The association between primary care quality and healthcare utilisation, costs and outcomes for people with serious mental illness: retrospective observational study

Rowena Jacobs [1*], Lauren Aylott [2,4], Ceri Dare [2], Tim Doran [3], Simon Gilbody [3,4], Maria Goddard [1], Hugh Gravelle [1], Nils Gutacker [1], Panagiotis Kasteridis [1], Tony Kendrick [6], Anne Mason [1], Nigel Rice [1], Jemimah Ride [1], Najma Siddiqi [3,4,5], Rachael Williams [7]

Authors:

[1] Centre for Health Economics, University of York, York, YO10 5DD, UK

[2] Expert by Experience

[3] Department of Health Sciences, University of York, York, YO10 5DD, UK

[4] Hull York Medical School, York, YO10 5DD, UK

[5] Bradford District Care NHS Foundation Trust, New Mill, Victoria Road, Shipley, Bradford, BD18 3LD, UK

[6] Primary Care and Population Sciences, Aldermoor Health Centre, University of Southampton, Southampton SO16 5ST, UK

[7] Clinical Practice Research Datalink (CPRD), MHRA, 10 South Colonnade, Canary Wharf, London, E14 4PU, UK

***Corresponding author**:

Tel: 01904 321425, Email: rowena.jacobs@york.ac.uk

Conflict of interest:

SG is Deputy Chair of the NIHR Health Technology Assessment Commissioning Board and sits on the HTA Post-Funding Committee teleconference (POC members to attend) and HTA Funding Committee Policy Group (formerly CSG). RW is employed by CPRD who received funding from the University of York for access to research data and services used in this study. CPRD additionally provided funding for access to research data and services used in this study. All others: None declared.

Key words: serious mental illness; quality indicators; general practitioners; primary healthcare; survival analysis; England

Type of study: Observational study and systematic review

Important

A 'first look' scientific summary is created from the original author-supplied summary once the normal NIHR Journals Library peer and editorial review processes are complete. The summary has undergone full peer and editorial review as documented at NIHR Journals Library website and may undergo rewrite during the publication process. The order of authors was correct at editorial sign-off stage.

A final version (which has undergone a rigorous copy-edit and proofreading) will publish as part of a fuller account of the research in a forthcoming issue of the Health Services and Delivery Research journal.

Any queries about this 'first look' version of the scientific summary should be addressed to the NIHR Journals Library Editorial Office – journals.library@nihr.ac.uk

The research reported in this 'first look' scientific summary was funded by the HS&DR programme as project number 13/54/40. For more information visit https://www.journalslibrary.nihr.ac.uk/programmes/hsdr/135440/#/

The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors have tried to ensure the accuracy of the authors' work and would like to thank the reviewers for their constructive comments however; they do not accept liability for damages or losses arising from material published in this scientific summary.

This 'first look' scientific summary presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health and Social Care. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health and Social Care.

Scientific Summary

Background

Serious mental illness (SMI) is a set of chronic conditions including schizophrenia, bipolar disorder and other psychoses. It is linked with high disease burden, poor health outcomes, high treatment costs, and lower life expectancy. The UK population prevalence of bipolar disorder is around 1-2% and the lifetime prevalence of schizophrenia is around 1%. Total monetary costs in England in 2012 were £6.0 billion for bipolar disorder and £11.8 billion for schizophrenia and psychoses, mainly from costs to public services, informal care, and lost labour market output. Most people with a SMI are treated chiefly in primary care by their general practitioner (GP).

Research questions

High quality primary care has the potential to improve the health and wellbeing of patients with SMI, to reduce healthcare utilisation, and costs. We examined the association between the quality of primary care for people with SMI and seven outcome measures:

(i) emergency hospital admissions for SMI;
(ii) preventable admissions - emergency admissions for ambulatory care sensitive conditions (ACSCs), which are conditions for which better quality care should reduce the probability of an emergency hospital admission;
(iii) all unplanned admissions;
(iv) attendance at Accident and Emergency (A&E) departments;
(v) mortality;
(vi) re-entry into specialist mental health services;
(vii) costs incurred for people with SMI in primary and secondary care and in community mental health services.

Outcomes (i) to (vi) were analysed in terms of 'time to event'.

Methods

Quality measures

The Quality and Outcomes Framework (QOF) incentivises GPs for meeting quality targets for patients with certain chronic conditions, including SMI. We studied two patient level quality indicators from the mental health domain of the QOF: whether a patient with SMI had a *care plan* and whether they had received an *annual physical health review*.

Since the QOF quality measures only cover some aspects of quality we undertook a systematic literature review to identify other measures of primary care quality for which indicators could be available in routine administrative data. This led us to choose two non-QOF patient level quality indicators: *continuity of consultations with the same GP* and *antipsychotic polypharmacy*.

We used three widely applied indices of GP care continuity. The extent of dispersion across different GPs involved in the patient's care was measured using the Continuity of Care index. The density of visits to a single GP was measured with the Usual Provider of Care index, and the pattern of visits across GPs was measured with the Sequential Continuity index.

We defined antipsychotic polypharmacy as the concurrent use of two or more antipsychotic substances for at least a 30-day period. As a check on the robustness of this, we also considered longer and shorter periods (thereby respectively reducing and increasing the amount of polypharmacy).

Data

We used a retrospective observational study design and followed four cohorts of primary care patients with SMI. We drew our patient samples from primary care practices in England that contribute to the Clinical Practice Research Datalink (CPRD) GOLD database. CPRD linked the general practice records of patients with (a) their records in the Hospital Episode Statistics (HES) Admitted Patient Care data and attendances at A&E departments, (b) community mental health service records in the Mental Health Minimum Dataset (MHMDS), and (c) mortality data from the Office of National Statistics. CPRD classified practices as rural or non-rural. We provided CPRD with data on the distances from all English general practices to the nearest hospital and nearest mental health inpatient facility and CPRD attached four categorical indicators of these distances to the practices in our sample.

In addition to the quality and outcome measures we constructed a set of covariates for each patient from the electronic patient records. Covariates included age (19-35, 36-45, 46-55, 56-65, >65), gender, number of Charlson comorbidities, depression, smoking status, alcohol status, type of SMI diagnosis (e.g. schizophrenia), and time since their first SMI diagnosis. For each patient, CPRD attached a categorical measure of deprivation from the Index of Multiple Deprivation rank of the small area (lower-layer super output area) in which the patient lived.

HES hospital admission data covered the period 1 April 2000 – 31 March 2014. A&E data were available for 1 April 2007 – 31 March 2014. We used MHMDS data for 1 April 2011 – 31 March 2014 since earlier data were in an alternate format.

The start of the observation period for a patient was the latest of: 365 days after their date of registration with the practice; 1 January of the year after the patient turned 18; or date of SMI diagnosis. The end of the observation period was the earliest of: the end of their registration with the practice; date of death; or 31 March 2014.

The four sample sizes for analyses varied because of differences in data availability on key characteristics and outcomes, and inclusion criteria for each specific analysis. For the analyses of the associations of unplanned hospital admissions and A&E attendances with care plans, annual reviews and continuity, data were available for 19,324 individuals. For models where the quality measure was polypharmacy, patients had to have had at least one record of an antipsychotic drug and the sample size was 17,255 patients for unplanned admissions and mortality, and 13,247 patients for A&E attendance. For models of re-entry to specialist mental health services we had data on 9,907 patients. The models of NHS cost used samples of 16,485 patients. The analysis samples were drawn from 214 or 215 GP practices.

Statistical methods

We used *survival analysis* to examine the relationship between quality and all of the outcomes, except NHS costs. Hospital admissions, A&E attendances, re-entry to specialist mental health services and mortality are events whose occurrence should be reduced or delayed by higher quality primary care. We therefore used survival models to investigate whether the time to first occurrence of the outcome of interest was associated with the quality measure.

We used *discrete time* survival analysis, which is appropriate where time to an event is recorded in discrete intervals rather than continuous time, for our analyses of continuity of care. This was because the measures of continuity were based on consultations with GPs within a 12-month period. We divided time into 3-month blocks and investigated the association between quality indicators in the prior twelve months (four blocks) and occurrence of the outcome in a 3-month period. We fitted a complementary log-log proportional hazards model for each outcome. The

hazard function is the probability the outcome event occurs during a particular, usually very small, period given that it has not occurred before the start of the period and that the individual is still observed in the data. We were interested in the effect of the quality measures (which vary from period to period) on the hazard rate. We also allowed the hazard function to vary between 3-month periods by specifying dummy variables for each 3-month period so that the hazard function is constant within each period, but can vary across periods. This allows for greater flexibility in the modelling.

Although we included observed characteristics of individuals in the model, it is possible that the hazard of the outcome is affected by unobserved patient characteristics, which may also be correlated with the observed quality indicators. These are often referred to as unobserved confounding factors and their omission from a model can lead to biased estimates of the treatment of interest. In models where the outcome is a linear function of the explanatory variables it is possible to control for unobserved time invariant patient factors by including a dummy variable for each individual. This is often termed a fixed effects model. This does not, however, extend to models where the outcome is a non-linear function of the explanatory variables, which is the case for our models. Instead we adopted an alternative procedure. We assumed that the effect of the unobserved patient characteristics is random and follows a normal distribution. The mean of this random error can be modelled as a function of the mean of the observed time varying patient characteristics. These variables capture confounding by unobserved time-invariant patient factors (e.g. long-standing illness, health seeking behaviour) that affect both primary care quality and healthcare utilisation and approximate a fixed effects approach. As the three continuity measures were highly correlated we estimated three separate models to investigate their association with outcomes.

We also investigated the association between polypharmacy and the occurrence of three outcomes: unplanned hospital admissions (all-cause), A&E attendances, and mortality. We again estimated survival models but since we did not study continuity of care as a quality indicator in these models, we estimated *continuous time* survival models instead. These models have the advantage of examining the exact timing of events, which provides more precise inference than can be obtained with a discrete time survival model.

For the analysis of the relationship between primary care quality and NHS costs incurred for people with SMI, we calculated costs of primary care, general hospital care (including A&E), and specialist mental healthcare (including inpatient and community-based care) for each quarter in each year for each patient. We then constructed a panel dataset of repeated observations on each patient.

Since patient healthcare costs are highly skewed, with a long right tail and a non-trivial proportion of zero costs, we estimated *two-part models*. The first part models the probability of non-zero costs using a probit model. The second part models the level of cost for those with positive costs using a generalised linear model with a gamma variance function and log link function. These were chosen on the basis of specification tests for best fit to data. The models contained three quality measures (care plan, annual review, GP continuity) plus patient and practice characteristics. To allow for unobserved patient factors correlated with cost and quality we assumed that they had random effects with a mean for each patient, which was determined by the mean of their observed characteristics.

For the survival analysis models of unplanned hospital use, A&E attendances, re-entry to specialist mental health services, and mortality we report *hazard ratios* (HR): the proportional change in the underlying hazard of the outcome for a unit change in the quality measure. The quality variable increased the outcome if its HR is greater than 1 and reduced it if the HR is less than 1.

PPI

Two members of the research team had lived experience of SMI and contributed to all aspects of the study.

Results

Having a CP was associated with lower hazard for A&E attendances of 26% (HR 0.74, 95% CI 0.69-0.80), 33% for SMI admission (HR 0.67, 95% CI 0.59-0.75), and 27% for preventable admission (HR 0.73, 95% CI 0.64-0.83). Care plans were associated with lower overall healthcare costs (£53 per patient on average), primary care costs (£9), hospital costs (£26) and mental healthcare costs (£12) in the current 3-month period. There was no statistically significant association of having a care plan with re-entering specialist mental healthcare.

Annual reviews were associated with a reduction of 20% for A&E attendances (HR 0.80, 95% CI 0.76-0.85), 25% for SMI admission (HR 0.75, 95% CI 0.67-0.84), and 24% for preventable admission (HR 0.76, 95% CI 0.67-0.87). Annual reviews were associated with lower primary care (£9), mental healthcare (£30), and total costs (£34), but not hospital costs.

High GP continuity on the continuity of care index (results similar for the other indices) was associated with 11% lower hazard of A&E presentation (HR 0.89, 95% CI 0.83-0.97), and 23% lower hazard of preventable admission (HR 0.77, 95% CI 0.65-0.92), but not with risk of SMI admission. High continuity was associated with lower primary care costs (£3), but not with other costs.

There was no statistically significant association of continuity with re-entering specialist mental healthcare.

Polypharmacy was not statistically significantly associated with the risk of A&E presentation, unplanned admission, or death.

Limitations

Patients were included in our analyses on the basis of SMI diagnosis codes in their practice record. Thus patients who were not permanently registered with a GP practice or with undetected, unrecorded or as yet undiagnosed SMI, were not included. GPs may also prefer to use free-text comments to record the mental health status of the patient. Thus the number of patients with SMI in a practice may be under-reported.

Concerns about identification of practices in CPRD means that there was relatively sparse information on practice characteristics, such as staffing, location, performance on other quality measures or patient reported access, which may affect outcomes.

Conclusions

Our study provides the first systematic identification of indicators of quality of primary care for people with SMI. These indicators were tested for their effect on outcomes in a robust way using linked primary and secondary data. Results confirmed the value of processes enshrined in

current incentive schemes. Care plans and annual reviews function as good quality indicators in the QOF. Results also suggest continuity of care as an important indicator. In particular, seeing the same GP over time can improve the physical health of people with SMI. Higher continuity may reduce the risk of preventable admissions through improved management of physical health, by facilitating familiarity, communication, trust, and quality of relationship between doctor and patient.

Recommendations for research

1. Better evidence is needed on the impact of primary care quality on a broader set of health outcomes. Routine recording of measures of social functioning, health related quality of life, patient experience, and key outcomes such as employment and housing status, are central to the ability to undertake research that goes beyond consideration of process measures.
2. The mechanisms by which primary care quality affects utilisation of secondary care needs to be better understood.
3. Understanding variations in an individual's capacity to benefit from specific interventions could enable clinicians to target efforts and deliver person-centred care.
4. A better evidence base is needed on what outcomes are valued by people with SMI so that efforts can be prioritised according to what matters most to patients.
5. Evidence is needed on the interfaces between healthcare, social care and informal care. Focusing only on one or two parts of the system risks ignoring wider social determinants of health.
6. A fuller understanding of resource implications is needed to inform resource allocation, for example how resources "saved" across sectors could be reinvested.
7. Data coverage and linkage, specifically for mental health, should be improved to address further research needs.

Funding details

This project was funded by the National Institute for Health Research HS&DR programme (project number 13/54/40).