Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes

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ORIGINAL ARTICLE

Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study

C. Burton*, C. Simpson and N. Anderson

Centre for Population Health Sciences, University of Edinburgh, UK

Background. Depression is common in chronic illness and screening for depression has been widely recommended. There have been no large studies of screening for depression in routine care for patients with chronic illness.

Method. We performed a retrospective cohort study to examine the timing of new depression diagnosis or treatment in relation to annual screening for depression in patients with coronary heart disease (CHD) or diabetes. We examined a database derived from 1.3 million patients registered with general practices in Scotland for the year commencing 1 April 2007. Eligible patients had either CHD or diabetes, were screened for depression during the year and either received a new diagnosis of depression or commenced a new course of antidepressant (excluding those commonly used to treat diabetic neuropathy). Analysis was by the self-controlled case-series method with the outcome measure being the relative incidence (RI) in the period 1–28 days after screening compared to other times.

Results. A total of 67358 patients were screened for depression and 2269 received a new diagnosis or commenced treatment. For the period after screening, the RI was 3.03 [95% confidence interval (CI) 2.44–3.78] for diagnosis and 1.78 (95% CI 1.54–2.05) for treatment. The number needed to screen was 976 (95% CI 886–1104) for a new diagnosis and 687 (95% CI 586–853) for new antidepressant treatment.

Conclusions. Systematic screening for depression in patients with chronic disease in primary care results in a significant but small increase in new diagnosis and treatment in the following 4 weeks.

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Key words: Antidepressant treatment, coronary heart disease, diabetes, depression, screening.

Introduction

Patients with chronic illnesses, including coronary heart disease (CHD) and diabetes, have an increased prevalence of depression, with rates estimated to be 15–20% (Ali *et al*. 2006; Whooley *et al*. 2008), and this is associated with impaired quality of life (Moussavi *et al*. 2007). Much of this depression seems to be unrecognized or untreated (Pouwer *et al*. 2006). The finding that structured depression treatment in patients with chronic illness leads to benefit in terms of mood and well-being (Katon *et al*. 2004; Davidson *et al*. 2010) has led to recommendations to screen for depression (Lichtman *et al*. 2008; NICE, 2009*b*; IDF, 2011).

Within the UK, the Quality and Outcomes Framework (QOF), a nationally implemented pay-for-performance scheme (Doran *et al*. 2006), introduced routine annual screening for depression for all patients with CHD or diabetes in primary care in April 2006. This has been widely adopted by primary care practices, with 90% of eligible patients with CHD or diabetes in Scotland screened during the 2007–2008 contract year (ISD Scotland, 2011). This screening comprises a clinician [most commonly a practice nurse but sometimes the general practitioner (GP)] asking the patient two validated questions (Whooley *et al*. 1997), with additional questions or follow-up if either of the answers is positive. The two questions used are: 'During the last month, have you often been bothered by feeling down, depressed or hopeless?' and 'During the last month, have you often been bothered by having little interest or pleasure in doing things?' Screening is typically carried out as part of a chronic illness review consultation but may occur opportunistically at other times, including if a patient with CHD or diabetes presents with depression. Estimates of the diagnostic accuracy of two-item depression screeners suggest a sensitivity of 80–90% and a specificity of 60–80% (Whooley *et al*. 1997; Thombs *et al*. 2008*b*; Arroll *et al*. 2010).

* Address for correspondence: Dr C. Burton, Centre for Population Health Sciences, University of Edinburgh, Doorway 1 Medical Quad, Teviot Place, Edinburgh EH8 9AG, UK.
(Email: chris.burton@ed.ac.uk)

Despite this enthusiasm for screening patients with chronic illnesses for depression, there are questions about its usefulness (Thombs *et al*. 2008*a*; Ziegelstein *et al*. 2009; Pouwer, 2009). There have been no studies in which screening for depression in patients with CHD or diabetes by their usual professional (as opposed to by researchers) has been linked to depression outcomes. Qualitative studies have identified practical difficulties in detecting and dealing with depression in consultations for physical health problems (Coventry *et al*. 2011) and evidence from more general primary care studies suggests that screening for depression does not improve outcomes (Gilbody *et al*. 2005) and is unlikely to be effective without additional interventions (Thombs *et al*. 2008*a*; O'Connor *et al*. 2009; Pouwer, 2009; Ziegelstein *et al*. 2009).

We hypothesized that if screening for depression in patients with diabetes and CHD in routine primary care is effective, it should lead to more new cases being diagnosed and treated in the weeks following screening compared to other time periods. As screening, diagnosis and treatment of depression are routinely recorded in primary care, we sought to measure the impact of screening on the diagnosis and treatment of depression within a large primary care database using the self-controlled case-series method. Specifically, we aimed to test the impact of screening by comparing the incidence of new depression diagnosis and antidepressant treatment between the time period following screening and other times.

Method

Data sources

We examined data from the Primary Care Clinical Informatics Unit Research (PCCIUR) database held by the University of Aberdeen. The PCCIUR database comprises anonymized extracts from the General Practice Administration System for Scotland (GPASS) clinical information system. This was the most widely used general practice clinical database in Scotland at the time of the study and was used for issuing almost all prescriptions and recording clinical codes and demographic data. For the observation period of 12 months commencing 1 April 2007, it contained data from 1280840 patients registered with 237 general practices containing 1245 GPs. The patients registered with these practices have been found to be representative of the Scottish population (5.1 million) (Elder *et al*. 2007). The study was approved by the PCCIUR steering committee. As an anonymized database was used for this research, ethical committee approval was not required.

Subjects and exposures

The sample in our study comprised all patients in the PCCIUR database during the observation period who met three criteria: (1) a recorded diagnosis of CHD and/or diabetes (Read codes in the online Appendix) before the study start date; (2) a record of screening for depression either once or twice during the study period; (3) either a new diagnosis of depression or initiation of an eligible antidepressant during the observation period. We deemed screening to have occurred if the records included the relevant Read code. As this code was used to measure QOF performance and hence influenced practice remuneration, practice staff were encouraged to record it whenever screening was carried out. Practices were not contractually required to code all new diagnoses of depression; if the diagnosis was entered in the text of the clinical record but not explicitly coded, we could not identify it. When GPs did code a new diagnosis of depression, they were contractually required to carry out, and record, a formal assessment of severity (Moore *et al*. 2009; Burton *et al*. 2012). For this reason we used either a coded diagnosis of a depressive disorder or initiation of antidepressant treatment. Eligible diagnostic codes included pure depression and mixed anxiety and depression and are listed in the online Appendix. Both were deemed to be new if they were recorded during the observation period but not in the 12 months preceding this. As GPs sometimes recorded codes for depressive symptoms (such as 'low mood'), we carried out a sensitivity analysis that included these. Eligible antidepressant drugs included those commonly used for depression, including selective serotonin reuptake inhibitors (SSRIs) and most serotonin–norepinephrine reuptake inhibitors (SNRIs), but excluded antidepressant drugs that are commonly prescribed for diabetic neuropathy and other painful conditions (amitriptyline and other tricyclic antidepressants and duloxetine) as these are no longer recommended for initial treatment of new depression (NICE, 2009*a*).

Exclusion criteria

For the primary analysis, we excluded patients who were diagnosed or began treatment on the same day as screening because we recognized that when a GP diagnosed or initiated treatment for a patient presenting with depression, they might record the patient as having been screened. We took this decision based on contextual knowledge of UK primary care: most

Table 1. *Contextual information used in interpreting diagnosis or treatment on the same day as screening*

(*a*) **Screening leading to diagnosis** Within UK primary care most routine diabetes care is carried out by primary care nurses working within general practices but autonomously from the general practitioners (GPs), who generally have fully booked clinic lists running in parallel with their nurses. This means that all but the most urgent cases for referral from nurse to GP are asked to make another appointment to see the GP, which will usually be on another day.
(*b*) **Diagnosis leading to apparent 'screening'** Under the Quality and Outcomes Framework (QOF) of the UK GP contract at the time of this study, if a GP made a diagnosis of depression this is required to be supported by completion of a validated assessment tool, usually the nine-item Patient Health Questionnaire (PHQ-9; Kroenke *et al*. 2001). If the GP completed the PHQ-9 then the computer system would automatically code the patient as having been screened (as the PHQ-9 includes the two designated screening questions). Even without coding a PHQ-9 score, a GP managing a patient presenting with depression who coincidentally had diabetes or coronary heart disease (CHD) could also include, and record, the screening questions as part of that process.
(*c*) **Exemption from screening** If a GP diagnosed or began treating a patient for depression but did not record them as screened at the time, they later exempt them from the contractual requirement to screen because they were already receiving treatment.

depression screening for patients with CHD and diabetes is carried out by nurses working semi-autonomously, whereas diagnosis and treatment (whether following screening or of patients presenting with symptoms of depression) is carried out separately by GPs. This contextual detail is expanded in Table 1. To test the effect of this assumption on our results, we conducted a sensitivity analysis that included patients who were screened and diagnosed on the same day.

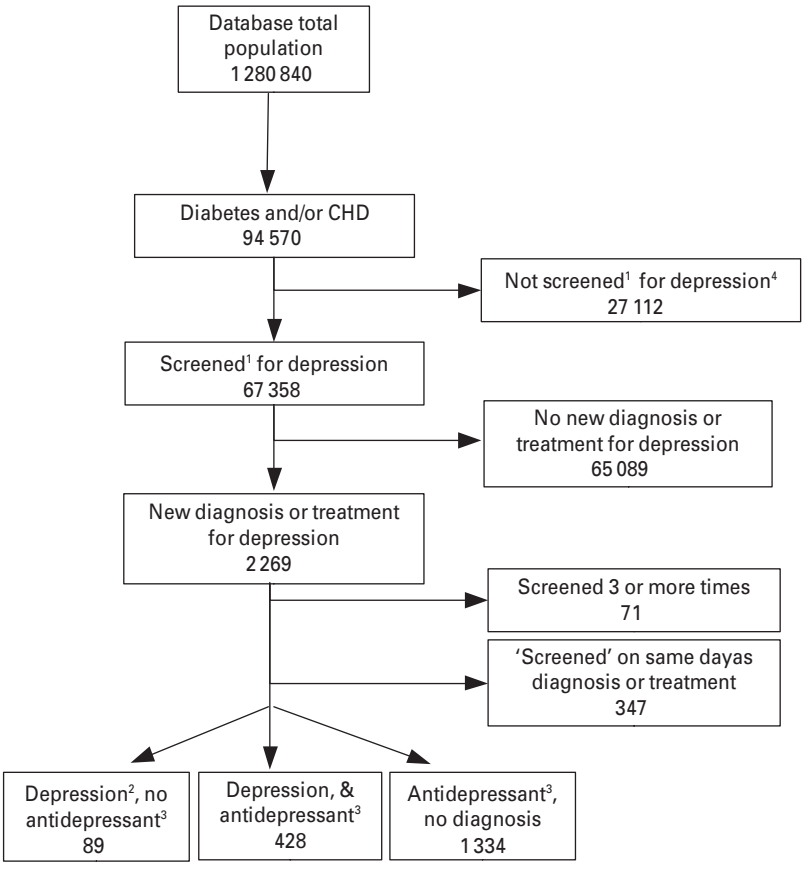
Statistical methods

We measured the relationship between screening and either a new depression diagnosis or antidepressant prescribing using the self-controlled case-series method. This method, which has been described extensively (Whitaker *et al*. 2006), investigates the association between a time-varying exposure (i.e. screening) and an event (i.e. depression diagnosis or treatment). By including only cases with both an exposure and an event, the temporal relationship between exposure and events can be examined for each individual, thereby controlling for inter-individual differences.

We reasoned that a new diagnosis or treatment following screening should occur within the exposure period defined as 1–28 days after the screening day. Therefore, we allocated all events (depression diagnosis or prescribing) occurring during the observation period to one of three categories: occurring before, during or after the exposure period following depression screening. We then determined the relative incidence (RI) of being diagnosed or treated for depression in this period compared to at other times. To illustrate the relative impact of screening, we also plotted bar charts in which each bar represented a 28-day block, with the central bar representing the exposure period of 28 days after screening and the remainder extending up to 20 weeks before and after this (data from the screening day were omitted). We checked the validity of using 28-day exposure period and blocks by examining weekly trends to ensure we did not lose data with this approach. For each patient we allocated their event (diagnosis or new treatment) to one 4-week block and calculated the event rate for each block as the number of events divided by the number of patients in the block.

We estimated the absolute impact of screening by determining the increased number of patients diagnosed or treated for depression in the 28 days after screening. This was calculated by dividing the observed number of diagnoses and treatments during the 4 weeks after screening by the RI and then subtracting this from the observed number of diagnoses to give the additional number of patients diagnosed or treated [with 95% confidence intervals (CIs)]. From this, we were able to calculate the number needed to screen to obtain one new diagnosis or treatment by dividing the total screened population by the additional number of patients diagnosed or treated.

We addressed the problem of patients with multiple screening events during the study period but only one new diagnosis or treatment in several ways. Where patients were screened twice in the year, we calculated the relative incidence based on the first recorded episode of screening. Patients who were screened three or more times were excluded because of the difficulty of choosing between screenings. In addition, we carried out two sensitivity analyses: first, we analysed only those patients with a single screening event and, second, we analysed the data using the screening event closest in time to the diagnosis of depression or



[1] Screening recorded in the 12 months study period
[2] New diagnosis of depression (relevant E.... or Eu... family read codes)
[3] Eligible antidepressants: all commonly used antidepressants except amitriptyline nortriptyline, imipramine and duloxetine.
[4] Includes 1438 patients diagnosed or treated for depression but who were not screened: 486 screened in the 3 months before the study, 182 exempted from screening, 169 coded for depression assessment but not screening and 601 patients with no apparent reason.

Fig. 1. Flow chart of entry into the study from the database.

antidepressant treatment. For the secondary analysis including patients with diagnosis or treatment on the same day as screening, we used this date. All analyses were conducted in R 2.14 (R Development Core Team, 2011); the self-controlled case-series analysis used the script published by the originators of the method (Whitaker *et al*. 2006).

Results

Patients and screening

At the start of the study period, 94 570 (7.4%) patients had a diagnosis of CHD or diabetes and, of these, 67 358 (71.2%) were screened at least once for depression during the study year. A total of 3707 (3.9%) patients with diabetes or CHD were either diagnosed with depression or began eligible antidepressant treatment during the year, of whom 2269 (61.2%) were screened for depression during the year. These patients were screened on a total of 2838 occasions; 1792 patients were screened once, 406 twice and 71 three times or more. Of those screened once or twice, 347 patients were recorded as screened on the same day they received a diagnosis of depression (233 patients) or began treatment (221 patients). These were excluded from the primary analysis. This left 1851 patients eligible for analysis, of whom 517 (27.9%) patients received a diagnosis of depression. Of these, 428 also received new antidepressant treatment and 89 did not. There were 1334 (72.1%) patients who started antidepressant treatment with no diagnostic code for depression. These data are summarized in Fig. 1. The demographic characteristics of included patients are listed in Table 2.

Impact of screening

A new diagnosis of depression was recorded between 1 and 28 days after the first screening during the study

Table 2. *Characteristics of patients screened and either diagnosed with depression or starting antidepressant*

	Patients	
	n	%
Age (years)		
<35	40	2
36–65	852	46
>65	959	52
Sex		
Male	804	43
Female	1047	57
Deprivation quintile		
1 (Least)	196	11
2	279	15
3	471	25
4	475	26
5 (Most)	430	23
Medical diagnosis		
CHD	1237	67
Diabetes	897	48
Both	293	16
Total	1851	

CHD, Coronary heart disease.

period in 103 (13.7%) patients who received a diagnosis within the study period (including on the same day as screening). Diagnosis was recorded before screening in 182 (24.3%) and more than 28 days after screening in 232 (30.9%). Antidepressant treatment was started between 1 and 28 days after the first screening in 225 (11.3%) patients receiving an antidepressant, before screening in 848 (42.8%) and more than 28 days after in 689 (34.7%). Figure 2 shows the relationship between first screening and diagnosis or starting treatment, excluding those patients recorded as screened and diagnosed or treated on the same day.

The RI for diagnosis in the 4 weeks after the first screening was 3.03 (95% CI 2.44–3.78) and for treatment the RI was 1.78 (95% CI 1.54–2.05). The absolute impact of screening and the corresponding results from the sensitivity analysis and the secondary analysis including patients with treatment or diagnosis on the same day as screening are shown in Table 3. The estimated figure of 69 (95% CI 61–76) additional diagnoses following screening accounted for 8.2% of all new diagnoses of depression in patients with CHD or diabetes in the year (including patients who were not screened). The comparable value for additional new treatment of 98 (95% CI 79–115) patients accounted for 2.8% of all newly initiated antidepressant treatments. Given the total population of patients screened in the study period of 67358, these figures equate to a number needed to screen for one new depression diagnosis of 976 (95% CI 886–1104) and for one new antidepressant treatment of 687 (95% CI 586–853) based on the first screening and excluding patients diagnosed or treated on the same day as screening.

The sensitivity analyses that included symptom codes in addition to depression diagnoses added 79 patients but made no difference to the results. The results of the analysis including patients diagnosed or treated on the same day as screening are shown in Table 3. When these patients were included in the analysis, the number needed to screen reduced to 232 for diagnosis and 203 for treatment.

Discussion

Summary of main findings

This is the first database study to examine the impact of systematic screening for depression in patients with chronic illness in a community setting. Although a new diagnosis of depression and initiation of antidepressant treatment were significantly more common in the 28 days after screening for depression, the absolute number of patients diagnosed with depression or beginning treatment after screening was small.

Strengths and weaknesses of this study

The large database used for this study is representative of the socio-economically diverse Scottish population (Elder *et al*. 2007). Records of CHD and diabetes diagnoses and screening are likely to be accurate because they are recorded as part of the QOF payment for performance scheme and subject to audit. The recording of a diagnosis of depression is subject to bias, such as different coding behaviours between practices: publicly available data show wide variation in coding rates between geographically similar practices within Scotland (ISD Scotland, 2011). Records of antidepressant treatment are likely to be complete because practices contributing to the database use computerized prescribing and the vast majority of antidepressant prescriptions in Scotland are issued in primary care, even when patients receive out-patient specialist care. Although some of the antidepressant prescribing may have been for indications other than depression, we excluded those antidepressants commonly prescribed for diabetic neuropathy and have no reason to suspect that screening for depression should affect any other indication for antidepressant treatment. Conversely, we may have missed some patients

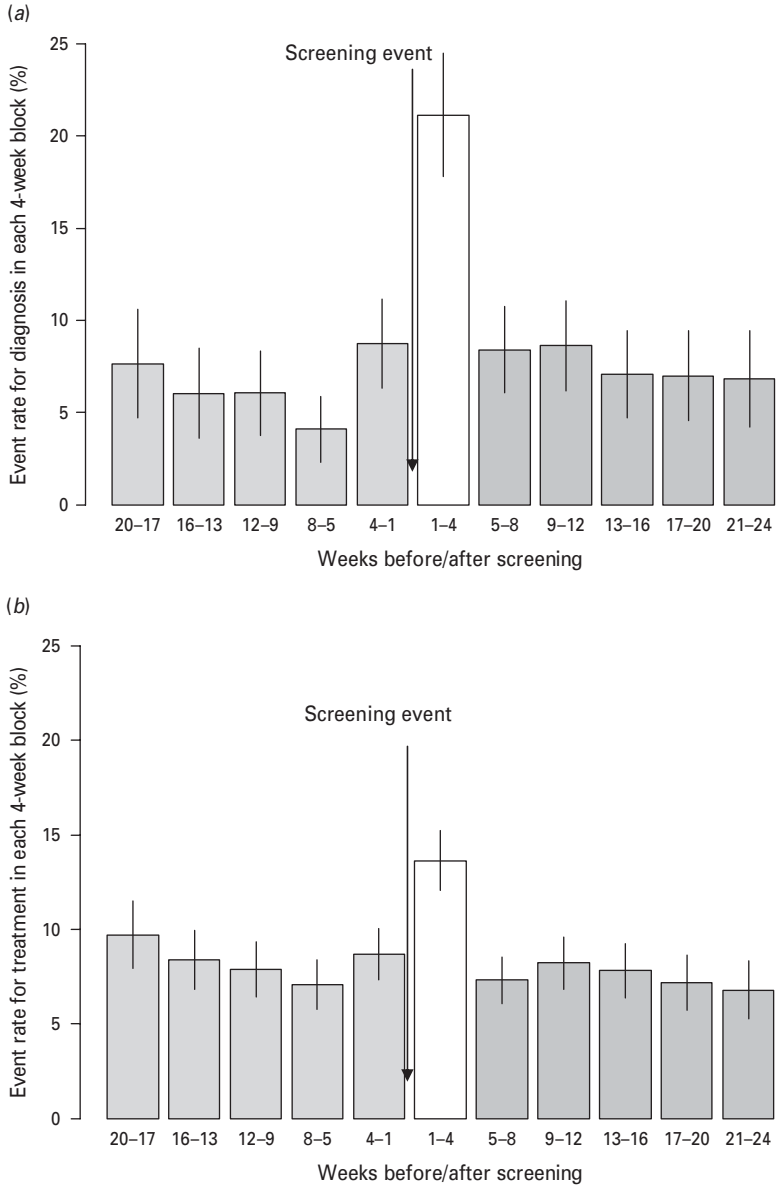


Fig. 2. The influence of screening on (*a*) diagnosis and (*b*) treatment. The event rate indicates the proportion of patients in each time period who were diagnosed or started treatment. The time periods more than 20 weeks before and 24 weeks after screening included smaller numbers of patients and have been omitted for clarity. Error bars indicate 95% confidence intervals (CIs). Patients diagnosed or starting treatment on the same day as screening were excluded. Data relate to the first screening episode in the study period.

who were prescribed ineligible antidepressants for depression; however, given that these agents are not recommended as first-line drugs (NICE, 2009*a*), this is unlikely to be important. We may also have missed patients who were diagnosed (but not coded) and referred for psychological treatment; however, drug treatment is prescribed for approximately 90% of patients managed with depression in UK primary care and a similar proportion (83%) was seen in our coded patients so it is unlikely that missing patients would substantially alter our findings. Our decision to use either antidepressant prescribing or a diagnosis of depression rather than diagnosis alone has been used previously (Burton *et al*. 2012), and although it differs from an English study using a different database (Moore *et al*. 2009), it reflects the fact that the PCCIUR database does not require participating practices to ensure all diagnoses are coded and is thus more representative of routine general practice.

We excluded patients from the primary analysis who were recorded as screened on the same day that

Table 3. *Results of the sensitivity analysis using the self-controlled case-series method*

Analysis	Diagnosis of depression		Starting antidepressant	
	RI[a] (95% CI)	Absolute excess[b] *n* (95% CI)	RI[a] (95% CI)	Absolute excess[b] *n* (95% CI)
First screening only[c]	3.03 (2.44–3.78)	69 (61–76)	1.78 (1.54–2.05)	98 (79–115)
Patients only screened once[c]	2.92 (2.26–3.79)	49 (42–55)	1.73 (1.47–2.03)	77 (58–92)
Nearest screening to event[c]	2.91 (2.31–3.66)	63 (54–70)	1.88 (1.64–2.16)	116 (97–133)
Including cases diagnosed or treated on same day as screening	10.59 (9.15–12.24)	308 (303–312)	3.52 (3.18–3.92)	322 (308–335)

RI, Relative incidence; CI, confidence interval.

[a] RI from self-controlled case-series analysis during the 4 weeks after screening of the specified event compared to other times.

[b] Absolute excess in cases in the 4 weeks after screening relative to the 4-week blocks either side of this.

[c] Excludes patients diagnosed or commencing treatment on the same day as screening.

they were diagnosed with depression or began antidepressant treatment because contextual evidence suggested that, in many cases, screening would be recorded after a diagnosis or treatment in patients presenting with depression, either by the GP or in some cases by the GPASS computer system itself. In other cases it was not recorded, possibly because treatment was not for depression, possibly because treatment was for another condition such as an anxiety disorder, or simply because the practitioner did not think to do it. This influenced our findings, and the secondary analysis including these patients showed a greater impact from screening. To examine the assumption that it was more appropriate to exclude patients diagnosed or treated on the same day as screening, we reviewed all instances of screening and diagnosis on the same day. One hundred and seven patients were recorded as having screening, diagnosis and commencement of treatment all on the same day, which we regarded as more in keeping with the primary reason for consultation being depression. A further 126 patients only had screening and diagnosis entered on the same date; 80 of them had neither antidepressant treatment nor codes that would indicate assessment of a new episode of depression as stipulated in the QOF. This pattern was more suggestive of the GP entering a past diagnosis at the time of current screening. Of the remaining 46 treated patients with a new depression diagnosis on the same day as 'screening', 22 had already received their new antidepressant prescription before their 'screening' date, suggesting that some assessment of depression had already been made before the screening was coded. Although we show only a small direct effect of screening, we cannot exclude indirect effects of screening, such as raising awareness among patients, nurses and GPs.

Generalizability of findings

The UK QOF is one of the first provider schemes to include systemic screening for depression in a community population with chronic disease. Compared to the results of trials of screening plus coordinated care (Katon *et al*. 2004; Davidson *et al*. 2010), the number of new depression diagnoses and courses of treatment in our study are disappointing. However, a recent trial from tertiary diabetes centres in The Netherlands (Pouwer *et al*. 2011) showed only a non-significant increase in use of mental health care among patients after additional depression detection and no measurable effect on clinical outcomes. There are substantial barriers to the recognition of depression in the context of management of chronic illness (Coventry *et al*. 2011) and to the initiation of treatment when depression is not the patient's presenting complaint (Karasz *et al*. 2012). Previous systematic reviews have reported that screening for depression without additional care does not translate into improved outcomes (Gilbody *et al*. 2005; O'Connor *et al*. 2009); although we could not examine outcomes of treatment, the very small increase in patients commencing treatment after recognition suggests that any difference in outcomes would have been small.

Implications for policy, practice and research

Our findings suggest that screening for depression leads to a statistically significant but small number of patients being diagnosed or receiving treatment in the period following screening. By contrast, GP practices diagnosed new depression and commenced treatment independently of screening for almost 4% of patients with CHD and depression during the year; this figure compares favourably with the 2.2%

of the overall population who began antidepressant treatment during the same year (Burton *et al*. 2012). Together these results suggest, at least in health-care systems in which primary care practitioners deal with both physical and mental health problems, that screening for depression leads to little additional recognition or treatment of depression in chronic illness over standard care.

Given these findings we recommend careful consideration before further extension of screening for depression in patients with chronic illness. The screening instruments themselves are commendably brief and have reasonable predictive values, so it may be that the way in which they are used could be more effective. Raising the issue of depression in the context of a complex disease-monitoring consultation may mitigate against its usefulness (Coventry *et al*. 2011; Karasz *et al*. 2012), and it is possible that administering the screening questions separately from the consultation may lead to more cases being detected. As current methods of brief screening in routine consultations lead to few new cases being treated, financial incentives to promote screening may be better used elsewhere, for instance in promoting structured management for patients who are recognized (Katon *et al*. 2004).

Conclusions

Routinely implemented screening for depression in patients with CHD or diabetes leads to more cases being diagnosed and treated in the 4 weeks after screening than at other times. However, its absolute impact is small and health-care systems should consider the resource implications of current or additional screening for depression in patients with chronic disease.

Supplementary material

For supplementary material accompanying this paper visit http://dx.doi.org/10.1017/S0033291712001481.

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Declaration of Interest

All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from C.B.) and declare that they have no relationships with any companies that might have an interest in the submitted work in the previous 3 years, except that C.B. is a GP working under the General Medical Services (GMS) contract, which remunerates screening for depression.

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