not distributed across the country in a way that matched need. University of Cambridge epidemiological discoveries about how the incidence of psychotic disorders varies with demography underpin www.PsyMaptic.org, a free, population prediction tool that Public Health England (PHE) used for its https://fingertips.phe.org.uk/ health indicators gazetteer. This was used to implement new policies for early intervention services (EIS) that came into effect in 2016. National Institute for Health and Care Excellence (NICE) guidance at the time recommended all NHS Clinical Commissioning Groups (CCGs) should use PsyMaptic predictions to re-commission EIS, matching resources to the needs of their communities; Professor Jones was appointed clinical lead for implementation of the new NICE standard across NHS England Midlands and East. Access to EIS in England within two weeks of a first psychotic episode has now increased from 33% of patients in 2014 to 76% in 2018/19, exceeding NHS targets of 50%. Updated guidance, published by NICE in 2020 continues to recommend use of PsyMaptic.		
2. Underpinning research (indicative maximum 500 words)		
Psychosis is one of the most life-impacting conditions in healthcare. The length of time from onset of psychosis to the provision of evidence-based treatment has a significant influence on long-term outcomes. The sooner treatment is started the better the outcome and the lower the overall cost of care. (Public Health England, Psychosis data report 2016). Epidemiological research undertaken by Professor Jones and Dr Kirkbride, Department of Psychiatry, University of Cambridge (Dr Kirkbride is now in the Division of Psychiatry, UCL), with collaborators from QMUL (Professor Jeremy Coid) and KCL (Professor Craig Morgan & Professor Sir Robin Murray), defined the existence and determinants of major differences in incidence rates of psychotic disorders across different geographic locations; national average figures are misleading at a local level. They translated this evidence into www.PsyMaptic.org, with Dr Kirkbride leading the modelling and site development with Prof Jones. Psymaptic.org is a practical prediction tool for NHS commissioners now adapted by Public Health England into its 'Fingertips tool', used to present health data in use throughout the NHS.		
Providing evidence of the relationship between psychotic illnesses and demographic and socio-economic factors		

The 2001 NHS Mental Health Policy Implementation Guide (PIG, p55) supported the first-wave commissioning of fifty EIS across England in 2001/2, each EIS serving a population of about 1,000,000 people. The Guide presumed a uniform annual referral rate of 150 new cases per million population such that each team would accumulate a three-year caseload of around 450 patients. This estimate was based on an international epidemiological study undertaken more than a decade earlier. However, many EIS in London, Birmingham and other urban areas become overwhelmed with much higher numbers of young adults with psychotic illnesses while others, particularly in affluent rural areas, had very few referrals. The commissioning model was not fit for purpose.

Reports of high rates in African-Caribbean communities had already prompted the UK Medical Research Council (MRC) to fund the ÆSOP study (Murray, Jones). Published in 2006, this examined 1.6 million person-years in Bristol, London and Nottingham during 1997-1999 identifying 568 new cases of psychosis; Prof Jones designed the epidemiological components. Analysis in Cambridge (1) demonstrated enormous diversity in psychosis incidence according to demographic and socio-economic factors: age, sex, and study centre accounted for a quarter of the raised rates in black and minority ethnic (BME) groups; urban areas had far higher rates than the PIG estimates. A household survey of 33 South London boroughs showed that population density, ethnic density and ethnic fragmentation determined psychosis incidence (2).

Collaborating with Coid (QMUL), the East London first episode psychosis study (ELFEP; 1996-2000) replicated ÆSOP's epidemiological design and refined the association between incidence and socio-economic status (3), facilitating population prediction. The Wellcome Trust then funded SEPEA (2009-2013), a new epidemiological study based in NHS services and involving 680 cases of incident psychotic illness in rural East Anglia (Kirkbride with Jones). Initial prediction models from ÆSOP and ELFEP were found to be applicable beyond urban areas (4).

Providing accurate predictions of the incidence of schizophrenia and other psychotic illness in England

Seeing the implications for NHS planning from this emerging work, in 2009 the Department of Health commissioned Prof Jones, Dr Kirkbride and Prof Murray to undertake a systematic review of studies of schizophrenia and other psychotic illness incidence in England since 1950. Their findings (5) confirmed that incidence (1,3) was heavily determined by socio-economic context. This prompted Dr Kirkbride and Prof Jones to develop a Bayesian model of the ELFEP data, including spatially structured neighbourhood-level random effects within characteristics that could be derived from the Office for National Statistics (ONS) census. Negative binomial regression models estimated risk coefficients across socio-demographic and socio-environmental factors, providing a framework for the PsyMaptic prediction tool developed in 2013 (6). The coefficients from ÆSOP and ELFEP were applied to the contrasting SEPEA population to predict expected caseloads in NHS EIS, comparing with the observed versus predicted incidence. Counts and 95% prediction intervals from a model with age, sex, ethnicity and population density most precisely predicted observed data at regional, EIS and local authority district levels. Put simply, they tested the model in different ways and integrated it with neighbourhood-level data from the ONS census to predict the numbers of people who will develop a psychotic illness anywhere in England. They then checked that the model predictions matched the numbers of psychosis patients the NHS was actually seeing more accurately than the 2001 PIG estimates of 150 cases per 1,000,000 population per year that was being used by the NHS to commission EIS across England. Updated in 2014 on the basis of data from the 2011 England census, the new predictions were used by Public Health England and made available to NHS Clinical Commissioning Groups (CCGs).

The tool was made freely available in 2013 at www.PsyMaptic.org, a process facilitated through work with the NIHR (National Institute of Health Research) East of England Collaboration for Leadership in Applied Health Research & Care (CLAHRC) for Cambridgeshire & Peterborough. While this version of PsyMaptic supported the 2016 second-

wave recommissioning of EIS, the tool has been considerably updated led by Dr Kirkbride to accurately predict population need for psychosis care at the small-area level, taking into account further risk factors such as social fragmentation and cannabis use. This will provide a basis on which to commission new developments in early treatment programmes for psychosis in England up to 2025, available via an open-access platform (<https://psymaptic.web.app/>).

3. References to the research

Evidence of min 2* quality: All outputs have been peer-reviewed; research supported by competitively won grant funding.

1. Kirkbride JB, Fearon P, Morgan C, Dazzan P, Morgan K, Tarrant J, Lloyd T, Holloway J, Hutchinson G, Leff JP, Mallett RM, Harrison GL, Murray RM, Jones PB. Heterogeneity in incidence rates of schizophrenia and other psychotic syndromes: findings from the 3-center AESOP study. *Arch Gen Psychiatry*. 2006 Mar;63(3):250-8.
2. Kirkbride JB, Fearon P, Morgan C, Dazzan P, Morgan K, Murray RM, Jones PB. Neighbourhood variation in the incidence of psychotic disorders in Southeast London. *Soc Psychiatry Psychiatr Epidemiol*. 2007 Jun;42(6):438-45.
3. Coid JW, Kirkbride JB, Barker D, Cowden F, Stamps R, Yang M, Jones PB. Raised incidence rates of all psychoses among migrant groups: findings from the East London first episode psychosis study. *Arch Gen Psychiatry*. 2008 Nov;65(11):1250-8.
4. Kirkbride JB, Stubbins C, Jones PB. Psychosis incidence through the prism of early intervention services. *Br J Psychiatry*. 2012 Feb;200(2):156-7.
5. Kirkbride JB, Errazuriz A, Croudace TJ, Morgan C, Jackson D, Boydell J, Murray RM, Jones PB. Incidence of schizophrenia and other psychoses in England, 1950-2009: a systematic review and meta-analyses. *PLoS One*. 2012;7(3):e31660.
6. Kirkbride JB, Jackson D, Perez J, Fowler D, Winton F, Coid JW, Murray RM, Jones PB. A population-level prediction tool for the incidence of first episode psychosis: translational epidemiology based on cross-sectional data. *BMJ Open* 2013 doi: 10.1136/bmjopen-2012-001998

Key relevant grants:

PI: Jones PB. Stanley Medical Research Institute (USA) Psychosis Research Center 2002-06, GBP400,000;
 PI: Coid J. St Bartholemew's and The London Hospitals' Trust 2001-4 GBP700,000;
 Jones PB and others. NIHR Programme Grant RP-PG-1335 Causes and effective interventions for psychotic disorders and at-risk mental states GBP1.98 million 2007-13;
 Jones PB and others. NIHR Collaboration for Leadership in Applied Health Research & Care (CLAHRC) for Cambridgeshire & Peterborough GBP9.5 million 2008-13, CLAHRC East of England, GBP9 million 2014-19 and Applied Research Collaboration East of England (2019-24).

Grants where the research above has been the main focus of the work that was funded:

Murray RM, Jones PB, Harrison GL, Leff JP. Aetiology and ethnicity in schizophrenia and other psychoses (AESOP) MRC Programme 1997-2003 GBP1.2 million;
 Jones PB, JB Kirkbride, RM Murray and others. DH Policy Research Programme. A systematic review of the incidence of schizophrenia in England 1950-2010 GBP75,000 2009-10;
 Kirkbride JB. Sir Henry Wellcome Post-Doctoral Research Fellowship GBP780,000 2010-13.

4. Details of the impact (indicative maximum 750 words)

Cambridge University's research contribution provide robust evidence to overturn the orthodox view that the incidence of psychotic illnesses, particularly schizophrenia, shows no variation in relation to geography and demographics. Translation of their findings into the PsyMaptic forecasting tool has had practical impact far beyond this, through being recommended in national guidelines and improving access to treatment for patients. PsyMaptic is directly available to the NHS at all levels and to the public.

PsyMaptic was designed to support more sophisticated commissioning decisions, providing predictions of new cases of psychotic illness each year at county, local authority and Clinical Commissioning Groups (CCG) levels to improve resource allocation and EIS service provision to meet local needs. It has shaped all NHS early intervention services (EIS) when they were systematically recommissioned across England in 2016, enabling better service delivery.

Inclusion in commissioning guidelines

The potential influence of PsyMaptic was recognised by public health planning and commissioning teams upon its online publication in 2013. Psymaptic was highlighted as an example of NIHR applied health research translated into practice, in the Annual Report of the Chief Medical Officer 2013 (pub 2014): *“Opensource models such as www.psymaptic.org reveal a more granular picture of need, in this case for early intervention for psychosis in young people. Accounting for demographic variation supports more sophisticated commissioning decisions, resource allocation and service provision to meet local needs.”* [A].

The 2015 Guidelines produced by the Joint Commissioning Panel for Mental Health (involving the Royal College of Psychiatrists, Royal College of General Practitioners & the Royal Society for Public Health) included recommendations for the use of PsyMaptic to inform commissioning decisions in the NHS: *“Local number of new [psychosis] cases can be estimated at www.psymaptic.org”* [B].

Impact on national recommissioning of Early Intervention Services (EIS) in 2016

In 2014, Public Health England incorporated the PsyMaptic predictions into their ‘Fingertips health profiles’, data tools that are used to support commissioning groups in reducing inequalities and improving health and wellbeing[C]. CCGs began to use this for planning EIS. In February 2015 the NHS announced its intention to develop a radical new access and waiting time target for EIS with specific standards, meaning that these services required review and recommissioning across England (NHS England (2015): ‘Guidance to support the introduction of access and waiting time standards for mental health services in 2015/16’). The standard required that, by 1 April 2016, more than 50% of people experiencing a first episode of psychosis would be treated with a NICE approved care package within two weeks of referral. As part of the planning process Prof Jones and Dr Kirkbride were invited onto the NHS England Expert Reference Group for its preparedness programme, and Prof Jones was appointed clinical lead for implementation of the standard by NHS England Midlands and East.

In April 2016, NHS England, the National Collaborating Centre for Mental Health and the National Institute for Health and Care Excellence (NICE) published detailed guidance on implementing the early intervention in psychosis access and waiting time standard. The guide describes the derivation from PsyMaptic of the Fingertips area-by-area estimates of the numbers of people with first-episode psychosis. In its key considerations for commissioning and service development, the guidance recommends their use of the Fingertips tool as ‘step one’ in order to understand local demand, underpinning data-driven commissioning *“Fingertips uses the predictions tool, PsyMaptic, which provides predicted incidence rates for local authority areas. Commissioners should familiarise themselves with the methodology used to produce these predictions, including the confidence levels and caveats that apply”*. An update to the guidance released in December 2020 continues to recommend use of Psymaptic[D].

In July 2016, NHS England reported that in order to achieve the NHS target of 50% of patients accessing EIS within 2 weeks, *“Health Education England (HEE) will deliver a programme to ensure there are sufficient numbers of appropriately trained staff to deliver the key interventions recommended by NICE, particularly psychological therapy (cognitive behavioural therapy for psychosis)”*, and that between 2017/18 and 2019/20 this would result in additional investment of GBP61 million [E]. All 211 CCGs (since reorganised into 135 CCGs) in England have used these tools since December 2016, reporting into the Royal College of Psychiatrists Centre for Care Quality Improvement as part of a survey commissioned by NHS England [F].

The forecasts available from PsyMaptic provided the first accurate predictions of the resources required in order to provide EIS according to the NHS gold standards laid out in the 2001 PIG. PsyMaptic began to be used by commissioning groups and NHS England in order to manage EIS activity and monitor workforce requirements. For example, NHS South reported that the data-driven approach had successfully leveraged more funding for EIS into NHS provider trusts: *“The reports detailed the number of people with psychosis that they were treating as a proportion of the expected incidence from PsyMaptic... in several cases have directly resulted in increased investment in EIP services from CCGs”*. They also noted the accuracy of PsyMaptic models to observed cases: *“PsyMaptic tool closely matching the actual numbers of people with first episode psychosis seen by services with fully functioning EIP teams in our area, and showing a gap in detection of cases in areas where EIP is not fully implemented”* [G].

Impact on patient care

Randomised controlled trials of early interventions demonstrate many benefits for patients with psychotic disorders and their families: symptoms are reduced with fewer relapses and shorter hospitalisations; longer-term outcomes including employment and quality of life are better than for standard care [D]. Matching resource to population needs by the use of the PsyMaptic predictions has made a real difference to patient access to EIS. For instance, its influence on healthcare guidelines has translated into demonstrable impact on patient access to care across the country. Early Intervention in Psychosis (EIP) audit data from 2014 showed that 33% of patients with first episode or suspected psychosis were allocated to, and engaged by, an EIP care co-ordinator within two weeks of referral (range 4% to 82%). The 2018/19 Royal College of Psychiatrists' National Clinical Audit of Psychosis demonstrated the effect of appropriate distribution of EIS; 76% of patients were being treated within two weeks (range 28% to 100%), exceeding the NHS England target of 50%, indicating that the new commissioning arrangements are better targeted to population incidence [H].

5. Sources to corroborate the impact (indicative maximum of 10 references)

- A. Annual Report of the Chief Medical Officer 2013, Public Mental Health Priorities: Investing in the Evidence (pages 122-123).
- B. The Royal College of Psychiatrists, Royal College of General Practitioners & Royal Society for Public Health's Joint Commissioning Panel on Mental Health "Public Mental Health" report, December 2015: (page 31 'Local levels of mental disorder').
- C. Fingertips PHE – screenshot of psychosis data citing PsyMaptic as data source. Available from <https://fingertips.phe.org.uk/>
- D. NHS England, the National Collaborating Centre for Mental Health and the National Institute for Health and Care Excellence (NICE): Implementing the Early Intervention in Psychosis Access and Waiting Time Standard: Guidance. (i) April 2016. Chapter 5, (pages 34-35). (ii) December 2020 Chapter 4 (pages 11, 38)
- E. The Five Year Forward view on Mental Health July 2016 (pages 23 & 24)
- F. Collaborations for Leadership in Applied Health Research and Care East of England BITE 216 (page 2).
- G. Correspondence from Senior Responsible Officer, NHS England South EIP Preparedness Programme, April 2016.
- H. (i) HQiP and the Royal College of Psychiatrists Report of the Early Intervention in Psychosis Audit 2016 (page 6) (ii) Royal College of Psychiatrists National Clinical Audit of Psychosis: National report for the Early Intervention in Psychosis Spotlight Audit 2018/2019 (page 9).