Title: Impact of financial incentives on alcohol consumption recording in primary health care among adults with schizophrenia and other psychoses: a cross-sectional and retrospective cohort study.

Running title: Impact of financial incentives on alcohol screening

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Abstract

BACKGROUND: Lack of financial incentive is a frequently cited barrier to alcohol screening in primary care. The Quality and Outcomes Framework (QOF) pay for performance scheme has reimbursed UK primary care practices for alcohol screening in people with schizophrenia since April 2011. This study aimed to determine the impact of financial incentives on alcohol screening by comparing rates of alcohol recording in people with versus those without schizophrenia between 2000 and 2013.

METHODS: Cross-sectional and retrospective cohort study. Alcohol data were extracted from The Health Improvement Network (THIN) database of UK primary care records using 1) Read Codes for level of alcohol consumption, 2) continuous measures of drinking (e.g. units a week), and 3) Read Codes for types of screening test.

RESULTS:

A total of 14,860 individuals (54% (8,068) men and 46% (6,792) women) from 409 general practices aged 18-99 years with schizophrenia were identified during April 2011 to March 2013. Of these, 11,585 (78%) had an alcohol record, of which 99% (8,150/8,257) of Read codes for level of consumption were eligible for recompense in the QOF. There was a 839% increase in alcohol recording among people with schizophrenia over the 13 year period (rate ratio per annum increase 1.19 (95% CI 1.18 to 1.20)), compared with a 62% increase among people without a severe mental illness (rate ratio per annum increase 1.04 (95% CI 1.03 to 1.05)).

CONCLUSION: Financial incentives offered by the QOF appear to have a substantial impact on alcohol screening among people with schizophrenia in UK primary care.

Short summary

Alcohol screening among people with schizophrenia increased dramatically in primary health care following the introduction of the UK pay for performance incentive scheme (Quality and Outcomes Framework - QOF) for severe mental illness, with an 839% rise (more than 8-fold increase), compared with a 62% increase among people without a severe mental illness over the 13 year study period (2000 – 2013).

Introduction

Alcohol screening and brief intervention is an example of an efficacious intervention that has attempted, yet failed to be routinely delivered in primary health care across the world. There are three decades of research to support the use of alcohol screening and brief intervention in primary care, where brief intervention is an umbrella term that encompasses interventions that range from brief structured advice through to motivational interviewing. Alcohol screening and brief intervention is advocated by the WHO global strategy to reduce harmful use of alcohol (World Health Organisation, 2010), the WHO comprehensive mental health action plan 2013–2020 (World Health Organisation, 2013), and by UK NICE guidance (NICE public health guidance 24, 2010). However, as few as 2% of risky drinkers are identified in UK primary care (Cheeta et al., 2008), and national survey data has shown that 6.5% of risky drinkers recall GP advice on their drinking, compared with 50% of smokers who recall GP advice on smoking cessation (Brown et al., 2016). In addition, when alcohol screening does take place in primary care, it is rarely with WHO validated screening tools (Khadjesari et al., 2013). There is a vast literature on the barriers to implementing alcohol screening and brief intervention in primary care (Johnson et al., 2011; Nilsen et al., 2006), with lack of financial incentive one of the key obstacles (Adams et al., 1997; Babor et al., 2005).

Pay for performance schemes are widespread in the UK and US, with financial incentives a recognised implementation / quality improvement strategy in health care systems (Powell et al., 2015). However, despite their widespread use, there is mixed evidence for their impact on quality of care, with few methodologically robust evaluations, such as interrupted time series or controlled before-and-after studies with contemporaneous control groups (Houle et al., 2012; Scott et al., 2011). The largest and most recent randomised controlled trial to explore the impact of implementation strategies for alcohol screening and brief interventions in 120 primary care practices in five European countries (ODHIN) found financial incentives combined with training and support to be most effective at improving rates of screening and brief intervention, compared with 1) treatment as usual, 2) training and support, 3) financial

reimbursement alone, 4) electronic screening and brief intervention, and combinations of these interventions (Anderson et al., 2016; Keurhorst et al., 2013). Moreover, financial incentives were found to be the most cost-effective of these implementation strategies, with incentive and delivery costs amounting to £110 million over 10 years, but leading to £250 million of savings to the NHS and saving 33,000 Quality Adjusted Life Years (QALYs) (Angus et al., 2014).

The Quality and Outcomes Framework (QOF), a pay for performance scheme, was introduced to primary care in the UK in 2004 to encourage best practice, currently in 19 clinical areas (including severe mental illness (SMI)) and six public health areas (British Medical Association. NHS England. NHS Employers, 2014). At present, there is no QOF incentive for universal alcohol screening of all registered patients, but there are QOF incentives for alcohol screening in specific subgroups of the population such as people with schizophrenia, where median prevalence of alcohol use disorders is 9.4% (interquartile range 4.6–19.0) and lifetime prevalence is 20.6% (interquartile range 12.0–34.5) (Koskinen et al., 2009). In April 2006, the QOF for severe mental illness (including schizophrenia, bipolar affective disorder and other psychoses) was amended to provide additional incentives for health screening (Indicator MH9) (British Medical Association. NHS Employers, 2006), replaced in April 2011 with additional incentives for specific components of the health screen, including alcohol screening (Indicator MH11), Body Mass Index, blood pressure, cholesterol and blood glucose (British Medical Association. NHS Employers, 2011). A recent study based in one inner-city London Borough with 30 General Practices found that the introduction of a local version of QOF that incentivised alcohol screening and brief intervention for patients with severe mental illness, cardiovascular disease, or risk or cardiovascular disease, increased recording of alcohol intake in patients with severe mental illness from 0.65% (95% CI 0.49% to 0.81%) to 48.6% (95% CI 47.8% to 49.4%) (Hamilton et al., 2014). Interestingly, a small improvement in alcohol screening was also found in patients without a severe mental illness, cardiovascular disease, or risk of cardiovascular

disease from 0.32% (CI 0.29% to 0.36%) to 14.7% (CI 14.5% to 14.9%). This regional study provides some insight into the impact of financial incentives on alcohol consumption recording in primary care, but to-date there has been no investigation into their impact at a national level.

Aims

To determine the extent to which alcohol consumption is recorded in people with schizophrenia and other psychoses in primary care, whether recording varies by socio-demographics, registration status and geographic region, and to compare rates of alcohol consumption recording in people with and without schizophrenia between 2000 and 2013.

Objectives

1. To describe how alcohol consumption has been recorded in individuals with schizophrenia and other psychoses in primary care, e.g. use of Read codes, quantity measures, screening tests.

2. To describe how the recording of alcohol consumption in individuals with schizophrenia and other psychoses varies by socio-demographic factors (age, sex, and social deprivation), by registration status, and by region (previous strategic health authority for England and country for Wales, Scotland, and Northern Ireland).

3. To evaluate the impact of QOF incentives by comparing rates of alcohol consumption recording over time in individuals with versus without schizophrenia and other psychoses: April 2000 to March 2004 (before the SMI QOF), April 2004 to March 2006 (SMI QOF introduced), April 2006 to March 2011 (addition of lifestyle screening to the SMI QOF indicators), April 2011 to March 2013 (addition of alcohol screening to the SMI QOF indicators).

Methods

Study design

Cross-sectional study and retrospective cohort study.

Data source

The Health Improvement Network (THIN) (The Health Improvement Network, 2012) is a primary care database containing anonymised electronic patient records from over 500 general practices, covering approximately 6% of the UK population and broadly representative in terms of age, sex, deprivation, and geographical distribution (Blak et al., 2011). Information is entered in primary care as free text or Read Codes, a hierarchical coding system standardised across all UK general practices (Chisholm, 1990; Dave and Petersen, 2009). THIN includes information about year of birth, gender and the Townsend deprivation index, which is a composite measure of social deprivation presented as quintiles (Townsend et al., 1988). Data from individual practices were included in this study if collected after the Acceptable Mortality Reporting (Maguire et al., 2009) and Acceptable Computer Usage dates (Horsfall et al., 2013); these are quality standards to ensure that data were acceptable for analyses. Acceptable mortality reporting is a validation of the mortality data recorded at the practice. Acceptable computer usage is measured by the number of clinical entries made on the computer systems. The scheme for THIN to obtain and provide anonymous patient data to researchers was approved by the National Health Service South-East Multicenter Research Ethics Committee in 2002. The scientific approval for this study was obtained from the Scientific Review Committee of Cegedim Strategic Data (CSD) Medical Research (the THIN database providers) in January 2015 (15-005).

Participant eligibility

The severe mental illness QOF relates to people with schizophrenia, bipolar affective disorder and other psychoses. Patients with bipolar disorder were excluded from these studies and explored by the research team in a separate analysis (Hardoon et al., 2016).

Cross-sectional study (objectives 1 and 2): Individuals aged between 18 and 99 years with a diagnosis of schizophrenia and other psychoses, registered with a THIN practice throughout April 2011 to March 2013, were included in the cross sectional study. Individuals with a diagnosis of schizophrenia and other psychoses were identified via relevant Read Codes in their electronic primary care health records, as used in a recent study of recording of severe mental illness in primary care (Hardoon et al., 2013).

Retrospective cohort study (objective 3): we expanded the study sample to include individuals registered for at least some part of the period April 2000 to March 2013. A separate cohort of individuals without a SMI was randomly selected among those of the same gender, practice, and age-band (18-29, 30-49, 50-69 and 70-99 years). For every one individual with schizophrenia, six individuals without a SMI were selected in-line with a similar study of cardiovascular screening in individuals with severe mental illness (Osborn et al., 2011).

Alcohol measures in THIN

1) Read Codes that reflect levels of drinking were selected. The codes were selected from those used in three recent studies of alcohol consumption recording in primary care (Hamilton et al., 2014; Khadjesari et al., 2013; O'Donnell, 2014). These Read Codes typically represent a drinking category, for example moderate drinker 3–6 units a day, but also include codes that indicate drinking above limits; for example, harmful drinking.

2) Data on alcohol consumption as a continuous measure of the number of units consumed in a week were extracted.

The above measures were also used to summarise the proportion of people with schizophrenia drinking at harmful levels (defined as a Read code indicative of heavy

drinking/ alcohol problem or a record of >35 units per week for women and >50 units per week men) (Department of Health, 2008; Prime Minister's Strategy Unit, 2004).

3) Read Codes that indicate the types of screening tool used were also included to determine how many people had completed a validated screening test. Results from validated screening tests are sometimes entered as free text and therefore not extractable for this study.

Analysis

To describe how alcohol consumption has been recorded in individuals with schizophrenia and other psychoses in primary care (objective 1), we computed the numbers of individuals with schizophrenia, registered with a practice between April 2011 and March 2013, who had Read codes for level of drinking and screening tests, and quantity measures for alcohol consumption during this period.

To describe how the recording of alcohol consumption in individuals with schizophrenia and other psychoses varies by socio-demographic factors, registration status and region (objective 2), the proportions of men and women with schizophrenia with an alcohol record between April 2011 and March 2013 and relative "risk" of recording of alcohol were presented by socio-demographic factors (age, sex, social deprivation), registration status and geographic region. Poisson regression was chosen here to enable computation of risk ratios as opposed to odds ratios to aid interpretation (Davies et al., 1998). Relative "risks" were obtained from Poisson regression with robust standard errors to account for clustering of individuals within general practices. Random effects regression modelling, with individuals nested in general practices, was used to examine the extent of practice variation in alcohol recording (Cameron et al., 2013).

To evaluate the impact of QOF incentives in individuals with versus without schizophrenia and other psychoses (objective 3), eligible individuals entered the retrospective cohort study at the latest of: registration, practice Acceptable Computer Usage and Acceptable Mortality Reporting date, 1 April 2000, 18th birthday, schizophrenia diagnosis date (or schizophrenia diagnosis date of matched individual with schizophrenia, among those without schizophrenia). Individuals left the study at the earliest of: date of death, when they leave the practice, the practice leaves THIN, 31 March 2013, or they reach 100 years of age. Rates of alcohol consumption recording were computed among those with and without schizophrenia during every two financial years follow-up period, between 1st April 2000 and 31 March 2013. Rates of alcohol consumption records in individuals with schizophrenia were compared with individuals without schizophrenia using Poisson regression, with robust standard errors to take into account potential clustering within practices. An interaction between schizophrenia status (yes or no) and calendar period (as a categorical variable, with categories for each two financial year period) was included to assess whether variations in recording among individuals with versus without schizophrenia have changed over time, in particular according to the four time periods described above. Poisson regression was chosen here as it enables proper treatment /accounting of the varying person-time each individual contributed to the analysis. Further, Poisson regression was appropriate for this time-trend analysis given the limited number of time-points (six two-yearly periods, reflecting the reporting periods of QOF), which makes alternative time-series analysis unsuitable. Age, gender, deprivation and UK region were included as covariates. All analyses were conducted in STATA version 13 (StataCorp., 2013).

Results

Recording of alcohol consumption in people with schizophrenia in primary care

In total, 14,860 individuals from 409 general practices aged 18-99 years with schizophrenia (or other psychoses) were identified throughout the period 1 April 2011 to 31 March 2013. There were 8,068 men (54%) and 6,792 (46%) women. The mean ages (standard

deviation) at the start of the period were 40 years (19.4) and 49 years (19.6) for men and women respectively. There was a median of 32 individuals (interquartile range 20 to 48) with a record of schizophrenia per general practice. Out of the 14,860 individuals, 881 (6%) were "newly registered" at the start of the period (i.e. had registered with the practice in the year prior to the period). The proportion of people with schizophrenia drinking at higher risk / harmful levels was 21% (1,658/8,068) in men and 10% (655/6,792) in women. There was considerable variation in recording levels between general practices, ranging from 42% to 100% ($p<0.001$ for practice level variation from random effects regression modelling).

Out of the 14,860 individuals, 11,585 (78%) had a relevant alcohol consumption record during this period, with data recorded as a Read Code for units in a week (only) (5,985, 52%), units of alcohol in a week (only) (3,151, 27%), a Read Code for type of screening test used (only) (38, 0.33%), or more than one of these methods of recording (2,411, 21%) (Figure 1). Of the 8,257 records comprising Read codes for alcohol consumption, 8,150 (99%) were codes found in the Quality and Outcomes Framework for severe mental illness business rules (QOF for SMI) (The NHS Information Centre - QOF Business Rules team, 2011). Appendix 1 and 2 list the Read codes used in this study to indicate level of alcohol consumption and screening test administered, respectively.

Recording of alcohol consumption in people with schizophrenia by socio-demographic
factors, registration status and region
Over 80% (5,435/6,664) of individuals aged 50–79 years had an alcohol consumption record, compared with 67% (650/978) of men and 72% (320/445) of women under the age of 30 (Table 1). The proportion of people with an alcohol consumption record in the least deprived quintile was 75% (1,371/1,840), compared with around 80% (3,318/4,136) in the most deprived quintile for both men and women (Table 1). There was also a statistically significant regional variation in alcohol consumption recording (overall p-values comparing all regions of p=0.02 and p=0.003 among men and women respectively, indicative of some

differences between regions). Recording rates appeared highest in London and lowest in the East Midlands (Table 1). There were no statistically significant differences in recording levels by registration status.

Impact of the severe mental illness QOF on alcohol consumption recording over time
Between April 2000 and April 2013, there were 34,440 individuals with schizophrenia or other psychoses and 226,984 individuals without a severe mental illness identified as a matched cohort; a total of 261,424 individuals from 484 general practices. There were a median of 162 (interquartile range: 89 to 264) individuals with schizophrenia or other psychoses and 1167 (interquartile range: 624 to 1908) individuals without a severe mental illness per general practice. Table 2 provides demographic characteristics of people with and without schizophrenia. Rates of alcohol recording increased rapidly over time among those with schizophrenia or other psychoses (Table 3 and Figure 2). In contrast, there appears to be only a modest increase in recording rates among individuals without a severe mental illness over time. Prior to April 2004, rates of alcohol recording among those individuals with schizophrenia or other psychoses were on par with or lower than those among individuals without a severe mental illness (rate ratios of 0.89 and 0.99) (Table 3), but after April 2004, were higher, with the gap widening over time (rate ratio of 1.34 in April 2004 to March 2006 to a rate ratio of 3.80 in the most recent time period).

Among individuals with schizophrenia or other psychoses, the alcohol recording rate ratio per annum increase in calendar time was 1.19 (95% CI 1.18 to 1.20), corresponding to a total percentage increase over the 13 year period of 839% (more than 8-fold increase). By contrast, among individuals without a severe mental illness, the alcohol recording rate ratio per annum increase in calendar time was 1.04 (95% CI 1.03 to 1.05), corresponding to a total percentage increase over the 13 year period of 62%. The difference in the time trends in alcohol recording between individuals with and without schizophrenia was statistically

significant (p<0.001 for interaction between time period and patient group: with and without schizophrenia)

Discussion

The majority of individuals with schizophrenia and other psychoses included in this study had an alcohol consumption record (78%, 11,585/14,860). Around 21% (1,658/8,068) of men and 10% (655/6,792) of women with schizophrenia were recorded as drinking at higher risk / harmful levels. Alcohol consumption recording varied statistically significantly by age, deprivation and region. Highest levels of recording were observed among those aged between 50 and 79 years, those with highest levels of deprivation and in London. Further analyses are needed to confirm differences between age categories, deprivation quintiles and regions to explore possible explanations for the differences. The recording of alcohol consumption increased dramatically following the introduction of the severe mental illness QOF, with an 839% rise (more than 8-fold increase) over the 13 year period. The most substantial rise occurred after the introduction of the indicator for alcohol consumption recording in April 2011.

This study found recording of alcohol consumption in primary care to occur in 78% of individuals with schizophrenia and other psychoses (April 2011 to March 2013), rising to 86% when individuals with exemption records were excluded. Perhaps unsurprisingly, 99% of Read codes used to record alcohol consumption in the current study were those provided in the severe mental illness QOF business rules (The NHS Information Centre - QOF Business Rules team, 2011), thereby enabling financial reimbursement. Conversely, in a study of alcohol consumption recording in *newly* registered patients in UK primary care, the codes necessary for recompense by a different pay for performance scheme (i.e. the Directed Enhanced Service) were rarely used – 9% (25,975/292,376) of patients completed a validated screening test, such as the AUDIT, AUDIT-C or the FAST (Khadjesari et al., 2013). The most plausible explanation for this finding is that the incentive offered by the

Directed Enhanced Service was substantially lower than that offered by the QOF (£2.38 per patient vs. £133.76 per point (up to 4 QOF points) in 2012/2013 respectively), and therefore has less influence on practitioner behaviour.

The Directed Enhanced Service pay for performance scheme, which ran from April 2008 to April 2014, was an attempt to broaden the delivery of alcohol screening in primary care to a population level, by incentivising alcohol screening among *newly* registered patients. A study of 16 primary care practices in North East England found better rates of alcohol screening and brief intervention recording in practices receiving Directed Enhanced Service incentives versus those not receiving incentives between 2010 and 2011 (3.73%, 95% CI: 3.65-3.89 vs 0.05%, 95% CI: 0.03-0.08; $p < 0.001$) (O'Donnell, 2014). However, the national primary care data analysed in the current study found no statistically significant differences in alcohol recording by registration status, again suggesting that the magnitude of the incentive reflects the degree of uptake of the activity. These findings are reinforced by a qualitative interview study with general practitioners, which found QOF incentives to be given priority above other incentive schemes because of their substantial contribution to practice income (O'Donnell, 2014). If alcohol screening is to be delivered at a population level, QOF incentives should be extended to all patient groups, especially in-light of their cost effectiveness relative to other implementation strategies (Angus et al., 2014).

The QOF has been criticised for incentivising recording practice, rather than quality of care, and is considered a move in the opposite direction from holistic, patient-centred practice that promotes self-management (Dixon et al., 2010). As a result, primary care practice is now seen as being task oriented, and where one-activity supersedes another, may result in detrimental effects on the quality of care for non-targeted patients. However, despite the failings of the QOF in this regard, it does appear to have an impact on alcohol consumption screening among patients with schizophrenia in this study. This is an important finding as these patients have high rates of harmful drinking compared with the general population:

21% men and 10% women with schizophrenia (2011-2013) vs. 1% men and 0.5% women who were *newly* registered with a UK general practice (2007-2009) (Khadjesari et al., 2013). It is important to note that the QOF indicator only provides recompense for the recording of alcohol consumption among patients with SMI and does not incentivise provision of treatment, leading to uncertainty over the extent to which patients with schizophrenia are supported in reducing their drinking. NICE guidance on the assessment and management of psychosis with substance misuse advocates the referral of patients identified in primary care to secondary care mental health services for assessment and further management (National Collaborating Centre for Mental Health (UK), 2011). Psychosocial treatment is advocated for patients drinking at harmful and dependent levels without severe mental illness (NICE clinical guidance 115, 2011), however, there is no evidence that psychosocial treatment (including assertive community outreach, intensive case management, motivational interviewing, cognitive behavioural therapy, contingency management or social skills training) reduces alcohol consumption or improves mental health in people with severe mental illness (Hunt et al., 2013), with most trials of poor methodological quality. Hunt et al's Cochrane review calls for robust research that uses validated outcome measures of clinical relevance to enable synthesis in future meta-analyses. Hunt et al also recommend that future trials evaluate brief interventions due to their potential cost-effectiveness and ease of integration within mental health services (Hunt et al., 2013).

Strengths and limitations

This is the first study to look at the impact of the severe mental illness QOF on alcohol consumption recording among people with schizophrenia in a large nationally representative sample of individuals from general practices in the UK. Data on alcohol status in primary care rely on self-report in the absence of a gold standard approach to ascertaining alcohol intake. Self-report is the most widely used means of eliciting drinking behaviour in research with non-dependent drinkers, providing a valid, reliable and feasible approach when compared with biochemical markers, coverage of sales data and collateral reports (Connors

and Maisto, 2003; Del Boca and Darkes, 2003; Midanik, 1988; Rehm, 1998). Finally, although we have data on whether an individual has completed a validated alcohol screening test, the results per se were not known, as they were recorded in the free text. Some of these results may be proxied as Read codes or number of units consumed in a week. However, it is important to determine the extent to which primary care practitioners are using validated tests to record alcohol consumption.

Implications

Our findings suggest that the financial incentives provided by the alcohol indicator of the severe mental illness QOF appear to have had a substantial impact on alcohol consumption recording among people with schizophrenia in primary care. Further research is needed to better inform the evidence base on interventions for patients with schizophrenia identified as drinking at higher risk levels.

Table 1: Proportions of men and women with a relevant alcohol record during the period

April 2011-March 2013 and relative "risk" of recording of alcohol by demographic group

	MEN			WOMEN		
	Records/N (%)	RR (95% CI)	p	Records/N (%)	RR (95% CI)	p
All	6247/8068 (77.4)			5338/6792 (78.6)		
Age, years						
18-29	650/978 (66.5)	0.85 (0.81 to 0.89)		320/445 (71.9)	0.92 (0.86 to 0.98)	
30-39	1278/1737 (73.6)	0.94 (0.90 to 0.97)		641/836 (76.7)	0.98 (0.94 to 1.03)	
40-49	1655/2109 (78.5)	1		1072/1380 (77.7)	1	
50-59	1243/1504 (82.6)	1.06 (1.02 to 1.10)		1155/1442 (80.1)	1.03 (0.99 to 1.07)	
60-69	896/1089 (82.3)	1.05 (1.02 to 1.09)		1002/1251 (80.1)	1.04 (0.99 to 1.08)	
70-79	406/489 (83.0)	1.07 (1.02 to 1.12)		733/889 (82.5)	1.07 (1.02 to 1.11)	
80-89	112/151 (74.2)	0.97 (0.88 to 1.06)		363/476 (76.3)	0.99 (0.93 to 1.05)	
90-99	7/11 (63.6)	0.81 (0.51 to 1.27)		52/73 (71.2)	0.92 (0.8 to 1.06)	
			<0.001			<0.001
Deprivation quintile*						
1 (Least deprived)	646/867 (74.5)	0.94 (0.89 to 0.98)		725/973 (74.5)	0.93 (0.88 to 0.98)	
2	858/1121 (76.5)	0.96 (0.92 to 1.00)		849/1083 (78.4)	0.98 (0.94 to 1.02)	
3	1157/1543 (75.0)	0.94 (0.90 to 0.98)		1094/1411 (77.5)	0.97 (0.93 to 1.01)	
4	1605/2054 (78.1)	0.98 (0.95 to 1.01)		1333/1672 (79.7)	0.99 (0.96 to 1.03)	
5 (Most deprived)	1981/2483 (79.8)	1		1337/1653 (80.9)	1	
			0.01			0.05
UK region+						
London	874/1063 (82.2)	1		753/897 (83.9)	1	
East Midlands	68/100 (68.0)	0.83 (0.62 to 1.12)		70/117 (59.8)	0.72 (0.49 to 1.06)	
East of England	366/472 (77.5)	0.95 (0.88 to 1.03)		297/378 (78.6)	0.95 (0.87 to 1.04)	
West Midlands	481/625 (77)	0.94 (0.87 to 1.02)		462/570 (81.1)	0.97 (0.92 to 1.04)	
North East	150/190 (78.9)	0.95 (0.88 to 1.04)		124/152 (81.6)	0.97 (0.89 to 1.05)	
North West	845/1084 (78.0)	0.95 (0.89 to 1.01)		681/863 (78.9)	0.95 (0.89 to 1.00)	
Yorkshire & Humber	75/98 (76.5)	0.92 (0.82 to 1.03)		62/87 (71.3)	0.85 (0.62 to 1.16)	
Northern Ireland	341/423 (80.6)	0.98 (0.91 to 1.05)		304/363 (83.7)	1.00 (0.94 to 1.07)	
Scotland	988/1269 (77.9)	0.93 (0.88 to 0.99)		789/1002 (78.7)	0.94 (0.89 to 0.99)	
South Central	675/869 (77.7)	0.96 (0.90 to 1.02)		637/801 (79.5)	0.96 (0.92 to 1.01)	
South East Coast	432/595 (72.6)	0.89 (0.83 to 0.95)		389/528 (73.7)	0.89 (0.83 to 0.95)	
South West	461/643 (71.7)	0.87 (0.82 to 0.93)		390/549 (71.0)	0.86 (0.79 to 0.93)	
Wales	491/637 (77.1)	0.94 (0.88 to 1.00)		380/485 (78.4)	0.94 (0.88 to 1.00)	
			0.02			0.003
Registration status						
Not newly registered	5846/7531 (77.6)	1		5072/6448 (78.7)	1	
Newly registered	401/537 (74.7)	0.98 (0.93 to 1.03)		266/344 (77.3)	0.99 (0.93 to 1.06)	
			0.4			0.9

*Deprivation measured using Townsend score +UK region (former Strategic Health Authorities in England, plus Scotland, Wales and N Ireland). RR = Relative risk, estimated from Poisson regression, adjusting for the other factors considered and for accounting for clustering of people within general practices

Table 2: Baseline demographic characteristics in people with and without schizophrenia

2000-2013

	People with schizophrenia	People without schizophrenia
Total individuals	34,440	226,984
	N (%)	**N (%)**
Gender		
Men	18,540 (53.8)	123,543 (54.4)
Women	15,900 (46.2)	103,441 (45.6)
Age, years		
18-29	6,274 (18.2)	43,151 (19.0)
30-49	13,627 (39.6)	89,457 (39.4)
50-69	9,299 (27.0)	59,138 (26.1)
70-99	5,240 (15.2)	35,238 (15.5)
Townsend deprivation quintile		
1 (Least deprived)	4,427 (12.9)	49,243 (21.7)
2	5,252 (15.3)	46,676 (20.6)
3	6,872 (20.0)	48,729 (21.5)
4	8,678 (25.2)	45,989 (20.3)
5 (Most deprived)	9,211 (26.8)	36,347 (16.0)
UK region		
London	4,351 (12.6)	27,908 (12.3)
East Midlands	1,353 (3.9)	9,060 (4.0)
East of England	2,380 (6.9)	15,803 (7.0)
West Midlands	2,587 (7.5)	17,201 (7.6)
North East	1,005 (2.9)	6,646 (2.9)
North West	4,083 (11.9)	26,827 (11.8)
Yorkshire & Humber	1,429 (4.2)	9,147 (4.0)
Northern Ireland	1,221 (3.6)	7,769 (3.4)
Scotland	4,071 (11.8)	26,231 (11.6)
South Central	3,902 (11.3)	26,059 (11.5)
South East Coast	2,614 (7.6)	17,430 (7.7)
South West	3,274 (9.5)	22,381 (9.9)
Wales	2,170 (6.3)	14,522 (6.4)

Table 3: Alcohol recording rates and adjusted rate ratios comparing people with and without schizophrenia within each time period

Time period	Individuals with Schizophrenia and psychoses				Individuals without Schizophrenia and psychoses				Adjusted Rate ratio* (95% CI) - cases v controls	p
	N	Total person years	No. with alcohol record	Rate of alcohol recording per 1000 person-years (95% CI)	N	Total person years	No. with alcohol record	Rate of alcohol recording per 1000 person-years (95% CI)		
1 Apr 2000 - 31 Mar 2002	9,033	15,177	1,241	81.8 (77.3 to 86.4)	54,198	93,656	8,339	89.0 (87.1 to 91.0)	0.89 (0.84 to 0.96)	0.001
1 Apr 2002 - 31 Mar 2004	12,303	19,650	3,043	154.9 (149.5 to 160.5)	78,869	129,750	19,675	151.6 (149.5 to 153.8)	0.99 (0.95 to 1.03)	0.6
1 Apr 2004 - 31 Mar 2006	15,617	22,436	5,099	227.3 (221.1 to 233.6)	106,136	169,080	27,571	163.1 (161.2 to 165.0)	1.34 (1.28 to 1.41)	<0.001
1 Apr 2007 - 31 Mar 2009	18,128	25,313	7,306	288.6 (282.1 to 295.3)	136,277	219,761	34,050	154.9 (153.3 to 156.6)	1.79 (1.69 to 1.89)	<0.001
1 Apr 2009 - 31 Mar 2011	19,229	24,265	9,025	371.9 (364.3 to 379.7)	151,126	234,391	40,034	170.8 (169.1 to 172.5)	2.09 (1.96 to 2.22)	<0.001
1 Apr 2011 - 31 Mar 2013	19,545	18,701	13,515	722.7 (710.6 to 735.0)	159,097	243,134	44,826	184.4 (182.7 to 186.1)	3.80 (3.54 to 4.08)	<0.001

*Adjusted rate ratio comparing people with bipolar disorder to people without severe mental illness, from Poisson regression adjusting for age, gender, deprivation, UK region and accounting for clustering of people in general practices

Figure 1: Types of alcohol records among people with schizophrenia in April 2011-March 2013

Venn Diagram

N = 11585

Read code for level of alcohol consumed

5985

244

1861

167

38

139

3151

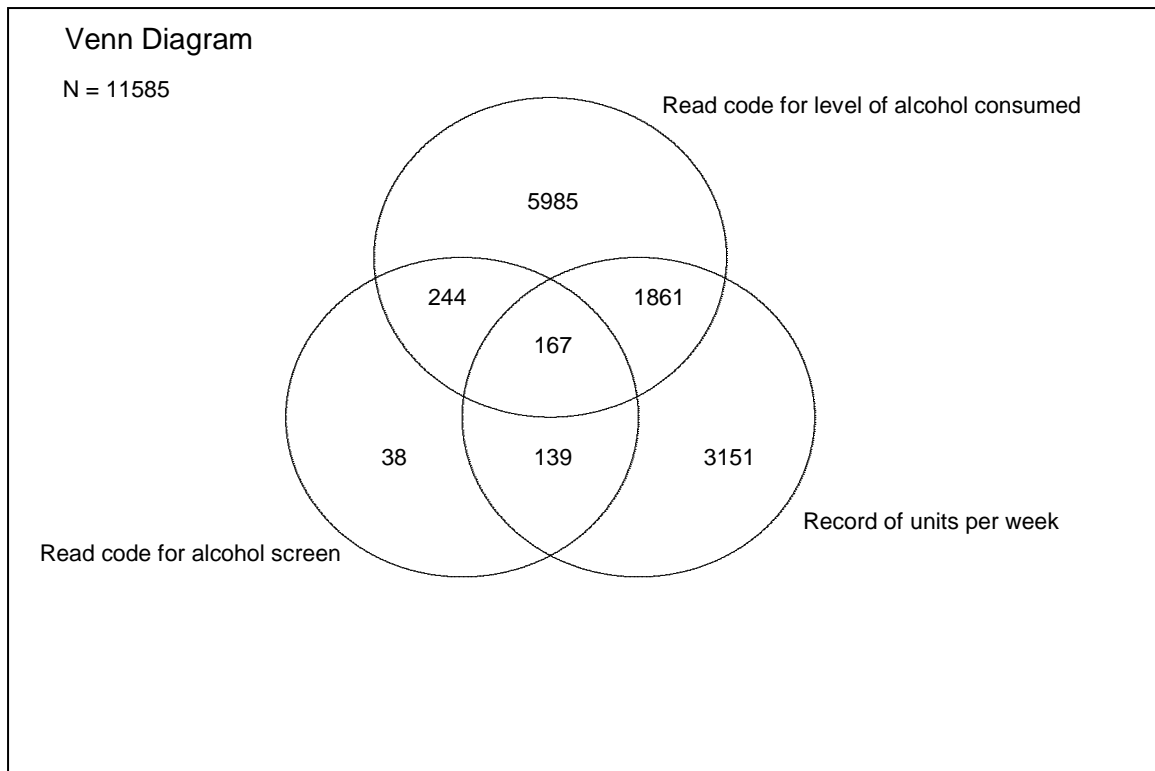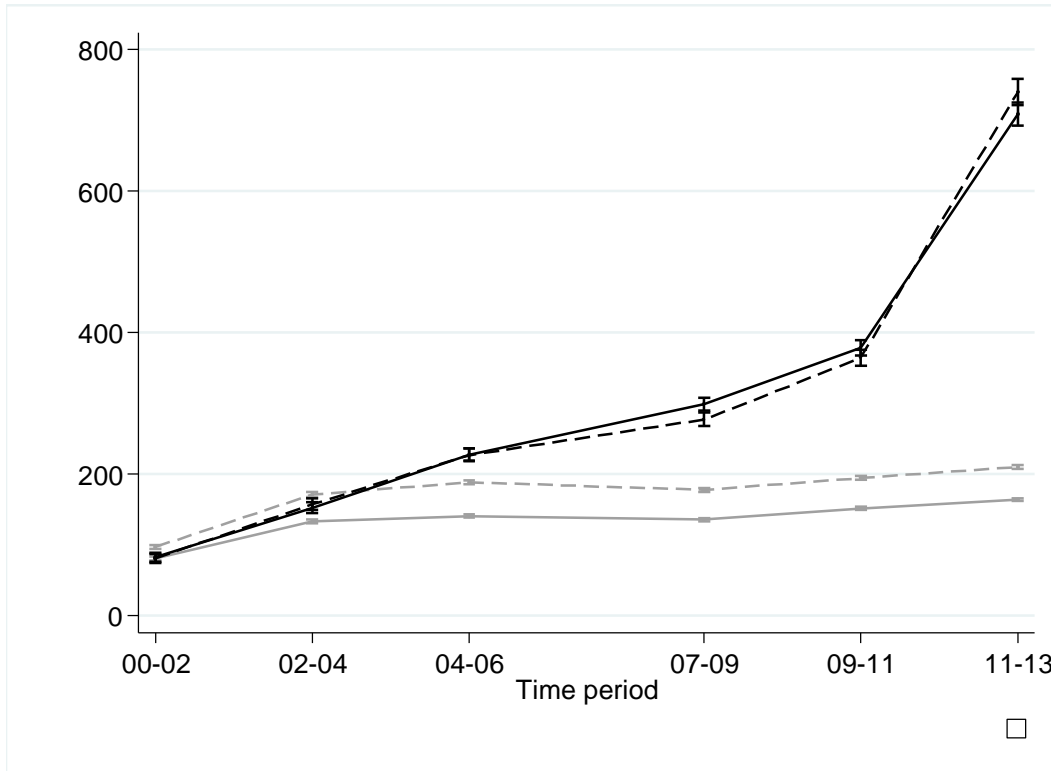Read code for alcohol screen

Record of units per week

Figure 2: Graph of alcohol recording rates over time, people with and without schizophrenia

KEY: Solid black line = men with schizophrenia; Dashed black line = women with schizophrenia; Solid grey line = men without schizophrenia; Dashed grey line = women without schizophrenia. Spikes with caps are 95% confidence interval

Appendix 1

Read codes for level of alcohol consumed, and frequency of use among people with schizophrenia in April 2011-March 2013

Read code	Description	In QOF?*	N
1361.00	Teetotaller	Yes	3603
1367.00	Stopped drinking alcohol	Yes	1690
1362.11	Drinks rarely	Yes	871
1362.12	Drinks occasionally	Yes	745
1362.00	Trivial drinker - <1u/day	Yes	309
1361.11	Non drinker alcohol	Yes	181
1363.00	Light drinker - 1-2u/day	Yes	154
1364.00	Moderate drinker - 3-6u/day	Yes	135
136L.00	Alcohol intake within recommended sensible limits	Yes	132
E23..00	Alcohol dependence syndrome	No	59
1365.00	Heavy drinker - 7-9u/day	Yes	51
136K.00	Alcohol intake above recommended sensible limits	Yes	48
1361.12	Non-drinker alcohol	Yes	43
1366.00	Very heavy drinker - >9u/day	Yes	33
136R.00	Binge drinker	Yes	27
E23..12	Alcohol problem drinking	No	25
136T.00	Harmful alcohol use	Yes	24
136J.00	Social drinker	Yes	19
136D.00	Ex-heavy drinker - (7-9u/day)	Yes	14
136S.00	Hazardous alcohol use	Yes	12
136C.00	Ex-moderate drinker - (3-6u/d)	Yes	10
136O.00	Moderate drinker	Yes	10
136P.00	Heavy drinker	Yes	10
136N.00	Light drinker	Yes	8
136B.00	Ex-light drinker - (1-2u/day)	Yes	6
136E.00	Ex-very heavy drinker-(>9u/d)	Yes	6
E23..11	Alcoholism	No	6
136A.00	Ex-trivial drinker (<1u/day)	Yes	5
136M.00	Current non drinker	No	3
136W.00	Alcohol misuse	No	2
136d.00	Lower risk drinking	Yes	2
1462.00	H/O: alcoholism	No	2
E231z00	Chronic alcoholism NOS	No	2
E250.00	Nondependent alcohol abuse	No	2
136Q.00	Very heavy drinker	Yes	1
136c.00	Higher risk drinking	Yes	1
E230.00	Acute alcoholic intoxication in alcoholism	No	1
E23z.00	Alcohol dependence syndrome NOS	No	1
E250000	Nondependent alcohol abuse, unspecified	No	1
E250200	Nondependent alcohol abuse, episodic	No	1
Eu10100	[X]Mental and behav dis due to use of alcohol: harmful use	No	1
Eu10211	[X]Alcohol addiction	No	1
136Y.00	Drinks in morning to get rid of hangover	No	0
136a.00	Increasing risk drinking	Yes	0
136b.00	Feels should cut down drinking	No	0
E230.11	Alcohol dependence with acute alcoholic intoxication	No	0
E230000	Acute alcoholic intoxication, unspecified, in alcoholism	No	0
E230100	Continuous acute alcoholic intoxication in alcoholism	No	0
E230200	Episodic acute alcoholic intoxication in alcoholism	No	0
E230300	Acute alcoholic intoxication in remission, in alcoholism	No	0
E230z00	Acute alcoholic intoxication in alcoholism NOS	No	0
E231.00	Chronic alcoholism	No	0

E231.11	Dipsomania	No	0
E231000	Unspecified chronic alcoholism	No	0
E231100	Continuous chronic alcoholism	No	0
E231200	Episodic chronic alcoholism	No	0
E231300	Chronic alcoholism in remission	No	0
E250100	Nondependent alcohol abuse, continuous	No	0
E250300	Nondependent alcohol abuse in remission	No	0
E250z00	Nondependent alcohol abuse NOS	No	0
Eu10200	[X]Mental and behav dis due to use alcohol: dependence syndr	No	0
Eu10212	[X]Chronic alcoholism	No	0
Eu10213	[X]Dipsomania	No	0
ZV11300	[V]Personal history of alcoholism	No	0

*In QOF = Included in the list of codes eligible for recompense in the Quality and Outcomes Framework Pay for Performance Scheme for alcohol screening in people with severe mental illness

Appendix 2

Read codes for screening and frequency of use among people with schizophrenia in April 2011-March 2013

Read code	Description	N
9k17.00	Alcohol screen - AUDIT C completed	263
9k16.00	Alcohol screen - fast alcohol screening test completed	117
68S..00	Alcohol consumption screen	67
9k13.00	Alcohol questionnaire completed	36
9k15.00	Alcohol screen - AUDIT completed	35
38D3.00	Alcohol use disorders identification test	28
6892.00	Alcohol consumption screen	16
388u.00	Fast alcohol screening test	12
38D4.00	Alcohol use disorder identificatn test consumptn questionnre	5
ZR1F.11	AUDIT - Alcohol use disorders identification test	4
ZR1F.00	Alcohol use disorders identification test	2
ZRLfD00	Hlth Nat Outcome Scale item 3	2
38Dz.00	Severity of alcohol dependence questionnaire	1
388j.00	Cage questionnaire	0
38D2.00	Single alcohol screening questionnaire	0
38D5.00	Alcoh use disor id test Piccinelli consumption questionnaire	0
38Df.00	Five-shot questionnaire on heavy drinking	0
38Dz.11	SADQ - Severity of alcohol dependence questionnaire	0
9k18.00	Alcohol screen - AUDIT PC completed	0
ZR1E.00	Alcohol dependence scale	0
ZR1E.11	ADS - Alcohol dependence scale	0
ZR1G.00	Alcohol use inventory	0
ZR31.00	Cage questionnaire	0
ZR3f.00	Comprehensive drinker profile	0
ZR3f.11	CDP - Comprehensive drinker profile	0
ZRBJ.00	Drinking problem scale	0
ZRBJ.11	DPS - Drinking problem scale	0
ZRLfD11	HoNOS item 3	0
ZRLfD12	HoNOS item 3 - alcohol/drug problem	0
ZRR..00	Inventory of drinking situations	0
ZRVK.00	Last six months of drinking questionnaire	0
ZRa1.00	Michigan alcoholism screening test	0
ZRa1.11	MAST - Michigan alcoholism screening test	0
ZRa1100	Brief Michigan alcoholism screening test	0
ZRa1111	BMAST - Brief Michigan alcoholism screening test	0
ZRa1200	Short Michigan alcoholism screening test	0
ZRa1211	SMAST - Short Michigan alcoholism screening test	0
ZRaU.00	Munich alcoholism test	0
ZRaU.11	MALT - Munich alcoholism test	0
ZRk6.00	Severity of alcohol dependence questionnaire	0
ZRk6.11	SADQ - Severity of alcohol dependence questionnaire	0
ZRk9.00	Short alcohol dependence data	0
ZRk9.11	SADD - Short alcohol dependence data	0
ZV79100	[V]Screening for alcoholism	0

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

IN, IP and ZK conceived the study. ZK prepared the protocol and all authors contributed to the study design and edited the protocol. SLH extracted and cleaned the data, undertook the statistical analysis. ZK wrote the first draft of the manuscript. All authors contributed to, and have approved, the final manuscript

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