

# **Monitoring of alcohol consumption in primary care among adults with bipolar disorder: a cross-sectional and retrospective cohort study**

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**Abstract** (250 words max; count: 250)

### **Background**

Screening for alcohol use disorders is an important priority in the healthcare of people with bipolar disorder, incentivised in UK primary care since 2011, through the Quality and Outcomes Framework (QOF). The extent of alcohol monitoring in primary care, and impact of QOF, is unknown. The aim was to examine recording of alcohol consumption in primary care.

### **Methods**

Poisson regression of biennial alcohol recording rates between 2000 and 2013 among 14,051 adults with bipolar disorder and 90,023 adults without severe mental illness (SMI), from 484 general practices contributing to The Health Improvement Network UK-wide primary care database.

### **Results**

Alcohol recording rates among people with bipolar disorder increased from 88.6 records per 1000 person-years (95% confidence interval 81.2 to 96.6) in 2000/2002 to 837.4 records per 1000 person-years (817.4 to 858.0) in 2011/2013; a more than nine-fold increase, mainly occurring after the introduction of the QOF incentive in 2011. In 2000/2002 alcohol recording levels among people with bipolar disorder were not statistically significantly different from those without SMI (adjusted rate ratio 0.96, 0.88 to 1.05). By 2011/2013, people with bipolar disorder were over four times as likely to have an alcohol record: adjusted rate ratio 4.45 (4.15 to 4.77).

### **Limitations**

The routinely collected data may be incomplete. Alcohol data entered as free-text was not captured.

### **Conclusions**

The marked rise in alcohol consumption recording highlights what can be achieved. It is most likely attributable to QOF, suggesting that QOF, or similar schemes, can be powerful tools in promoting aspects of healthcare.

### **Keywords**

Bipolar disorder; Alcohol; Screening; Primary care; QOF

## **Short communication (limit 2000 words; word count 1998)**

### **1. Introduction**

Individuals with bipolar disorder have a lifetime risk of more than one in three of developing an alcohol use disorder (AUD)(Di Florio et al., 2014). Among people with bipolar disorder, comorbid AUD is associated with poorer prognosis including increased suicide risk(Cardoso et al., 2008;Carra et al., 2014), increased severity and frequency of manic and depressive episodes(Cardoso et al., 2008;Salloum et al., 2001;Salloum et al., 2002), and poorer adherence and response to treatments(Leclerc et al., 2013). Screening for, and management of, AUDs is therefore an important priority in the healthcare of people with bipolar disorder. In April 2011, financial incentives were introduced in the UK primary care setting to encourage general practitioners (GPs) to screen for alcohol consumption in people with severe mental illness (SMI), including bipolar disorder, within the Quality and Outcomes Framework (QOF) scheme(British Medical Association, 2014). QOF, introduced in April 2004, is the principal Payment for Performance scheme in the UK, designed to incentivise good practice in primary care by providing financial reward for achieving targets in monitoring and care of patients for different medical conditions.

There are no national studies examining alcohol screening in primary care among people with bipolar disorder and the impact of the national QOF on alcohol screening rates is unknown. The aims of this study were therefore to i) examine demographic patterns in alcohol consumption recording since the introduction of the QOF incentive for alcohol screening in SMI in April 2011 in a large, national sample of people with bipolar disorder in primary care, and ii) to compare these alcohol recording levels with the levels of recording in people without SMI over time.

### **2. Methods**

#### **2.1 Study design**

Cross-sectional and retrospective cohort study

#### **2.2 Data source**

Data came from The Health Improvement Network (THIN) primary care database(Blak et al., 2011) which comprises longitudinal electronic patient records retrieved from over 500 general practices

across the UK (approximately 6% of the UK population). Diagnoses, symptoms and other relevant health information are principally entered into the THIN database in coded form, using the Read Code clinical classification system, described in **Supplemental Table s1** (Chisholm, 1990). THIN includes the Townsend deprivation index, which is a composite measure of social deprivation (Townsend et al., 1988). Two established data quality control measures ensure data quality and completeness (Horsfall et al., 2013; Maguire et al., 2009).

### **2.3 Study population**

The study population comprised men and women aged 18-99 years with a prior Read code in their primary care records indicative of a bipolar disorder diagnosis (**Supplemental Table s1**). A separate comparison cohort of people without SMI was formed, matched to the bipolar disorder study population on practice, gender, and age at baseline. Each individual with bipolar disorder was matched with up to six people without SMI.

### **2.4 Setting and Quality and Outcomes Framework context**

The setting was UK general practice, over the period 1 April 2000 to 31 March 2013, which includes time periods before and after the introduction of, and subsequent amendments to, the QOF scheme for SMI (British Medical Association, 2014). SMI has been included in QOF since 2004. Initially, the QOF for SMI rules comprised keeping a register of people with SMI and offering them an annual review. In April 2006, general lifestyle screening was incorporated. In April 2011 alcohol screening was added, whereby general practices are offered up to 4 QOF points (£133.76 per point in 2012/2013) for recording of alcohol consumption for people with SMI during the preceding 15 months.

### **2.5 Principal outcome: Alcohol consumption recording**

Three different means of recording of alcohol consumption in THIN were considered:

1. Read Codes indicative of level of alcohol consumption (**Supplemental Table s2**)
2. Read Codes indicative of use of a validated alcohol screening test (**Supplemental Table s3**)
3. Continuous measure of drinking (e.g. units per week)

## **2.6 Socio-demographic characteristics**

Patterns in alcohol recording by the following characteristics were investigated: gender, age, registration status (newly registered with the GP in the last year versus registered for over one year), Townsend deprivation quintile, and UK region (former Strategic Health Authority for England, and country for Wales, Scotland and Northern Ireland).

## **2.7 Statistical Analysis**

To address the first aim, (cross-sectional study to examine socio-demographic variations in recording since the addition of alcohol screening to the QOF for SMI in 2011) the study population was restricted to those individuals with bipolar disorder with complete follow up during the period 1 April 2011 to 31 March 2013. The relative risk of having an alcohol record, by 10-year age group, deprivation quintile, UK region, and registration status was estimated from multivariable Poisson regression, stratifying by gender, and adjusting for the other demographic characteristics, with robust standard errors to account for clustering of individuals within general practices.

To address the second aim (cohort study to compare time-trends in alcohol recording among people with and without bipolar disorder), the full study sample of people both with and without bipolar disorder was used. Rates of recording of alcohol consumption (any record type) per 1000 person-years were computed among those with and without bipolar disorder during two-year periods between April 2000 and March 2013 (reflecting QOF reporting periods). Rate ratios of alcohol recording comparing individuals with bipolar disorder against individuals without SMI were estimated using Poisson regression, adjusting for age, gender, deprivation, and UK region, with robust standard errors to take into account clustering within practices. An interaction between bipolar disorder status (yes or no) and time period was included to assess whether differences in recording among individuals with and without SMI have changed over time.

## **3. Results**

### **3.1 Alcohol recording levels among adults with bipolar disorder in 2011-2013**

Among 6,768 individuals from 409 general practices, 5,663 (84%) individuals had a relevant alcohol consumption record during the two-year period. 80 practices (19.6%) had 100% recording levels.

**Supplemental Figure s1** illustrates the types of alcohol data recorded among these 5,663 individuals. 243 (4.3%) had a Read code for an alcohol screen (with or without additional alcohol data). 2,893 (51.4%) individuals had a record of the units of alcohol consumed. Of the 3,787 records comprising Read codes for alcohol consumption, 3,750 (99%) were codes listed as eligible for recompense in the QOF for SMI (**Supplemental Table s2**). Alcohol recording levels were higher in women (85.1%), compared with men (81.6%) and were lowest in the youngest and oldest age groups (**Table 1 and Supplemental Table s4**). There were no statistically significant differences in recording levels by deprivation, registration status, or UK region.

### **3.2 Time trend in alcohol recording, comparing adults with and without bipolar disorder**

In total, 14,051 individuals with bipolar disorder and 90,023 individuals without SMI from 484 practices were included in this time-trend analysis. Demographic characteristics are presented in **Supplemental Table s5**. Rates of alcohol recording increased rapidly over time among individuals with bipolar disorder with an average annual increase in recording rate of 20% (95% CI 19% to 21%), and a more than 9-fold increase over the 13 year period April 2000-March 2013 (**Table 2 and Supplemental Table s6**). Recording rates rose particularly rapidly between the periods April 2009-March 2011 and April 2011-March 2013, that is, following the addition of alcohol screening to the QOF for SMI in April 2011 (**Supplemental Figure s2**). There was a comparatively modest average annual increase in recording rates of 4% (95% CI 3% to 4%) among those without SMI, corresponding to a total increase of 57%. As such, rates of alcohol recording among individuals with and without bipolar disorder were similar in the earliest period April 2000-March 2002, (adjusted rate ratio of 0.96 (95% CI 0.88 to 1.05),  $p=0.4$ ), but by April 2011-March 2013, people with bipolar disorder were more than four times as likely to have an alcohol record than those without SMI; adjusted rate ratio 4.45 (95% CI 4.15 to 4.77),  $p<0.001$ .

## **4. Discussion**

There has been a nine-fold increase in recording of alcohol consumption in primary care among people with bipolar disorder between 2000 and 2013, compared with a modest 57% increase among people without SMI. Correspondingly, in 2011-2013, over 80% of individuals with bipolar disorder had

their current alcohol levels recorded in primary care, with one fifth of general practices attaining 100% recording levels.

The alcohol recording rate among people with bipolar disorder began to diverge from that among people without SMI after the introduction of the QOF for SMI in 2004. The rise in recording of alcohol consumption among people with bipolar disorder was particularly marked following the addition of alcohol screening to the QOF for SMI in 2011, offering general practices remuneration for recording of alcohol consumption in people with SMI (British Medical Association, 2014). While the concurrence of this rise in recording with the modification of QOF to include alcohol screening does not prove that the rise is a result of QOF, the absence of alternative likely influences, along with the observed relative stability of alcohol recording rates in people without SMI, supports that the QOF for SMI has played an important role.

#### **4.1 Comparison with other studies**

A previous study examined the impact of a local version of the QOF in a single London borough (Hamilton et al., 2014). This local QOF rewarded general practices for alcohol screening and brief intervention in people with cardiovascular disease (CVD) or SMI, between 2008 and 2011 (that is, prior to the introduction of alcohol screening to the national QOF for SMI in 2011). In line with the present study findings, a marked increase in screening rates was observed in the 30 participating practices following the introduction of this local QOF (from 4.8% to 65.7% in the combined population of people with CVD or SMI). However, even while the local QOF was in effect, alcohol screening rates among people with SMI remained considerably lower (49%) than in the present study population. The lower recording rate could reflect that the national QOF is a greater incentiviser than the local scheme.

#### **4.2 Strengths and limitations**

Diagnoses of SMI in primary care records have been previously validated (Nazareth et al., 1993), and the THIN SMI population has been shown to be representative of the UK SMI population (Hardoon et al., 2013). A limitation of the study is the use of routine data, not collected specifically for research purposes, which may therefore be subject to errors and omissions. However, established data quality

control measures (Horsfall et al., 2013;Maguire et al., 2009) were used to ensure good data quality. Three different means of recording of alcohol in the patient records were considered (Read codes for screening tests, Read codes for alcohol level, and inputted units of alcohol consumed). Alcohol data may also be entered into a patient's records as free text, which is not captured in this study, and which therefore could have led to underestimation of alcohol recording rates, particularly among those without bipolar disorder, among whom use of Read codes is not incentivised. However, given the relative ease of recording of units of alcohol or Read codes in a patient's records, compared with free text, the sole use of free text is likely to be limited.

### **4.3 Implications**

The current high alcohol recording rates in people with bipolar disorder is very encouraging, especially given evidence that assessment of alcohol use alone (without subsequent intervention) can lead to reductions in hazardous drinking(Kypri et al., 2007;McCambridge and Day, 2008;McCambridge and Kypri, 2011). Nevertheless screening is just a first step in the management of AUDs in people with bipolar disorder. To fully address the high prevalence of AUDs in this population, appropriate effective interventions need to be delivered, where indicated by the screening. Further research is needed to determine the extent to which alcohol interventions are implemented in people with bipolar disorder.

The results suggest that QOF can be a powerful tool in boosting monitoring of alcohol use among people with bipolar disorder in the primary care setting. Such schemes may further provide an opportunity to encourage other relevant screening, treatment or interventions for people with bipolar disorder, and present an exciting prospect for promoting the healthcare of people with bipolar disorder, which merits further investigation.

### **Ethical approval**

The scheme for THIN to obtain and provide anonymous patient data to researchers was approved by the National Health Service South-East Multicentre Research Ethics Committee in 2002, and scientific approval for this study was obtained from CSD Medical Research's Scientific Review Committee in January 2015.



**Contributors**

IP, IN 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 and wrote the first draft of the manuscript. All authors contributed to, and have approved, the final manuscript

**Role of the funding source**

This research was carried out independently of the funders. The views expressed are those of the authors and not necessarily those of the funders.

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**Conflict of interest**

None

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## Tables and Figures

**Table 1:** Proportions of men and women with bipolar disorder who have an 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
<b>All</b>	2185/2679 (81.6)			3478/4089 (85.1)		
<b>Age, years</b>						
18-29	150/203 (73.9)	0.91 (0.82 to 1.00)		217/275 (78.9)	0.94 (0.87 to 1.00)	
30-39	294/399 (73.7)	0.90 (0.84 to 0.97)		515/618 (83.3)	0.99 (0.95 to 1.04)	
40-49	566/693 (81.7)	1		818/974 (84.0)	1	
50-59	484/588 (82.3)	1.01 (0.96 to 1.06)		772/877 (88.0)	1.05 (1.01 to 1.09)	
60-69	416/485 (85.8)	1.06 (1.01 to 1.11)		647/733 (88.3)	1.05 (1.01 to 1.09)	
70-79	216/243 (88.9)	1.09 (1.03 to 1.16)		372/435 (85.5)	1.02 (0.97 to 1.07)	
80-89	55/63 (87.3)	1.08 (0.98 to 1.18)		130/161 (80.7)	0.97 (0.89 to 1.05)	
90-99	4/5 (80.0)	0.99 (0.63 to 1.55)		7/16 (43.8)	0.52 (0.30 to 0.92)	
			<0.001			<0.001
<b>Deprivation quintile</b>						
1 (Least deprived)	399/493 (80.9)	0.98 (0.92 to 1.03)		642/780 (82.3)	0.95 (0.91 to 1.00)	
2	406/510 (79.6)	0.96 (0.91 to 1.03)		665/780 (85.3)	0.99 (0.95 to 1.04)	
3	465/568 (81.9)	1.00 (0.94 to 1.06)		740/868 (85.3)	1.00 (0.96 to 1.04)	
4	492/590 (83.4)	1.02 (0.97 to 1.08)		805/929 (86.7)	1.01 (0.97 to 1.05)	
5 (Most deprived)	423/518 (81.7)	1		626/732 (85.5)	1	
			0.4			0.1
<b>UK Region</b>						
London	249/301 (82.7)	1		334/391 (85.4)	1	
East Midlands	33/41 (80.5)	0.96 (0.78 to 1.18)		37/48 (77.1)	0.92 (0.72 to 1.18)	
East of England	143/173 (82.7)	1.01 (0.92 to 1.10)		220/256 (85.9)	1.01 (0.94 to 1.08)	
West Midlands	189/227 (83.3)	1.01 (0.92 to 1.11)		296/333 (88.9)	1.05 (0.98 to 1.12)	
North East	62/69 (89.9)	1.08 (0.95 to 1.23)		91/107 (85.0)	0.99 (0.90 to 1.10)	
North West	251/309 (81.2)	0.98 (0.91 to 1.06)		395/463 (85.3)	1.00 (0.94 to 1.07)	
Yorks & Humber	28/41 (68.3)	0.82 (0.65 to 1.03)		38/44 (86.4)	1.01 (0.87 to 1.18)	
N Ireland	92/108 (85.2)	1.03 (0.93 to 1.14)		151/172 (87.8)	1.03 (0.96 to 1.11)	
Scotland	335/407 (82.3)	0.99 (0.92 to 1.07)		557/656 (84.9)	0.99 (0.93 to 1.06)	
South Central	289/352 (82.1)	1.00 (0.92 to 1.08)		494/572 (86.4)	1.02 (0.96 to 1.09)	
South East Coast	211/262 (80.5)	0.97 (0.88 to 1.07)		352/424 (83.0)	0.98 (0.91 to 1.05)	
South West	176/220 (80.0)	0.97 (0.89 to 1.06)		297/360 (82.5)	0.97 (0.90 to 1.05)	
Wales	127/169 (75.1)	0.92 (0.82 to 1.02)		216/263 (82.1)	0.96 (0.88 to 1.05)	
			0.6			0.6
<b>Registration status</b>						
Not newly registered	2048/2502 (81.9)	1		3276/3843 (85.2)	1	
Newly registered	137/177 (77.4)	0.97 (0.90 to 1.05)		202/246 (82.1)	0.98 (0.92 to 1.04)	
			0.5			0.4

\*RR = Relative risk, estimated from Poisson regression, adjusting for the other factors considered and accounting for clustering of people within general practices. Unadjusted relative risks are presented in the Supplemental Table s4 for comparison.

**Table 2:** Rates of recording of alcohol consumption among people with and without bipolar disorder, and corresponding rate ratios, according to time period

Time period*	People with bipolar disorder				People without severe mental illness				Adjusted rate ratio# (95% CI)	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)		
<b>Apr 00 - Mar 02</b> (before SMI QOF)	3,377	5,759	510	88.6 (81.2 to 96.6)	20,262	34,891	3,186	91.3 (88.2 to 94.5)	0.96 (0.88 to 1.05)	0.4
<b>Apr 02 - Mar 04</b> (before SMI QOF)	4,713	7,604	1,280	168.3 (159.4 to 177.8)	29,185	47,990	7,290	151.9 (148.5 to 155.4)	1.09 (1.04 to 1.16)	0.001
<b>Apr 04 - Mar 06</b> (SMI QOF in effect)	6,172	8,890	2,175	244.7 (234.6 to 255.2)	39,182	61,735	10,720	173.6 (170.4 to 177.0)	1.39 (1.31 to 1.47)	<0.001
<b>Apr 07 - Mar 09</b> (lifestyle screening added in SMI QOF)	7,589	10,578	3,253	307.5 (297.2 to 318.3)	51,623	82,931	13,292	160.3 (157.6 to 163.0)	1.89 (1.77 to 2.01)	<0.001
<b>Apr 09 - Mar 11</b> (lifestyle screening added in SMI QOF)	8,356	10,567	4,100	388.0 (376.3 to 400.1)	59,205	91,434	15,806	172.9 (170.2 to 175.6)	2.22 (2.09 to 2.36)	<0.001
<b>Apr 11 - Mar 13</b> (alcohol screening added in SMI QOF)	8,754	7,800	6,532	837.4 (817.4 to 858.0)	63,930	97,599	18,204	186.5 (183.8 to 189.2)	4.45 (4.15 to 4.77)	<0.001

\*Time periods chosen to reflect the reporting periods for, and updates to, the Quality and Outcomes Framework (QOF) Pay for Performance scheme for severe mental illness (SMI)

#Adjusted rate ratio comparing people with bipolar disorder to people without severe mental illness, from Poisson regression adjusting for age, gender, deprivation, and UK region and accounting for clustering of people in general practices. Unadjusted rate ratios are presented in the Supplemental Table s6 for comparison.

## Supplemental Material

**Table s1:** List of Read codes\* identified as indicative of bipolar disorder. Individuals were eligible for inclusion in the cohort of people with bipolar disorder if they had at least one of these codes in their primary care records

Read code*	Description
146D.00	H/O: manic depressive disorder
E11..11	Bipolar psychoses
E11..13	Manic psychoses
E110.00	Manic disorder, single episode
E110.11	Hypomanic psychoses
E110000	Single manic episode, unspecified
E110100	Single manic episode, mild
E110200	Single manic episode, moderate
E110300	Single manic episode, severe without mention of psychosis
E110400	Single manic episode, severe, with psychosis
E110500	Single manic episode in partial or unspecified remission
E110600	Single manic episode in full remission
E110z00	Manic disorder, single episode NOS
E111.00	Recurrent manic episodes
E111000	Recurrent manic episodes, unspecified
E111100	Recurrent manic episodes, mild
E111200	Recurrent manic episodes, moderate
E111300	Recurrent manic episodes, severe without mention psychosis
E111400	Recurrent manic episodes, severe, with psychosis
E111500	Recurrent manic episodes, partial or unspecified remission
E111600	Recurrent manic episodes, in full remission
E111z00	Recurrent manic episode NOS
E114.00	Bipolar affective disorder, currently manic
E114.11	Manic-depressive - now manic
E114000	Bipolar affective disorder, currently manic, unspecified
E114100	Bipolar affective disorder, currently manic, mild
E114200	Bipolar affective disorder, currently manic, moderate
E114300	Bipolar affect disord, currently manic, severe, no psychosis
E114400	Bipolar affect disord, currently manic,severe with psychosis
E114500	Bipolar affect disord,currentlly manic, part/unspec remission
E114600	Bipolar affective disorder, currently manic, full remission
E114z00	Bipolar affective disorder, currently manic, NOS
E115.00	Bipolar affective disorder, currently depressed
E115.11	Manic-depressive - now depressed
E115000	Bipolar affective disorder, currently depressed, unspecified
E115100	Bipolar affective disorder, currently depressed, mild
E115200	Bipolar affective disorder, currently depressed, moderate
E115300	Bipolar affect disord, now depressed, severe, no psychosis
E115400	Bipolar affect disord, now depressed, severe with psychosis
E115500	Bipolar affect disord, now depressed, part/unspec remission
E115600	Bipolar affective disorder, now depressed, in full remission
E115z00	Bipolar affective disorder, currently depressed, NOS
E116.00	Mixed bipolar affective disorder
E116000	Mixed bipolar affective disorder, unspecified
E116100	Mixed bipolar affective disorder, mild
E116200	Mixed bipolar affective disorder, moderate
E116300	Mixed bipolar affective disorder, severe, without psychosis
E116400	Mixed bipolar affective disorder, severe, with psychosis
E116500	Mixed bipolar affective disorder, partial/unspec remission
E116600	Mixed bipolar affective disorder, in full remission
E116z00	Mixed bipolar affective disorder, NOS

E117.00	Unspecified bipolar affective disorder
E117000	Unspecified bipolar affective disorder, unspecified
E117100	Unspecified bipolar affective disorder, mild
E117200	Unspecified bipolar affective disorder, moderate
E117300	Unspecified bipolar affective disorder, severe, no psychosis
E117400	Unspecified bipolar affective disorder, severe with psychosis
E117500	Unspecified bipolar affect disord, partial/unspec remission
E117600	Unspecified bipolar affective disorder, in full remission
E117z00	Unspecified bipolar affective disorder, NOS
E11y.00	Other and unspecified manic-depressive psychoses
E11y000	Unspecified manic-depressive psychoses
E11y100	Atypical manic disorder
E11y300	Other mixed manic-depressive psychoses
E11yz00	Other and unspecified manic-depressive psychoses NOS
Eu30.00	[X]Manic episode
Eu30.11	[X]Bipolar disorder, single manic episode
Eu30000	[X]Hypomania
Eu30100	[X]Mania without psychotic symptoms
Eu30200	[X]Mania with psychotic symptoms
Eu30211	[X]Mania with mood-congruent psychotic symptoms
Eu30212	[X]Mania with mood-incongruent psychotic symptoms
Eu30213	[X]Manic stupor
Eu30y00	[X]Other manic episodes
Eu30z00	[X]Manic episode, unspecified
Eu30z11	[X]Mania NOS
Eu31.00	[X]Bipolar affective disorder
Eu31.11	[X]Manic-depressive illness
Eu31.12	[X]Manic-depressive psychosis
Eu31.13	[X]Manic-depressive reaction
Eu31000	[X]Bipolar affective disorder, current episode hypomanic
Eu31100	[X]Bipolar affect disorder cur epi manic wout psychotic symp
Eu31200	[X]Bipolar affect disorder cur epi manic with psychotic symp
Eu31300	[X]Bipolar affect disorder cur epi mild or moderate depressn
Eu31400	[X]Bipol aff disord, curr epis sev depress, no psychot symp
Eu31500	[X]Bipolar affect dis cur epi severe depres with psyc symp
Eu31600	[X]Bipolar affective disorder, current episode mixed
Eu31700	[X]Bipolar affective disorder, currently in remission
Eu31800	[X]Bipolar affective disorder type I
Eu31900	[X]Bipolar affective disorder type II
Eu31911	[X]Bipolar II disorder
Eu31y00	[X]Other bipolar affective disorders
Eu31y11	[X]Bipolar II disorder
Eu31y12	[X]Recurrent manic episodes
Eu31z00	[X]Bipolar affective disorder, unspecified
Eu33213	[X]Manic-depress psychosis, depressd, no psychotic symptoms
Eu33312	[X]Manic-depress psychosis, depressed type+psychotic symptoms
ZV11111	[V]Personal history of manic-depressive psychosis
ZV11112	[V]Personal history of manic-depressive psychosis

\* Diagnoses, symptoms, procedures, and other relevant health information are principally entered into the THIN primary care database in coded form, using the Read Code clinical classification system, (Chisholm, 1990). The Read code system has been adopted as the standard means of recording of patient findings in UK primary care since 1990, currently used in virtually all general practices throughout the UK. It is a hierarchical classification system, linked to the International Classification of Diseases (ICD 10), but more comprehensive. Each diagnosis, symptom or other health information has a unique code, and the codes are grouped into chapters and subchapters for different clinical areas, with the first digits of the code referring to the parent chapters. For example, chapter E refers to mental disorders, and within that chapter, sub-chapter E11 is for affective psychoses, within which codes relating to bipolar disorder may be found, such as code E114.00 for "Bipolar affective disorder,

currently manic". Individual codes may correspond to very specific patient findings, and as such, many different codes may be indicative of an overall diagnosis or condition(Dave and Petersen, 2009). The list of Read codes for bipolar disorder was based on those used in a recent study of recording of SMI in primary care(Hardoon et al., 2013).



**Table s2:** Read codes\* identified to indicate alcohol consumption and frequency of use of the codes among people with bipolar disorder in the period April 2011- March 2013

Read code*	Description	In QOF#?	N
1361.00	Teetotaler	Yes	1499
1367.00	Stopped drinking alcohol	Yes	701
1362.11	Drinks rarely	Yes	515
1362.12	Drinks occasionally	Yes	381
1362.00	Trivial drinker - <1u/day	Yes	176
1363.00	Light drinker - 1-2u/day	Yes	108
1361.11	Non drinker alcohol	Yes	81
136L.00	Alcohol intake within recommended sensible limits	Yes	75
1364.00	Moderate drinker - 3-6u/day	Yes	70
1361.12	Non-drinker alcohol	Yes	24
1365.00	Heavy drinker - 7-9u/day	Yes	22
136K.00	Alcohol intake above recommended sensible limits	Yes	20
E23..00	Alcohol dependence syndrome	No	17
1366.00	Very heavy drinker - >9u/day	Yes	15
136R.00	Binge drinker	Yes	11
E23..12	Alcohol problem drinking	No	11
136J.00	Social drinker	Yes	9
136T.00	Harmful alcohol use	Yes	9
136N.00	Light drinker	Yes	6
136S.00	Hazardous alcohol use	Yes	6
E23..11	Alcoholism	No	5
136D.00	Ex-heavy drinker - (7-9u/day)	Yes	4
136A.00	Ex-trivial drinker (<1u/day)	Yes	3
136C.00	Ex-moderate drinker - (3-6u/d)	Yes	3
136E.00	Ex-very heavy drinker-(>9u/d)	Yes	3
136O.00	Moderate drinker	Yes	3
136P.00	Heavy drinker	Yes	3
E250.00	Nondependent alcohol abuse	No	2
136B.00	Ex-light drinker - (1-2u/day)	Yes	1
136Q.00	Very heavy drinker	Yes	1
136a.00	Increasing risk drinking	Yes	1
E230.00	Acute alcoholic intoxication in alcoholism	No	1
E230.11	Alcohol dependence with acute alcoholic intoxication	No	1
136M.00	Current non drinker	No	0
136W.00	Alcohol misuse	No	0
136Y.00	Drinks in morning to get rid of hangover	No	0
136b.00	Feels should cut down drinking	No	0
136c.00	Higher risk drinking	Yes	0
136d.00	Lower risk drinking	Yes	0
1462.00	H/O: alcoholism	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
E231z00	Chronic alcoholism NOS	No	0
E23z.00	Alcohol dependence syndrome NOS	No	0
E250000	Nondependent alcohol abuse, unspecified	No	0

E250100	Nondependent alcohol abuse, continuous	No	0
E250200	Nondependent alcohol abuse, episodic	No	0
E250300	Nondependent alcohol abuse in remission	No	0
E250z00	Nondependent alcohol abuse NOS	No	0
Eu10100	[X]Mental and behav dis due to use of alcohol: harmful use	No	0
Eu10200	[X]Mental and behav dis due to use alcohol: dependence syndr	No	0
Eu10211	[X]Alcohol addiction	No	0
Eu10212	[X]Chronic alcoholism	No	0
Eu10213	[X]Dipsomania	No	0
ZV11300	[V]Personal history of alcoholism	No	0

\*See Appendix Table s1 for explanation of Read codes. Read Codes indicative of level of alcohol consumption were identified using established search techniques (Dave and Petersen, 2009) and by drawing from those used in a recent study of alcohol consumption recording in primary care (Khadjesari et al., 2013). Read Codes indicative of level of alcohol consumption 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, hazardous or harmful drinking.

#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 (British Medical Association, 2014).

**Table s3:** Read codes\* identified to indicate alcohol screening and frequency of use of the codes among people with bipolar disorder in the period April 2011- March 2013

Read code*	Description	N
9k17.00	Alcohol screen - AUDIT C completed	104
9k16.00	Alcohol screen - fast alcohol screening test completed	45
68S..00	Alcohol consumption screen	36
9k13.00	Alcohol questionnaire completed	16
9k15.00	Alcohol screen - AUDIT completed	11
6892.00	Alcohol consumption screen	10
388u.00	Fast alcohol screening test	8
38D3.00	Alcohol use disorders identification test	7
38D4.00	Alcohol use disorder identificatn test consumptn questionre	2
ZR1F.11	AUDIT - Alcohol use disorders identification test	2
ZRLfD00	Hlth Nat Outcome Scale item 3	2
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.00	Severity of alcohol dependence questionnaire	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
ZR1F.00	Alcohol use disorders identification test	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

\* See Appendix Table s1 for explanation of Read codes. Read Codes indicative of use of a screening test were identified using established search techniques(Dave and Petersen, 2009) and by drawing from those used in a recent study of alcohol consumption recording in primary care(Khadjesari et al., 2013).

**Table s4:** Unadjusted relative risk of recording of alcohol by demographic group among men and women with bipolar disorder during the period April 2011- March 2013

	Men		Women	
	Unadjusted RR (95% CI)*	p	Unadjusted RR (95% CI)*	p
<b>All</b>				
<b>Age, years</b>				
18-29	0.90 (0.82 to 1.00)		0.94 (0.88 to 1.01)	
30-39	0.90 (0.84 to 0.97)		0.99 (0.95 to 1.04)	
40-49	1		1	
50-59	1.01 (0.96 to 1.06)		1.05 (1.01 to 1.09)	
60-69	1.05 (1.00 to 1.10)		1.05 (1.01 to 1.09)	
70-79	1.09 (1.03 to 1.15)		1.02 (0.97 to 1.07)	
80-89	1.07 (0.97 to 1.18)		0.96 (0.88 to 1.05)	
90-99	0.98 (0.63 to 1.51)		0.52 (0.30 to 0.91)	
		<0.001		<0.001
<b>Deprivation quintile</b>				
1 (Least deprived)	0.99 (0.94 to 1.05)		0.96 (0.92 to 1.01)	
2	0.97 (0.92 to 1.04)		1.00 (0.95 to 1.04)	
3	1.00 (0.95 to 1.06)		1.00 (0.96 to 1.04)	
4	1.02 (0.97 to 1.08)		1.01 (0.97 to 1.05)	
5 (Most deprived)	1		1	
		0.6		0.2
<b>UK Region</b>				
London	1		1	
East Midlands	0.97 (0.79 to 1.20)		0.90 (0.72 to 1.14)	
East of England	1.00 (0.91 to 1.09)		1.01 (0.94 to 1.07)	
West Midlands	1.01 (0.92 to 1.10)		1.04 (0.97 to 1.11)	
North East	1.09 (0.96 to 1.22)		1.00 (0.91 to 1.09)	
North West	0.98 (0.91 to 1.06)		1.00 (0.93 to 1.07)	
Yorkshire & Humber	0.83 (0.65 to 1.05)		1.01 (0.87 to 1.18)	
Northern Ireland	1.03 (0.93 to 1.14)		1.03 (0.96 to 1.10)	
Scotland	0.99 (0.92 to 1.07)		0.99 (0.93 to 1.06)	
South Central	0.99 (0.92 to 1.07)		1.01 (0.95 to 1.07)	
South East Coast	0.97 (0.89 to 1.07)		0.97 (0.91 to 1.04)	
South West	0.97 (0.89 to 1.06)		0.97 (0.89 to 1.04)	
Wales	0.91 (0.82 to 1.01)		0.96 (0.88 to 1.05)	
		0.6		0.7
<b>Registration status</b>				
Not newly registered	1		1	
Newly registered	0.95 (0.87 to 1.03)		0.96 (0.91 to 1.02)	
		0.2		0.2

\*RR = Unadjusted relative risk, estimated from Poisson regression

**Table s5:** Baseline characteristics of people with and without bipolar disorder between April 2000 and March 2013

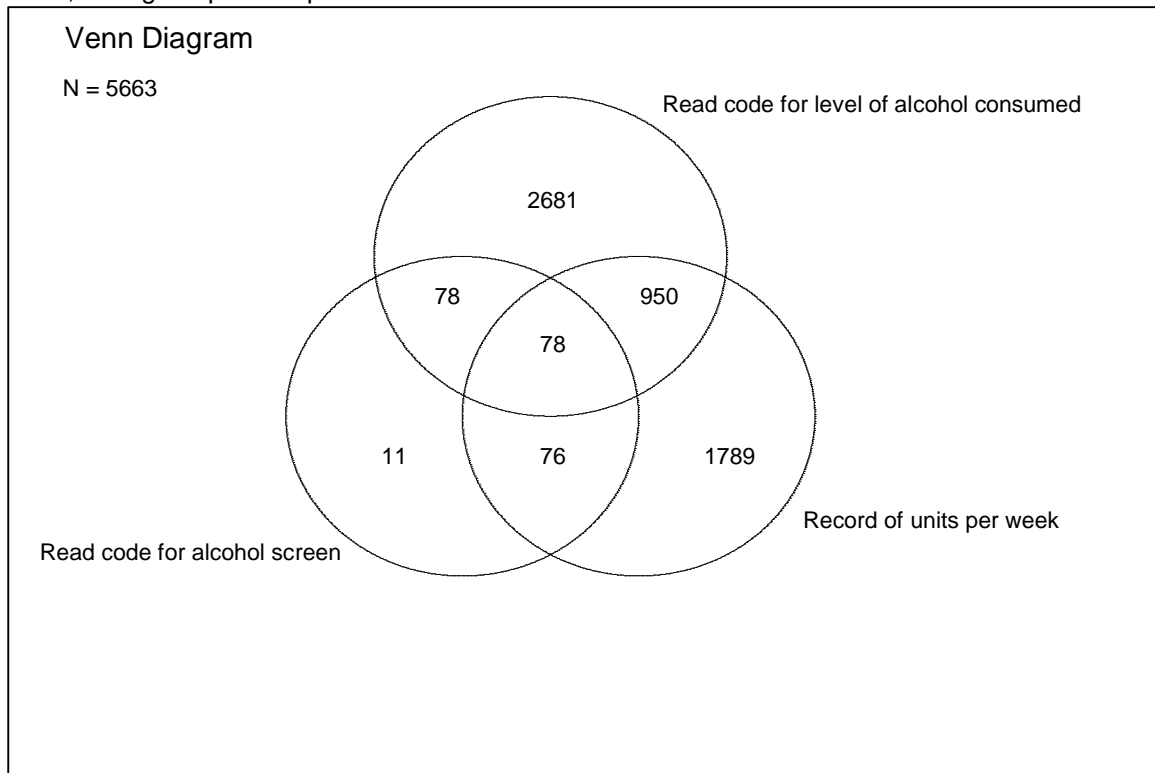
	People with bipolar disorder	People without severe mental illness
<b>Total individuals</b>	14,051	90,023
	<b>n (%)</b>	<b>n (%)</b>
<b>Gender</b>		
Men	5577 (39.7)	36223 (40.2)
Women	8474 (60.3)	53800 (59.8)
<b>Age, years</b>		
18-29	1927 (13.7)	12569 (14.0)
30-49	5968 (42.5)	38218 (42.5)
50-69	4402 (31.3)	28000 (31.1)
70-99	1754 (12.5)	11236 (12.5)
<b>Deprivation quintile</b>		
1 (Least deprived)	2574 (18.3)	21987 (24.4)
2	2674 (19.0)	20082 (22.3)
3	2987 (21.3)	19224 (21.4)
4	3217 (22.9)	17141 (19.0)
5 (Most deprived)	2599 (18.5)	11589 (12.9)
<b>UK region</b>		
London	1392 (9.9)	8786 (9.8)
East Midlands	520 (3.7)	3329 (3.7)
East of England	1089 (7.8)	6965 (7.7)
West Midlands	1055 (7.5)	6833 (7.6)
North East	457 (3.3)	2929 (3.3)
North West	1429 (10.2)	9256 (10.3)
Yorkshire & Humber	516 (3.7)	3291 (3.7)
Northern Ireland	418 (3.0)	2628 (2.9)
Scotland	1800 (12.8)	11310 (12.6)
South Central	1858 (13.2)	12008 (13.3)
South East Coast	1387 (9.9)	8709 (9.7)
South West	1371 (9.8)	9060 (10.1)
Wales	759 (5.4)	4919 (5.5)

**Table s6:** Unadjusted rate ratios for recording of alcohol consumption comparing people with and without bipolar disorder, according to time period

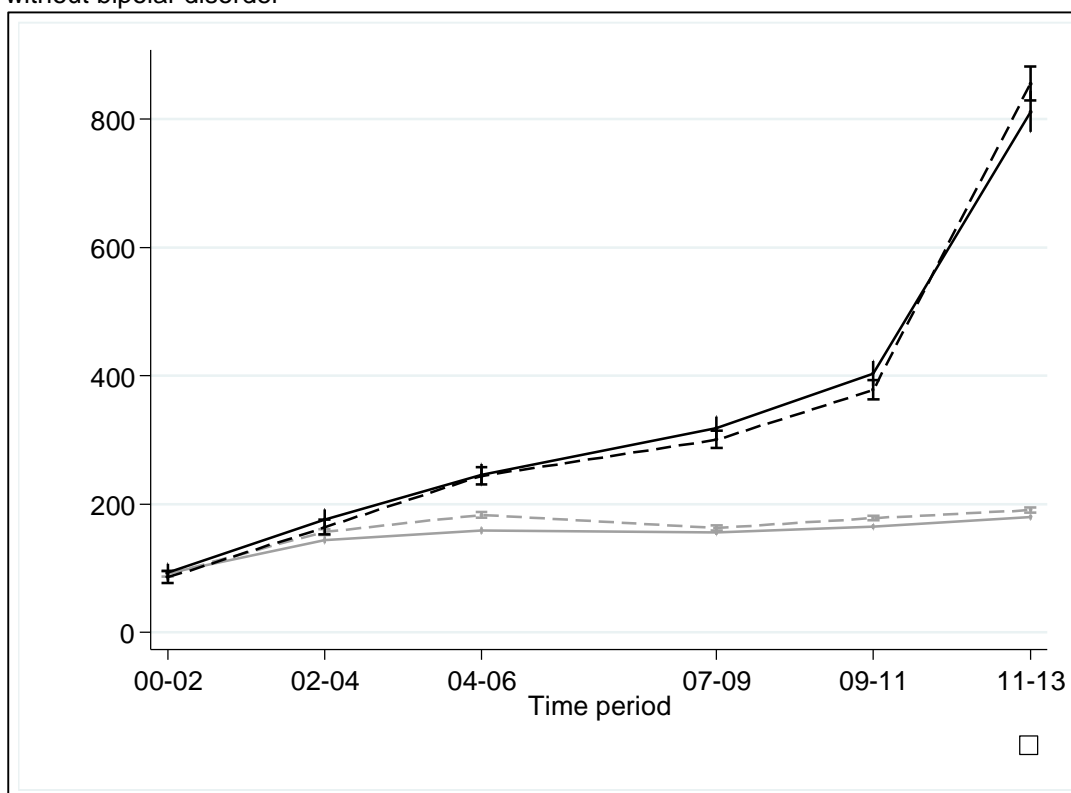
<b>Time period</b>	<b>Unadjusted rate ratio (95% CI)*</b>	<b>p</b>
<b>1 Apr 2000 - 31 Mar 2002</b>	0.97 (0.89 to 1.06)	0.5
<b>1 Apr 2002 - 31 Mar 2004</b>	1.11 (1.05 to 1.17)	<0.001
<b>1 Apr 2004 - 31 Mar 2006</b>	1.41 (1.33 to 1.50)	<0.001
<b>1 Apr 2007 - 31 Mar 2009</b>	1.92 (1.80 to 2.04)	<0.001
<b>1 Apr 2009 - 31 Mar 2011</b>	2.24 (2.12 to 2.38)	<0.001
<b>1 Apr 2011 - 31 Mar 2013</b>	4.49 (4.20 to 4.80)	<0.001

\*Unadjusted rate ratio for record of alcohol consumption, comparing people with bipolar disorder to people without severe mental illness

**Figure s1:** Venn diagram of the numbers of people with bipolar disorder with Read codes for level of alcohol consumed, Read codes for alcohol screening, and records of units of alcohol consumed per week, during the period April 2011 to March 2013



**Figure s2:** Rate of recording of alcohol consumption over time among men and women with and without bipolar disorder



KEY: Solid black line = men with bipolar disorder; Dashed black line = women with bipolar disorder; Solid grey line = men without severe mental illness; Dashed grey line = women without severe mental illness. Spikes with caps are 95% confidence intervals

### Supplemental material reference list

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