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Abstract

Objectives

To evaluate the effects of Quality and Outcomes Framework (QOF) incentivised case finding for depression on diagnosis and treatment in targeted and non-targeted long-term conditions.

Design

Interrupted time series analysis

Setting

General practices in Leeds, United Kingdom (UK).

Participants

Sixty-five (58%) of 112 general practices shared data on 37,229 patients with diabetes and coronary heart disease (CHD) targeted by case finding incentives, and 101,008 patients with four other long-term conditions not targeted (hypertension, epilepsy, chronic obstructive pulmonary disease (COPD) and asthma).

Intervention

Incentivised case finding for depression using two standard screening questions.

Main Outcome Measures

Clinical codes indicating new depression-related diagnoses and new prescriptions of antidepressants. We extracted routinely recorded data from February 2002 through April 2012.

Results

New diagnoses of depression increased from 21 to 94 per 100,000 per month in targeted patients between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). The rate increased from 27 to 77 per 100,000 per month in non-targeted patients (OR 1.53; 1.46 to 1.62). The slopes in prescribing for both groups flattened to zero immediately after QOF

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was introduced but before incentivised case finding (p<0.01 for both). Antidepressant prescribing in targeted patients returned to the pre-QOF secular upward trend (Wald test for equivalence of slope, z=0.73, p=0.47); the slope was less steep for non-targeted patients (z=-4.14, p<0.01).

Conclusions

Incentivised case finding increased new depression-related diagnoses in people with diabetes, CHD and other long term conditions. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants. These trends resumed following the introduction of incentivised case finding with a modest deceleration in prescribing for non-targeted conditions. The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

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Article summary

Strengths and limitations of this study

Strengths

- Rigorous quasi-experimental design demonstrating policy effects on patient populations within a representative sample of general practices
- Further insights gained from comparison of trends in patient populations targeted and non-targeted by intervention

Limitations

- Relatively high 'signal to noise' ratio inherent in use of routinely recorded data may have diminished the magnitude of observed effects
- The absence of a control population of practices, making it hard to rule out possibility that concurrent national and local initiatives contributed to observed trends
- Lack of data on patient outcomes, such as recovery from depression or the appropriateness of treatment

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Background

Long-term physical conditions are associated with a high prevalence of depression; people with diabetes or CHD have a two to three-fold increased lifetime risk.[1 2] Such co-morbidity can make depression hard to recognise,[3 4] worsens the prognosis of both conditions [1 5 6] and increases healthcare and societal costs.[1 7] According to expected prevalence, 'usual care' by general practitioner under diagnoses depression by 30-50%.[8]

The UK National Institute for Health and Care Excellence (NICE) recommends case finding for depression in people with long-term physical conditions.[9 10] The Quality Outcomes Framework (QOF) for general practice correspondingly rewarded case finding for depression in all patients with a diagnosis of CHD or diabetes over 2006-13 through the use of two standard screening questions.[11] A designated clinical code indicating the use of screening questions was recorded in the patient record whenever the Patient Health Questionnaire-2 (PHQ2) was administered, irrespective of the responses. Practices were reimbursed according to the proportion of patients with a record of case finding in the preceding 15 months. This incentivised case finding has now been withdrawn from the QOF because of doubts over benefits.[12]

The impact of this policy has been uncertain. The effectiveness of financial incentives in changing clinical behaviour is limited[13] and pay-for-performance schemes often have unintended adverse consequences.[14] More specifically, a systematic review concluded advances in quality of care for long-term conditions included in UK QOF were modest.[15] There are few rigorous evaluations of the effects of pay-for-performance, given that controlled comparisons are rarely acceptable to policy-makers. Two interrupted time series evaluations of QOF have not shown any sustained effects on processes of care or clinical outcomes.[16 17] Whilst there are no coded data prior to the introduction of the case finding indicator, at face value the QOF did incentivise a change in practice given that around 86% of patients with diabetes and CHD have been coded as screened at least every 15 months since its inception.[18] Yet there is no evidence that case finding for depression in the absence

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of coordinated care systems improves patient outcomes.[19 20] A cohort study found a greater likelihood of a new diagnosis of depression and initiation of antidepressant treatment in the 28 days following QOF-incentivised case finding;[21] the longer term effects on the whole population eligible for case finding are unknown. There may be further unintended effects on populations with other long-term conditions not targeted by incentivised case finding. Examining quality of care across a number of conditions Doran et al found that improvements associated with QOF incentives occurred at the expense of small detrimental effects on aspects of non-incentivised care.[22]

We evaluated the effects of incentivised case finding on new depression-related diagnoses and new prescriptions of antidepressants in patient populations with long-term conditions targeted or not by financial incentives.

Methods

Study design

We used an interrupted time series design to evaluate the effects of incentivised case finding whilst accounting for underlying secular trends. We also compared trends in depression diagnosis and treatment between those patient populations targeted by incentivised case finding (diabetes and CHD) and other patient populations with long-term physical conditions not targeted by incentivised case finding (hypertension, epilepsy, COPD and asthma). Our rationale was that we would not expect outcomes in the non-targeted group to diverge from underlying secular trends.

Practices and participants

We invited all 112 general practices in Leeds to share anonymised patient data via the Data Quality Team of the then National Health Service (NHS) primary care trust. No distinction was made between users of different electronic records systems. Compared with English indicators the physical health of people in Leeds is generally worse and levels of deprivation

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are higher.[23] Recorded depression in adults is similar (both around 11%)[24] as is the last performance on the QOF incentivised case finding indicator (87% for Leeds over 2011-12 compared to England average of 86%).[18 25] We sought data on patients with diabetes and CHD targeted by case finding and data from other patients with the four comparator and non-target, long-term physical conditions from QOF registers. Patients with conditions in both targeted and non-targeted groups were excluded from non-targeted group analysis to avoid double counting. Therefore, any change in outcomes in the non-targeted group could not be attributable to individuals being screened because they had a targeted condition.

Data Collection

We collected retrospective, electronic data from February 2002 through April 2012 for patients aged 18 years and over. Data were extracted through a MIQUEST query. Participating practices consented to the extraction of anonymised patient data and did not need to take any further action.

We recognised that the diagnosis of depression was likely to be under-recorded in clinical records because of factors such as diagnostic uncertainty and patient preference. The recording of certain diagnostic Read Codes, such as 'depressive disorder,' automatically triggers alerts for further assessments required by QOF. Failure to meet these targets reduces practice income and hence coding behaviour may have changed. We therefore also searched for use of more sensitive but less specific Read codes such as 'low mood' or 'depressed mood' which are not assessed by the QOF and included these in our main outcome of diagnosis. We excluded codes related to postnatal depression.

Data on the prescription of licensed antidepressant drugs listed in British National Formulary section 4.3 were collected, with the exception of antidepressants judged by clinicians involved in the project (RF, AH, SA, KM) to be more commonly prescribed for other indications (e.g. amitriptyline and nortriptyline for neuropathic pain).[26]

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A complete list of clinical codes for each outcome measure is available as an electronic web appendix.

Data analysis

The denominators comprised the numbers of patients on practice registers for each financial year (starting 1st April) targeted by incentivised case finding (diabetes and CHD) and those not targeted (hypertension, epilepsy, COPD and asthma). We assumed that registered long-term condition populations would be relatively stable over each year. We took the number of registered long-term condition populations per practice as constant over each QOF year. The error from this in our subsequent analysis was negligible, as verified by sensitivity analysis.

For each targeted and non-targeted patient group, we analysed trends in new depression-related diagnoses and antidepressant prescribing. We also examined the uptake of case finding for depression. We recognised that these trends could relate to changes in coding as well as clinical practice; we mainly used their outputs to guide interpretation of the main outcomes. Data were aggregated by month for each of the 65 practices so that each time series is 123 months long (February 2002 to April 2012). Analysis was carried out at the practice level using a binomial regression based on the calculated numerators and the available denominators. Discontinuities were modelled at key dates: April 2004 for the introduction of QOF; and April 2006 for the introduction of incentives for case finding for depression. A further discontinuity was introduced at April 2007 to isolate exceptional behaviour noted during the QOF year April 2006 through March 2007. For each time period (February 2002 to March 2004; April 2004 to March 2006; April 2006 to March 2007; April 2007 to April 2012) the model has an overall constant and slope. Specific slope terms were dropped when they were found not to be statistically significant from zero at the 5% level. This permitted a more parsimonious model to facilitate interpretation.

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Results

We recruited 65 (58%) of 112 Leeds practices. Their 2012 QOF registers indicated that they served 37,229 patients with diabetes and CHD targeted for case finding for depression and 101,008 patients with other long-term conditions not targeted. Table 1 compares characteristics of recruited practices with those in England.

Practice-level analysis found significant increases in new coded case finding following the initiation of incentives, also reflected in aggregated city-wide level trends (Figure 1). Coded case finding increased exceptionally during 2006, especially for the targeted population. Comparing the period April 2004 to March 2006 with April 2007 to March 2012, rates of case finding increased in the targeted population from 0.07 to 7.45 per 1000 per month (OR 99.76; 95% confidence interval 83.15 to 119.68) and in the non-targeted population increased from 0.1 to 0.78 per 1000 per month (OR 7.54; 6.91 to 8.24).

Binomial regression of the practice level data confirmed statistically significant rate increases in new depression-related diagnoses in both patient populations. In targeted patients, the diagnosis rate increased from 21 to 94 per 100,000 per month between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). In non-targeted patients, the rate increased from 27 to 77 per 100,000 per month (OR 1.53; 1.46 to 1.62). In neither of these periods was the slope statistically significant from zero: that is the rates can be, and were, taken as constant during these periods. Figure 2 shows these trends aggregated at a city level.

Figure 3 shows the city-level trends for new antidepressant prescribing with fitted constants and slopes. Rates of prescribing increased over the full period of observation. During the period after QOF was introduced but before incentives (April 2002 to March 2004), the slopes for both populations flattened to zero ($p<0.01$ for both groups). For targeted patients, the slopes before the introduction of QOF and after the exceptional year were similar (Wald test for equivalence of slope, $z=0.73$, $p=0.47$). For non-targeted patients the slope for the latter period was less steep (Wald test for slope, $z=-4.14$, $p<0.01$). All Wald tests for slopes were undertaken using practice level data.

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Discussion

Incentivised case finding increased rates of new depression-related diagnoses in patients with CHD and diabetes and, to a lesser extent, in those with non-targeted long-term conditions. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants; these resumed following the introduction of incentivised case finding, although there was a modest deceleration in antidepressant prescribing for non-targeted conditions. Rates of new prescriptions for antidepressants exceeded those for depression-related diagnoses.

Quasi-experimental evaluations of QOF have found no sustained effects for other clinical indicators.[15-17] Financial incentives in primary care tend to have modest effects on relatively simple clinical behaviours such as risk factor recording or test ordering.[13] The nature of targeted clinical behaviours is likely to influence the effectiveness of incentives.[27 28] Given that the QOF incentives directly rewarded case finding, we sought and found evidence of changed clinical practice 'downstream' to case finding. Previous research has found associations between case finding for depression and both new diagnoses and antidepressant prescribing.[21 29] However, our analysis of longitudinal data demonstrates policy effects at a population level and highlights the importance of accounting for secular trends and additional insights from comparative data.

The mechanisms by which rates of depression-related diagnoses increased remains unclear. Following the introduction of incentivised case finding, rates of new depression-related diagnoses rose in non-targeted long-term conditions, coincident with only a modest rise in recorded case finding in these patients. Incentivised case finding may have directly affected pathways of care or, more generally, increased awareness of the higher risk of depression in all patients with long-term conditions. A combination of these explanations seems likely given that our parallel ethnographic study of general practices demonstrated the absence of a systematic approach to following up and managing screen-positive cases.[30]

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The interpretation of prescribing trends is more challenging. Taking pre-QOF trends into account, new prescriptions of antidepressants in patients with long-term conditions plateaued following the introduction of QOF before resuming the underlying trend in targeted conditions when incentivised case finding for depression was introduced. This plateau effect appears compatible with a view that the initial introduction of QOF diverted attention from psychosocial aspects of long-term condition care towards achieving biomedical targets.[31] It is also consistent with a longitudinal analysis of QOF in English general practice which found lower overall achievement rates for non-incentivised indicators compared to predicted values than for incentivised indicators.[22] Arguably, this might not represent a detrimental unintended consequence in the case of a potentially over-medicalised condition such as depression.[32]

The causes of on-going secular increases in antidepressant prescribing have been debated.[33 34] Hypotheses include poor compliance with clinical guidelines which do not recommend prescribing in the more commonly encountered mild to moderate depression,[29 35-37] an increase in duration of antidepressant prescribing in line with clinical guidelines rather than an increase in the number of patients prescribed for,[38] and the intensifying effect of QOF on prescribing patterns.[39] Our data included only the first prescription of any antidepressant for each patient, indicating that our observed trends are attributable to greater numbers of patients being treated rather than extended periods of prescribing. Therefore, our analysis supports the explanation that incentivised case finding perpetuated the rise in antidepressant prescribing because of a perceived need for clinical action over and above referral for counselling or watchful waiting.

The rate of antidepressant prescribing in this study exceeded the rate of diagnosis of depression in targeted and non-targeted groups, this trend was also reported by Burton and colleagues.[21] The limited use of clinical codes in the diagnosis of depression is recognised. Rather than a lack of diagnostic accuracy, it probably reflects how clinical coding is not always a part of routine practice and how GPs pragmatically prescribe according to symptoms and responses to treatment rather than diagnostic categories.[40 41]

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Whilst we drew upon published guidance in conducting this interrupted time series, [42 43] we identified four main limitations. First, the high 'signal to noise' ratio inherent in the use of routinely recorded data may have diminished the magnitude of observed effects.[44] Second, we were unable to examine patient outcomes, such as recovery from depression, nor the appropriateness of treatment. We explored the use of routinely collected referral data but these were unreliably recorded and prone to temporal changes in coding practices. Third, our analysis is based upon one geographical area. However, over half of the practices we approached agreed to share data for the study, their characteristics were broadly similar to those for England. Previous time series analyses have drawn upon self-selected general practices which contribute data to research databases;[16 17] the clinical behaviour of such practices may systematically differ from 'typical' practices in the UK. Hence, these time series might have been less able to demonstrate change beyond existing ceilings on performance. Studies evaluating effects of policy interventions on clinical behaviour need to ensure the representativeness of their general practice as well as their patient participants. Fourth, given the absence of a control population of practices, it is possible that concurrent national and local initiatives may have contributed to our observed trends. NICE issued a clinical guideline on depression in 2004, which was subsequently revised in 2009;[45] even allowing for delayed diffusion or anticipatory effects, it is unlikely to explain any changes we observed from 2006 onwards. Nor do the introduction of the Improving Access to Psychological Therapies programme in Leeds from 2008-09 onwards or publication of the NICE clinical guideline on depression in adults with a chronic physical health problem in 2009 offer plausible alternative explanations.[46 47] Furthermore, the isolation of the exceptional year when case finding incentives were first introduced permits us to infer with confidence that we observed sustained higher rates of diagnosis.

Given the sustained promotion of case finding for depression across a range of long-term conditions and for carers,[9 10 48] there is a need for clearer guidance to optimise the pathway and outcomes of care for case finding-detected depression, including limiting antidepressant

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prescribing to patients most likely to benefit. Any effects of incentivised case finding need to be considered alongside costs. Based on payments offered under the 2011-12 UK QOF contract and without considering opportunity costs, we estimate that case finding for depression in CHD and diabetes cost up to £6.3 million per annum. These costs, the limited benefits we found, and the withdrawal of incentivised case finding for depression demonstrate the risk of rolling out policies in the absence of rigorous supporting evidence. Although policy-makers express frustration when debates about evidence appear to hold back service improvement,[49] there are hazards in following assumptions about how and whether apparently simple but deceptively complex interventions such as incentivised case finding work.[50]

The impact of the withdrawal of QOF incentivised case finding for depression is not yet known. A retrospective longitudinal study suggested levels of performance remain stable across a range of clinical activities following the removal of QOF incentives, although all indicators studied were indirectly or partly linked to activities which remained incentivised.[51] The longer term effects of completely withdrawing an incentive, such as case finding for depression, on clinical behaviour is unknown and merits further research.

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What is already known on this topic
• Patients with long term conditions are at a higher risk of depression • There is limited knowledge about the population effects of incentivised case screening for depression in patients with long term conditions
What this study adds
• Incentivised case finding increased new depression-related diagnoses in people with long term conditions, including those not targeted by incentives. • The establishment of QOF disrupted rising trends in new prescriptions of antidepressants, which returned to earlier rates of increase in targeted conditions whilst modestly decelerating in non-targeted conditions • The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

Competing Interests Statement
All authors report grants from National Institute for Health Research under its Research for Patient Benefit Programme, during the conduct of the study.

Ethics Approval

This study was approved by the East Midlands - Derby 2 Research Ethics Committee (reference 11/EM/0144).

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analysis and interpretation of data, in the writing of the report, and in the decision to submit the article for publication. All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency Declaration

Dr Kate McLintock, the lead author (the manuscript's guarantor), affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Data sharing statement

Full dataset and statistical code available from the corresponding author at k.l.mclintock@leeds.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

Contributorship Statement

RF and AH conceived the project. RF was principal investigator. KM and SA designed the study. KM and AR were responsible for running the project. RW was responsible for statistical analyses. All authors interpreted the data and findings. KM wrote the first draft of the manuscript. RF commented on the first draft and all authors commented on further revisions. KM is guarantor of the paper.

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References

1. R D Goldney, P J Phillips, L J Fisher, et al. Diabetes, Depression and Quality of Life. Diabetes Care 2004;27:1066-70.

For peer review only

2. S J C Davies, P R Jackson, J Pokotar, et al. Treatment of anxiety and depressive disorders in patients with cardiovascular disease. BMJ 2004;328:939-43.
3. H Lester, A Howe. Depression in Primary Care: three key challenges. Postgrad Med J 2008;84(996):545-48.
4. J R T Davidson, S E Meltzer-Brody. The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion. J Clin Psychiatry 1990;60 (supplement 7):4-9.
5. R M Carney, K E Freedland, G E Miller, et al. Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. J Psychosom Res 2002;53:897-902.
6. M A Whooley, P de Jonge, E Vittinghoff, et al. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA 2008;300(20):2379-88.
7. G E Simon, W J Katon, E H B Lin, et al. Diabetes complications and depression as predictors of health service costs. Gen Hosp Psychiatry 2005;27(5):344-51.
8. G E Simon, M Von Korff. Recognition, management and outcomes of depression in Primary Care. Arch Fam Med 1995;4:99-105
9. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:8.
10. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009:8.
11. The NHS Information Centre for Health & Social Care. QOF clinical domain: depression. Secondary QOF clinical domain: depression 2013. https://mqi.ic.nhs.uk/IndicatorDefaultView.aspx?ref=1.07.04.
12. National Institute for Health and Clinical Excellence Special Health Authority Primary Care Quality and Outcomes Framework Indicator Advisory Committee. Confirmed minutes of the June 2011 QOF Advisory Committee: National Institute for Health and Clinical Excellence, 2011:23-24.
13. A Scott, P Sivey, D Ait Ouakrim, et al. The effect of financial incentives on the quality of health care provided by primary care physicians (Review). Cochrane Database of Systematic Reviews 2011;9.
14. L A Petersen, L D Woodard, T Urech, et al. Does Pay-for-Performance Improve the Quality of Health Care? Ann Intern Med 2006;145(4):265-72.
15. S Gillam, N Siriwardena, N Steel. Pay-for-performance in the UK: the impact of the quality and outcomes framework - a systematic review. Ann Fam Med 2012;10(5):461-68.
16. B Serumaga, D Ross-Degnan, A Avery, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ 2011;342:d108.
17. E Kontopantelis, D Reeves, J M Valderas, et al. Recorded quality of primary care for patients with diabetes in England before and after the introduction of a financial incentive scheme: a longitudinal observational study. BMJ Qual Saf 2013;22:53-64.
18. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, England level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9548&q=qof+depression&sort=Relevance&size=10&page=1#top.
19. S M Gilbody, T A Sheldon, A O House. Screening and case-finding instruments for depression: a meta-analysis. CMAJ 2008;178:997-1003.
20. E A O'Connor, E P Whitlock, T L Beil, et al. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Int Med 2009;151(11):793-803.
21. C Burton, C Simpson, N Anderson. Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study. Psychol Med 2013;43(3):529-37.

For peer review only

22. T Doran, E Kontopantelis, J M Valderas, et al. Effect of Financial Incentives on Incentivised and Non-incentivised Clinical Activities: Longitudinal Analysis of Data from the UK Quality and Outcomes Framework. BMJ 2011;342:d3590
23. Public Health Observatories of England. Health Profile 2012; Leeds. Health Profiles 2012. http://www.apho.org.uk/resource/view.aspx?RID=50215&SEARCH=L* (accessed 18 February 2014).
24. Public Health Observatories of England. Community Mental Health Profiles. 2013. www.nepho.org.uk/cmhp (accessed 18 February 2014).
25. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, PCT level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9592&q=qof+depression&sort=Relevance&size=10&page=1#top.
26. British National Formulary. 4.7.3 Neuropathic Pain. 2014; (7 February 2014). http://www.medicinescomplete.com/mc/bnf/current/PHP2814-neuropathic-pain.htm.
27. C Arditi, M Rège-Walther, J C Wyatt, et al. The effect of automatically generated reminders delivered to providers on paper on professional practice. Cochrane Database of Systematic Reviews 2012;12.
28. T Custers, J Hurley, N S Klazinga, et al. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv Res 2008;8:66.
29. B D Jani, D Purves, S Barry, et al. Challenges and implications of routine depression screening for depression in chronic disease and multimorbidity: a cross sectional study. PLoS ONE 2013;8(9):e74610.
30. S L Alderson, A Russell, K McLintock, et al. Incentivised screening for depression in patients with chronic heart disease and diabetes: an ethnographic study. (In preparation).
31. K Checkland, S Harrison. The impact of the Quality and Outcomes Framework on practice organisation and service delivery: summary of evidence from two qualitative studies. Qual Prim Care 2010;18:139-46.
32. C Dowrick, A Frances. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ 2013;347:f7140.
33. D Spence, I Reid. Head to Head: Are antidepressants overprescribed? BMJ 2013;346:f190.
34. T Kendrick. Letters: Where next for QOF? Killing the Quality and Outcomes Framework won't decrease prescribing for depression. BMJ 2013;346:f2742.
35. R C Kessler, P Berglund, O Demler, et al. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). JAMA 2003;289(23):3095-105.
36. H Dumesnil, S Cortaredona, H Verdoux, et al. General practitioners' choices and their determinants when starting treatment for major depression: a cross sectional, randomized case-vignette survey. PLOS ONE 2012;7:e52429
37. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:9.
38. M Moore, H M Yuen, N Dunn, et al. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. BMJ 2009;339:b3999.
39. S P MacBride-Stewart, R Elton, T Walley. Do quality incentives change prescribing patterns in primary care? An observational study in Scotland. Fam Pract 2008;25(1):27-32.
40. G Rait, K Walters, M Griffin, et al. Recent trends in the incidence of recorded depression in primary care. Br J Psychiatry 2009;195:520-254.
41. K J Joling, H W van Marwijk, E Piek, et al. Do GPs' medical records demonstrate a good recognition of depression? A new perspective on case extraction. J Affect Disord 2011;133:522-257.

For peer review only

42. Cochrane Effective Practice and Organisation of Care Group. Data Collection Checklist. In: Cochrane Effective Practice and Organisation of Care Group, ed. EPOC Resources. Ottawa, Ontario, Canada: University of Ottawa, 2002.
43. C R Ramsay, L Matowe, R Grilli, et al. Interrupted time series designs in health technology assessment: Lessons from two systematic reviews of behavior change strategies. Int J Technol Assess Health Care 2003;19(4):613-23.
44. C Brown, T Hofer, A Johal, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care 2008;17:170-77.
45. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009.
46. IAPT Programme. IAPT. Improving Access to Psychological Therapies. 2013. http://www.iapt.nhs.uk/ (accessed 18 February 2014).
47. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009.
48. Royal College of General Practitioners. Supporting Carers: An action guide for general practitioners and their teams. Second ed. London, 2013:26.
49. J Oldham. Reform reform: an essay by John Oldham. BMJ 2013;347:f6716.
50. P Craig, P Dieppe, S Macintyre, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
51. E Kontopantelis, D Springate, D Reeves, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. BMJ 2014;348:g330.

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Table 1 Comparison of recruited practice characteristics with England average.

	Recruited Practice Average	England Average
List Size (patients) [a]	7182	5987
Under 18 years (%)	20.7	20.5
65 years and over (%)	14.5	16.2
Number of GPs in the practice (mean) [b]	5.3	4.4
Male	2.5	2.4
Female	2.8	2
Indices of Multiple Deprivation [a]	25.8	21.97
Income Deprivation Affecting Children Index	22	20
Income Deprivation Affecting Older People Index	25.5	20
Patient Survey (%)[a]		
Would Recommend	83.2	85.9
Have a Chronic Disease	52.5	53.4
Carers	17.1	18.2
Working	61.7	60.1
Unemployed	5.76	5.2
QOF (%)[a]		
Total Score	98.8	98.5
Exception Rate	5.4	5.1
Chronic Disease Rates (%)[a]		
Coronary Heart Disease	3.6	3.4
Stroke/Transient Ischaemic Attack	1.7	1.7
Hypertension	13	13.9
Chronic Obstructive Pulmonary Disease	1.7	1.6
Hypothyroid	2.2	3.1
Cancer	1.7	1.7
Mental Health	0.1	0.8
Asthma	6	5.9
Heart Failure	0.7	0.7
Palliative Care	0.2	0.2
Dementia	0.5	0.4
Atrial Fibrillation	1.3	1.4
Cardiovascular Disease Primary Prevention register	1.4	1.7

[a] Public Health England. *Fingertips. National Public Health Profiles.* [Online]. 2012. [Accessed 28 January 2014]. Available from: http://fingertips.phe.org.uk/

[b] Health and Social Care Information Centre. *NHS Staff - 2001-2011, General Practice.* [Online]. 2012. [Accessed 28 January 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.

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Figure 1 Rates of coded case finding for depression in patients with targeted and non-targeted conditions over 2002-12

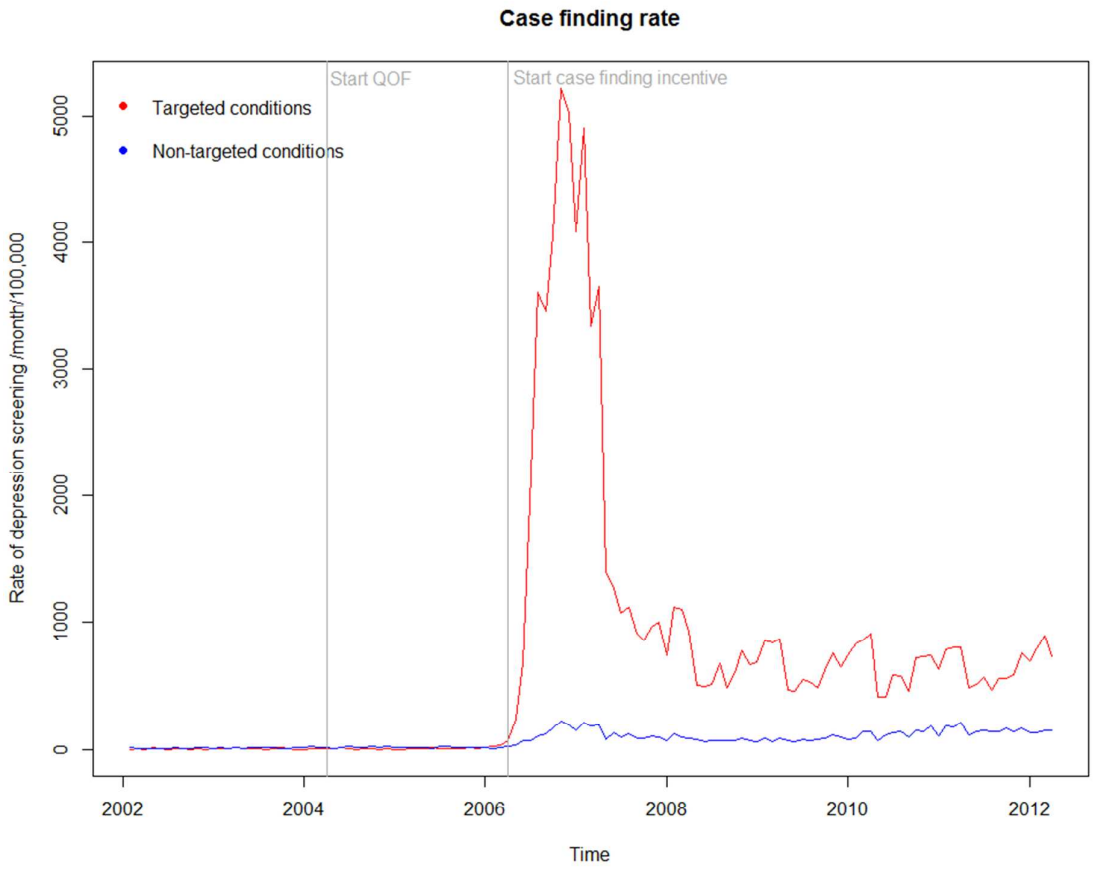


Figure 2 Rates of coded diagnosis in patients with targeted and non-targeted conditions over 2002-12

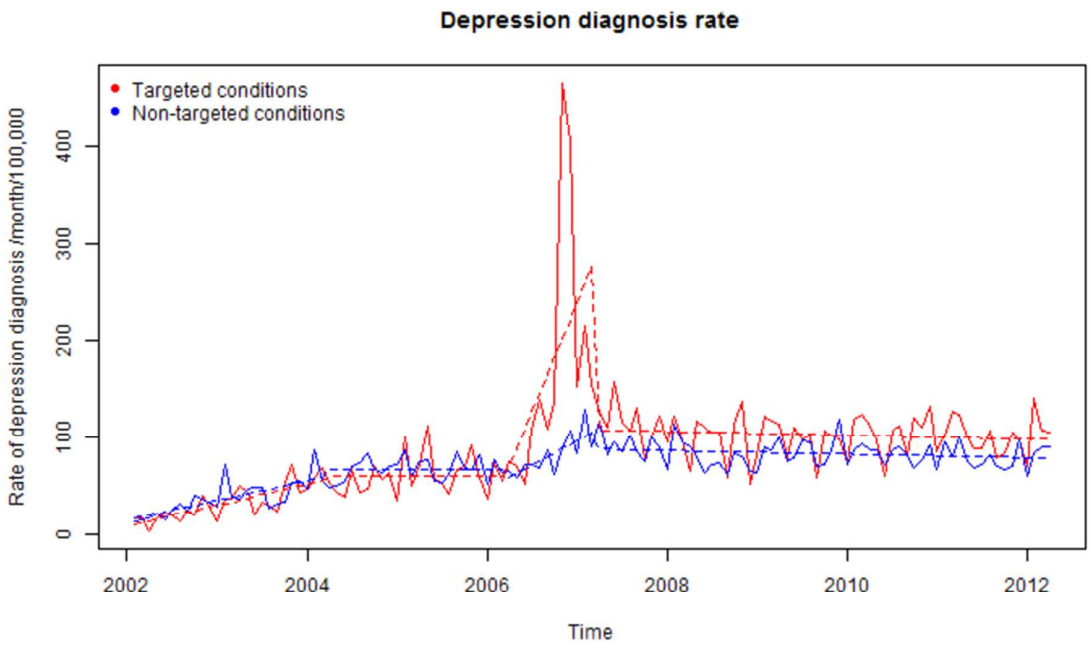
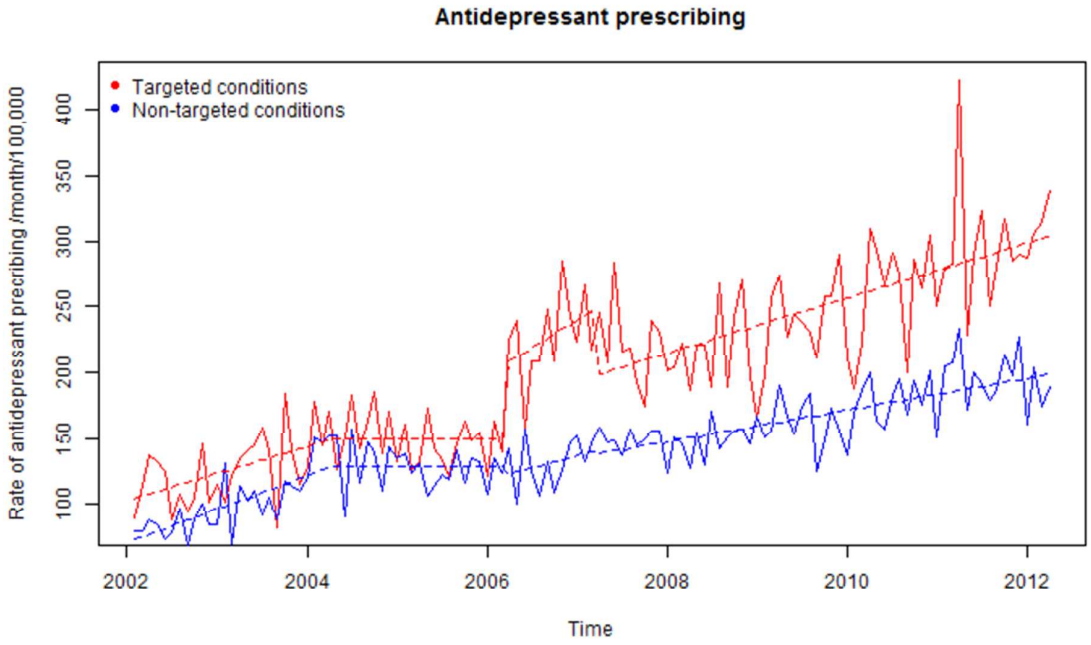


Figure 3 Rates of antidepressant prescribing in patients with targeted and non-targeted conditions over 2002-12



Electronic Web Appendix; clinical codes for each outcome measure

Table 1

Clinical codes for the diagnosis of depression recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
[X] Depression recurrent: [unspecified] or [monopolar NOS]	Eu33z
[X](Depressn: [episode unsp][NOS (& react)][depress dis NOS]	Eu32z
[X]Depress with psych sympt: [recurr: (named vars)][endogen]	Eu333
[X]Depression: [oth episode][atypic][single epis masked NOS]	Eu32y
[X]Depressive episode, unspecified	XE1Zb
[X]Depressn, no psych symp: [recurr: (named var)]/[endogen]	Eu332
[X]Mild depressive episode	Eu320
[X]Moderate depressive episode	Eu321
[X]Other depressive episodes	XE1Za
[X]Recurr depress disorder cur epi severe without psyc sympt	XE1Zd
[X]Recurrent depress disorder cur epi severe with psyc symp	XE1Ze
[X]Recurrent depressive disorder, current episode moderate	Eu331
[X]Recurrent depressive disorder, unspecified	XE1Zf
[X]Sev depress epis + psych symp:(& singl epis [named vars])	Eu323
[X]Sev depress epis, no psych: (& single [agit][maj][vital])	Eu322
[X]Severe depressive episode with psychotic symptoms	XE1ZZ
[X]Severe depressive episode without psychotic symptoms	XE1ZY
[X]Single episode agitated depressn w'out psychotic symptoms	XaCHr
[X]Single episode major depression w'out psychotic symptoms	XaCHs
Agitated depression	X00SQ
Atypical depressive disorder	E11y2
Chronic depression	E2B1.
Cotard syndrome	XSKr7
Depression NOS	XaB9J
Depression: [reactive (neurotic)] or [postnatal]	XE1aY
Depression: [single maj episode][agit][endogen (& 1st epis)]	E112.
Depressive disorder	X00SO
Depressive disorder NEC	E2B..

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Endogenous depression	X00SR
Endogenous depression - recurrent	XM1GC
Endogenous depression first episode	X00SS
Major depressive disorder	XSEGJ
Masked depression	X00SU
Mild depression	XaCIs
Mild major depression	XSGok
Mixed anxiety and depressive disorder	X00Sb
Moderate depression	XaCIt
Moderate major depression	XSGol
Post-schizophrenic depression	X00S8
Reactive depression	XE1YC
Reactive depressive psychosis	E130.
Recurrent brief depressive disorder	Xa0wV
Recurrent depression	E1137
Recurrent depression: [major episode] or [endogenous]	E113.
Recurrent major depressive episode NOS	E113z
Recurrent major depressive episodes	XE1Y1
Recurrent major depressive episodes, in full remission	E1136
Recurrent major depressive episodes, mild	E1131
Recurrent major depressive episodes, moderate	E1132
Recurrent major depressive episodes, severe, no psychosis	E1133
Recurrent major depressive episodes, severe, with psychosis	E1134
Recurrent major depressive episodes, unspecified	E1130
Recurrent major depressive episodes,partial/unspec remission	E1135
Seasonal affective disorder	X761L
Severe depression	XaCIu
Severe major depression with psychotic features	XSGon
Severe major depression without psychotic features	XSGom
Single major depressive episode	XE1Y0
Single major depressive episode NOS	E112z
Single major depressive episode, in full remission	E1126
Single major depressive episode, mild	E1121
Single major depressive episode, moderate	E1122
Single major depressive episode, partial or unspec remission	E1125
Single major depressive episode, severe, with psychosis	E1124

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Single major depressive episode, severe, without psychosis	E1123
Single major depressive episode, unspecified	E1120

Table 2

Clinical codes for the diagnosis of depression not recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
Anxiety with depression	Y5448
Depressed mood	XE0re
Symptoms of depression	XaLmU
C/O - feeling depressed	XM0CR
O/E - depressed	2257
[X]Recurrent depressive disorder	XE1Zc
Depression medication review	XaK6e
Depression annual review	XaK6d
Depression interim review	XaK6f
On depression register	XaJWh
Depression monitoring administration	XaMGL
Depression monitoring first letter	XaMGN
Depression monitoring second letter	XaMGO
Depression monitoring third letter	XaMGP
Patient given advice about management of depression	XaKEz
Depression worse in morning	761J
Depression management programme	Xaltx
Depression screen	Y6303
Depression screening	6891.
[X]Other mood affective disorders	Eu3y.
[X]Other persistent mood affective disorders	Eu34y
[X]Other recurrent mood affective disorders	XE1Zh
[X]Other single mood affective disorders	XE1Zg
[X]Other specified mood affective disorders	Eu3yy
[X]Persistent mood affective disorder, unspecified	Eu34z
[X]Persistent mood affective disorders	Eu34.
[X]Unspecified mood affective disorder	XE1Zi

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Adjustment reaction with anxious mood	E2924
Crying associated with mood	XM0Ar
Cyclic mood swings	XaAyL
Blunting of mood	Xa00z
Diurnal variation of mood	X761I
Dysphoric mood	XaKUk
Mood disorder	XE1Xy
Moody	Xa3Xf
Moody after illness	Y4284
Moody before illness	Y4236

Table 3

Antidepressant drugs

Drug Class	**Drugs included in search**	**Drugs excluded from search (and rationale)**
Selective serotonin reuptake inhibitors (SSRIs)	Citalopram Escitalopram Fluoxetine Fluvoxamine Paroxetine Sertraline	
Tricyclic and related antidepressants	Clomipramine Dosulepin Doxepin Lofepramine Trimipramine	Amitriptyline (neuropathic pain) Nortriptyline (neuropathic pain) Imipramine (nocturnal eneuresis)
Monoamine oxidase inhibitors (MAOIs)	Phenelzine Isocarboxazid Tranylcypromine Moclobemide	
Other antidepressant	Mirtazipine	Duloxetine (Stress incontinence or

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drugs	Venlafaxine Agomelatine Tryptophan Reboxetine	diabetic neuropathy) Flupentixol (psychoses)

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Evaluation of screening for depression in patients with coronary heart disease and diabetes in primary care

Investigators

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Summary

This work seeks to understand current practice in relation to Quality and Outcomes Framework (QOF) based screening for depression and assesses its impact, to inform the development of effective strategies to detect and treat depression associated with chronic physical disease.

Aim: To evaluate screening for depression associated with a chronic physical illness undertaken for QOF.

Objective 1: To assess the impact of QOF-driven screening for depression associated with chronic physical illness, by analysing routinely collected data to determine trends in diagnosis, treatment and referral rates for depression before and after the introduction of QOF.

Objective 2: To investigate the process of depression screening during routine patient reviews, and its relation to subsequent clinical management of patients with depression.

This protocol is concerned with the first of these objectives. Detailed development of the second objective will follow and form the basis of a further application for ethical review.

Funding Agency

National Institute for Health Research (NIHR) Research for Patient Benefit Programme (RfPB)

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Background

Chronic physical illness is associated with a high prevalence of depression; 33% in ischaemic heart disease (IHD)[1] and 24% in diabetes.[2] This co-morbidity can make depression hard to recognise,[3, 4] worsen the prognosis of both conditions[2, 5, 6] and increase healthcare and societal costs.[2, 7] Studies suggest that 'usual care' by general practitioners fails to detect between 30-50% of depressed patients.[8]

As a consequence NICE guidance has suggested, since 2004, that screening for depression should be undertaken in high-risk groups; this includes those with a 'chronic physical health problem with associated functional impairment.'[9] The Quality Outcomes Framework (QOF) for general practice has correspondingly rewarded screening for depression in all patients with a diagnosis of IHD or diabetes since 2006/2007 through the QOF DEP1 domain; 'the percentage of patients on the diabetes register and/or the IHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions' (PHQ2.)

QOF aims to bring about major improvements in the quality of primary care, it is based upon the idea that financial incentives improve GPs' adherence to evidence-based practice, and hence reduce inequalities in the delivery and outcomes of care. Critics of QOF argue that it undermines holistic patient care by encouraging a 'tick box' culture. Research so far indicates that QOF has improved the quality of care for some conditions but has also had unintended adverse consequences.[10] Routine data collected by The National Health Service (NHS) Information Centre for Health and Social Care indicates widespread adoption of incentivised screening under QOF by general practitioners (GPs) across England, with 92.6% of eligible patients screened in 2008/2009.[11]

Notwithstanding NICE recommendations and QOF initiatives, meta-analysis suggests screening alone does not improve recognition or management of depression.[12, 13] Published audit,[14] and analysis of local QOF-associated screening data by members of the research team, corroborate this finding. If QOF driven screening has not had a positive effect on detection and treatment of depression then this incentivised initiative may represent an inefficient use of limited NHS resources. With this in mind this project aims to evaluate the impact of QOF driven screening on depression care via an interrupted time series analysis. This assessment, along with a parallel ethnographic study to investigate the process of depression screening during routine patient reviews, will form part of an overall appraisal of whether primary care practice needs to change to take advantage of screening being

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undertaken through QOF, or should address the problem of comorbid depression by means other than the screen-treat model.

Aim

To evaluate screening for depression associated with a chronic physical illness undertaken for the Quality Outcomes Framework.

Objective

To assess the impact of QOF-driven screening for depression associated with chronic physical illness, by analysing routinely-collected data to determine trends in diagnosis, treatment and referral rates for depression before and after the introduction of QOF.

Research Questions

The following QOF indicator was introduced in 2006-7: The percentage of patients with diabetes and/or heart disease for whom case finding for depression has been undertaken on one occasion during the previous 15 months using the two standard screening questions. Has its introduction been associated with any changes in underlying trends of:

- Coded diagnoses of depression recorded in patient notes?
- Prescribing of drugs used for depression?
- Referrals to Primary Care Mental Health Teams (PCMHTs), Community Mental Health Teams (CMHTs) or psychiatrists?

Given the impracticality of addressing the study aims using a randomised design, a quasi-experimental time series analysis that makes full use of existing routine clinical data will be used. A similar approach has been used previously to examine the impact of QOF incentives[10] and time series analyses represent an acceptably robust evaluation design where randomisation is not feasible.[15, 16]

Time series analyses can be difficult to interpret, especially given, in this case, the lack of any one optimal outcome measure and the difficulty in ruling out alternative explanations for changes in trends. The study design will therefore address the following questions:

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- Over the period of analysis which initiatives relevant to depression, and not directly related to QOF, may have influenced these processes of care?
- Have there been any changes in trends of depression case finding, diagnosis, or the treatment of depression for people with other chronic diseases (e.g. hypertension, epilepsy, asthma, chronic obstructive pulmonary disease [COPD]) or within the wider general practice population?

By synthesizing the answers to these questions, it will be possible to make a transparent and empirically-informed judgement about the impact of the QOF DEP1 incentive for depression screening.

Methods

Study design

Time series analysis

Study Population

General practices within one PCT, NHS Leeds, will be approached with a request that the research team can collect and examine existing, routinely collected, anonymised clinical data from their electronic records systems.

All practices in NHS Leeds use electronic records systems to document consultations with patients, record diagnoses, for prescribing and to catalogue referrals. Electronic records systems vary in structure according to provider (TPP SystmOne, EMIS etc.) but all can be accessed remotely or locally and used to extract both identifiable and anonymised patient data. This function is utilised at a practice level and by PCTs to conduct audit, review and monitor practice and when analysing practice activity to calculate practice based payments (e.g. global sum, quality and enhanced services payments.) This project would tap into these existing data sets without any disruption to ongoing practice activity and without altering historical patient records or data.

Sampling Frame

It is planned that all 115 practices overseen by NHS Leeds will be approached and asked to participate in this research project. No distinction will be made between users of different

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brands of clinical records system. As such, assuming no problems are encountered during recruitment, the representativeness of participating practices should not be an issue.

Leeds is typical of UK cities in terms of social deprivation indices, demographics, characteristics of primary care services and distribution of common diseases such as IHD and diabetes. It is sufficiently large that it is believed data from the city will reflect practice in much of England and Wales.

Inclusion Criteria

- NHS general practice
- Overseen by NHS Leeds
- Uses electronic clinical records system
- Participates in QOF

Exclusion Criteria

- Non-NHS practice
- Outside the authority of NHS Leeds
- Does not use electronic clinical records system
- Does not participate in QOF

Recruitment

An agreement has been made with NHS Leeds Information in General Practice (IiGP) team to approach practices within the established, quarterly audit programme which is managed by the organisation. Practices are approached on an annual basis to participate in this programme and research data collection will be incorporated into customary audit data gathering; this fact will be made wholly transparent to practices. The quarterly audit reports are anonymised and information is gathered from the GP electronic records system by members of the IiGP team. This data extraction is performed remotely in the case of practices that use TPP SystmOne and locally, by team members visiting the practice, for users of all other clinical records systems. One member of our study team, and IiGP manager, Mrs. Karen Johnson, has confirmed that typically 113 of 115 practices in Leeds participate in the programme.

To formally arrange inclusion in the quarterly audit an application will be made to NHS Leeds using the 'audit application overview' form (appendix one.) This document details why data

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are required, what data will be collected, who will have access to it and be responsible for data analysis, what the intended outcome is, how the data will be destroyed, what support is required from the NHS Leeds IiGP team and individual general practices and what workload impact this will have on these agencies. If the application is accepted participant documents will then be made available to NHS Leeds by the research team. The IiGP team will send this correspondence along with the 'data extraction programme' which is mailed to practice managers (example, appendices two and three.) The 'data extraction programme' summarises the audits being conducted in the coming year and seeks practice level consent to participate in the audit programme as a whole. The participant documents provided will comprise a participant information sheet (appendix four) and consent form (appendix five.) The participant information sheet will summarise the research plan detailed in the audit application overview and seek practice level consent to participate in this research project. Practices give consent to participate in the quarterly audit programme by returning a signed data sharing agreement to NHS Leeds IiGP team, the separate consent form to cover data collection for this research project will make explicit the fact that one set of data is being collected for research purposes rather than to provide evidence for targets or assist with commissioning. The research consent form will be returned to NHS Leeds in the same way as the quarterly audit data sharing agreement before being collected by a member of the research team. As such it will be overt, through the participant information sheet and separate consent form, that practices are being recruited to and data collected for a research project managed by the University of Leeds.

This recruitment strategy will maximise participation and, hence, generalisability, because the study will use only anonymised patient data, there is little or no work required by practices to collect data, and no individual practices will be identifiable during aggregated data analysis. Over 90% participation has been achieved in a previous study using similar data collection methods.[17]

Originally, prior to the offer of inclusion in the NHS Leeds quarterly audit programme, an alternative approach to recruitment was considered; collecting anonymised patient data via TPP SystmOne only. Whilst, unlike other electronic records systems, SystmOne offers the ability to access anonymised data remotely this method of recruitment would exclude users of other these other electronic records systems, creating a potential source of bias.

Data Collection

Collecting anonymised data via NHS Leeds quarterly audit programme, utilising the skills and experience of the IiGP team, ensures a uniform and systematic approach to data

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gathering. A MIQUEST search of records systems to include all items listed in this section of the protocol will be designed by the research team in conjunction with the IiGP team. Using the existing audit programme also minimises the burden on practices and ensures negligible disruption and inconvenience is imposed by this research project. As noted previously, extracting data from the electronic patient record does not change the content of the medical notes or affect the function of the records system in any way.

The quarterly audit programme collects data on a three monthly basis for twelve months. It is not anticipated four episodes of data collection will be required. The data described below will be sought at the first collection point. It is not anticipated that revisions to the data collection agreement will be necessary, though if analysis reveals points or potential trends which require further investigation an amendment could be sought by submitting a request to NHS Leeds, recruited practices and the appropriate Research Ethics Committee (REC.)

This interrupted time series is evaluating the impact of the incentivised indicator QOF DEP1 introduced in 2006/2007: 'the percentage of patients on the diabetes register and/or the IHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions (PHQ2.)' The PHQ2 can be administered as part of regular, routine chronic illness reviews or opportunistically during other consultations; this is left to the discretion of the practice or individual clinicians. A specific Read Code, designated by QOF and which indicates the depression screening questions have been asked, is recorded in the patient record whenever PHQ2 is administered, whether the outcome of screening is positive or negative. If this code is detected on a search of the patient's electronic medical record within a fifteen month period the practice attains the QOF DEP1 target for that patient.
Based on this the following time points and outcome measures have been selected to investigate the impact of QOF DEP1.

Date

Data will be collected retrospectively at monthly intervals for the years 2002-2011. This time frame and frequency of collection has been chosen to allow a sufficient number of data points to be collected before and after the introduction of QOF in 2004/2005 and QOF DEP1 in 2006/7.

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Clinical codes

The Read code XaLIc, signifying 2 question screening for depression has taken place will be collected along with the following clinical codes which indicate that patients have been excepted from the QOF DEP domain. This strategy allows information relating to all patients eligible for inclusion in QOF DEP1 to be collected. Exception reporting was introduced to 'allow practices exclude specific patients from data collected to calculate QOF achievement scores' and avoid being penalised where this data collection is not possible.[18] Within the depression domain exception can be justified on the basis of patient refusal to participate or the individual being unsuitable for involvement in the incentivised activity.

Table 1: QOF DEP exception reporting codes

	Name	Clinical code	QOF Flag
QOF	Excepted from depression quality indicators: Informed dissen	XaLFr	In the DEPEXC QOF cluster
	Excepted from depression quality indicators: Patient unsuita	XaLFq	In the DEPEXC QOF cluster
	Exception reporting: depression quality indicators	XaLFe	

Codes which signify a diagnosis of depression has been made will also be collected to begin to assess the outcome of screening (appendices six and seven.) These codes for depression diagnosis are divided into those recognised by QOF and used to form a population of patients who should be subject to assessment of severity of depression at the outset of treatment (DEP2) and after 5-12 weeks (DEP3), and those which are not recognised by QOF. This distinction has been made as non-QOF codes may be selected by clinicians to avoid the further workload and financial implications should they fail to complete this work, associated with entering a code recognised by QOF. Codes relating to postnatal depression have been excluded.

In addition to the variation in choice of code it is recognised that a diagnosis may not be recorded in this way at all. This may be due to patient preference (e.g. not wanting a diagnosis of depression to be recorded in their notes) or clinicians deciding it would be inappropriate to code a diagnosis for clinical or financial reasons. Clinical codes alone, therefore, will have limited sensitivity to identify all patients with depression, though this should not affect the internal validity of the time series design.

Considering incidence and prevalence data both sets of figures will be collected at monthly intervals. Precise incidence data may not be available from electronic records systems due to the way data is entered. Therefore first or new episodes of each of the codes will be

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collected and used as a substitute measure of incidence. It is planned incidence data will be used to assess the impact of QOF DEP1 on rates of diagnosis and prevalence data considered as a measure of overall trends and potentially as a denominator when analysing prescribing rates, concerns about the inclusivity of clinical coding of diagnoses notwithstanding.

Prescribing

NICE clinical guideline 90 'depression in adults'[9] recommends selective serotonin reuptake inhibitors (SSRIs) are normally prescribed first line for depression. Data on prescription of all drugs in this class will be sought. Whilst other anti-depressants are prescribed less frequently they are recommended in specific circumstances, most significantly in chronic illness where poly-pharmacy and drug interactions are often a concern, as reported by NICE clinical guideline 91 'depression with a chronic physical health problem.'[19] Data on drugs included in this guideline, and other antidepressants licensed in the United Kingdom,[20] will be gathered independently from SSRIs in view of the more limited scope for prescribing. Medication licensed for the treatment of depression, but which is judged to be more commonly prescribed for other indications by the clinicians involved in this research project (Dr Kate McLintock, Dr Sarah Alderson, Professors Robbie Foy and Allan House), will be excluded from data collection. It is accepted that some antidepressants included in this data collection strategy have dual licenses and the underlying reason for which they are prescribed will not be determined. It is believed the approach to data gathering on prescribing outlined here, collecting data on first line SSRIs independently from that relating to other antidepressants and excluding agents largely used for other indications, will limit this bias. The table below uses the classification of antidepressants found in the British National Formulary section 4.3, antidepressant drugs.[20]

Table 2: Antidepressant drugs

Drug Class	Drugs included in search	Drugs excluded from search (and rationale)
Selective serotonin reuptake inhibitors (SSRIs)	Citalopram Escitalopram Fluoxetine Fluvoxamine	

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	Paroxetine Sertraline	
Tricyclic and related antidepressants	Clomipramine Dosulepin Doxepin Lofepramine Trimipramine	Amitriptyline (neuropathic pain) Nortriptyline (neuropathic pain) Imipramine (nocturnal eneuresis)
Monoamine oxidase inhibitors (MAOIs)	Phenelzine Isocarboxazid Tranylcypromine Moclobemide	
Other antidepressant drugs	Mirtazipine Venlafaxine Agomelatine Tryptophan Reboxetine	Duloxetine (Stress incontinence or diabetic neuropathy) Flupentixol (psychoses)

Referrals

NICE clinical guideline 90 'depression in adults'[9] recommends low intensity psychological interventions for mild to moderate depression and high intensity intervention for moderate, severe or complex depression. As such referrals to Primary Care Mental Health Teams (PCMHT), Improving Access to Psychological Therapies (IAPT) therapists and Community Mental Health Teams (CMHT) or secondary care psychiatrists are important and regularly used management options for patients with depression and data will be gathered on these markers (appendix eight.) Both outpatient and inpatient referral data will be collected. Once again there may be some overlap between referrals for depression and other mental health problems; whilst the reason for initiating the referral will remain unknown the value of referral data as a marker of clinical activity around depression is felt to outweigh this limitation. Sensitivity analysis may be employed to examine this further during analysis of specific codes.

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Electronic records systems will be interrogated for referral data of this type and the research team will explore the feasibility of using practice-based data in study analysis. Based on the experience of Mrs Karen Johnson, member of the study team and IiGP manager, who has observed that recording of referrals can be inconsistent or incomplete, the research team have low expectations of the quality of this data and hence also plan to explore the utility of anonymised, routinely collected referral data from primary and secondary care providers. It is hoped this action will enhance the accuracy of referral data collected.

Patient Populations

Data on each of these outcome measures will be collected for patients allocated a clinical code signifying a diagnosis or IHD or diabetes (appendices nine and ten.) These codes are used to compile QOF registers of patients with diabetes and ischaemic heart disease, the individuals targeted by QOF DEP1. A clinical code search has been chosen in preference to the use of existing QOF registers held by practices in the recognition that such registers would not have been in existence, or only partially developed, prior to the introduction of QOF in 2004. As retrospective data collection for this research study dates from 2002 the use of a code search will identify the patient population in question in the most inclusive way. It is recognised that the introduction of QOF and increasing adoption of paper free practice by practices during the time period in question will have influenced the way practices record clinical codes and identify patient groups. The impact of these and other secular events will be considered during the discussion of data analysis. Data from these populations will be broken down by age, postcode (first four digits) and practice code when collected. These divisions may be maintained during analysis if they are found to be instructive; alternatively if the categories do not aid understanding of the data they will be disregarded. No patient identifiable information will be collected though practices may be identifiable by their practice code or postcode data, as such these data will be treated confidentially and it will be emphasised to practices that the research team are interested solely in general patterns and trends rather than individual practice activity.

Data will also be collected at a whole practice level and for up to four other chronic disease groups recognised by QOF; hypertension, epilepsy, asthma and COPD. As before the clinical codes recommended by QOF will be used to search for and identify those with these specified illnesses (appendices eleven, twelve, thirteen and fourteen.) All groups will be considered including and excluding those patients with coexisting diabetes or IHD as part of a sensitivity and exploratory analysis. These four groups are included as controls, patients who should not have been exposed to incentivised screening for depression. The control

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chronic illness of hypertension was chosen following the publication of an interrupted time series which concluded that the introduction of QOF had, 'no discernible effects on processes of care or on hypertension related clinical outcomes.'[21] As data on hypertension monitoring and management have already been examined for this patient group this study will assess whether there has been any intersection of other aspects of QOF incentivised care. The control chronic illnesses of epilepsy and asthma were chosen as being clinical domains covered by QOF for which there might be fewer concurrent diagnoses of diabetes and IHD as they do not share a common aetiology (e.g. cigarette smoking is implicated in stroke, cancer and chronic obstructive pulmonary disease), they do not share a physiological link (e.g. IHD and atrial fibrillation, hypertension or heart failure, diabetes and CKD) and for which, although mood disorder or emotional symptoms may complicate the illness, they are not a potential presenting complaint (e.g. hypothyroidism, dementia.) The research team recognised that through seeking to minimise any overlap in aetiology the potential confounding factor, of effect modifier, of age of onset of disease is introduced; asthma and epilepsy commonly presenting in childhood or early adulthood. Accordingly COPD was selected as a further chronic disease that whilst, as hypertension, having some crossover with IHD, is more commonly seen in older adults and frequently develops later in life.

Data for patients age 18 years and older will be gathered. This decision is based on QOF guidance which specifies QOF DEP1 which excludes patients under 18 years.[22] Whilst it is unlikely patients aged less than 18 years will hold a diagnosis of IHD or COPD there may be a significant number with diabetes, epilepsy or asthma and a small number with secondary hypertension. Applying a minimum age to the data collection strategy ensures information relating only adults, and therefore those with depression which would be principally managed in primary care, is analysed.

The limitations of these outcome measures are recognised. Whilst clinical code data is relatively specific it lacks sensitivity, prescribing and referral data have limited sensitivity and specificity. Despite this each of the objective markers described represent logical steps in the management of depression following diagnosis and will potentially generate signals indicating changes in practice following the introduction of QOF DEP1. Outcomes will be interpreted as a whole to build a more complete understanding of any changes identified.

Security Protocol and Handling of Data

Caldicott guidelines[23] are being followed; anonymised patient data is sufficient for the purposes of this project. Anonymised data will be collected by members of the IiGP team via a MIQUEST search and delivered to the research team. No direct access to patient records

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is required and identifiable information will not be handled at any time. Data will be transferred to the University of Leeds research team from the IiGP team via an encrypted memory stick which will be erased immediately after transfer of data to the N:Drive.

Anonymised data will be stored in a secure, password protected file on the N:Drive of the University of Leeds network. Only University of Leeds system administrators and research team members will be password holders; Professor Robbie Foy, Professor Allan House, Dr Kate McLintock, Dr Robert West, Dr Sarah Alderson, Dr Barbara Potrata and a research fellow employed to oversee both arms of the RfPB funded project. Holding the data securely on the shared N:Drive allows all team members to access and work on the data. To ensure transparency team members will be asked to revise the name given to any documents within the file each time they work on it to indicate the date the document was last amended. This will ensure only the most current document is referred to and an audit trail of changes is available.

Consent forms, and any other paper notes or documents, will be held securely in a locked cabinet in the University Of Leeds Institute of Health Sciences. Consent forms will bear a NHS Leeds practice code and will be stored in a separate locked cabinet to the code key. Again only the named members of the research team will have access to these files.

After three years all primary data and documentation relating to this study held in electronic or paper form, including primary data, will be deleted or shredded.

Data Management and Analysis

Data analysis will be led by Dr Robert West, Professor of biostatistics, and Dr Kate McLintock with input from Professor Robbie Foy and Professor Allan House.

The data will be analysed as an interrupted time series. The analysis for each outcome measure will be conducted in four steps. To summarise the data collection plan. Measurements will be made monthly for each of the outcomes. Outcome measures are Read codes for 2 question screening for depression, QOF recognised clinical codes for the diagnosis of depression and non-QOF codes for the diagnosis of depression, prescription of an SSRI or other antidepressant and referral to one of four agencies (PCMHT, IAPT, CMHT & secondary care.) Patients with up to four different chronic physical illnesses (hypertension, epilepsy, asthma and COPD) and the whole practice populations, minus without either diabetes or IHD, will be used as control groups to establish underlying temporal trends in diagnosis and management.

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Step 1: The data will first be aggregated over all practices and plotted graphically. This will indicate if a level change model or a slope change model is most appropriate. The control groups will also indicate if a more sophisticated underlying trend should be modelled, for example by regression splines or by higher order terms (for time).

Step 2: The interrupted time series analysis will look for evidence that depression case finding has had an effect over time, indicated by a statistically significant result in any of the outcome measures. It will include autocorrelation terms and adjust for general trends. The results of these tests will determine Step 4.

Step 3: A richer analysis will be investigated by permitting the extension of the models of Step 2 to include random effects term dependent on the general practice. The methodology will follow that of Pinhero and Bates.[24] This will reveal if the change of level or slope varies between practices: that is to what degree QOF-driven implementations vary by practice.

Step 4: If the results are not significant and there is no evidence that the introduction of QOF depression screening has affected the pre-existing trend, then no further analysis will be performed. If the results of either test are significant and there is evidence of an effect then this will be investigated further by using the coefficients from the time series analysis to compare the immediate and long term effects. Alternative explanations (other than QOF-driven screening for depression) will be actively explored and alternative explanations considered if any significant time trends are recognised. Potential sources of instrumentation bias or secular change at a local and national level identified to date, through discussion between research team members, communication with NHS Leeds and reference to guidelines, reports and published literature, are listed below. Ongoing awareness of any other initiatives during the time frame in question which may be influence rates of recorded diagnosis and treatment of depression will be maintained.

Table 3: Potential sources of instrumentation bias or secular change

Year	Local/PCT initiatives
2003/2004 to 2005/2006	Intensive training programme concentrating on clinical systems and clinical code training introduced. Intervention continued for approximately 2 years
2004/2005	Training in summarising to improve electronic coding and recording of data
2006	IM&T DES introduced, aimed to improve the quality of data recording
2007	Push for paperlight practice accreditation across Leeds (dates on which

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	individual practices were accredited are available from the PCT)
2008/2009	IAPT initiative introduced to Leeds
	National Initiatives
2004/2005	QOF introduced
2004	Choose & Book introduced
December 2004	NICE clinical guideline 23, 'Depression: management of depression in primary and secondary care,' published in December. (This guideline advocates screening for depression in 'high risk groups.' The definition of high risk included those with 'significant physical illnesses causing disability')
2005/2006	Choose & Book rolled out
2006/2007	**QOF DEP1 introduced**
October 2009	NICE clinical guideline 91, 'Depression with a chronic physical health problem'
October 2009	NICE clinical guideline 90, 'Depression: the treatment and management of depression in adults (update)'

Although an interrupted time series approach is the preferred method of analysis there are concerns about a 'weaning' effect. Indeed weaning may vary by practice and this could create larger problems in the analysis. If this difficulty is encountered a state space model (Kalman filter)[25] will be considered as an alternative.

Duration

Table 4: Duration of study

Activity	Estimated Duration
Recruitment	Month 1-3 (NHS Leeds existing time frame)
Data collection	Month 4-7
Data analysis	Month 8-14
Consensus development	Month 14-15
Write up	Month 15-16
Dissemination	Month 17-18

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Total estimated duration	*Eighteen months*

Follow up

It is not anticipated that any direct follow up will be required; indeed it will not be possible as only anonymised data will be collected from practice records.

Dissemination of Results

This research will be written up for publication in a peer reviewed journal and will be included in the PhD of one of the research team members, Dr Kate McLintock. It is intended that results will be shared within the University of Leeds Institute of Health Sciences and at national conferences.

Problems Anticipated

Recruitment of practices for primary care research is often considered challenging. As noted previously it is hoped the recruitment strategy described will maximise enrolment by using anonymised then aggregated data, minimising disruption to practices and employing a previously successful approach.

Interrupted time series analyses require a sufficient number of data points be collected pre and post intervention. Collecting monthly data from 2002-2011, with the QOF DEP1 being introduced in 2006/2007, will ensure ample data is available, with more than 20 points pre and post intervention.[26] The adequacy of data collection and consequent analysis has been discussed with Dr Robert West.

Project Management

Project management will be overseen by Dr Kate McLintock, with data analysis led by Dr Robert West and methodological input from Professor Robbie Foy and Professor Allan House.

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Ethics

Dominant issues such as obtaining consent and ensuring confidentiality through the use of anonymised, aggregated data have been discussed earlier in this protocol. It is not anticipated that this research poses any direct risk to participating practices or their patients. NHS ethics permissions will be gained via the Integrated Research Application System Coordinated System.

Appendices

Appendix one	-	'audit application overview' form
Appendix two	-	example letter of approach
Appendix three	-	example 'data extraction programme'
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Appendix six	-	depression clinical codes (QOF)
Appendix seven	-	depression clinical codes (non-QOF)
Appendix eight	-	referral clinical codes
Appendix nine	-	IHD clinical codes (QOF)
Appendix ten	-	diabetes clinical codes (QOF)
Appendix eleven	-	hypertension clinical codes (QOF)
Appendix twelve	-	epilepsy clinical codes (QOF)
Appendix thirteen	-	asthma clinical codes (QOF)
Appendix fourteen	-	COPD clinical codes (QOF)

1. Davies, S.J.C., et al., *Treatment of anxiety and depressive disorders in patients with cardiovascular disease.* British Medical Journal, 2004. **328**: p. 939-943.
2. Goldney, R.D., et al., *Diabetes, Depression and Quality of Life.* Diabetes Care, 2004. **27**: p. 1066-1070.
3. Lester, H., Howe, A., *Depression in Primary Care: three key challenges.* Postgraduate Medical Journal 2008. **84**(5): p. 545-548.

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4. Davidson, J.R.T., Meltzer-Brody, S. E., et al., *The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion.* The Journal of clinical psychiatry (Supplement), 1990. **60**(7): p. 4-9, discussion 10-11.

5. Carney, R.M., Freedland, K. E., Miller, G. E., Jaffe, A. S., *Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms.* Journal of Psychosomatic Research, 2002. **53**: p. 897-902.

6. Whooley, M.A., de Jonge, P., Vittinghoff, E., Otte. C., Moos, R., Carney, R.M., Ali, S., Dowray, S., Na, B., Feldman, M.D., Schiller, N.B., Browner, W.S., *Depressive Symptoms, Health Behaviors, and Risk of Cardiovascular Events in Patients With Coronary Heart Disease.* Journal of the American Medical Association, 2008. **300**(20): p. 2379-2388.

7. Simon, G.E., Katon, W.J., Lin, E.H.B., Ludman, E., Von Korff, M., Ciechanowski, P., Young, B.A., *Diabetes complications and depression as predictors of health service costs.* General Hospital Psychiatry, 2005. **27**(5): p. 344-351.

8. Simon, G.E. and M. Von Korff, *Recognition, management and outcomes of depression in Primary Care. Archives of Family Medicine*, 1995. **4**: p. 99-105.

9. National Institute for Health and Clinical Excellence, *Clinical Guideline 90. Depression: the treatment and management of depression in adults (update)*. 2009, National Institute for Health and Clinical Excellence, London.

10. Campbell, S.M., Reeves, D., Kontopantelis, E., Sibbald, B., Roland, M., *Effects of Pay for Performance on the Quality of Primary Care in England.* New England Journal of Medicine, 2009. **361**: p. 368-378.

11. The NHS Information Centre for Health and Social Care (2009) *Quality and Outcomes Framework 2008/2009. (http://www.ic.nhs.uk/statistics-and-data-collections/supporting-information/audits-and-performance/the-quality-and-outcomes-framework/qof-2008/09/data-tables/england-level-data-tables)*

Last accessed 7/7/10.

12. Gilbody, S.M., T.A. Sheldon, and A.O. House, *Screening and case-finding instruments for depression: a meta-analysis.* Canadian Medical Association Journal, 2008. **178**: p. 997-1003.

13. Dowrick, C., Buchan, I. , *Twelve month outcome of depression in general practice: does detection or disclosure make a difference? .* British Medical Journal, 1995. **311**: p. 1274-1276.

14. Subramanian, D.N. and K. Hopayian, *An audit of the first year of screening for depression in patients with diabetes and ischaemic heart disease under the Quality and Outcomes Framework.* Quality in Primary Care, 2008. **16**(5): p. 341-344.

15. Eccles, M., Grimshaw, J.M., Campbell, M., Ramsay, C.,, *Research designs for studies evaluating the effectiveness of change and quality improvement strategies.* Quality and Safety in Health Care, 2003. **12**: p. 47-52.

16. Ukomunne, O.C., Gulliford, M.C., Chinn, S., Sterne, J.A.C., Burney, P.G.J.,, *Methods for evaluating area-wide and organisation-based interventions in health and health care: a systematic review.* Health Technology Assessment, 1999. **2**(5): p. iii-92.

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17. Foy, R., Walker, A., Ramsay, C., Penney, G., Grimshaw, J., Francis, J.J., *Theory-based identification of barriers to quality improvement: induced abortion care.* International Journal for Quality in Health Care, 2005. **17**: p. 147-155.

18. The NHS Information Centre for Health and Social Care. *The Quality and Outcomes Framework Exception Reporting 2009/10*. 2010 [cited 2011 29/3/11]; Available from: http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework/the-quality-and-outcomes-framework-exception-reporting-2009-10.

19. National Institute for Health and Clinical Excellence, *Clinical Guideline 91: Depression with a chronic physical health problem*. 2009, National Institute for Health and Clinical Excellence, London.

20. British National Formulary 61. *4.3 Antidepressant drugs*. March 2011 17/3/2011]; Available from: http://bnf.org/bnf/bnf/current/3294.htm.

21. Serumaga, B., Ross-Degnan, D., Avery, A.J., Elliott, R.A., Majumdar S.R., Zhang, F., Soumerai, S.B.,, *Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study* British Medical Journal, 2011(342:d108).

22. The NHS Information Centre - QOF Business Rules team, *New GMS Contract QOF Implementation Dataset And Business Rules - Depression Indicator Set*, D.o. Health, Editor. 2010, Department of Health: London. p. 6.

23. Department of Health. Caldicott Committee. Chair: Dame Fiona Caldicott, *The Caldicott Committee. Report on the Review of Patient-IdentifiableInformation*, D.o. Health, Editor. 1997, Department of Health: London.

24. Pinheiro, J.C., Bates, D.M.,, *Mixed-Effects Models in S and S-PLUS*, ed. J. Chambers, Eddy, W., Hardle, W., Sheather, S., Tierney, L.,. 2000, New York: Springer.

25. Harvey, A., Koopman S.J., Shephard, N., ed. *State Space and Unobserved Component Models: Theory and Applications*. 2004, Cambridge University Press: Cambridge.

26. Cochrane Effective Practice and Organisation of Care Group. (EPOC). (1998) *Draft. EPOC Methods Paper. Including Interrupted Time Series (ITS) Designs in an EPOC Review*.

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Appendix One

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Information

IN GENERAL

Audit Project Initiation

Application Overview

NHS Leeds

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Name:	Kate McLintock
Title:	GP and Clinical Lecturer
Department:	Academic Unit of Primary Care, University of Leeds
Date:	29/3/11

1. **Why is the data required?**

To conduct a time series analysis investigating the process of QOF-driven depression screening during routine patient reviews, and its relation to subsequent clinical management of patients with depression. This work has been funded by the National Institute for Health Research Research for Patient Benefit Programme.

2. **What data is required?**

Retrospective data at monthly intervals for the years 2002-2011 is required. This time frame and frequency of collection has been chosen to allow a sufficient number of data points to be collected before and after the introduction of QOF in 2004/2005 and QOF DEP1 in 2006/7. This amount of data is necessary for analysis via the time series analysis method to take place.

Specific data required;

Clinical code signifying 2 question screening under QOF has taken place and related exception reporting codes

Clinical codes for diagnosis of depression; QOF depression registers and selected non-QOF codes (total and first or new episodes of each of the codes will be requested)

Prescribing data for specified antidepressant drugs

Selected clinical codes for referral to primary and secondary care mental health services

This data will be required for the following groups;

All patients in the practice age over 18 years, including those specifically on QOF diabetes, ischaemic heart disease, hypertension, epilepsy, asthma and COPD registers and all patients in the practice minus those on QOF diabetes and ischaemic heart disease registers.

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3. Who will have access to the data?

The research team comprises;

Professor Robbie Foy, Professor of Primary care, University of Leeds (principal investigator)

Dr Sarah Alderson, Clinical Lecturer in Primary Care, University of Leeds

Dr Kate McLintock, Clinical Lecturer in Primary Care, University of Leeds

Dr Robert West, Professor of Biostatistics, University of Leeds

Dr Barbara Potrata, Research Fellow, University of Leeds

Professor Allan House, Professor of Liaison Psychiatry, University of Leeds

Mrs Karen Johnson, Information in General Practice Manager, NHS Leeds

Electronic data and any resulting paper documentation will be stored securely at the University of Leeds. All electronic and paper documentation relating to this study will be destroyed after a maximum of three years.

4. What is the outcome you require?

Anonymised, routinely collected patient data from practices (as described in point two) will be analysed via time series analysis to determine trends in diagnosis, treatment and referral rates for depression before and after the introduction of QOF DEP1 (case-finding for depression in patients with diabetes and heart disease.)

5. What input / support do you require, either from the IiGP Team or the General Practice?

IiGP team;

a)Build a search strategy based on clinical codes and outcome measures provided by the research team

b) Conduct an anonymised search in each consenting general practice

c) Transfer the anonymised data to the research team

General Practice;

a) Consent to data sharing

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6. **What support will you, the PCT audit co-ordinator provide to either the IiGP Team or the General Practice?**

We will provide information as to the purpose of the research project, rationale for data collection and an outline of analysis. Any specific queries will also be answered. A summary of the results of the research project will be circulated to all participating practices where they indicate a wish to receive this.

7. **Who will be responsible for the data analysis?**

Members of the research team;

Professor Robbie Foy, Professor of Primary care, University of Leeds (principal investigator)

Dr Kate McLintock, Clinical Lecturer in Primary Care, University of Leeds

Dr Robert West, Professor of Biostatistics, University of Leeds

Professor Allan House, Professor of Liaison Psychiatry, University of Leeds

8. **Who will be responsible for supporting the practice with any queries regarding the purpose of the audit?**

Professor Robbie Foy, Professor of Primary care, University of Leeds (principal investigator) or Dr Kate McLintock, Clinical Lecturer in Primary Care, University of Leeds

9. **What future workload impact will this have, and on whom, e.g. General Practice and/or PCT?**

No future workload impact is envisaged.

10. **Required Quarter to be run (see Pg. 3); 1st .... 2nd .... 3rd .... 4th .... All ....**

Quarterly Audit Timeframe – 2010/11

Quarter 1 – July 2010	***No later than.....***
New audit / request for changes	1st April 2010
Audit Project Initiation	3rd May 2010
Codes agreed	17th May 2010
Draft queries written	31st May 2010
Queries tested	14th June 2010
Testing results validated	18th June 2010
Final queries run	1st July 2010 (start of Qtr1 audit run)

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Results submitted	23rd July 2010

Quarter 2 – October 2010	***No later than.....***
New audit / request for changes	1st July 2010
Audit Project Initiation	2nd August 2010
Codes agreed	16th August 2010
Draft queries written	30th August 2010
Queries tested	13th September 2010
Testing results validated	17th September 2010
Final queries run	1st October 2010 (start of Qtr2 audit run)
Results submitted	22nd October 2009

Quarter 3 – January 2011	***No later than.....***
New audit / request for changes	1st October 2010
Audit Project Initiation	1st November 2010
Codes agreed	15th November 2010
Draft queries written	29th November 2010
Queries tested	6th December 2010
Testing results validated	10th December 2010
Final queries run	1st January 2011 (start of Qtr3 audit run)
Results submitted	21st January 2011

Quarter 4 – April 2011	***No later than.....***
New audit / request for changes	3rd January 2011
Audit Project Initiation	1st February 2011
Codes agreed	14th February 2011
Draft queries written	28th February 2011
Queries tested	7th March 2011
Testing results validated	11th March 2011
Final queries run	1st April 2011 (start of Qtr4 audit run)
Results submitted	22nd April 2011

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If an additional audit is included in one or more quarters, each Practice must complete and sign a specific Data Collection Agreement giving consent for that particular audit to be carried out. Each Practice has the option to decline a new audit whilst still participating in the main audit run.

Application Summary (to be completed by member of the IiGP team)

1. Information required;

2. Is this information available elsewhere?

   Yes / No

3. Sample size;

4. Quarterly run;

   1st .... 2nd .... 3rd .... 4th .... All .... Not Confirmed ....

5. Summarised by;

6. Audit Co-ordinator;

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Appendix Two

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27th May 2010

Information in General Practice (IiGP)
Chief Information Officer's Department
2nd Floor, North West House
West Park Ring Road
Leeds
LS16 6QG

Dear Practice Manager

Re: NHS Leeds Quarterly Audit Programme 2010/11

Each year NHS Leeds has to report on services provided within General Practice. These reports are then used to provide evidence for local and/or national targets and to assist Practice Based Commissioning. The information is gathered by extracting anonymous data from the GP clinical system, and as in previous years these extractions will be carried out by the Information in General Practice (IiGP) team.

Once the attached Data Sharing Agreement is signed and returned to us, a member of the IiGP team will contact you to arrange a convenient time to visit the Practice and complete the audit. If you are a TPP SystmOne site, a visit will not be necessary as we can complete the audit remotely from the PCT. A full explanation of the audit process can be found on Page 3 of the Data Sharing Agreement.

The audits which will be completed quarterly during 2010/11 are;

- Smoking & Obesity
- Disease Registers
- Sexual Health & Contraception
- Learning Disabilities
- Childhood Immunisations & Vaccinations
- Vascular Risk
- Alcohol
- National Diabetes Audit *(completed annually)*
- Glaucoma
- Improving Access to Psychological Therapies (IAPT)
- Palliative Care
- 6-8 Week Newborn Health Check

The output of each audit will assist NHS Leeds in delivering a broad spectrum of healthcare services, meeting certain NHS reporting requirements and assisting Practice Based Commissioning.

In order for this work to be carried out, we are asking Practices to complete the attached Data Sharing Agreement (specifically Page 1 and Page 16) and return it to us by **Wednesday 23rd June 2010**. You can return the completed form to us by post (addressed envelope provided) or by fax (0113 3057398).

Please be assured that this work is being carried out in accordance with Data Protection and Caldicott Principles, and in agreement with the NHS Leeds Information Governance Department.

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The quarterly extractions will be carried out during;

- Qtr1 – July 2010
- Qtr2 – October 2010
- Qtr3 – January 2011
- Qtr4 – April 2011

Yours sincerely,

Information in General Practice Facilitators

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Appendix Three

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Data Extraction Programme 2010-2011

Practice Name:

Practice Address / Stamp:

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Section 1

Introduction

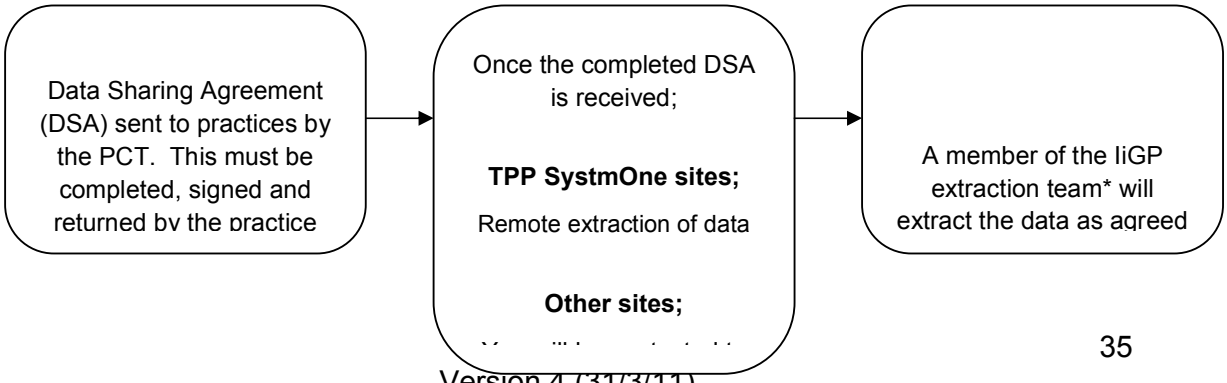
This is an agreement between the above named practice and NHS Leeds concerning participation in the audits listed in Section 2. NHS Leeds will use the requested data to address the health needs of the local population, and will develop and implement action to tackle significant and deep-rooted health inequalities within our city. Using outcome-focussed commissioning and targeted delivery, NHS Leeds will tackle health inequalities and deliver effective interventions for those most in need. This work is evident in our Vascular Disease and Long Term Conditions programmes, as well as action on the wider determinants of health, such as poverty and poor housing.

Local action to narrow the health gap has to be focused, evidence based, accountable and supported by performance management. The benefits of such action are medium and long-term, but there is also a need to make an impact in the short term. The focus is on the NHS contribution – helping those who already have disease and ensuring treatment reaches those who need it. The data extracted from Practices will enable in depth knowledge of disease prevalence and those potentially at risk of developing disease within later life. The data will be analysed and shared with Practices and used to further develop services for Leeds. Some aggregated information (not Practice specific) will be used as an input to the 'Vital Signs' process, which is used by the Department of Health and Health Care Commission as a key measure of NHS Leeds performance.

NHS Leeds will undertake to feed back the resulting analyses to the Practice and the associated Practice Based Commissioning Consortium (where applicable).

Data Collection Process

2010/11 Extraction Programme



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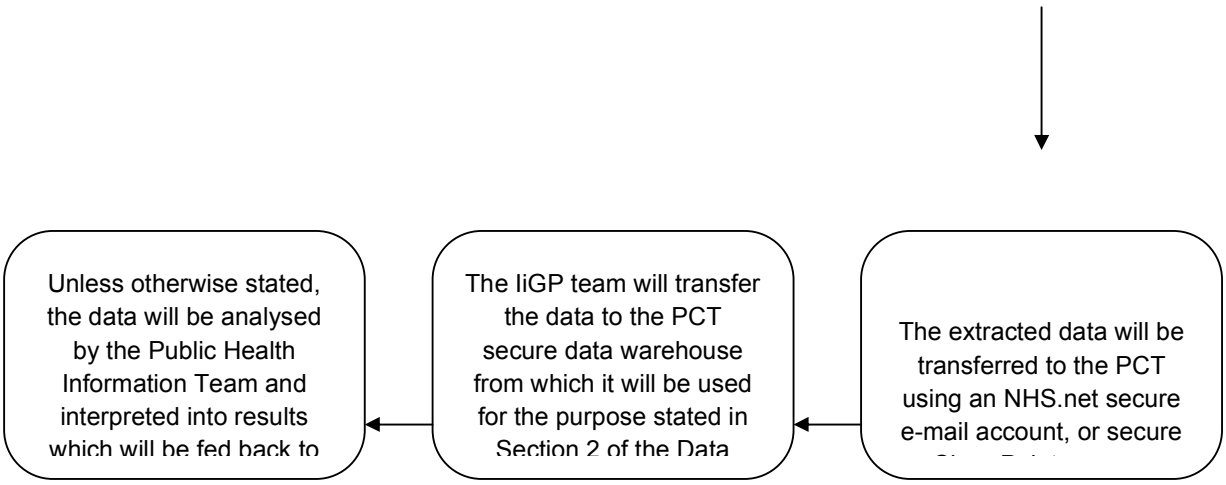

** Either Dominic Pickering, James Womack, Adam Taylor, Martel Henry or Stephanie Robinson*

Section 2

1. Smoking Audit

This data is extracted on behalf of the 'Staying Healthy' Department which is part of the Strategy & Commissioning Directorate.

Data items to be collected for the Smoking Audit;		
Age		
Sex		
Postcode (first four digits)		
Ethnicity	Code	Date
Latest Smoking Status	Code	Date
Latest Smoking Cessation Advice	Code	Date

Aims of the Audit

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- To retrieve patient anonymised data to provide baseline information for the NHS Leeds Operation Plan on routine recording of smoking status of all patients
- To assist the validation of data quality across patient disease management and assist in the planning of any corrective work that may be necessary
- To inform local decisions on commissioning additional smoking services based on local need in communities
- Completed quarterly

2. Obesity Audit

This data is extracted on behalf of the 'Staying Healthy' Department which is part of the Strategy & Commissioning Directorate.

Data items to be collected for the Obesity Audit;			
Age			
Sex			
Postcode (first four digits)			
Ethnicity	Code	Date	
BMI	Code	Date	Value
Height	Code	Date	Value
Weight	Code	Date	Value

Aims of the Audit

- To retrieve patient anonymised data to provide baseline information for the NHS Leeds Operation Plan on the recording of Body Mass Index (Height/Weight Ratio) of all patients
- To assist the validation of data quality across patient disease management and assist in the planning of any corrective work that may be necessary
- Completed quarterly

3. Disease Registers Audit

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This data is extracted on behalf of a number of NHS Leeds Departments and reported directly to PBC Consortia.

Data items to be collected for the Disease Register Audit;		
Age		
Sex		
Postcode (first four digits)		
Ethnicity	Code	Date
Asthma	Code	Date
Atrial fibrillation	Code	Date
Cancer	Code	Date
Coronary Heart Disease	Code	Date
Chronic kidney Disease	Code	Date
Chronic Obstructive Pulmonary Disease	Code	Date
Dementia	Code	Date
Diabetes	Code	Date
Heart Failure	Code	Date
Mental Health	Code	Date
Stroke and TIA	Code	Date

Data items to be collected for the Disease Register Audit – Hypertension;				
Age				
Sex				
Postcode (first four digits)				
Ethnicity	Code	Date		
Hypertension	Code	Date		
Blood pressure	Code	Date	Value 1	Value 2

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Data items to be collected for the Disease Register Audit – Cancer;		
Age		
Sex		
Postcode (first four digits)		
Ethnicity	Code	Date
Referrals for Chest X-Ray	Code	Date
Referrals to NHS Stop Smoking Services	Code	Date
Urgent Referrals for Bowel, Breast & Lung Cancer	Code	Date
Number of Lung Cancer cases	Code	Date

Aims of the Audit

- To collect patient anonymised data on the prevalence and treatment of people with disease in Leeds
- To assist the validation and assessment of data quality across patient disease management and risk and assist in the planning of any corrective work that may be necessary
- To provide patient anonymised baseline data and quarterly progress reports for the NHS Leeds Operation Plan and the Local Area Agreement
- To enable city wide comparison and gauge progress towards evidence based clinical practice
- Completed quarterly

4. Sexual Health & Contraception Audit

This data is extracted on behalf of the 'Staying Healthy' Department which is part of the Strategy & Commissioning Directorate.

Sexual Health services will be focused on improving outcomes in sexual health, including reducing the incidence of Sexually Transmitted Infections and improving reproductive health. Clearer evidence of uptake of services will help to prioritise future resources to those most at risk of the consequences of sexual ill health.

Data items to be collected for the Sexual Health and Contraception Audit;

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Age			
Sex			
Postcode (first four digits)			
Ethnicity	Code	Date	
Sexual Transmitted Infection Test	Code	Date	Age at event
Sexual Transmitted Infection Result	Code	Date	Age at event
Contraception	Code	Date	Age at event
STI Diagnosis	Code	Date	Age at event

Aims of the Audit

- To retrieve patient anonymised data to provide baseline information for the NHS Leeds Operation Plan on recording of sexual health and contraception information of all patients
- To enable city wide comparison and gauge progress towards evidence based clinical practice
- To assist in the assessment of data quality in relation to disease risk and assist in the planning of any corrective work that may be necessary
- To demonstrate the incidence of infections and contraception use, and inform the future commissioning and locations of sexual health service commissioned by the NHS Leeds, as well as helping to inform PBC
- Completed quarterly

5. Learning Disabilities

This data is extracted on behalf of 'Mental Health & Learning Disabilities' Department which is part of the Strategy & Commissioning Directorate.

Data items to be collected for the Learning Disabilities Audit;		
Age		
Sex		
Postcode (first four digits)		
Ethnicity	Code	Date
Learning Disabilities Diagnosis	Code	Date

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On Learning Disability Register	Code	Date
Learning Disabilities Health Action Plan Offered	Code	Date
Learning Disabilities Health Action Plan Completed	Code	Date
Health Ed. Testicular Examination	Code	Date
Breast Neoplasm Screen	Code	Date
Ca Cervix - Screen Done	Code	Date
Medication Review Done	Code	Date
Coronary Heart Disease Diagnosis	Code	Date
Diabetes Diagnosis	Code	Date
Mental Health Diagnosis	Code	Date
BMI	Value	Date

Aims of the Audit

- To provide a baseline to inform service planning, development and partnership working to reduce health inequalities experienced by learning disabled people
- To meet the requirements for NHS Leeds regarding the Yorkshire & Humber SHA Self Assessment & Performance Framework and Primary Care Service Framework: Management of Health for People with Learning Disabilities in Primary Care (2007)
- To formulate and implement a work plan to support primary care in meeting the health needs of learning disabled people
- To enable city wide comparison and gauge progress towards evidence based clinical practice
- To contribute to the SHA Annual Learning Disability Self-Assessment and Performance Framework submission, in particular the need to access disease prevention, screening and health promoting activities to the same extent as the rest of the population.
- To support the delivery of the action plan for improving health inequalities for people with learning disabilities devised as part of the annual self assessment, and to updating the Learning Disability Needs Assessment as part of the Joint Strategic Needs Assessment (JSNA).
- Completed quarterly

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6. Childhood Immunisations and Vaccinations

This data is extracted on behalf of the 'Health Protection' Department which is part of the Public Health Directorate.

Data items to be collected for the Childhood Imms & Vaccs Audit;			
Age (0 – 19 years)			
Sex			
Postcode (first four digits)			
Tetanus	Code	Date	Age at event
Diphtheria	Code	Date	Age at event
Polio	Code	Date	Age at event
HPV – Human Papillomavirus	Code	Date	Age at event
Pertussis	Code	Date	Age at event
Haemophilus Influenzae Type b (Hib)	Code	Date	Age at event
Pneumococcal	Code	Date	Age at event
Meningitis C (MenC)	Code	Date	Age at event
Measles, Mumps and Rubella (MMR)	Code	Date	Age at event

Aims of the Audit

- To retrieve patient anonymised data to provide information to confirm the number of children who have received an immunisation
- To confirm the number of vaccinations given to all children for each Practice, this will support the data provided by Child Health in Leeds
- To inform planning and development between Public Health and Primary Care to support the vaccination programme for Leeds
- To enable city wide comparison and gauge vaccination uptake across Leeds
- To support the process for payments within Leeds
- To support national reporting for all childhood immunisations for NHS Leeds
- Completed quarterly

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7. Vascular Risk

This data is extracted on behalf of the 'Innovation & Improvement' Department which is part of the Corporate Development Directorate

Data items to be collected for the Vascular Risk Audit;				
Age				
Sex				
Postcode (first four digits)				
Ethnicity	Code	Date		
Coronary Heart Disease	Code	Date		
Diabetes	Code	Date		
Stroke & TIA	Code	Date		
Chronic Kidney Disease	Code	Date		
Peripheral Arterial Disease	Code	Date		
Hypertension	Code	Date		
Atrial Fibrillation	Code	Date		
Family History of CHD/CVD	Code	Date		
Blood Pressure	Code	Date	Value 1	Value 2
Cholesterol	Code	Date	Value 1	
BMI	Code	Date	Value 1	
CVD Risk Score	Code	Date	Value 1	
CHD Risk Score	Code	Date	Value 1	
QRISK score	Code	Date	Value 1	
Framingham CHD Score	Code	Date	Value 1	
CVD Assessment Invitation	Code	Date		
CVD Risk Assessment	Code	Date		
Simvastatin	Code	Date		
Atorvastatin	Code	Date		

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Fluvastatin	Code	Date		
Pravastatin	Code	Date		
Lipid-Lowering Therapy	Code	Date		
Antiplatelet	Code	Date		
Anticoagulant	Code	Date		
Warfarin	Code	Date		
Glucose Level	Code	Date	Value 1	
Smoking Status	Latest in 15m	Date		
Alcohol Screen	Code	Date		
GPAQ	Code	Date		
Drug & Weight Man. Referral	Code	Date		
Health Education	Code	Date		
Review Codes	Latest in 15m	Date		

Aims of the Audit

- To collect patient anonymised data to identify the number of patients aged 40-74 who have either a CVD and/or CHD risk score
- To collect patient anonymised data to identify the number of patients without CVD who have a CVD risk score ≥ 20% over 10 years or CHD ≥ 15% over 10 years, and the risk reduction interventions offered to these patients
- To provide patient anonymised baseline data and quarterly progress reports for the NHS Leeds Operation Plan and the Local Area Agreement
- To enable city wide comparison and gauge progress towards evidence based clinical practice
- To assist in the assessment of data quality in relation to CVD risk and assist in the planning of any corrective work that may be necessary
- Completed quarterly

8. Alcohol

This data is extracted on behalf of the 'Staying Healthy' Department which is part of the Strategy & Commissioning Directorate.

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Data items to be collected for the Diabetes Audit;			
Age			
Sex			
Postcode (first four digits)			
Ethnicity			
FAST and AUDIT-C Screening	Code	Date	Value
Full Alcohol Screen	Code	Date	Value
Referral to Specialist Services	Code	Date	
Extended / Brief Advice	Code	Date	
Alcohol Status	Code	Date	
Alcohol Units	Code	Date	Value

Aims of the Audit

- To allow comparisons between the work carried out within the Alcohol & Drug Service and within Primary Care, to identify, for example, whether appropriate referrals are being made.
- To enable planning for future services across Leeds, and to establish which Primary Care providers could be approached for shared care services
- To assist in the evaluation of which areas of Leeds have the greatest need for additional services
- To enable additional work to be carried out to reduce hospital admissions
- Completed quarterly

9. National Diabetes Audit

The National Diabetes Audit (NDA) is run annually within General Practice on behalf of the 'NHS Information Centre for Health & Social Care' (NHS IC). Unlike the audits carried out directly for the PCT, the NDA extracts patient identifiable information and therefore requires specific approval to do so (under Section 251). The NHS IC has informed the PCT that an application for 'National Information Governance Board Ethics and Confidentiality Committee' (NIGB ECC) approval has been submitted and conditional approval has already been granted (May 2010), with full approval expected soon. Once full approval is granted, the Information Centre will contact

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Practices regarding preparation for the audit including the EEC approval number. Information will not be extracted without this approval.

If you require any further information on the National Diabetes Audit, please click;

http://www.ic.nhs.uk/services/national-clinical-audit-support-programme-ncasp/diabetes

If you require any further information on NIGB EEC approval, please click;

http://www.nigb.nhs.uk/ecc

Diabetes services will be focused on improving outcomes in diabetes, including reducing the number of complications due to disease exacerbations brought on by gaps in care provision. The audit uses NHS Number to link the patient to hospital activity and compiles data to ensure a single record and a complete patient journey is generated. The NHS Number is only visible at Practice level when used in conjunction with the data quality facility that is available to organisations submitting data. This view of the data is only available to those with appropriate access, approved by the relevant Caldicott Guardian for each organisation. The data available in the on-line analysis is anonymised and aggregated so that no patient level data can be viewed.

Data items to be collected for the Diabetes Audit;		
NHS Number		
Year Of Birth (translated to age band for analysis)		
Postcode (translated to super output area for analysis)		
Sex		
Ethnicity (translated to ethnic category for analysis)	Code	Date
Death Date		
GP Practice Code/NHS Organisation Provider Code		
Diabetes Type	Code	Date
Date Of Diagnosis		
BMI	Code	Date
HbA1c	Code	Date
Cholesterol	Code	Date

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Eye Exam	Code	Date
Foot Exam	Code	Date
Structured Education	Code	Date
Blood Pressure	Code	Date
Albumin	Code	Date
Creatinin	Code	Date
Smoking Status	Code	Date
Stroke And Cerebro-Vascular Accident	Code	Date
Hyperglycaemic Emergencies	Code	Date
Angina	Code	Date
Myocardial Infarction	Code	Date
Cardiac Failure	Code	Date
End Stage Renal Failure Requiring Renal Replacement Therapy	Code	Date
End Stage Renal Failure Requiring Renal Replacement Therapy	Code	Date
Ocular Retinal Photocoagulation	Code	Date
Minor Amputation (toe or below ankle)	Code	Date
Major Amputation (leg, above or below knee)	Code	Date

Aims of the Audit

- To inform local decisions on care delivery and commissioning services based on local need in communities.
- To retrieve patient data as above to provide baseline comparable information for the Practice, PBC Consortia, NHS Leeds, Regional and National Planning on Diabetes management along the whole patient journey
- Completed annually

10. Glaucoma

This data is extracted on behalf of the 'Healthcare Effectiveness & Equity' Department which is part of the Public Health Directorate

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Data items to be collected for the Glaucoma Audit;		
Age		
Sex		
Postcode (first four digits)		
Ethnicity	Code	Date
Glaucoma Diagnosis And Associated Codes	Code	Date

Aims of the Audit

- To collect patient anonymised data on the prevalence of people with glaucoma
- To provide information to support a Health Needs Assessment
- To inform local decisions on care delivery and commissioning services based on local need in communities
- Completed quarterly

11. Improving Access to Psychological Therapies (IAPT)

This data is extracted on behalf of the 'Mental Health & Learning Disabilities' Department which is part of the Strategy & Commissioning Directorate

Data items to be collected for the IAPT Audit;	
New diagnoses of depression (i.e. not diagnosed in preceding 12 months) and of at least 3 months duration	Count
New diagnoses of anxiety disorder (i.e. not diagnosed in preceding 12 months) and of at least 3 months duration	Count

Aims of the Audit

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- To retrieve patient anonymised data to provide information for the local Increasing Access to Psychological Therapies Programme
- To provide clearer evidence of the uptake of services this will help to prioritise future resources to those most at risk of the consequences of mental ill health
- To demonstrate the incidence of recognition of common mental health problems in primary care, and can be used to inform the future commissioning of Primary Care Mental Health Services by NHS Leeds as well as helping to inform PBC.
- Completed quarterly

12. Palliative Care

This data is extracted on behalf of the 'Commissioning Adult SRS & Palliative Care' Department which is part of the Strategy & Commissioning Directorate

Data items to be collected for the Palliative Care audit;		
Age		
Sex		
Ethnicity		
Postcode (first four digits)		
Palliative Care QOF	Code	Date
Cancer	Code	Date
Heart Failure	Code	Date
Dementia	Code	Date
Assessment	Code	Date
Place of death	Code	Date
Date of death		Date

Aims of the Audit

- To retrieve patient anonymised data to provide baseline information for NHS Leeds on routine recording of palliative care status

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- To collect patient anonymised data on the prevalence and management of palliative care treatment of people within Leeds
- To assist the validation of data quality across patient care management and assist in the planning of any corrective work that may be necessary
- To inform local decisions on commissioning additional services based on local need in communities
- To enable city-wide comparison and gauge progress towards the standards of care
- To demonstrate progress towards national palliative care targets
- To validate national palliative care data
- To determine the extent of palliative care in Leeds
- To identify any inequalities to help prioritise need.
- To identify the percentage of patients who may be recorded as dying in 'an institution' and the nature of that institution
- To identify the percentage of patients on the palliative care register who have a diagnosis of either cancer, dementia or heart-failure in the last 6 months.
- Completed quarterly

13. 6-8 Week Newborn Health Check

This data is extracted on behalf of the 'Children & Families' Department which is part of the Strategy & Commissioning Directorate

Data items to be collected for the 6-8 Week Health Check audit;		
Count of Eligible Babies	Count	
Count of Completed Checks	Count	

Aims of the Audit

- To retrieve a count of 6-8 week olds eligible for the health check during each reporting quarter
- To retrieve a count of completed health checks carried out during each reporting quarter
- To gather evidence in support of the delivery of the Healthy Child Programme
- Completed quarterly

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SECTION 3

NHS Leeds Responsibilities

- To facilitate the quarterly data audits and provide feedback reports as appropriate
- The patient anonymised data will be aggregated at NHS Leeds by the IiGP Team and analysed by the Public Health Information Team on behalf of the Departments identified in Section 2.
- Any comparative reports produced by NHS Leeds will be fed back to the Practices and the associated PBC Consortium, where applicable
- To adhere to the confidentiality guidelines laid out in Section 3 of this document

Practice Responsibilities

- To nominate a project lead to be the main contact within the practice for the audits. This individual will be responsible for reviewing and authorising requests for data
- To allow access to the practice system remotely, if available, to allow the queries to be loaded, run and the results extracted
- To work with the NHS Leeds IiGP Team to improve any deficiencies in data quality identified by the analyses
- To permit the release of patient anonymised data to NHS Leeds for the purposes of local comparative analysis
- To permit the release of patient anonymised data to NHS Leeds for the purposes of specified national comparative analysis and statutory annual audits conducted by the Audit Commission and other approved bodies
- To work with NHS Leeds to develop the audit criteria in line with local needs for future audit requirements
- To document and expedite action plans on one or more disease areas (as considered a priority by the practice and NHS Leeds), following feedback of audit results by NHS Leeds, within 12 months of the audit

Confidentiality Guidelines

All involved in the audit will comply with the following core principles;

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Caldicott Principles

When using confidential information;

- Justify the purpose
- Only use it when absolutely necessary
- Use the minimum amount required
- Access should be on a strict need-to-know basis
- Everyone must be aware of and

Data Protection Principles

Data must be;

- Processed fairly and lawfully
- Processed for a specified purpose
- Adequate, relevant and not excessive
- Accurate and kept up-to-date
- Not kept for longer than necessary
- Processed appropriately
- Protected by appropriate security

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SECTION 4

Data Sharing Agreement

April 2010 – March 2011

SIGNATURE SHEET

The Practice, as identified on Page 1 of the agreement, consents to participate in the following audits as part of the 2010/11 Data Extraction Programme;

	Please Tick
We wish to participate in the **COMPLETE** audit programme	☐
We **DO NOT** wish to participate in the audit programme	☐

If you have selected to participate in the audit programme, please indicate below any audits that you **DO NOT** wish to be included in, if any;

Signed on behalf of the Practice

Name; ..... Signature; .....

Date; .....

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Signed on behalf of NHS Leeds

Name; ..... Signature; .....

Date; .....

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Appendix Four

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University of Leeds headed paper

Participant Information Sheet: Evaluation of screening for depression in patients with coronary heart disease and diabetes in primary care

Invitation We would like to invite you to take part in a research study, tell you why we are doing the research and what it would involve.

Why are we doing the study? This study is being undertaken for educational purposes, as part of a PhD by Dr Kate McLintock. We aim to assess the impact on the detection and clinical management of depression of QOF-incentivised screening in people with chronic physical illness. We will do this by analysing existing, routinely collected data from patient records to determine trends in diagnosis, treatment and referral rates for depression before and after the introduction of QOF. All data used in this project will be anonymised. This work has been funded by the National Institute for Health Research, Research for Patient Benefit Programme.

Why am I being asked? Because your practice participates in QOF and is encouraged to screen patients with heart disease and diabetes for depression.

Do I have to take part? No, it is voluntary. If you want to take part we will ask you to sign a consent form to show you have agreed to take part. You can still change your mind at any time without giving a reason.

What will I have to do if I take part? If you want to take part please return the signed consent form along with the 'Data Sharing Agreement' to NHS Leeds. Data collection will be carried out by the Information in General Practice team from NHS Leeds when they extract data for the quarterly audit programme. Data will be collected in the same way as for NHS Leeds audit and your practice will not need to take any further action.

We are collecting anonymised and aggregated patient data to judge the effects of QOF-related screening on clinical practice. For the analysis, we will only identify general practices by practice code; this allows us to compare effects in practices from different areas. All data will be treated confidentially and reported anonymously. We are not interested in evaluating individual practices.

The following data will be collected for all patients aged 18 years and over; clinical codes signifying 2 question screening has taken place, exception codes for 2 question screening,

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clinical codes for diagnosis of depression, prescribing data for antidepressants and clinical codes indicating a referral to mental health services has taken place. Collecting data on all patients allows us to compare those eligible for screening under QOF to other patients.

Will I be paid? No

What are the possible benefits of taking part? Individually you do not stand to gain but your contribution will help us to understand whether QOF-driven screening for depression has had an impact on patient care; this may help to improve depression care in the future.

What are the possible disadvantages of taking part? No specific risks have been identified, after giving consent you need take no further action.

Will my taking part in the study be kept confidential? Yes. Data collection will be managed by NHS Leeds. The information we collect will be anonymous and kept securely so that only authorised people have access to it; they will be bound by the rules of confidentiality.

What will happen to the results of the study? It will take about 18 months to complete the study. When it is finished we will send you a report of the results. We expect the results will also be presented at medical conferences and published in a medical journal. No confidential information will be used.

Who is organising the study? The principal investigator is Robbie Foy, a GP and Professor of Primary Care from the University of Leeds. The other people involved are Dr Kate McLintock, Dr Robert West and Professor Allan House from the University of Leeds.

Who has reviewed the study? This study has been reviewed by the North East Research Ethics Proportionate Review Sub-Committee.

What if I have a complaint? We think this is unlikely to happen, but if it does you can contact us at the email address or telephone number below, or speak to the complaints department of NHS Leeds on 0800 052 5270.

If you want to discuss this project in further detail please contact:

Dr Kate McLintock, e: K.L.McLintock@leeds.ac.uk t: (0113) 343 2708

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Appendix Five

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University of Leeds headed paper

Practice code:

Evaluation of screening for depression in patients with coronary heart disease and diabetes in primary care

Please initial or tick all boxes that apply

1. I confirm that I have read and understand the participant information sheet for this study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily ☐

2. I understand that only anonymised patient data will be collected ☐

3. I understand that practice participation is confidential and voluntary. I am aware the practice is free to withdraw from the study at any time, without giving any reason and without its legal rights being affected ☐

4. I am authorised to act as practice representative and agree for the practice to take part in this study ☐

5. I would like to be sent a summary of the results of the study

Yes ☐ No ☐

……. ……...

Name of representative Designation

……. ……...

Signature Date

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Appendix Six

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Clinical codes linked to QOF DEP1 and QOF DEP2 (diagnosis of depression)

	Name	Clinical code	QOF Flag
QOF	[X] Depression recurrent: [unspecified] or [monopolar NOS]	Eu33z	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X](Depressn: [episode unsp][NOS (& react)][depress dis NOS]	Eu32z	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X]Depress with psych sympt: [recurr: (named vars)][endogen]	Eu333	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X]Depression: [oth episode][atypic][single epis masked NOS]	Eu32y	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X]Depressive episode, unspecified	XE1Zb	In the DRDEP1 and DEPR QOF clusters
	[X]Depressn, no psych symp: [recurr: (named var)]/[endogen]	Eu332	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X]Mild depressive episode	Eu320	In the DRDEP1 and DEPR QOF clusters
	[X]Moderate depressive episode	Eu321	In the DRDEP1 and DEPR QOF clusters
	[X]Other depressive episodes	XE1Za	In the DRDEP1 and DEPR QOF clusters
	[X]Recurr depress disorder cur epi severe without psyc sympt	XE1Zd	In the DRDEP1 and DEPR QOF clusters
	[X]Recurrent depress disorder cur epi severe with psyc symp	XE1Ze	In the DRMH1, DRDEP1 and DEPR QOF clusters
	[X]Recurrent depressive disorder, current episode moderate	Eu331	In the DRDEP1 and DEPR QOF clusters
	[X]Recurrent depressive disorder, unspecified	XE1Zf	In the DRDEP1 and DEPR QOF clusters
	[X]Sev depress epis + psych symp:(& singl epis [named vars])	Eu323	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	[X]Sev depress epis, no psych: (&	Eu322	In the DRDEP1 and

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single [agit][maj][vital])		DEPR QOF clusters Not recommended for use
[X]Severe depressive episode with psychotic symptoms	XE1ZZ	In the DRMH1, DRDEP1 and DEPR QOF clusters
[X]Severe depressive episode without psychotic symptoms	XE1ZY	In the DRDEP1 and DEPR QOF clusters
[X]Single episode agitated depressn w'out psychotic symptoms	XaCHr	In the DRDEP1 and DEPR QOF clusters
[X]Single episode major depression w'out psychotic symptoms	XaCHs	In the DRDEP1 and DEPR QOF clusters
Agitated depression	X00SQ	In the DRDEP1 and DEPR QOF clusters
Atypical depressive disorder	E11y2	In the DRDEP1 and DEPR QOF clusters
Chronic depression	E2B1.	In the DRDEP1 and DEPR QOF clusters
Cotard syndrome	XSKr7	In the MH, DRMH1, DRDEP1 and DEPR QOF clusters
Depression NOS	XaB9J	In the DRDEP1 and DEPR QOF clusters
Depression: [reactive (neurotic)] or [postnatal]	XE1aY	In the DRDEP1 and DEPR QOF clusters Not recommended for use
Depression: [single maj episode][agit][endogen (& 1st epis)]	E112.	In the DRDEP1 and DEPR QOF clusters Not recommended for use
Depressive disorder	X00SO	In the DRDEP1 and DEPR QOF clusters
Depressive disorder NEC	E2B..	In the DRDEP1 and DEPR QOF clusters
Endogenous depression	X00SR	In the DRDEP1 and DEPR QOF clusters
Endogenous depression - recurrent	XM1GC	In the DRDEP1 and DEPR QOF clusters
Endogenous depression first episode	X00SS	In the DRDEP1 and DEPR QOF clusters
Major depressive disorder	XSEGJ	In the DRDEP1 and DEPR QOF clusters
Masked depression	X00SU	In the DRDEP1 and DEPR QOF clusters

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	Mild depression	XaCIs	In the DRDEP1 and DEPR QOF clusters
	Mild major depression	XSGok	In the DRDEP1 and DEPR QOF clusters
	Mixed anxiety and depressive disorder	X00Sb	In the DRDEP1 and DEPR QOF clusters
	Moderate depression	XaCIt	In the DRDEP1 and DEPR QOF clusters
	Moderate major depression	XSGol	In the DRDEP1 and DEPR QOF clusters
	Post-schizophrenic depression	X00S8	In the MH, DRMH1, DRDEP1 and DEPR QOF clusters
	Reactive depression	XE1YC	In the DRDEP1 and DEPR QOF clusters
	Reactive depressive psychosis	E130.	In the DRDEP1 and DEPR QOF clusters
	Recurrent brief depressive disorder	Xa0wV	In the DRDEP1 and DEPR QOF clusters
	Recurrent depression	E1137	In the DRDEP1 and DEPR QOF clusters
	Recurrent depression: [major episode] or [endogenous]	E113.	In the DRDEP1 and DEPR QOF clusters Not recommended for use
	Recurrent major depressive episode NOS	E113z	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes	XE1Y1	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, in full remission	E1136	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, mild	E1131	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, moderate	E1132	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, severe, no psychosis	E1133	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, severe, with psychosis	E1134	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes, unspecified	E1130	In the DRDEP1 and DEPR QOF clusters
	Recurrent major depressive episodes,partial/unspec remission	E1135	In the DRDEP1 and DEPR QOF clusters
	Seasonal affective disorder	X761L	In the DRDEP1 and

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			DEPR QOF clusters
	Severe depression	XaClu	In the DRDEP1 and DEPR QOF clusters
	Severe major depression with psychotic features	XSGon	In the DRMH1, DRDEP1 and DEPR QOF clusters
	Severe major depression without psychotic features	XSGom	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode	XE1Y0	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode NOS	E112z	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, in full remission	E1126	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, mild	E1121	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, moderate	E1122	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, partial or unspec remission	E1125	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, severe, with psychosis	E1124	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, severe, without psychosis	E1123	In the DRDEP1 and DEPR QOF clusters
	Single major depressive episode, unspecified	E1120	In the DRDEP1 and DEPR QOF clusters

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Clinical codes not recognised by QOF DEP1 or QOF DEP2

	Name	Clinical code	QOF Flag
Non-QOF	Anxiety with depression	Y5448	
	Depressed mood	XE0re	
	Symptoms of depression	XaLmU	
	C/O - feeling depressed		
	O/E - depressed	2257	
	[X]Recurrent depressive disorder	XE1Zc	
	Depression medication review	XaK6e	
	Depression annual review	XaK6d	
	Depression interim review	XaK6f	
	On depression register	XaJWh	
	Depression monitoring administration	XaMGL	
	Depression monitoring first letter	XaMGN	
	Depression monitoring second letter	XaMGO	
	Depression monitoring third letter	XaMGP	
	Patient given advice about management of depression	XaKEz	
	Depression worse in morning	761J	
	Depression management programme	Xaltx	
	Depression screen	Y6303	
	Depression screening	6891.	
	[X]Other mood affective disorders	Eu3y.	
	[X]Other persistent mood affective disorders	Eu34y	
	[X]Other recurrent mood affective disorders	XE1Zh	
	[X]Other single mood affective disorders	XE1Zg	
	[X]Other specified mood affective disorders	Eu3yy	
	[X]Persistent mood affective disorder, unspecified	Eu34z	
	[X]Persistent mood affective disorders	Eu34.	
	[X]Unspecified mood affective	XE1Zi	

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	disorder	
	Adjustment reaction with anxious mood	E2924
	Crying associated with mood	XM0Ar
	Cyclic mood swings	XaAyL
	Blunting of mood	Xa00z
	Diurnal variation of mood	X761I
	Dysphoric mood	XaKUk
	Mood disorder	XE1Xy
	Moody	Xa3Xf
	Moody after illness	Y4284
	Moody before illness	Y4236

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Clinical codes for referral to primary and secondary care

	Name	Clinical code	QOF Flag
Referral	Referral for guided self-help for depression	XaL0r	
	Referral to improving access to psychological therapies prog	XaPvw	
	Referral to mental health team	XaIPw	
	Referral to primary care mental health gateway worker	XaLFL	
	Discharged by mental health primary care worker	XaOxM	
	Referral to primary care mental health graduate worker	XaLFk	
	Referral to primary care mental health team	XaMhM	
	Seen by primary care graduate mental health worker	XaL0t	
	Seen by primary care mental health gateway worker	XaM7s	
	Psychological therapies	XaIOt	
	Psychological therapies – 1-2 contacts/week	XaIXC	
	Psychological therapies – 1-3 contacts/month	XaIXE	
	Psychological therapies – 24 hour not intensive	XaIX1	
	Psychological therapies – 3-5 contacts/week	XaIX8	
	Psychological therapies - <1 contact/month	XaIXH	
	Psychological therapies – Daily intensive	XaIX7	
	Psychological therapies – Full day: day care	XaIX2	
	Psychological therapies – Part day: day care	XaIX3	
	Therapeutic psychology	8G91	
	Referral to psycho-educational group	XaKbY	
	Referral to counsellor	XaBT1	
	Psychological counselling	6779	

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	Counselling service	XaC6N
	Referral to counselling service	XaAeI
	Referral for mental health counseling	XaAen
	Referral to mental health counselling service	XaAem
	Referral to mental health counsellor	XaAfJ
	Discharge by mental health counsellor	XaAil
	Seen by counsellor	9N2B
	Seen by mental health counselllor	XaAS4
	Under care of counsellor	XaAOd
	In-house counselling	9NJ1
	In-house counselling first appointment	XaLnp
	In-house counselling follow-up appointment	XaLnr
	In-house counselling discharge	XaLnq
	Counselling by other agency	6715
	Counselling offered	6712
	Patient counselled	6721
	Counselled by a counsellor	6736
	Counselling carried out	6714
	Referral to psychiatric nurse	XaAh4
	Under care of psychiatric nurse	XaAQi
	Psychiatric social worker	03AJ
	Community mental health nurse	Ua0ZJ
	Seen by community mental health nurse	XaAUA
	Under care of community mental health nurse	XaAQo
	Community mental health team	Ua0um
	Psychiatric self-referral	8HJ3
	Referral to psychogeriatric day hospital	XaAeM
	Private referral to psychogeriatrician	8HVS
	Under care of psychogeriatrician	XaAPr
	Discharge by psychogeriatrician	ZaAjP
	General psychiatric care of older	XaIOo

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	adults	
	Referral to psychiatry day hospital	XaAeL
	Referral for mental illness domiciliary visit	XaAeu
	Referral to liaison psychiatrist	XaAgC
	Seen by liaison psychiatrist	XaATF
	Urgent referral to psychiatrist	XaPDH
	Private psychiatric referral	Y8647
	Under care of hospital psychiatric team	XaL2L
	Psychiatric outreach clinic	XaL03
	Emergency psychiatric admission MHA	8H230
	Emergency voluntary psychiatric admission Mental Health Act	XaNIN
	Non-urgent psychiatric admission	8H38
	Admission by psychiatrist	XaAM0
	Brief solution focused psychotherapy	Xaltc
	General psychotherapy	8G1
	Group psychotherapy	8G51
	Other psychotherapy	8G9
	Interpersonal psychotherapy	XaQBz
	Psychoanalytic and psychodynamic therapy	Xa8IG
	Psychotherapy	X71bp
	Psychotherapy service	XaC8T
	Psychotherapy/sociotherapy	Xe0iL
	Psychotherapy (specialty)	Xalm4
	Referral to nurse psychotherapist	XaAh1
	Referral to psychotherapist	XaAhN
	Referral to psychotherapy service	XaAdM
	Seen by psychotherapy – service	XaAXe
	Seen by psychotherapist	XaAUN
	Under care of psychotherapist	XaAR3
	Cognitive - behaviour therapy	XaABO
	Cognitive and behavioural therapy	Ub0qp
	Cognitive behavioural therapy by multidisciplinary team	XaM2J

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	Cognitive behavioural therapy by unidisciplinary team	XaM2I	
	Cognitive behavioural therapy NOS	XaM2L	
	Computerised cognitive behavioural therapy	XaKzQ	
	Did not attend cognitive behaviour therapy	XaLCQ	
	Generic cognitive behavioural therapy	Xa8I9	
	Guided self help cognitive behavioural therapy	XaQC0	
	Other specified cognitive behavioural therapy	XaM2K	
	Referral for cognitive behavioural therapy	XaR5D	
	Referral to cognitive behavioural therapist	XaR2j	

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Appendix Nine

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IHD clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Ischaemic Heart Disease	(Angina:[cresc][unstabl][at rest])(preinfar syn)(imp infarc)	G311.	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters Not recommended for use
	(Myocard inf (& [ac][silent][card rupt])) or (coron thromb)	G30..	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters Not recommended for use
	[X]Acute transmural myocardial infarction of unspecif site	Gyu34	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	[X]Other current complicatns following acute myocard infarct	Gyu31	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	[X]Other forms of acute ischaemic heart disease	Gyu32	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	[X]Other forms of angina pectoris	Gyu30	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	[X]Other forms of chronic ischaemic heart disease	Gyu33	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	[X]Subsequent myocardial infarction of other sites	Gyu35	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	[X]Subsequent myocardial infarction of unspecified site	Gyu36	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Aborted myocardial infarction	G3110	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute anterior myocardial infarction	Xa0YL	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute anteroapical infarction	G3010	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute anterolateral myocardial infarction	G300.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute anteroseptal myocardial infarction	G3011	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute atrial infarction	G30y0	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute coronary insufficiency	G31y0	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Acute coronary syndrome	XaINF	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute inferior myocardial infarction	X200K	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Acute inferolateral myocardial infarction	G302.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute inferoposterior infarction	G303.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute lateral myocardial infarction	X200P	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute myocardial infarction	XE0Uh	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute myocardial infarction NOS	G30z.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction	XaAzi	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction - anterolateral	X200J	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction - anteroseptal	X200H	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction - inferior	X200M	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction - inferolateral	X200O	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Acute non-Q wave infarction - lateral	X200R	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-Q wave infarction - widespread	X200U	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute non-ST segment elevation myocardial infarction	XaIwY	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute papillary muscle infarction	G30y1	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute posterior myocardial infarction	X200V	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute posterolateral myocardial infarction	XaJX0	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave infarction - anterolateral	X200I	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave infarction - anteroseptal	X200G	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave infarction - inferior	X200L	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave infarction - inferolateral	X200N	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Acute Q wave infarction - lateral	X200Q	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave infarction - widespread	X200T	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute Q wave myocardial infarction	XaAC3	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute septal infarction	G30y2	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute ST segment elevation myocardial infarction	XaIwM	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute subendocardial infarction	G307.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute widespread myocardial infarction	X200S	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Acute/subacute ischaemic heart disease NOS	XE0WC	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Angina	G33..	'/ang' synonym In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Angina at rest	X2007	In the IHD, DRSMOK1, DRDEP5, DRCHD1

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			and ANG QOF clusters
	Angina decubitus	G330.	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Angina decubitus NOS	G330z	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Angina pectoris NOS	G33z.	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Anterior myocardial infarction NOS	G301z	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Asymptomatic coronary heart disease	XaG1Q	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Cardiac rupture after acute myocardial infarction	X200e	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Chronic ischaemic heart disease NOS	XE0WG	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Chronic myocardial ischaemia	G34y1	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Coronary (atheroscl or artery dis) or triple vess dis heart	G340.	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters Not recommended for use

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	Coronary artery atheroma	XSDT6	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Coronary thrombosis not resulting in myocardial infarction	G312.	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Double coronary vessel disease	G3401	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Exercise-induced angina	Xa7nH	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	First myocardial infarction	XaIf1	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Heart disease: [arteriosclerotic] or [chronic ischaemic NOS]	XE0WE	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters Not recommended for use
	Inferior myocardial infarction NOS	G308.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Ischaemic heart disease	XE2uV	'/ihd' synonym In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Ischaemic heart disease (& [arteriosclerotic])	G3...	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters Not recommended

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			for use
	Ischaemic heart disease NOS	G3z..	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Lateral myocardial infarction NOS	G305.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Microinfarction of heart	G31y1	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Myocardial infarction	X200E	'mi' synonym In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Myocardial infarction (& [acute]) or coronary thrombosis	XE0WA	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters Not recommended for use
	Myocardial ischaemia	X200C	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	New onset angina	X200A	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Nocturnal angina	G3300	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Non-Q wave myocardial infarction	XaEgZ	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Old anterior myocardial infarction	X200W	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Old inferior myocardial infarction	X200X	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Old lateral myocardial infarction	X200Y	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Old myocardial infarction	XE2aA	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Old posterior myocardial infarction	X200Z	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other acute and subacute ischaemic heart disease	G31..	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other acute and subacute ischaemic heart disease NOS	G31yz	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other acute myocardial infarction	G30y.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other acute myocardial infarction NOS	G30yz	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other chronic ischaemic heart disease	G34..	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Other chronic ischaemic heart disease NOS	G34z.	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other specified anterior myocardial infarction	G301.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other specified chronic ischaemic heart disease	G34y.	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other specified chronic ischaemic heart disease NOS	G34yz	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Other specified ischaemic heart disease	G3y..	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Post infarct angina	XaEXt	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Post-infarction ventricular septal defect	X200d	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Posterior myocardial infarction NOS	G304.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative myocardial infarction	XaD2b	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative myocardial infarction, unspecified	XaD2i	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Postoperative subendocardial myocardial infarction	XaD2h	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative transmural myocardial infarction anterior wall	XaD2d	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative transmural myocardial infarction inferior wall	XaD2e	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative transmural myocardial infarction other sites	XaD2f	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Postoperative transmural myocardial infarction unspec site	XaD2g	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Preinfarction syndrome NOS	G311z	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Refractory angina	XaFsG	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Ruptur cardiac wall w'out haemopericard/cur comp fol ac MI	G363.	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Silent myocardial infarction	X200a	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Silent myocardial ischaemia	X200D	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters

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	Single coronary vessel disease	G3400	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Stable angina	X2008	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Status anginosus	G33z0	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Stenocardia	G33z1	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Subendocardial ischaemia	G31y2	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Subsequent myocardial infarction	G35..	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Subsequent myocardial infarction of anterior wall	G350.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Subsequent myocardial infarction of inferior wall	G351.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Subsequent myocardial infarction of other sites	G353.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Syncope anginosa	G33z2	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters

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	Transient myocardial ischaemia	XaFsH	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Triple vessel disease of the heart	X2006	In the IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	True posterior myocardial infarction	G306.	In the MI, IHD, DRSMOK1, DRDEP5 and DRCHD1 QOF clusters
	Unstable angina	X2009	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters
	Worsening angina	XE0Ui	In the IHD, DRSMOK1, DRDEP5, DRCHD1 and ANG QOF clusters

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Appendix Ten

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Diabetes clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Diabetes	Insulin treated Type 2 diabetes mellitus	X40J6	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Insulin-dependent diabetes mellitus secretory diarrhoea synd	X40JY	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Pre-existing diabetes mellitus, insulin-dependent	L1805	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Pre-existing diabetes mellitus, non-insulin-dependent	L1806	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type 1 diabetes mellitus with exudative maculopathy	XaJSr	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type 1 diabetes mellitus with gastroparesis	XaKyW	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type 1 diabetes mellitus with persistent microalbuminuria	XaIzN	In the MAL, DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type 1 diabetes mellitus with persistent proteinuria	XaIzM	In the PRT, DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus	X40J4	'/dm1' synonym In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus - poor control	C1088	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus maturity onset	C1089	In the DRSMOK6, DRDM1, DRDEP3

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			and DM QOF clusters
	Type I diabetes mellitus with arthropathy	XaFmL	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with diabetic cataract	XaFm8	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with gangrene	C1086	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with hypoglycaemic coma	XaFWG	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with mononeuropathy	XaEnn	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with multiple complications	C1083	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with nephropathy	XaF04	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with neurological complications	C1082	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with neuropathic arthropathy	XaFmM	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with ophthalmic complications	C1081	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with peripheral angiopathy	XaFmK	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with polyneuropathy	XaEno	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF

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			clusters
	Type I diabetes mellitus with renal complications	C1080	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with retinopathy	C1087	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus with ulcer	C1085	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type I diabetes mellitus without complication	XaELP	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus	X40J5	'/dm2' synonym In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus - poor control	C1097	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with arthropathy	XaFn8	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with diabetic cataract	XaFmA	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with exudative maculopathy	XaJQp	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with gangrene	C1095	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with gastroparesis	XaKyX	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with	XaFWI	In the DRSMOK6, DRDM1, DRDEP3

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	hypoglycaemic coma		and DM QOF clusters
	Type II diabetes mellitus with mononeuropathy	XaEnp	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with multiple complications	C1093	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with nephropathy	XaF05	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with neurological complications	C1092	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with neuropathic arthropathy	XaFn9	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with ophthalmic complications	C1091	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with peripheral angiopathy	XaFn7	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with persistent microalbuminuria	XaIzR	In the MAL, DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with persistent proteinuria	XaIzQ	In the PRT, DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with polyneuropathy	XaEnq	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with renal complications	C1090	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes	C1096	In the DRSMOK6,

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	mellitus with retinopathy		DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus with ulcer	C1094	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Type II diabetes mellitus without complication	XaELQ	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters
	Unstable type I diabetes mellitus	Xa4g7	In the DRSMOK6, DRDM1, DRDEP3 and DM QOF clusters

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Hypertension clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Hypertension	[X]Hypertension secondary to other renal disorders	Gyu21	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	[X]Hypertensive diseases	Gyu2.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	[X]Other secondary hypertension	Gyu20	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Benign essential hypertension	G201.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters In Read code Benign essential hypertension
	Diastolic hypertension	XSDSb	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Essential hypertension	XE0Uc	'/ht' synonym In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Essential hypertension NOS	XE0Ud	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Hypertension	XE0Ub	In the HYP, DRSMOK4 and DRHYP1 QOF clusters In Read code Hypertension
	Hypertension secondary to drug	G24z1	In the HYP, DRSMOK4 and DRHYP1 QOF clusters

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	Hypertension secondary to endocrine disorders	G244.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Hypertensive disease	G2...	'/hyp' synonym In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Hypertensive disease NOS	G2z..	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Labile hypertension	Xa0Cs	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Malignant essential hypertension	G200.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Malignant hypertension	Xa3fQ	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Malignant secondary hypertension	G240.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Other specified hypertensive disease	G2y..	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Pre-exist 2ndry hypertens comp preg childbth and puerprum	L1282	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Renovascular hypertension	Xa0kX	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary benign hypertension	G241.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary benign hypertension NOS	G241z	In the HYP, DRSMOK4 and DRHYP1 QOF

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			clusters
	Secondary benign renovascular hypertension	G2410	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary hypertension	G24..	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary hypertension NOS	G24z.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary malignant hypertension NOS	G240z	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary malignant renovascular hypertension	G2400	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Secondary renovascular hypertension NOS	G24z0	In the HYP, DRSMOK4 and DRHYP1 QOF clusters
	Systolic hypertension	G202.	In the HYP, DRSMOK4 and DRHYP1 QOF clusters

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Epilepsy clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Epilepsy	(Epilepsy NOS) or (fit in known epileptic NOS)	F25z.	In the EPIL and DREPIL1 QOF clusters Not recommended for use
	(Epilepsy) or (epileptic attack)	XE185	In the EPIL and DREPIL1 QOF clusters Not recommended for use
	(Grand mal status) or (status epilepticus)	F253.	In the EPIL and DREPIL1 QOF clusters Not recommended for use
	[X]Other epilepsy	Fyu51	In the EPIL and DREPIL1 QOF clusters
	[X]Other generalised epilepsy and epileptic syndromes	Fyu50	In the EPIL and DREPIL1 QOF clusters
	[X]Other status epilepticus	Fyu52	In the EPIL and DREPIL1 QOF clusters
	[X]Status epilepticus, unspecified	Fyu59	In the EPIL and DREPIL1 QOF clusters
	Alcohol-induced epilepsy	X006u	In the EPIL and DREPIL1 QOF clusters
	Amygdalo-hippocampal epilepsy	X005y	In the EPIL and DREPIL1 QOF clusters
	Anterior frontopolar epilepsy	X0064	In the EPIL and DREPIL1 QOF clusters
	Aquagenic epilepsy	X0079	In the EPIL and DREPIL1 QOF clusters
	Chr progressive epilepsia partialis continua of childhood	X006C	In the EPIL and DREPIL1 QOF clusters

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	Cingulate epilepsy	X0063	In the EPIL and DREPIL1 QOF clusters
	Complex partial epileptic seizure	XaJFI	In the EPIL and DREPIL1 QOF clusters
	Complex partial status epilepticus	X007G	In the EPIL and DREPIL1 QOF clusters
	Convulsive status epilepticus	XE15Y	In the EPIL and DREPIL1 QOF clusters
	Cryptogenic generalised epilepsy	X006N	In the EPIL and DREPIL1 QOF clusters
	Cryptogenic Lennox-Gastaut syndrome	X006R	In the EPIL and DREPIL1 QOF clusters
	Cryptogenic myoclonic epilepsy	X006Z	In the EPIL and DREPIL1 QOF clusters
	Cryptogenic West syndrome	X006O	In the EPIL and DREPIL1 QOF clusters
	Cursive (running) epilepsy	F25y0	In the EPIL and DREPIL1 QOF clusters
	Decision-making epilepsy	X0078	In the EPIL and DREPIL1 QOF clusters
	Dorsolateral epilepsy	X0066	In the EPIL and DREPIL1 QOF clusters
	Drug-induced epilepsy	X006t	In the EPIL and DREPIL1 QOF clusters
	Early infant epileptic encephalopathy wth suppression bursts	X006e	In the EPIL and DREPIL1 QOF clusters
	Early myoclonic encephalopathy	X006d	In the EPIL and DREPIL1 QOF clusters
	Eating epilepsy	X0075	In the EPIL and DREPIL1 QOF clusters
	Epilepsy	F25..	'/epi' synonym

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			In the EPIL and DREPIL1 QOF clusters
	Epilepsy associated with specific stimuli	F2551	In the EPIL and DREPIL1 QOF clusters
	Epilepsy NOS	XE15a	In the EPIL and DREPIL1 QOF clusters
	Epilepsy only in relation to photic stimulation	X006z	In the EPIL and DREPIL1 QOF clusters
	Epilepsy undetermined whether focal or generalised	X006l	In the EPIL and DREPIL1 QOF clusters
	Epilepsy with continuous spike wave during slow-wave sleep	X006p	In the EPIL and DREPIL1 QOF clusters
	Epilepsy: [Jacksonian] or [focal] or [motor]	F2550	In the EPIL and DREPIL1 QOF clusters Not recommended for use
	Epileptic seizures - myoclonic	F2513	In the EPIL and DREPIL1 QOF clusters
	Eyelid myoclonus with absences	X0070	In the EPIL and DREPIL1 QOF clusters
	Fit (in known epileptic) NOS	XaC34	In the EPIL and DREPIL1 QOF clusters
	Frontal lobe epilepsy	X0061	In the EPIL and DREPIL1 QOF clusters
	Generalised convulsive epilepsy	F251.	In the EPIL and DREPIL1 QOF clusters
	Generalised convulsive epilepsy NOS	F251z	In the EPIL and DREPIL1 QOF clusters
	Generalised epilepsy	F2510	In the EPIL and DREPIL1 QOF clusters
	Generalised non-convulsive epilepsy	F250.	In the EPIL and DREPIL1 QOF clusters

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	Generalised non-convulsive epilepsy NOS	F250z	In the EPIL and DREPIL1 QOF clusters
	Hemiplegia-hemiconvulsion-epilepsy syndrome	X006E	In the EPIL and DREPIL1 QOF clusters
	Idiopathic myoclonic epilepsy	X006a	In the EPIL and DREPIL1 QOF clusters
	Infantile spasms NOS	F256z	In the EPIL and DREPIL1 QOF clusters
	Jacksonian, focal or motor epilepsy	XaB4S	In the EPIL and DREPIL1 QOF clusters
	Kojevnikov's epilepsy	F257.	In the EPIL and DREPIL1 QOF clusters
	Lafora disease	X006X	In the EPIL and DREPIL1 QOF clusters
	Lateral temporal epilepsy	X0060	In the EPIL and DREPIL1 QOF clusters
	Lennox-Gastaut syndrome	X006Q	In the EPIL and DREPIL1 QOF clusters
	Localisation-related cryptogenic epilepsy	X006F	In the EPIL and DREPIL1 QOF clusters
	Localisation-related epilepsy	X005m	In the EPIL and DREPIL1 QOF clusters
	Localisation-related symptomatic epil with spec precipitant	X006D	In the EPIL and DREPIL1 QOF clusters
	Localisation-related symptomatic epilepsy	X005x	In the EPIL and DREPIL1 QOF clusters
	Locl-rlt(foc)(part)idiop epilep&epilptic syn seiz locl onset	F25y2	In the EPIL and DREPIL1 QOF clusters
	Menstrual epilepsy	X006w	In the EPIL and DREPIL1 QOF clusters
	Mesiobasal limbic epilepsy	F2543	In the EPIL and DREPIL1 QOF

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			clusters
	Motor cortex epilepsy	XE15Z	In the EPIL and DREPIL1 QOF clusters
	Motor epilepsy	XaB4R	In the EPIL and DREPIL1 QOF clusters
	Motor simple partial status	X007F	In the EPIL and DREPIL1 QOF clusters
	Musicogenic epilepsy	X0073	In the EPIL and DREPIL1 QOF clusters
	Myoclonic absence epilepsy	X006U	In the EPIL and DREPIL1 QOF clusters
	Myoclonic astatic epilepsy	X006T	In the EPIL and DREPIL1 QOF clusters
	Myoclonic encephalopathy	F1322	In the EPIL and DREPIL1 QOF clusters
	Myoclonic epilepsy - ragged red fibres	X006Y	In the EPIL and DREPIL1 QOF clusters
	Narcotic withdrawal epilepsy	X006v	In the EPIL and DREPIL1 QOF clusters
	Nocturnal epilepsy	X006x	In the EPIL and DREPIL1 QOF clusters
	Non-convulsive simple partial status epilepticus	X007E	In the EPIL and DREPIL1 QOF clusters
	Non-convulsive status epilepticus with 3/sec spike wave	X007C	In the EPIL and DREPIL1 QOF clusters
	Non-convulsive status epilepticus without 3/s spike wave	X007D	In the EPIL and DREPIL1 QOF clusters
	Non-convulsive status epilepticus wth impaired consciousness	F252.	In the EPIL and DREPIL1 QOF clusters
	Non-progressive Kozhevnikow syndrome	X0068	In the EPIL and DREPIL1 QOF clusters

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	Occipital lobe epilepsy	X006A	In the EPIL and DREPIL1 QOF clusters
	Opercular epilepsy	X0067	In the EPIL and DREPIL1 QOF clusters
	Orbitofrontal epilepsy	X0065	In the EPIL and DREPIL1 QOF clusters
	Other forms of epilepsy	F25y.	In the EPIL and DREPIL1 QOF clusters
	Other forms of epilepsy NOS	F25yz	In the EPIL and DREPIL1 QOF clusters
	Other specified generalised convulsive epilepsy	F251y	In the EPIL and DREPIL1 QOF clusters
	Other specified generalised non-convulsive epilepsy	F250y	In the EPIL and DREPIL1 QOF clusters
	Parietal lobe epilepsy	X0069	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy with autonomic symptoms	F2553	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy with impairment of consciousness	F254.	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy with impairment of consciousness NOS	F254z	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy without impairment of consciousness	F255.	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy without impairment of consciousness NOS	F255z	In the EPIL and DREPIL1 QOF clusters
	Partial epilepsy without impairment of consciousness OS	F255y	In the EPIL and DREPIL1 QOF clusters
	Petit mal (minor) epilepsy	XaQbJ	In the EPIL and DREPIL1 QOF clusters
	Photosensitive epilepsy	X006y	In the EPIL and DREPIL1 QOF

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			clusters
	Post-anoxic myoclonus	X004s	In the EPIL and DREPIL1 QOF clusters
	Progressive myoclonic epilepsy	XE15I	In the EPIL and DREPIL1 QOF clusters
	Progressive myoclonic epilepsy (& [Unverricht-Lundborg dis])	F1321	In the EPIL and DREPIL1 QOF clusters Not recommended for use
	Psychomotor epilepsy	XaB4T	In the EPIL and DREPIL1 QOF clusters
	Psychosensory epilepsy	F2542	In the EPIL and DREPIL1 QOF clusters
	Rasmussen syndrome	X001S	In the EPIL and DREPIL1 QOF clusters
	Reading epilepsy	X006q	In the EPIL and DREPIL1 QOF clusters
	Rhinencephalic epilepsy	X005z	In the EPIL and DREPIL1 QOF clusters
	Secondary reading epilepsy	X006s	In the EPIL and DREPIL1 QOF clusters
	Self-induced non-photosensitive epilepsy	X007A	In the EPIL and DREPIL1 QOF clusters
	Simple partial epileptic seizure	XaL2B	In the EPIL and DREPIL1 QOF clusters
	Somatosensory epilepsy	F2552	In the EPIL and DREPIL1 QOF clusters
	Status epilepticus	X007B	In the EPIL and DREPIL1 QOF clusters
	Stress-induced epilepsy	XaJgP	In the EPIL and DREPIL1 QOF clusters
	Supplementary motor epilepsy	X0062	In the EPIL and DREPIL1 QOF

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			clusters
	Symptomatic generalised epilepsy	X006c	In the EPIL and DREPIL1 QOF clusters
	Symptomatic Lennox-Gastaut syndrome	X006S	In the EPIL and DREPIL1 QOF clusters
	Symptomatic myoclonic epilepsy	X006f	In the EPIL and DREPIL1 QOF clusters
	Symptomatic West syndrome	X006P	In the EPIL and DREPIL1 QOF clusters
	Tactile epilepsy	X0074	In the EPIL and DREPIL1 QOF clusters
	Tapping epilepsy	X0076	In the EPIL and DREPIL1 QOF clusters
	Temporal lobe epilepsy	F2540	In the EPIL and DREPIL1 QOF clusters
	Toothbrushing epilepsy	X0077	In the EPIL and DREPIL1 QOF clusters
	Traumatic epilepsy	SC200	In the EPIL and DREPIL1 QOF clusters
	Unilateral epilepsy	F2555	In the EPIL and DREPIL1 QOF clusters
	Unverricht-Lundborg syndrome	X006V	In the EPIL and DREPIL1 QOF clusters
	Visual reflex epilepsy	F2554	In the EPIL and DREPIL1 QOF clusters
	West syndrome	F256.	In the EPIL and DREPIL1 QOF clusters
	Writing epilepsy	X0072	In the EPIL and DREPIL1 QOF clusters

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Asthma clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Asthma	(Asthma:[exerc ind][allerg NEC][NOS]) or (allerg bronch NEC)	H33zz	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	(Hay fever + asthma) or (extr asthma without status asthmat)	H3300	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	(Intrinsic asthma) or (late onset asthma)	H331.	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	(Severe asthma attack) or (status asthmaticus NOS)	H33z0	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	Acute asthma	Xa9zf	In the DRSMOK9, DRAST1 and AST QOF clusters
	Allergic asthma	X101x	In the DRSMOK9, DRAST1 and AST QOF clusters
	Allergic asthma NEC	X101z	In the DRSMOK9, DRAST1 and AST QOF clusters
	Allergic atopic asthma	XE0YQ	In the DRSMOK9, DRAST1 and AST QOF clusters
	Allergic non-atopic asthma	X1021	In the DRSMOK9, DRAST1 and AST QOF clusters
	Aspirin-induced asthma	XaJFG	In the DRSMOK9, DRAST1 and AST QOF clusters
	Aspirin-sensitive asthma with nasal polyps	X1024	In the DRSMOK9, DRAST1 and AST QOF clusters
	Asthma	H33..	'/ast' synonym

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			In the DRSMOK9, DRAST1 and AST QOF clusters
	Asthma NOS	XE0YX	In the DRSMOK9, DRAST1 and AST QOF clusters
	Asthma unspecified	H33z.	In the DRSMOK9, DRAST1 and AST QOF clusters
	Asthma: [extrins - atop][allerg][pollen][childh][+ hay fev]	H330.	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	Asthma: [intrinsic] or [late onset]	XE0ZR	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	Asthma: [NOS] or [attack]	XE0ZT	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	Asthmatic bronchitis	Xa0lZ	In the DRSMOK9, DRAST1 and AST QOF clusters
	Baker's asthma	X1026	In the DRSMOK9, DRAST1 and AST QOF clusters
	Brittle asthma	Ua1AX	In the DRSMOK9, DRAST1 and AST QOF clusters
	Byssinosis	H440.	In the DRSMOK9, DRAST1 and AST QOF clusters
	Byssinosis grade 3	X101k	In the DRSMOK8, DRSMOK9, DRCOPD1, DRAST1, COPD and AST QOF clusters
	Cannabinosis	H441.	In the DRSMOK9, DRAST1 and AST QOF clusters
	Childhood asthma	X101t	In the DRSMOK9, DRAST1 and AST

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			QOF clusters
	Chronic asthmatic bronchitis	H3120	In the DRSMOK9, DRAST1 and AST QOF clusters
	Colophony asthma	X1027	In the DRSMOK9, DRAST1 and AST QOF clusters
	Detergent asthma	H47y0	In the DRSMOK9, DRAST1 and AST QOF clusters
	Drug-induced asthma	X1023	In the DRSMOK9, DRAST1 and AST QOF clusters
	Exercise-induced asthma	173A.	In the DRSMOK9, DRAST1 and AST QOF clusters
	Extrinsic asthma - atopy (& pollen)	XE0ZP	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use
	Extrinsic asthma NOS	H330z	In the DRSMOK9, DRAST1 and AST QOF clusters
	Extrinsic asthma with asthma attack	X101y	In the DRSMOK9, DRAST1 and AST QOF clusters
	Extrinsic asthma with status asthmaticus	XE0YS	In the DRSMOK9, DRAST1 and AST QOF clusters
	Extrinsic asthma without status asthmaticus	XE0YR	In the DRSMOK9, DRAST1 and AST QOF clusters
	Flax-dressers' disease	XaEKI	In the DRSMOK9, DRAST1 and AST QOF clusters
	Grain worker's asthma	X1028	In the DRSMOK9, DRAST1 and AST QOF clusters
	Hay fever with asthma	X1020	In the DRSMOK9, DRAST1 and AST QOF clusters
	Intrins asthma with: [asthma attack] or [status asthmaticus]	H3311	In the DRSMOK9, DRAST1 and AST QOF clusters Not recommended for use

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	Intrinsic asthma NOS	H331z	In the DRSMOK9, DRAST1 and AST QOF clusters
	Intrinsic asthma with asthma attack	X1022	In the DRSMOK9, DRAST1 and AST QOF clusters
	Intrinsic asthma with status asthmaticus	XE0YU	In the DRSMOK9, DRAST1 and AST QOF clusters
	Intrinsic asthma without status asthmaticus	H3310	In the DRSMOK9, DRAST1 and AST QOF clusters
	Late onset asthma	X101u	In the DRSMOK9, DRAST1 and AST QOF clusters
	Mill fever	X102B	In the DRSMOK9, DRAST1 and AST QOF clusters
	Mixed asthma	H332.	In the DRSMOK9, DRAST1 and AST QOF clusters
	Nocturnal asthma	XaLPE	In the DRSMOK9, DRAST1 and AST QOF clusters
	Non-allergic asthma	XE0YT	In the DRSMOK9, DRAST1 and AST QOF clusters
	Occupational asthma	X1025	In the DRSMOK9, DRAST1 and AST QOF clusters
	Status asthmaticus	X102D	In the DRSMOK9, DRAST1 and AST QOF clusters
	Status asthmaticus NOS	XE0YV	In the DRSMOK9, DRAST1 and AST QOF clusters
	Sulphite-induced asthma	X1029	In the DRSMOK9, DRAST1 and AST QOF clusters
	Work aggravated asthma	XaKdk	In the DRSMOK9, DRAST1 and AST QOF clusters

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Appendix Fourteen

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COPD clinical codes recognised by QOF

Disease Register	Name	Clinical code	QOF Flag
Epilepsy	(Sawyer-Jones syndrome) or (other emphysema NOS)	H32yz	In the DRSMOK8, DRCOPD1 and COPD QOF clusters Not recommended for use
	[X]Other emphysema	Hyu30	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	[X]Other specified chronic obstructive pulmonary disease	Hyu31	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Acute vesicular emphysema	H32y0	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Atrophic (senile) emphysema	XE0YO	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Bronchiolitis obliterans	X101l	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Bronchiolitis obliterans with usual interstitial pneumonitis	X102z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Bullous emphysema with collapse	XE0YN	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Byssinosis grade 3	X101k	In the DRSMOK8, DRSMOK9, DRCOPD1, DRAST1, COPD and AST QOF clusters
	Centrilobular emphysema	H322.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic bronchitis	H31..	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic bronchitis NOS	H31z.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic bullous emphysema	H320.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters

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	Chronic bullous emphysema NOS	H320z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic emphysema due to chemical fumes	H4640	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic obstructive airways disease NOS	H3z..	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic obstructive lung disease	H3...	'/copd' synonym In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic tracheobronchitis	H31y1	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Chronic: [bronchitis NOS] or [tracheobronchitis]	XE0ZN	In the DRSMOK8, DRCOPD1 and COPD QOF clusters Not recommended for use
	Compensatory emphysema	H582.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Congenital lobar emphysema	X101q	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Drug-induced bronchiolitis obliterans	X101m	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Emphysema	H32..	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Emphysema NOS	H32z.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Emphysematous bronchitis	H3121	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	End stage chronic obstructive airways disease	XaIND	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Giant bullous emphysema	H3202	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Interstitial pulmonary	XaIQg	In the DRSMOK8,

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	emphysema		DRCOPD1 and COPD QOF clusters
	MacLeods syndrome	H32y2	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Mild chronic obstructive pulmonary disease	XaEIV	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Mixed simple and mucopurulent chronic bronchitis	H313.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Moderate chronic obstructive pulmonary disease	XaEIW	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Mucopurulent chronic bronchitis	H311.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Mucopurulent chronic bronchitis NOS	H311z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Obstructive chronic bronchitis NOS	H312z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Occupational chronic bronchitis	X101j	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Other chronic bronchitis	H31y.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Other chronic bronchitis NOS	H31yz	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Other emphysema	H32y.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Other emphysema NOS	XE0YP	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Other specified chronic obstructive airways disease	H3y..	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Panlobular emphysema	H321.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Pulmonary emphysema	X101n	In the DRSMOK8, DRCOPD1 and COPD QOF clusters

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	Pulmonary emphysema in alpha-1 PI deficiency	X101o	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Purulent chronic bronchitis	XE0YM	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Scar emphysema	X101r	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Segmental bullous emphysema	H3200	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Severe chronic obstructive pulmonary disease	XaEIY	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Simple chronic bronchitis	H310.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Simple chronic bronchitis NOS	H310z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Toxic bronchiolitis obliterans	H4641	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Toxic emphysema	X101p	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Very severe chronic obstructive pulmonary disease	XaN4a	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Zonal bullous emphysema	H3201	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Panlobular emphysema	H321.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Pulmonary emphysema	X101n	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Pulmonary emphysema in alpha-1 PI deficiency	X101o	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Purulent chronic bronchitis	XE0YM	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Scar emphysema	X101r	In the DRSMOK8, DRCOPD1 and

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			COPD QOF clusters
	Segmental bullous emphysema	H3200	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Severe chronic obstructive pulmonary disease	XaEIY	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Simple chronic bronchitis	H310.	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Simple chronic bronchitis NOS	H310z	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Toxic bronchiolitis obliterans	H4641	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Toxic emphysema	X101p	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Very severe chronic obstructive pulmonary disease	XaN4a	In the DRSMOK8, DRCOPD1 and COPD QOF clusters
	Zonal bullous emphysema	H3201	In the DRSMOK8, DRCOPD1 and COPD QOF clusters

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The effects of financial incentives for case finding for depression in patients with diabetes and coronary heart disease: interrupted time series analysis

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Abstract

Objectives

To evaluate the effects of Quality and Outcomes Framework (QOF) incentivised case finding for depression on diagnosis and treatment in targeted and non-targeted long-term conditions.

Design

Interrupted time series analysis

Setting

General practices in Leeds, United Kingdom (UK).

Participants

Sixty-five (58%) of 112 general practices shared data on 37,229 patients with diabetes and coronary heart disease (CHD) targeted by case finding incentives, and 101,008 patients with four other long-term conditions not targeted (hypertension, epilepsy, chronic obstructive pulmonary disease (COPD) and asthma).

Intervention

Incentivised case finding for depression using two standard screening questions.

Main Outcome Measures

Clinical codes indicating new depression-related diagnoses and new prescriptions of antidepressants. We extracted routinely recorded data from February 2002 through April 2012. The number of new diagnoses and prescriptions for those on registers was modelled with a binomial regression which provided the strength of associations between time periods and their rates.

Results

New diagnoses of depression increased from 21 to 94 per 100,000 per month in targeted patients between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). The rate

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increased from 27 to 77 per 100,000 per month in non-targeted patients (OR 1.53; 1.46 to 1.62). The slopes in prescribing for both groups flattened to zero immediately after QOF was introduced but before incentivised case finding (p<0.01 for both). Antidepressant prescribing in targeted patients returned to the pre-QOF secular upward trend (Wald test for equivalence of slope, z=0.73, p=0.47); the slope was less steep for non-targeted patients (z=-4.14, p<0.01).

Conclusions

Incentivised case finding increased new depression-related diagnoses. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants which resumed following the introduction of incentivised case finding. Prescribing trends are of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

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Article summary

Strengths and limitations of this study

Strengths

- Rigorous quasi-experimental design demonstrating policy effects on patient populations within a sample of general practices which appears broadly representative on key parameters.
- Further insights gained from comparison of trends in patient populations targeted and non-targeted by intervention

Limitations

- Relatively high ‘signal to noise’ ratio inherent in use of routinely recorded data may have diminished the magnitude of observed effects
- The absence of a control population of practices, making it hard to rule out possibility that concurrent national and local initiatives contributed to observed trends
- Lack of data on patient outcomes, such as recovery from depression or the appropriateness of treatment

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Background

Long-term physical conditions are associated with a high prevalence of depression; people with diabetes or CHD have a two to three-fold increased lifetime risk.[1 2] Such co-morbidity can make depression hard to recognise,[3 4] worsens the prognosis of both conditions [1 5 6] and increases healthcare and societal costs.[1 7]

The UK National Institute for Health and Care Excellence (NICE) recommends case finding for depression in people with long-term physical conditions.[8 9] The Quality Outcomes Framework (QOF) for general practice was established in 2004 and correspondingly rewarded case finding for depression in all patients with a diagnosis of CHD or diabetes over 2006-13 (QOF years three to nine). This indicator was known as 'QOF DEP1' and defined as, "the percentage of patients on the diabetes register and/or the CHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions."[10] A designated clinical code indicating the use of these questions was recorded in the patient record whenever the Patient Health Questionnaire-2 (PHQ2) was administered, irrespective of the responses. Practices were reimbursed according to the proportion of patients with a record of case finding in the preceding 15 months. Payment thresholds were set at achievements of 40-90% of eligible patients until 2012, and 50-90% 2012-13. The indicator had a value of eight points from 2006-10 and six points from 2010-13. Each point was worth £133.76 in 2012-13, the final year of incentivisation. This incentivised case finding has now been withdrawn from the QOF because of doubts over benefits.[11]

The impact of this policy has been uncertain. The effectiveness of financial incentives in changing clinical behaviour is limited[12] and pay-for-performance schemes often have unintended adverse consequences.[13] More specifically, a systematic review concluded advances in quality of care for long-term conditions included in UK QOF were modest.[14] There are few rigorous evaluations of the effects of pay-for-performance, given that

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controlled comparisons are rarely acceptable to policy-makers. Two interrupted time series evaluations of QOF have not shown any sustained effects on processes of care or clinical outcomes.[15 16] Whilst there are no coded data prior to the introduction of the case finding indicator, at face value the QOF did incentivise a change in practice given that around 86% of patients with diabetes and CHD have been coded as screened at least every 15 months since its inception.[17] Yet there is no evidence that case finding for depression, whether in the presence[18] or absence of coordinated care systems, [19 20] improves patient outcomes. A cohort study found a greater likelihood of a new diagnosis of depression and initiation of antidepressant treatment in the 28 days following QOF-incentivised case finding;[21] the longer term effects on the whole population eligible for case finding are unknown. There may be further unintended effects on populations with other long-term conditions not targeted by incentivised case finding. Examining quality of care across a number of conditions Doran et al found that improvements associated with QOF incentives occurred at the expense of small detrimental effects on aspects of non-incentivised care.[22]

We evaluated the effects of incentivised case finding on new depression-related diagnoses and new prescriptions of antidepressants in patient populations with long-term conditions targeted or not by financial incentives.

Methods

Study design

We used an interrupted time series design to evaluate the effects of incentivised case finding whilst accounting for underlying secular trends. We also compared trends in depression diagnosis and treatment between those patient populations targeted by incentivised case finding (diabetes and CHD) and other patient populations with long-term physical conditions not targeted by incentivised case finding (hypertension, epilepsy, COPD and asthma). Our rationale was that we would not expect outcomes in the non-targeted group to diverge from underlying secular trends.

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Practices and participants

We invited all 112 general practices in Leeds to share anonymised patient data via the Information in General Practice Team of the then National Health Service (NHS) primary care trust. No distinction was made between users of different electronic records systems. Compared with English indicators the physical health of people in Leeds is generally worse and levels of deprivation are higher.[23] Recorded depression in adults is similar (both around 11%)[24] as is performance on the QOF incentivised case finding indicator in our final year of data collection (87% for Leeds over 2011-12 compared to England average of 86%).[17 25] We sought data on patients with diabetes and CHD targeted by case finding and data from other patients with the four comparator and non-target, long-term physical conditions from QOF registers. Patients with conditions in both targeted and non-targeted groups were excluded from non-targeted group analysis to avoid double counting. Therefore, any change in outcomes in the non-targeted group could not be attributable to individuals being screened because they had a targeted condition.

Data Collection

We collected retrospective, electronic data from February 2002 through April 2012 for patients aged 18 years and over. Data were extracted through Morbidity Information Query and Export Syntax (MIQUEST) software, used for collecting data from general practice clinical computing systems in a consistent and comparable way. The tool utilises a query language, which incorporates security and confidentiality safeguards; pseudoanonymisation supports the extraction of patient level information but ensures it is not attributable to individual patients.[26] Participating practices consented to the extraction of anonymised patient data and did not need to take any further action.

We recognised that the diagnosis of depression was likely to be under-recorded in clinical records because of factors such as diagnostic uncertainty and patient preference. The recording of certain diagnostic Read Codes, such as ‘depressive disorder,’ automatically triggers alerts for further assessments required by QOF. Failure to meet these targets

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reduces practice income and hence coding behaviour may have changed. We therefore also searched for use of more sensitive but less specific Read codes such as 'low mood' or 'depressed mood' which are not assessed by the QOF and included these in our main outcome of diagnosis. We excluded codes related to postnatal depression.

Data on the prescription of licensed antidepressant drugs listed in British National Formulary section 4.3 were collected, with the exception of antidepressants judged by clinicians involved in the project (RF, AH, SA, KM) to be more commonly prescribed for other indications (e.g. amitriptyline and nortriptyline for neuropathic pain).[27]

A complete list of clinical codes for each outcome measure is available as an electronic web appendix.

Data analysis

The denominators comprised the numbers of patients on practice registers for each financial year (starting 1st April) targeted by incentivised case finding (diabetes and CHD) and those not targeted (hypertension, epilepsy, COPD and asthma). We assumed that registered long-term condition populations would be relatively stable over each year. We took the number of registered long-term condition populations per practice as constant over each QOF year. This permitted a more parsimonious model to facilitate interpretation.

For each targeted and non-targeted patient group, we analysed trends in new depression-related diagnoses and antidepressant prescribing. We also examined the uptake of case finding for depression. We recognised that these trends could relate to changes in coding as well as clinical practice; we mainly used their outputs to guide interpretation of the main outcomes. Data were aggregated by month for each of the 65 practices so that each time series is 123 months long (February 2002 to April 2012). Analysis was carried out at the practice level using a binomial regression based on the calculated numerators and the available denominators. Discontinuities were modelled at key dates: April 2004 for the

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introduction of QOF; and April 2006 for the introduction of incentives for case finding for depression. A further discontinuity was introduced at April 2007 to isolate exceptional behaviour noted during the QOF year April 2006 through March 2007. Our focus and interest was on the long-term sustained effect seen after the introduction of case finding incentives rather than the immediate change. To avoid bias from this first year (2006/7) rates were permitted to be different in that year, so isolating it from the sustained effect we sought to assess. For each time period (February 2002 to March 2004; April 2004 to March 2006; April 2006 to March 2007; April 2007 to April 2012) the model has an overall constant and slope. Specific slope terms were dropped when they were found not to be statistically significant from zero at the 5% level.

Fitting seasonal effects improved the model but added complexity. As reference and intervention periods were integer multiples of complete years, there would be no perturbation of level or slope if explicit seasonality terms were not included, but rather seasonality was encompassed within the error term. Since the profile of seasonality appeared to change from the reference period to the intervention period and vary in the group with targeted interventions compared to the group for other long-term conditions, this option was selected to yield the clearest effect in the model. The model can be expressed as:

Let Y_{Tit} and Y_{Nit} be random variables representing the number of diagnoses at practice i in month t for targetted and non-targetted patients respectively. Then

$$\Pr\ (Y_{Tit}=y_{Tit}) = \binom{n_{Tit}}{y_{Tit}}\ \pi_{Tit}^{y_{Tit}}\ (1-\pi_{Tit})^{(n_{Tit}-y_{Tit})} \qquad (1)$$

where $y_{Tit} \in \{0, 1, \dots, n_{Tit}\}$, n_{Tit} is the relevant denominator for practice i in month t, and π_{Tit} is the corresponding rate of diagnosis. Using a logit link function in the generalised regression, we model the rate π_{Tit} with

$$\log\left(\frac{\pi_{Tit}}{1-\pi_{Tit}}\right) = \mu_{T0} + m_{Ti} + \beta_{T1}\ 1_{t\in 2006} + \beta_{T2}\ 1_{t>2006} \qquad (2)$$

and

$$m_i \in N\ (0, \sigma^2) \qquad (3)$$

where $1_{t \in 2006}$ is an indicator variable for the year 2006/2007 and $1_{t>2006}$ is an indicator for the intervention period, that is after the year 2006/2007. Note that a random intercept m_{Ti} is included to account for clustering within practices. Slope terms were also added where appropriate. The open source software R 2.12.0 64 bit version was used for all statistical analysis.[28]

Results

We recruited 65 (58%) of 112 Leeds practices. Their 2012 QOF registers indicated that they served 37,229 patients with diabetes and CHD targeted for case finding for depression and 101,008 patients with other long-term conditions not targeted. Table 1 provides data on all English practices and compares characteristics of recruited and not-recruited practices.

Overall, the practices recruited were larger; however, we found no significant differences in Indices of Multiple Deprivation or, total QOF scores. The majority of practices used one clinical computing system by the end of data collection. Tables 2 and 3 summarise the annual incidences of case finding, depression-related diagnoses and prescription of antidepressants by count and rates per 100,000 patients, for targeted and non-targeted patients.

Practice-level analysis found significant increases in new coded case finding following the initiation of incentives, also reflected in aggregated city-wide level trends (Figure 1). The exceptional rise in 2006 reflects first coding in patients with existing diagnoses of diabetes and CHD. Comparing the period April 2004 to March 2006 with April 2007 to March 2012, rates of case finding increased in the targeted population from 0.07 to 7.45 per 1000 per

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month (OR 99.76; 95% confidence interval 83.15 to 119.68) and in the non-targeted population increased from 0.1 to 0.78 per 1000 per month (OR 7.54; 6.91 to 8.24).

Binomial regression of the practice level data confirmed statistically significant rate increases in new depression-related diagnoses in both patient populations. In targeted patients, the diagnosis rate increased from 21 to 94 per 100,000 per month between the periods 2002-4 and 2007-12 (OR 2.09; 1.92 to 2.27). In non-targeted patients, the rate increased from 27 to 77 per 100,000 per month (OR 1.53; 1.46 to 1.62). In neither of these periods was the slope statistically significant from zero: that is the rates can be assumed to be constant during these periods. Figure 2 shows these trends aggregated at a city level with fitted constants and slopes, indicated by dashed lines. Figure 3 shows the city-level trends for new antidepressant prescribing with fitted constants and slopes. Rates of prescribing increased over the full period of observation. During the period after QOF was introduced but before incentives (April 2004 to March 2006), the slopes for both populations flattened to zero ($p<0.01$ for both groups). For targeted patients, the slopes before the introduction of QOF and after the exceptional year were similar (Wald test for equivalence of slope, $z=0.73$, $p=0.47$). For non-targeted patients the slope for the latter period was less steep (Wald test for slope, $z=-4.14$, $p<0.01$). All Wald tests for slopes were undertaken using practice level data.

Discussion

Incentivised case finding increased rates of new depression-related diagnoses in patients with CHD and diabetes and, to a lesser extent, in those with non-targeted long-term conditions. The spike in diagnoses immediately following incentivisation probably reflects coding patterns before general practitioners began to realise they would trigger alerts for further assessments required by QOF when recording depression related diagnoses. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants; these resumed following the introduction of incentivised case finding, although there was a modest

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deceleration in antidepressant prescribing for non-targeted conditions. Rates of new prescriptions for antidepressants exceeded those for depression-related diagnoses.

Quasi-experimental evaluations of QOF have found no sustained effects for other clinical indicators.[14-16] Financial incentives in primary care tend to have modest effects on relatively simple clinical behaviours such as risk factor recording or test ordering.[12] The nature of targeted clinical behaviours is likely to influence the effectiveness of incentives.[29 30] Given that the QOF incentives directly rewarded case finding, we sought and found evidence of changed clinical practice 'downstream' to case finding. Previous research has found associations between case finding for depression and both new diagnoses and antidepressant prescribing.[21 31] However, our analysis of longitudinal data demonstrates policy effects at a population level and highlights the importance of accounting for secular trends and additional insights from comparative data.

The mechanisms by which rates of depression-related diagnoses increased remains unclear. Following the introduction of incentivised case finding, rates of new depression-related diagnoses rose in non-targeted long-term conditions, coincident with only a modest rise in recorded case finding in these patients. Incentivised case finding may have directly affected pathways of care or, more generally, increased awareness of the higher risk of depression in all patients with long-term conditions. A combination of these explanations seems likely given that our parallel ethnographic study of general practices demonstrated the absence of a systematic approach to following up and managing screen-positive cases.[32] It remains uncertain how the QOF and other payment for performance systems work.[33]

The interpretation of prescribing trends is more challenging. Taking pre-QOF trends into account, new prescriptions of antidepressants in patients with long-term conditions plateaued following the introduction of QOF before resuming the underlying trend in targeted conditions when incentivised case finding for depression was introduced. This plateau effect appears compatible with a view that the initial introduction of QOF diverted attention from psychosocial aspects of long-term condition care towards achieving biomedical targets.[34] It

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is also consistent with a longitudinal analysis of QOF in English general practice which found lower overall achievement rates for non-incentivised indicators compared to predicted values than for incentivised indicators.[22] Arguably, this might not represent a detrimental unintended consequence in the case of a potentially over-medicalised condition such as depression.[35]

The causes of on-going secular increases in antidepressant prescribing have been debated.[36 37] Hypotheses include poor compliance with clinical guidelines which do not recommend prescribing in the more commonly encountered mild to moderate depression,[31 38-40] an increase in duration of antidepressant prescribing in line with clinical guidelines rather than an increase in the number of patients prescribed for,[41] and the intensifying effect of QOF on prescribing patterns.[42] Our data included only the first prescription of any antidepressant for each patient, indicating that our observed trends are attributable to greater numbers of patients being treated rather than extended periods of prescribing. Therefore, our analysis supports the explanation that incentivised case finding perpetuated the rise in antidepressant prescribing because of a perceived need for clinical action over and above referral for counselling or watchful waiting.

The rate of antidepressant prescribing in this study exceeded the rate of diagnosis of depression in targeted and non-targeted groups, this trend was also reported by Burton and colleagues.[21] The limited use of clinical codes in the diagnosis of depression is recognised. Rather than a lack of diagnostic accuracy, it probably reflects how clinical coding is not always a part of routine practice and how GPs pragmatically prescribe according to symptoms and responses to treatment rather than diagnostic categories.[43 44]

Whilst we drew upon published guidance in conducting this interrupted time series, [45 46] we identified seven main limitations. First, the high 'signal to noise' ratio inherent in the use of routinely recorded data may have diminished the magnitude of observed effects.[47] Second, the true denominator for the binomial regression varies monthly as patients as patients exit the denominator population after undergoing incentivised case finding. There are also

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variations due patients dying and leaving the practice. We used annual QOF reports for the denominator values and took them to be constant for that year. Since the denominator is large compared to the number screened, the error of the model will be small. Third, we were unable to examine patient outcomes, such as recovery from depression, nor the appropriateness of treatment. We explored the use of routinely collected referral data but these were unreliably recorded and prone to temporal changes in coding practices. Fourth, targeted patients with diagnoses of diabetes and CHD may include individuals with a greater number of comorbidities than non-targeted patients.[48] Depression is more prevalent in patients with a greater number of physical comorbidities,[49 50] suggesting we were more likely to identify depression related diagnoses in this group. Fifth, our analysis is based upon one geographical area with a response rate of 58%. However, the characteristics of practices participating in the study were broadly similar to those for England and the non-participating practices. Sixth, observed trends may also have been related to changes in practice computerised record systems. Leeds practices began migrating to The Phoenix Partnership (TPP) SystmOne after 2006 until it became the majority provider in 2012 (Table 1). The choice of clinical computing system is associated with variations in practice QOF performance.[51] Seventh, given the absence of a control population of practices, it is possible that concurrent national and local initiatives may have contributed to our observed trends. NICE issued a clinical guideline on depression in 2004, which was subsequently revised in 2009;[52] even allowing for delayed diffusion or anticipatory effects, it is unlikely to explain any changes we observed from 2006 onwards. Nor do the introduction of the Improving Access to Psychological Therapies programme in Leeds from 2008-09 onwards or publication of the NICE clinical guideline on depression in adults with a chronic physical health problem in 2009 offer plausible alternative explanations.[53 54] Furthermore, the isolation of the exceptional year when case finding incentives were first introduced permits us to infer with confidence that we observed sustained higher rates of diagnosis.

Given the sustained promotion of case finding for depression across a range of long-term conditions and for carers,[8 9 55] there is a need for clearer guidance to optimise the pathway

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and outcomes of care for case finding-detected depression, including limiting antidepressant prescribing to patients most likely to benefit. Any effects of incentivised case finding need to be considered alongside costs. Based on payments offered under the 2012-13 UK QOF contract and without considering opportunity costs, we estimate that case finding for depression in CHD and diabetes cost over £6 million per annum[56] in the context of the £1 billion total estimated cost of QOF each year. These costs, the limited benefits we found, and the withdrawal of incentivised case finding for depression demonstrate the risk of rolling out policies in the absence of rigorous supporting evidence. Although policy-makers express frustration when debates about evidence appear to hold back service improvement,[57] there are hazards in following assumptions about how and whether apparently simple but deceptively complex interventions such as incentivised case finding work.[58]

The impact of the withdrawal of QOF incentivised case finding for depression is not yet known. A retrospective longitudinal study suggested levels of performance remain stable across a range of clinical activities following the removal of QOF incentives, although all indicators studied were indirectly or partly linked to activities which remained incentivised.[59] The longer term effects of completely withdrawing an incentive, such as case finding for depression, on clinical behaviour is unknown and merits further research.

What is already known on this topic
• Patients with long term conditions are at a higher risk of depression • There is limited knowledge about the population effects of incentivised case finding for depression in patients with long term conditions
What this study adds
• Incentivised case finding increased new depression-related diagnoses in people with long term conditions, including those not targeted by incentives.

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- The establishment of QOF disrupted rising trends in new prescriptions of antidepressants, which returned to earlier rates of increase in targeted conditions whilst modestly decelerating in non-targeted conditions
- The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

Competing Interests Statement

All authors report grants from National Institute for Health Research under its Research for Patient Benefit Programme, during the conduct of the study.

Ethics Approval

This study was approved by the East Midlands - Derby 2 Research Ethics Committee (reference 11/EM/0144).

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Transparency Declaration

Dr Kate McLintock, the lead author (the manuscript's guarantor), affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no

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important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Data sharing statement

Full dataset and statistical code available from the corresponding author at k.l.mclintock@leeds.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

Contributorship Statement

RF and AH conceived the project. RF was principal investigator. KM and SA designed the study. KM and AR were responsible for running the project. RW was responsible for statistical analyses. All authors interpreted the data and findings. KM wrote the first draft of the manuscript. RF commented on the first draft and all authors commented on further revisions. KM is guarantor of the paper.

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References

1. R D Goldney, P J Phillips, L J Fisher, et al. Diabetes, Depression and Quality of Life. Diabetes Care 2004;27:1066-70.
2. S J C Davies, P R Jackson, J Pokotar, et al. Treatment of anxiety and depressive disorders in patients with cardiovascular disease. BMJ 2004;328:939.
3. H Lester, A Howe. Depression in Primary Care: three key challenges. Postgrad Med J 2008;84(996):545-48.
4. J R T Davidson, S E Meltzer-Brody. The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion. J Clin Psychiatry 1990;60 (supplement 7):4-9.
5. R M Carney, K E Freedland, G E Miller, et al. Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. J Psychosom Res 2002;53:897-902.
6. M A Whooley, P de Jonge, E Vittinghoff, et al. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA 2008;300(20):2379-88.
7. G E Simon, W J Katon, E H B Lin, et al. Diabetes complications and depression as predictors of health service costs. Gen Hosp Psychiatry 2005;27(5):344-51.
8. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90, 2009:8.
9. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009:8.
10. The NHS Information Centre for Health & Social Care. QOF clinical domain: depression. Secondary QOF clinical domain: depression 2013. https://mqi.ic.nhs.uk/IndicatorDefaultView.aspx?ref=1.07.04.
11. National Institute for Health and Clinical Excellence Special Health Authority Primary Care Quality and Outcomes Framework Indicator Advisory Committee. Confirmed minutes of the June 2011 QOF Advisory Committee: National Institute for Health and Clinical Excellence, 2011:23-24.
12. A Scott, P Sivey, D Ait Ouakrim, et al. The effect of financial incentives on the quality of health care provided by primary care physicians (Review). Cochrane Database of Systematic Reviews 2011;9.
13. L A Petersen, L D Woodard, T Urech, et al. Does Pay-for-Performance Improve the Quality of Health Care? Ann Intern Med 2006;145(4):265-72.
14. S Gillam, N Siriwardena, N Steel. Pay-for-performance in the UK: the impact of the quality and outcomes framework - a systematic review. Ann Fam Med 2012;10(5):461-68.
15. B Serumaga, D Ross-Degnan, A Avery, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ 2011;342:d108.
16. E Kontopantelis, D Reeves, J M Valderas, et al. Recorded quality of primary care for patients with diabetes in England before and after the introduction of a financial incentive scheme: a longitudinal observational study. BMJ Qual Saf 2013;22:53-64.
17. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, England level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9548&q=qof+depression&sort=Relevance&size=10&page=1#top.
18. Thombs B, Ziegelstein R, Roseman M, et al. There are no randomized controlled trials that support the United States Preventive Services Task Force guideline on screening for depression in primary care: a systematic review. BMC Medicine 2014;12(1):13.
19. S M Gilbody, T A Sheldon, A O House. Screening and case-finding instruments for depression: a meta-analysis. CMAJ 2008;178:997-1003.

For peer review only

20. E A O'Connor, E P Whitlock, T L Beil, et al. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Int Med 2009;151(11):793-803.
21. C Burton, C Simpson, N Anderson. Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study. Psychol Med 2013;43(3):529-37.
22. T Doran, E Kontopantelis, J M Valderas, et al. Effect of Financial Incentives on Incentivised and Non-incentivised Clinical Activities: Longitudinal Analysis of Data from the UK Quality and Outcomes Framework. BMJ 2011;342:d3590
23. Public Health Observatories of England. Health Profile 2012; Leeds. Health Profiles 2012. http://www.apho.org.uk/resource/view.aspx?RID=50215&SEARCH=L* (accessed 18 February 2014).
24. Public Health Observatories of England. Community Mental Health Profiles. 2013. www.nepho.org.uk/cmhp (accessed 18 February 2014).
25. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, PCT level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9592&q=qof+depression&sort=Relevance&size=10&page=1#top.
26. V Hammersley, A Meal, L Wright, et al. Journal of Informatics in Primary Care. 1998(November):3-7.
27. British National Formulary. 4.7.3 Neuropathic Pain. 2014; (7 February 2014). http://www.medicinescomplete.com/mc/bnf/current/PHP2814-neuropathic-pain.htm.
28. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. 2010. http://www.R-project.org/.
29. C Arditi, M Rège-Walther, J C Wyatt, et al. The effect of automatically generated reminders delivered to providers on paper on professional practice. Cochrane Database of Systematic Reviews 2012;12.
30. T Custers, J Hurley, N S Klazinga, et al. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv Res 2008;8:66.
31. B D Jani, D Purves, S Barry, et al. Challenges and implications of routine depression screening for depression in chronic disease and multimorbidity: a cross sectional study. PLoS ONE 2013;8(9):e74610.
32. S L Alderson, A Russell, K McLintock, et al. Incentivised screening for depression in patients with chronic heart disease and diabetes: an ethnographic study. (In preparation).
33. B Guthrie, Morales DR. What happens when pay for performance stops? BMJ 2014;348:g1413.
34. K Checkland, S Harrison. The impact of the Quality and Outcomes Framework on practice organisation and service delivery: summary of evidence from two qualitative studies. Qual Prim Care 2010;18:139-46.
35. C Dowrick, A Frances. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ 2013;347:f7140.
36. D Spence, I Reid. Head to Head: Are antidepressants overprescribed? BMJ 2013;346:f190.
37. T Kendrick. Letters: Where next for QOF? Killing the Quality and Outcomes Framework won't decrease prescribing for depression. BMJ 2013;346:f2742.
38. R C Kessler, P Berglund, O Demler, et al. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). JAMA 2003;289(23):3095-105.
39. H Dumesnil, S Cortaredona, H Verdoux, et al. General practitioners' choices and their determinants when starting treatment for major depression: a cross sectional, randomized case-vignette survey. PLOS ONE 2012;7:e52429

For peer review only

40. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:9.
41. M Moore, H M Yuen, N Dunn, et al. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. BMJ 2009;339:b3999.
42. S P MacBride-Stewart, R Elton, T Walley. Do quality incentives change prescribing patterns in primary care? An observational study in Scotland. Fam Pract 2008;25(1):27-32.
43. G Rait, K Walters, M Griffin, et al. Recent trends in the incidence of recorded depression in primary care. Br J Psychiatry 2009;195:520-254.
44. K J Joling, H W van Marwijk, E Piek, et al. Do GPs' medical records demonstrate a good recognition of depression? A new perspective on case extraction. J Affect Disord 2011;133:522-257.
45. Cochrane Effective Practice and Organisation of Care Group. Data Collection Checklist. In: Cochrane Effective Practice and Organisation of Care Group, ed. EPOC Resources. Ottawa, Ontario, Canada: University of Ottawa, 2002.
46. C R Ramsay, L Matowe, R Grilli, et al. Interrupted time series designs in health technology assessment: Lessons from two systematic reviews of behavior change strategies. Int J Technol Assess Health Care 2003;19(4):613-23.
47. C Brown, T Hofer, A Johal, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care 2008;17:170-77.
48. K Barnett, S W Mercer, M Norbury, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. The Lancet 2012;380(9836):37-43.
49. J M Gunn, D R Ayton, K Densley, et al. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Soc Psychiat Epidemiol 2012;47(2):175-84.
50. S Moussavi, S Chatterji, E Verdes, et al. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet 2007;370(9590):851-58.
51. E Kontopantelis, I Buchan, D Reeves, et al. Relationship between quality of care and choice of clinical computing system: retrospective analysis of family practice performance under the UK's quality and outcomes framework. BMJ Open 2013;3:e003190.
52. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009.
53. IAPT Programme. IAPT. Improving Access to Psychological Therapies. 2013. http://www.iapt.nhs.uk/ (accessed 18 February 2014).
54. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009.
55. Royal College of General Practitioners. Supporting Carers: An action guide for general practitioners and their teams. Second ed. London, 2013:26.
56. Health and Social Care Information Centre. Quality and Outcomes Framework - 2012-13: England level data. Secondary Quality and Outcomes Framework - 2012-13: England level data 2013. http://www.hscic.gov.uk/article/2021/Website-Search?productid=12972&q=quality+outcomes+framework+2012-13&sort=Relevance&size=10&page=1&area=both#top.
57. J Oldham. Reform reform: an essay by John Oldham. BMJ 2013;347:f6716.
58. P Craig, P Dieppe, S Macintyre, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
59. E Kontopantelis, D Springate, D Reeves, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. BMJ 2014;348:g330

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Figure Legends

Table 1 Characteristics of general practices in England and those in Leeds which did and did not share data for the study based upon data published in 2012.

Table 2 Annual numbers of case finding, new depression-related diagnoses and new prescriptions of antidepressants in Leeds over 2001-12 for conditions targeted or not by incentivised case-finding.

Table 3 Annual incidences of case finding, new depression-related diagnoses and new prescriptions of antidepressants (per 100,000 patients) in Leeds over 2001--12, for conditions targeted or not by incentivised case-finding.

Figure 1 Rates of coded case finding for depression in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 2 Rates of new depression-related coded diagnoses in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 3 Rates of new antidepressant prescribing in patients with conditions targeted or not by incentivised case-finding, 2002-12.

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Table 1

Practice characteristics	All England	Recruited	Not-recruited	p
Practices, n[a]	8323	65	47	
List Size (patients, median)[a]	5987	**7182**	**4694**	**0.03**
Under 18 years (%)	20.5	20.7	20.2	0.29
65 years and over (%)	16.2	14.5	15.8	0.05
Number of GPs in the practice (mean)[b]	4.4	5.3	**4.2**	**0.04*†**
Male	2.4	2.5	2.2	0.28*†
Female	2	**2.8**	**1.9**	**0.02*†**
Inidices of Multiple Deprivation[a]	23.9	28.5	28.9	0.88
Rural/Urban Classification (% urban)[c]*	84.9	96.9	97.9	0.93
Patient Survey (%)[a]				
Would Recommend	85.9	83.2	82.8	0.8
Have a Chronic Disease	53.4	52.5	53.7	0.17
Carers	18.2	**17.1**	**18.9**	**0.04**
Working	60.1	61.7	58.9	0.13
Unemployed	5.2	5.76	6.42	0.91
Clinical Computing System[d]*				
TPP SystmOne	1494	42	33	-
EMIS (combined LV, PCS, Web)	4649	22	11	-
Other	2231	1	3	0.25‡
QOF (%)[a]				
Total Score	98.5	98.8	98.7	0.99
Exception Rate	5.1	5.4	4.7	0.08
Chronic Disease Prevalence (%)[a]				
CHD	3.4	**3.6**	**4.1**	**0.03**
Hypertension	13.9	**13**	**13.8**	**0.04**
Diabetes	4.7	4.4	4.6	0.48
Asthma	5.9	6	5.9	0.81
COPD	1.6	**1.7**	**2**	**0.02**
Depression	8.7	8.7	7.8	0.35
Epilepsy	0.6	**0.6**	**0.7**	**0.04**
Dementia	0.4	0.5	0.5	0.69

Data published 2012, except *2011. Averages are median unless otherwise stated. Comparison with Kruskall-Wallis test except †Student's T-test when comparison of means was more appropriate, and ‡Fisher's exact where comparison was between proportions. Comparison is between recruited and not-recruited practices, there is no comparison to 'All England' as the local practices are also in this group and cannot be compared to a group containing themselves.

[a] Public Health England. Fingertips. National Public Health Profiles. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://fingertips.phe.org.uk/

[b] Health and Social Care Information Centre. NHS Staff - 2001-2011, General Practice. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.

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[c] Health and Social Care Information Centre. Indicator Portal. [Online]. 2011. [Accessed 6 May 2014]. Available from: https://indicators.ic.nhs.uk/

[d] Direct enquiry to Health and Social Care Information Centre, May 2014. Reference NIC-270580-S0V6P. The total number of practices for these data (2011) differ from the Practices, n denominator (2012) due to the different year of data collection.

Table 2

Year	Counts					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	1	20	11	36	99	199
2002-03	14	99	97	323	406	864
2003-04	18	121	165	477	526	1163
2004-05	17	144	218	687	575	1324
2005-06	68	169	260	706	604	1312
2006-07	13363	1555	705	927	909	1429
2007-08	4242	1089	438	985	871	1594
2008-09	2741	800	423	860	925	1752
2009-10	2809	1080	420	1003	1028	1921
2010-11	2801	1691	458	979	1244	2195
2011-12	2830	1755	435	937	1306	2319

Table 3

Year	Rates per 100,000 patients					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	0.0010	0.0058	0.0061	0.0138	0.1050	0.0662
2002-03	0.0038	0.0072	0.0279	0.0286	0.1118	0.0794
2003-04	0.0039	0.0088	0.0366	0.0441	0.1257	0.1057
2004-05	0.0032	0.0103	0.0557	0.0710	0.1565	0.1354
2005-06	0.0210	0.0121	0.0648	0.0664	0.1524	0.1314
2006-07	3.3199	0.1450	0.1946	0.0907	0.2296	0.1359
2007-08	1.0276	0.0989	0.1127	0.1077	0.2185	0.1564
2008-09	0.7139	0.0732	0.1125	0.0918	0.2414	0.1674
2009-10	0.7244	0.0850	0.1212	0.0952	0.2543	0.1774
2010-11	0.6708	0.1293	0.1258	0.0905	0.2783	0.1843
2011-12	0.6849	0.1254	0.1093	0.0805	0.2954	0.1973

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The effects of financial incentives for case finding for depression in patients with diabetes and coronary heart disease: interrupted time series analysis

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Abstract

Objectives

To evaluate the effects of Quality and Outcomes Framework (QOF) incentivised case finding for depression on diagnosis and treatment in targeted and non-targeted long-term conditions.

Design

Interrupted time series analysis

Setting

General practices in Leeds, United Kingdom (UK).

Participants

Sixty-five (58%) of 112 general practices shared data on 37,229 patients with diabetes and coronary heart disease (CHD) targeted by case finding incentives, and 101,008 patients with four other long-term conditions not targeted (hypertension, epilepsy, chronic obstructive pulmonary disease (COPD) and asthma).

Intervention

Incentivised case finding for depression using two standard screening questions.

Main Outcome Measures

Clinical codes indicating new depression-related diagnoses and new prescriptions of antidepressants. We extracted routinely recorded data from February 2002 through April 2012. The number of new diagnoses and prescriptions for those on registers was modelled with a binomial regression which provided the strength of associations between time periods and their rates.

Results

New diagnoses of depression increased from 21 to 94 per 100,000 per month in targeted patients between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). The rate

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increased from 27 to 77 per 100,000 per month in non-targeted patients (OR 1.53; 1.46 to 1.62). The slopes in prescribing for both groups flattened to zero immediately after QOF was introduced but before incentivised case finding (p<0.01 for both). Antidepressant prescribing in targeted patients returned to the pre-QOF secular upward trend (Wald test for equivalence of slope, z=0.73, p=0.47); the slope was less steep for non-targeted patients (z=-4.14, p<0.01).

Conclusions

Incentivised case finding increased new depression-related diagnoses. ~~in people with diabetes, CHD and other long term conditions.~~ The establishment of QOF disrupted rising trends in new prescriptions of antidepressants~~. These trends~~ which resumed following the introduction of incentivised case finding ~~with a modest deceleration in prescribing for non-targeted conditions~~. ~~The continued rise in antidepressant p~~Prescribing trends are ~~is~~ of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

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Article summary

Strengths and limitations of this study

Strengths

- Rigorous quasi-experimental design demonstrating policy effects on patient populations within a ~~representative~~ sample of general practices which appears broadly representative on key parameters.
- Further insights gained from comparison of trends in patient populations targeted and non-targeted by intervention

Limitations

- Relatively high 'signal to noise' ratio inherent in use of routinely recorded data may have diminished the magnitude of observed effects
- The absence of a control population of practices, making it hard to rule out possibility that concurrent national and local initiatives contributed to observed trends
- Lack of data on patient outcomes, such as recovery from depression or the appropriateness of treatment

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Background

Long-term physical conditions are associated with a high prevalence of depression; people with diabetes or CHD have a two to three-fold increased lifetime risk.[1 2] Such co-morbidity can make depression hard to recognise,[3 4] worsens the prognosis of both conditions [1 5 6] and increases healthcare and societal costs.[1 7] ~~According to expected prevalence, 'usual care' by general practitioner under diagnoses depression by 30-50%.~~

The UK National Institute for Health and Care Excellence (NICE) recommends case finding for depression in people with long-term physical conditions.[8 9] The Quality Outcomes Framework (QOF) for general practice was established in 2004 and correspondingly rewarded case finding for depression in all patients with a diagnosis of CHD or diabetes over 2006-13 (QOF years three to nine) ~~through the use of two standard screening questions~~. This indicator was known as 'QOF DEP1' and defined as, "the percentage of patients on the diabetes register and/or the CHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions."[10] A designated clinical code indicating the use of these ~~screening~~ questions was recorded in the patient record whenever the Patient Health Questionnaire-2 (PHQ2) was administered, irrespective of the responses. Practices were reimbursed according to the proportion of patients with a record of case finding in the preceding 15 months. Payment thresholds were set at achievements of 40-90% of eligible patients until 2012, and 50-90% 2012-13. The indicator had a value of eight points from 2006-10 and six points from 2010-13. Each point was worth £133.76 in 2012-13, the final year of incentivisation. This incentivised case finding has now been withdrawn from the QOF because of doubts over benefits.[11]

The impact of this policy has been uncertain. The effectiveness of financial incentives in changing clinical behaviour is limited[12] and pay-for-performance schemes often have unintended adverse consequences.[13] More specifically, a systematic review concluded advances in quality of care for long-term conditions included in UK QOF were modest.[14]

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There are few rigorous evaluations of the effects of pay-for-performance, given that controlled comparisons are rarely acceptable to policy-makers. Two interrupted time series evaluations of QOF have not shown any sustained effects on processes of care or clinical outcomes.[15 16] Whilst there are no coded data prior to the introduction of the case finding indicator, at face value the QOF did incentivise a change in practice given that around 86% of patients with diabetes and CHD have been coded as screened at least every 15 months since its inception.[17] Yet there is no evidence that case finding for depression, whether- in the presence[18] or in the absence of coordinated care systems, improves patient outcomes.[19] [20] improves patient outcomes. A cohort study found a greater likelihood of a new diagnosis of depression and initiation of antidepressant treatment in the 28 days following QOF-incentivised case finding;[21] the longer term effects on the whole population eligible for case finding are unknown. There may be further unintended effects on populations with other long-term conditions not targeted by incentivised case finding. Examining quality of care across a number of conditions Doran et al found that improvements associated with QOF incentives occurred at the expense of small detrimental effects on aspects of non-incentivised care.[22]

We evaluated the effects of incentivised case finding on new depression-related diagnoses and new prescriptions of antidepressants in patient populations with long-term conditions targeted or not by financial incentives.

Methods

Study design

We used an interrupted time series design to evaluate the effects of incentivised case finding whilst accounting for underlying secular trends. We also compared trends in depression diagnosis and treatment between those patient populations targeted by incentivised case finding (diabetes and CHD) and other patient populations with long-term physical conditions not targeted by incentivised case finding (hypertension, epilepsy, COPD and asthma). Our

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rationale was that we would not expect outcomes in the non-targeted group to diverge from underlying secular trends.

Practices and participants

We invited all 112 general practices in Leeds to share anonymised patient data via the Information in General Practice~~/ Data Quality~~ Team of the then National Health Service (NHS) primary care trust. No distinction was made between users of different electronic records systems. Compared with English indicators the physical health of people in Leeds is generally worse and levels of deprivation are higher.[23] Recorded depression in adults is similar (both around 11%)[24] as is ~~the last~~ performance on the QOF incentivised case finding indicator in our final year of data collection (87% for Leeds over 2011-12 compared to England average of 86%).[17 25] We sought data on patients with diabetes and CHD targeted by case finding and data from other patients with the four comparator and non-target, long-term physical conditions from QOF registers. Patients with conditions in both targeted and non-targeted groups were excluded from non-targeted group analysis to avoid double counting. Therefore, any change in outcomes in the non-targeted group could not be attributable to individuals being screened because they had a targeted condition.

Data Collection

We collected retrospective, electronic data from February 2002 through April 2012 for patients aged 18 years and over. Data were extracted through Morbidity Information Query and Export Syntax (MIQUEST) software, used for collecting data from general practice clinical computing systems in a consistent and comparable way. The tool utilises a query language, which incorporates security and confidentiality safeguards; pseudoanonymisation supports the extraction of patient level information but ensures it is not attributable to individual patients.[26] Participating practices consented to the extraction of anonymised patient data and did not need to take any further action.

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We recognised that the diagnosis of depression was likely to be under-recorded in clinical records because of factors such as diagnostic uncertainty and patient preference. The recording of certain diagnostic Read Codes, such as 'depressive disorder,' automatically triggers alerts for further assessments required by QOF. Failure to meet these targets reduces practice income and hence coding behaviour may have changed. We therefore also searched for use of more sensitive but less specific Read codes such as 'low mood' or 'depressed mood' which are not assessed by the QOF and included these in our main outcome of diagnosis. We excluded codes related to postnatal depression.

Data on the prescription of licensed antidepressant drugs listed in British National Formulary section 4.3 were collected, with the exception of antidepressants judged by clinicians involved in the project (RF, AH, SA, KM) to be more commonly prescribed for other indications (e.g. amitriptyline and nortriptyline for neuropathic pain).[27]

A complete list of clinical codes for each outcome measure is available as an electronic web appendix.

Data analysis

The denominators comprised the numbers of patients on practice registers for each financial year (starting 1st April) targeted by incentivised case finding (diabetes and CHD) and those not targeted (hypertension, epilepsy, COPD and asthma). We assumed that registered long-term condition populations would be relatively stable over each year. We took the number of registered long-term condition populations per practice as constant over each QOF year. ~~The error from this in our subsequent analysis was negligible, as verified by sensitivity analysis.~~ This permitted a more parsimonious model to facilitate interpretation.

For each targeted and non-targeted patient group, we analysed trends in new depression-related diagnoses and antidepressant prescribing. We also examined the uptake of case finding for depression. We recognised that these trends could relate to changes in coding as

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well as clinical practice; we mainly used their outputs to guide interpretation of the main outcomes. Data were aggregated by month for each of the 65 practices so that each time series is 123 months long (February 2002 to April 2012). Analysis was carried out at the practice level using a binomial regression based on the calculated numerators and the available denominators. Discontinuities were modelled at key dates: April 2004 for the introduction of QOF; and April 2006 for the introduction of incentives for case finding for depression. A further discontinuity was introduced at April 2007 to isolate exceptional behaviour noted during the QOF year April 2006 through March 2007. Our focus and interest was on the long-term sustained effect seen after the introduction of case finding incentives rather than the immediate change. To avoid bias from this first year (2006/7) rates were permitted to be different in that year, so isolating it from the sustained effect we sought to assess. For each time period (February 2002 to March 2004; April 2004 to March 2006; April 2006 to March 2007; April 2007 to April 2012) the model has an overall constant and slope. Specific slope terms were dropped when they were found not to be statistically significant from zero at the 5% level. ~~This permitted a more parsimonious model to facilitate interpretation.~~

Fitting seasonal effects improved the model but added complexity. As reference and intervention periods were integer multiples of complete years, there would be no perturbation of level or slope if explicit seasonality terms were not included, but rather seasonality was encompassed within the error term. Since the profile of seasonality appeared to change from the reference period to the intervention period and vary in the group with targeted interventions compared to the group for other long-term conditions, this option was selected to yield the clearest effect in the model. The model can be expressed as:

Let Y_{Tit} and Y_{Nit} be random variables representing the number of diagnoses at practice i in month t for targetted and non-targetted patients respectively. Then

$$\Pr\left(Y_{Tit}=y_{Tit}\right)=\binom{n_{Tit}}{y_{Tit}}\pi_{Tit}^{y_{Tit}}\left(1-\pi_{Tit}\right)^{(n_{Tit}-y_{Tit})} \qquad (1)$$

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where $y_{Tit} \in \{0, 1, \ldots, n_{Tit}\}$, n_{Tit} is the relevant denominator for practice i in month t, and π_{Tit} is the corresponding rate of diagnosis. Using a logit link function in the generalised regression, we model the rate π_{Tit} with

$$\log\left(\frac{\pi_{Tit}}{1-\pi_{Tit}}\right) = \mu_{T0} + m_{Ti} + \beta_{T1} 1_{t\in 2006} + \beta_{T2} 1_{t>2006} \qquad (2)$$

and

$$m_i \in N(0, \sigma^2) \qquad (3)$$

where $1_{t\in 2006}$ is an indicator variable for the year 2006/2007 and $1_{t>2006}$ is an indicator for the intervention period, that is after the year 2006/2007. Note that a random intercept m_{Ti} is included to account for clustering within practices. Slope terms were also added where appropriate. The open source software R 2.12.0 64 bit version was used for all statistical analysis.[28]

Results

We recruited 65 (58%) of 112 Leeds practices. Their 2012 QOF registers indicated that they served 37,229 patients with diabetes and CHD targeted for case finding for depression and 101,008 patients with other long-term conditions not targeted. Table 1 provides data on all English practices and compares characteristics of recruited and not-recruited practices. ~~with those in England.~~

Overall, the practices recruited were larger; however, we found no significant differences in Indices of Multiple Deprivation or, total QOF scores. The majority of practices used ~~data were drawn from~~ one clinical computing system by the end of data collection. Tables 2 and 3 summarise~~s~~ the annual incidences of case finding, depression-related diagnoses and prescription of antidepressants by count and rates per 100,000 patients, for targeted and non-targeted patients.

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Practice-level analysis found significant increases in new coded case finding following the initiation of incentives, also reflected in aggregated city-wide level trends (Figure 1). The exceptional rise in 2006 reflects first coding ~~Coded case finding increased exceptionally during 2006, especially for the targeted population~~ in patients with existing diagnoses of diabetes and CHD. Comparing the period April 2004 to March 2006 with April 2007 to March 2012, rates of case finding increased in the targeted population from 0.07 to 7.45 per 1000 per month (OR 99.76; 95% confidence interval 83.15 to 119.68) and in the non-targeted population increased from 0.1 to 0.78 per 1000 per month (OR 7.54; 6.91 to 8.24).

Binomial regression of the practice level data confirmed statistically significant rate increases in new depression-related diagnoses in both patient populations. In targeted patients, the diagnosis rate increased from 21 to 94 per 100,000 per month between the periods 2002-4 and 2007-12~~1~~ (OR 2.09; 1.92 to 2.27). In non-targeted patients, the rate increased from 27 to 77 per 100,000 per month (OR 1.53; 1.46 to 1.62). In neither of these periods was the slope statistically significant from zero: that is the rates can be~~, and were, taken as~~ assumed to be constant during these periods. Figure 2 shows these trends aggregated at a city level with fitted constants and slopes, indicated by dashed lines.

Figure 3 shows the city-level trends for new antidepressant prescribing with fitted constants and slopes. Rates of prescribing increased over the full period of observation. During the period after QOF was introduced but before incentives (April 2004~~2~~ to March 2006~~4~~), the slopes for both populations flattened to zero (p<0.01 for both groups). For targeted patients, the slopes before the introduction of QOF and after the exceptional year were similar (Wald test for equivalence of slope, z=0.73, p=0.47). For non-targeted patients the slope for the latter period was less steep (Wald test for slope, z=-4.14, p<0.01). All Wald tests for slopes were undertaken using practice level data.

Discussion

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Incentivised case finding increased rates of new depression-related diagnoses in patients with CHD and diabetes and, to a lesser extent, in those with non-targeted long-term conditions. The spike in diagnoses immediately following incentivisation probably reflects coding patterns before general practitioners began to realise they would trigger alerts for further assessments required by QOF when recording depression related diagnoses. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants; these resumed following the introduction of incentivised case finding, although there was a modest deceleration in antidepressant prescribing for non-targeted conditions. Rates of new prescriptions for antidepressants exceeded those for depression-related diagnoses.

Quasi-experimental evaluations of QOF have found no sustained effects for other clinical indicators.[14-16] Financial incentives in primary care tend to have modest effects on relatively simple clinical behaviours such as risk factor recording or test ordering.[12] The nature of targeted clinical behaviours is likely to influence the effectiveness of incentives.[29 30] Given that the QOF incentives directly rewarded case finding, we sought and found evidence of changed clinical practice 'downstream' to case finding. Previous research has found associations between case finding for depression and both new diagnoses and antidepressant prescribing.[21 31] However, our analysis of longitudinal data demonstrates policy effects at a population level and highlights the importance of accounting for secular trends and additional insights from comparative data.

The mechanisms by which rates of depression-related diagnoses increased remains unclear. Following the introduction of incentivised case finding, rates of new depression-related diagnoses rose in non-targeted long-term conditions, coincident with only a modest rise in recorded case finding in these patients. Incentivised case finding may have directly affected pathways of care or, more generally, increased awareness of the higher risk of depression in all patients with long-term conditions. A combination of these explanations seems likely given that our parallel ethnographic study of general practices demonstrated the absence of

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a systematic approach to following up and managing screen-positive cases.[32] It remains uncertain how the QOF and other payment for performance systems work.[33]

The interpretation of prescribing trends is more challenging. Taking pre-QOF trends into account, new prescriptions of antidepressants in patients with long-term conditions plateaued following the introduction of QOF before resuming the underlying trend in targeted conditions when incentivised case finding for depression was introduced. This plateau effect appears compatible with a view that the initial introduction of QOF diverted attention from psychosocial aspects of long-term condition care towards achieving biomedical targets.[34] It is also consistent with a longitudinal analysis of QOF in English general practice which found lower overall achievement rates for non-incentivised indicators compared to predicted values than for incentivised indicators.[22] Arguably, this might not represent a detrimental unintended consequence in the case of a potentially over-medicalised condition such as depression.[35]

The causes of on-going secular increases in antidepressant prescribing have been debated.[36 37] Hypotheses include poor compliance with clinical guidelines which do not recommend prescribing in the more commonly encountered mild to moderate depression,[31 38-40] an increase in duration of antidepressant prescribing in line with clinical guidelines rather than an increase in the number of patients prescribed for,[41] and the intensifying effect of QOF on prescribing patterns.[42] Our data included only the first prescription of any antidepressant for each patient, indicating that our observed trends are attributable to greater numbers of patients being treated rather than extended periods of prescribing. Therefore, our analysis supports the explanation that incentivised case finding perpetuated the rise in antidepressant prescribing because of a perceived need for clinical action over and above referral for counselling or watchful waiting.

The rate of antidepressant prescribing in this study exceeded the rate of diagnosis of depression in targeted and non-targeted groups, this trend was also reported by Burton and colleagues.[21] The limited use of clinical codes in the diagnosis of depression is recognised. Rather than a lack of diagnostic accuracy, it probably reflects how clinical coding is not

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always a part of routine practice and how GPs pragmatically prescribe according to symptoms and responses to treatment rather than diagnostic categories.[43 44]

Whilst we drew upon published guidance in conducting this interrupted time series, [45 46] we identified ~~four~~ seven main limitations. First, the high 'signal to noise' ratio inherent in the use of routinely recorded data may have diminished the magnitude of observed effects.[47] Second, the true denominator for the binomial regression varies monthly as patients as patients exit the denominator population after undergoing incentivised case finding. There are also variations due patients dying and leaving the practice. We used annual QOF reports for the denominator values and took them to be constant for that year. Since the denominator is large compared to the number screened, the error of the model will be small.~~Second~~ Third, we were unable to examine patient outcomes, such as recovery from depression, nor the appropriateness of treatment. We explored the use of routinely collected referral data but these were unreliably recorded and prone to temporal changes in coding practices. Fourth, targeted patients with diagnoses of diabetes and CHD may include individuals with a greater number of comorbidities than non-targeted patients.[48] Depression is more prevalent in patients with a greater number of physical comorbidities,[49 50] suggesting we were more likely to identify depression related diagnoses in this group.~~Third~~ Fifth, our analysis is based upon one geographical area with a response rate of 58%. However, ~~over half~~the characteristics of ~~the~~ practices ~~we approached agreed to share data for~~participating in the study~~, their characteristics~~ were broadly similar to those for England and the non-participating practices. Sixth, observed trends may also have been related to changes in practice computerised record systems. Leeds practices began migrating to The Phoenix Partnership (TPP) SystmOne after 2006 until it became the majority provider in 2012 (Table ~~2~~1). The choice of clinical computing system is associated with variations in practice QOF performance.[51] ~~Fourth~~Seventh, given the absence of a control population of practices, it is possible that concurrent national and local initiatives may have contributed to our observed trends. NICE issued a clinical guideline on depression in 2004, which was subsequently revised in 2009;[52]

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even allowing for delayed diffusion or anticipatory effects, it is unlikely to explain any changes we observed from 2006 onwards. Nor do the introduction of the Improving Access to Psychological Therapies programme in Leeds from 2008-09 onwards or publication of the NICE clinical guideline on depression in adults with a chronic physical health problem in 2009 offer plausible alternative explanations.[53 54] Furthermore, the isolation of the exceptional year when case finding incentives were first introduced permits us to infer with confidence that we observed sustained higher rates of diagnosis.

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Given the sustained promotion of case finding for depression across a range of long-term conditions and for carers,[8 9 55] there is a need for clearer guidance to optimise the pathway and outcomes of care for case finding-detected depression, including limiting antidepressant prescribing to patients most likely to benefit. Any effects of incentivised case finding need to be considered alongside costs. Based on payments offered under the ~~2011-12~~2012-13 UK QOF contract and without considering opportunity costs, we estimate that case finding for depression in CHD and diabetes cost over £6~~-3~~ million per annum[56] in the context of the £1 billion total estimated cost of QOF each year. These costs, the limited benefits we found, and the withdrawal of incentivised case finding for depression demonstrate the risk of rolling out policies in the absence of rigorous supporting evidence. Although policy-makers express frustration when debates about evidence appear to hold back service improvement,[57] there are hazards in following assumptions about how and whether apparently simple but deceptively complex interventions such as incentivised case finding work.[58]

The impact of the withdrawal of QOF incentivised case finding for depression is not yet known. A retrospective longitudinal study suggested levels of performance remain stable across a range of clinical activities following the removal of QOF incentives, although all indicators studied were indirectly or partly linked to activities which remained incentivised.[59] The longer term effects of completely withdrawing an incentive, such as case finding for depression, on clinical behaviour is unknown and merits further research.

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What is already known on this topic
• Patients with long term conditions are at a higher risk of depression • There is limited knowledge about the population effects of incentivised case ~~screening~~ finding for depression in patients with long term conditions
What this study adds
• Incentivised case finding increased new depression-related diagnoses in people with long term conditions, including those not targeted by incentives. • The establishment of QOF disrupted rising trends in new prescriptions of antidepressants, which returned to earlier rates of increase in targeted conditions whilst modestly decelerating in non-targeted conditions • The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

Competing Interests Statement

All authors report grants from National Institute for Health Research under its Research for Patient Benefit Programme, during the conduct of the study.

Ethics Approval

This study was approved by the East Midlands - Derby 2 Research Ethics Committee (reference 11/EM/0144).

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the article for publication. All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency Declaration

Dr Kate McLintock, the lead author (the manuscript's guarantor), affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Data sharing statement

Full dataset and statistical code available from the corresponding author at k.l.mclintock@leeds.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

Contributorship Statement

RF and AH conceived the project. RF was principal investigator. KM and SA designed the study. KM and AR were responsible for running the project. RW was responsible for statistical analyses. All authors interpreted the data and findings. KM wrote the first draft of the manuscript. RF commented on the first draft and all authors commented on further revisions. KM is guarantor of the paper.

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Figure Legends

Table 1. Characteristics of general practices in England and those in Leeds which did and did not share data for the study based upon data published in 2012.

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Table 2 Annual numbers of case finding, new depression-related diagnoses and new prescriptions of antidepressants in Leeds over 2001-12 for conditions targeted or not by incentivised case-finding.

Table 3 Annual incidences of case finding, new depression-related diagnoses and new prescriptions of antidepressants (per 100,000 patients) in Leeds over 2001--12, for conditions targeted or not by incentivised case-finding.

Figure 1 Rates of coded case finding for depression in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 2 Rates of new depression-related coded diagnoses in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 3 Rates of new antidepressant prescribing in patients with conditions targeted or not by incentivised case-finding, 2002-12.

References

1. R D Goldney, P J Phillips, L J Fisher, et al. Diabetes, Depression and Quality of Life. Diabetes Care 2004;27:1066-70.
2. S J C Davies, P R Jackson, J Pokotar, et al. Treatment of anxiety and depressive disorders in patients with cardiovascular disease. BMJ 2004;328:939.
3. H Lester, A Howe. Depression in Primary Care: three key challenges. Postgrad Med J 2008;84(996):545-48.
4. J R T Davidson, S E Meltzer-Brody. The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion. J Clin Psychiatry 1990;60 (supplement 7):4-9.
5. R M Carney, K E Freedland, G E Miller, et al. Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. J Psychosom Res 2002;53:897-902.
6. M A Whooley, P de Jonge, E Vittinghoff, et al. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA 2008;300(20):2379-88.
7. G E Simon, W J Katon, E H B Lin, et al. Diabetes complications and depression as predictors of health service costs. Gen Hosp Psychiatry 2005;27(5):344-51.
8. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90, 2009:8.
9. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009:8.

For peer review only

10. The NHS Information Centre for Health & Social Care. QOF clinical domain: depression. Secondary QOF clinical domain: depression 2013. https://mqi.ic.nhs.uk/IndicatorDefaultView.aspx?ref=1.07.04.
11. National Institute for Health and Clinical Excellence Special Health Authority Primary Care Quality and Outcomes Framework Indicator Advisory Committee. Confirmed minutes of the June 2011 QOF Advisory Committee: National Institute for Health and Clinical Excellence, 2011:23-24.
12. A Scott, P Sivey, D Ait Ouakrim, et al. The effect of financial incentives on the quality of health care provided by primary care physicians (Review). Cochrane Database of Systematic Reviews 2011;9.
13. L A Petersen, L D Woodard, T Urech, et al. Does Pay-for-Performance Improve the Quality of Health Care? Ann Intern Med 2006;145(4):265-72.
14. S Gillam, N Siriwardena, N Steel. Pay-for-performance in the UK: the impact of the quality and outcomes framework - a systematic review. Ann Fam Med 2012;10(5):461-68.
15. B Serumaga, D Ross-Degnan, A Avery, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ 2011;342:d108.
16. E Kontopantelis, D Reeves, J M Valderas, et al. Recorded quality of primary care for patients with diabetes in England before and after the introduction of a financial incentive scheme: a longitudinal observational study. BMJ Qual Saf 2013;22:53-64.
17. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, England level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9548&q=qof+depression&sort=Relevance&size=10&page=1#top.
18. Thombs B, Ziegelstein R, Roseman M, et al. There are no randomized controlled trials that support the United States Preventive Services Task Force guideline on screening for depression in primary care: a systematic review. BMC Medicine 2014;12(1):13.
19. S M Gilbody, T A Sheldon, A O House. Screening and case-finding instruments for depression: a meta-analysis. CMAJ 2008;178:997-1003.
20. E A O'Connor, E P Whitlock, T L Beil, et al. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Int Med 2009;151(11):793-803.
21. C Burton, C Simpson, N Anderson. Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study. Psychol Med 2013;43(3):529-37.
22. T Doran, E Kontopantelis, J M Valderas, et al. Effect of Financial Incentives on Incentivised and Non-incentivised Clinical Activities: Longitudinal Analysis of Data from the UK Quality and Outcomes Framework. BMJ 2011;342:d3590
23. Public Health Observatories of England. Health Profile 2012; Leeds. Health Profiles 2012. http://www.apho.org.uk/resource/view.aspx?RID=50215&SEARCH=L* (accessed 18 February 2014).
24. Public Health Observatories of England. Community Mental Health Profiles. 2013. www.nepho.org.uk/cmhp (accessed 18 February 2014).
25. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, PCT level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9592&q=qof+depression&sort=Relevance&size=10&page=1#top.
26. V Hammersley, A Meal, L Wright, et al. Journal of Informatics in Primary Care. 1998(November):3-7.
27. British National Formulary. 4.7.3 Neuropathic Pain. 2014; (7 February 2014). http://www.medicinescomplete.com/mc/bnf/current/PHP2814-neuropathic-pain.htm.

For peer review only

28. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. 2010. http://www.R-project.org/.
29. C Arditi, M Rège-Walther, J C Wyatt, et al. The effect of automatically generated reminders delivered to providers on paper on professional practice. Cochrane Database of Systematic Reviews 2012;12.
30. T Custers, J Hurley, N S Klazinga, et al. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv Res 2008;8:66.
31. B D Jani, D Purves, S Barry, et al. Challenges and implications of routine depression screening for depression in chronic disease and multimorbidity: a cross sectional study. PLoS ONE 2013;8(9):e74610.
32. S L Alderson, A Russell, K McLintock, et al. Incentivised screening for depression in patients with chronic heart disease and diabetes: an ethnographic study. (In preparation).
33. B Guthrie, Morales DR. What happens when pay for performance stops? BMJ 2014;348:g1413.
34. K Checkland, S Harrison. The impact of the Quality and Outcomes Framework on practice organisation and service delivery: summary of evidence from two qualitative studies. Qual Prim Care 2010;18:139-46.
35. C Dowrick, A Frances. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ 2013;347:f7140.
36. D Spence, I Reid. Head to Head: Are antidepressants overprescribed? BMJ 2013;346:f190.
37. T Kendrick. Letters: Where next for QOF? Killing the Quality and Outcomes Framework won't decrease prescribing for depression. BMJ 2013;346:f2742.
38. R C Kessler, P Berglund, O Demler, et al. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). JAMA 2003;289(23):3095-105.
39. H Dumesnil, S Cortaredona, H Verdoux, et al. General practitioners' choices and their determinants when starting treatment for major depression: a cross sectional, randomized case-vignette survey. PLOS ONE 2012;7:e52429
40. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:9.
41. M Moore, H M Yuen, N Dunn, et al. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. BMJ 2009;339:b3999.
42. S P MacBride-Stewart, R Elton, T Walley. Do quality incentives change prescribing patterns in primary care? An observational study in Scotland. Fam Pract 2008;25(1):27-32.
43. G Rait, K Walters, M Griffin, et al. Recent trends in the incidence of recorded depression in primary care. Br J Psychiatry 2009;195:520-254.
44. K J Joling, H W van Marwijk, E Piek, et al. Do GPs' medical records demonstrate a good recognition of depression? A new perspective on case extraction. J Affect Disord 2011;133:522-257.
45. Cochrane Effective Practice and Organisation of Care Group. Data Collection Checklist. In: Cochrane Effective Practice and Organisation of Care Group, ed. EPOC Resources. Ottawa, Ontario, Canada: University of Ottawa, 2002.
46. C R Ramsay, L Matowe, R Grilli, et al. Interrupted time series designs in health technology assessment: Lessons from two systematic reviews of behavior change strategies. Int J Technol Assess Health Care 2003;19(4):613-23.
47. C Brown, T Hofer, A Johal, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care 2008;17:170-77.

For peer review only

48. K Barnett, S W Mercer, M Norbury, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. The Lancet 2012;380(9836):37-43.
49. J M Gunn, D R Ayton, K Densley, et al. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Soc Psychiat Epidemiol 2012;47(2):175-84.
50. S Moussavi, S Chatterji, E Verdes, et al. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet 2007;370(9590):851-58.
51. E Kontopantelis, I Buchan, D Reeves, et al. Relationship between quality of care and choice of clinical computing system: retrospective analysis of family practice performance under the UK's quality and outcomes framework. BMJ Open 2013;3:e003190.
52. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009.
53. IAPT Programme. IAPT. Improving Access to Psychological Therapies. 2013. http://www.iapt.nhs.uk/ (accessed 18 February 2014).
54. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009.
55. Royal College of General Practitioners. Supporting Carers: An action guide for general practitioners and their teams. Second ed. London, 2013:26.
56. Health and Social Care Information Centre. Quality and Outcomes Framework - 2012-13: England level data. Secondary Quality and Outcomes Framework - 2012-13: England level data 2013. http://www.hscic.gov.uk/article/2021/Website-Search?productid=12972&q=quality+outcomes+framework+2012-13&sort=Relevance&size=10&page=1&area=both#top.
57. J Oldham. Reform reform: an essay by John Oldham. BMJ 2013;347:f6716.
58. P Craig, P Dieppe, S Macintyre, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
59. E Kontopantelis, D Springate, D Reeves, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. BMJ 2014;348:g330

~~Table 1 Comparison of recruited and not-recruited practice characteristics with England average.~~

	~~Recruited Practice Average~~	~~England Average~~
~~List Size (patients)~~ [a]	~~7182~~	~~5987~~
~~Under 18 years (%)~~	~~20.7~~	~~20.5~~
~~65 years and over (%)~~	~~14.5~~	~~16.2~~
~~Number of GPs in the practice (mean)~~ [b]	~~5.3~~	~~4.4~~
~~Male~~	~~2.5~~	~~2.4~~
~~Female~~	~~2.8~~	~~2~~
~~Indices of Multiple Deprivation~~ [a]	~~25.8~~	~~21.97~~
~~Income Deprivation Affecting Children Index~~	~~22~~	~~20~~
~~Income Deprivation Affecting Older People Index~~	~~25.5~~	~~20~~
~~Patient Survey (%)~~ [a]		

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~~Would Recommend~~	~~83.2~~	~~85.9~~
~~Have a Chronic Disease~~	~~52.5~~	~~53.4~~
~~Carers~~	~~17.1~~	~~18.2~~
~~Working~~	~~61.7~~	~~60.1~~
~~Unemployed~~	~~5.76~~	~~5.2~~
~~QOF (%)[a]~~		
~~Total Score~~	~~98.8~~	~~98.5~~
~~Exception Rate~~	~~5.4~~	~~5.1~~
~~Chronic Disease Rates (%)[a]~~		
~~Coronary Heart Disease~~	~~3.6~~	~~3.4~~
~~Stroke/Transient Ischaemic Attack~~	~~1.7~~	~~1.7~~
~~Hypertension~~	~~13~~	~~13.9~~
~~Chronic Obstructive Pulmonary Disease~~	~~1.7~~	~~1.6~~
~~Hypothyroid~~	~~2.2~~	~~3.1~~
~~Cancer~~	~~1.7~~	~~1.7~~
~~Mental Health~~	~~0.1~~	~~0.8~~
~~Asthma~~	~~6~~	~~5.9~~
~~Heart Failure~~	~~0.7~~	~~0.7~~
~~Palliative Care~~	~~0.2~~	~~0.2~~
~~Dementia~~	~~0.5~~	~~0.4~~
~~Atrial Fibrillation~~	~~1.3~~	~~1.4~~
~~Cardiovascular Disease Primary Prevention register~~	~~1.4~~	~~1.7~~
-	-	-

~~[a]Public Health England. *Fingertips. National Public Health Profiles.* [Online]. 2012. [Accessed 28 January 2014]. Available from: http://fingertips.phe.org.uk/~~

~~[b]Health and Social Care Information Centre. *NHS Staff - 2001-2011, General Practice.* [Online]. 2012. [Accessed 28 January 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.~~

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Table 1

Practice characteristics	All England	Recruited	Not-recruited	p
Practices, n[a]	8323	65	47	-
List Size (patients, median)[a]	5987	**7182**	**4694**	**0.03**
Under 18 years (%)	20.5	20.7	20.2	0.29
65 years and over (%)	16.2	14.5	15.8	0.05
Number of GPs in the practice (mean)[b]	4.4	5.3	**4.2**	**0.04*†**
Male	2.4	2.5	2.2	0.28*†
Female	2	**2.8**	**1.9**	**0.02*†**
Inidices of Multiple Deprivation[a]	23.9	28.5	28.9	0.88
Rural/Urban Classification (% urban)[c]*	84.9	96.9	97.9	0.93
Patient Survey (%)[a]	-	-	-	-
Would Recommend	85.9	83.2	82.8	0.8
Have a Chronic Disease	53.4	52.5	53.7	0.17
Carers	18.2	**17.1**	**18.9**	**0.04**
Working	60.1	61.7	58.9	0.13
Unemployed	5.2	5.76	6.42	0.91
Clinical Computing System[d]*	-	-	-	-
TPP SystmOne	1494	42	33	-
EMIS (combined LV, PCS, Web)	4649	22	11	-
Other	2231	1	3	0.25‡
QOF (%)[a]	-	-	-	-
Total Score	98.5	98.8	98.7	0.99
Exception Rate	5.1	5.4	4.7	0.08
Chronic Disease Prevalence (%)[a]	-	-	-	-
CHD	3.4	**3.6**	**4.1**	**0.03**
Hypertension	13.9	**13**	**13.8**	**0.04**
Diabetes	4.7	4.4	4.6	0.48
Asthma	5.9	6	5.9	0.81
COPD	1.6	**1.7**	**2**	**0.02**
Depression	8.7	8.7	7.8	0.35
Epilepsy	0.6	**0.6**	**0.7**	**0.04**
Dementia	0.4	0.5	0.5	0.69

Data published 2012, except *2011. Averages are median unless otherwise stated. Comparison with Kruskall-Wallis test except †Student's T-test when comparison of means was more appropriate, and ‡Fisher's exact where comparison was between proportions. Comparison is between recruited and not-recruited practices, there is no comparison to 'All England' as the local practices are also in this group and cannot be compared to a group containing themselves.

[a] Public Health England. Fingertips. National Public Health Profiles. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://fingertips.phe.org.uk/

[b] Health and Social Care Information Centre. NHS Staff - 2001-2011, General Practice. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.

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[c] Health and Social Care Information Centre. Indicator Portal. [Online]. 2011. [Accessed 6 May 2014]. Available from: https://indicators.ic.nhs.uk/

[d] Direct enquiry to Health and Social Care Information Centre, May 2014. Reference NIC-270580-S0V6P. The total number of practices for these data (2011) differ from the Practices, n denominator (2012) due to the different year of data collection.

Table 2

Year	Counts					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	1	20	11	36	99	199
2002-03	14	99	97	323	406	864
2003-04	18	121	165	477	526	1163
2004-05	17	144	218	687	575	1324
2005-06	68	169	260	706	604	1312
2006-07	13363	1555	705	927	909	1429
2007-08	4242	1089	438	985	871	1594
2008-09	2741	800	423	860	925	1752
2009-10	2809	1080	420	1003	1028	1921
2010-11	2801	1691	458	979	1244	2195
2011-12	2830	1755	435	937	1306	2319

Table 3

Year	Rates per 100,000 patients					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	0.0010	0.0058	0.0061	0.0138	0.1050	0.0662
2002-03	0.0038	0.0072	0.0279	0.0286	0.1118	0.0794
2003-04	0.0039	0.0088	0.0366	0.0441	0.1257	0.1057
2004-05	0.0032	0.0103	0.0557	0.0710	0.1565	0.1354
2005-06	0.0210	0.0121	0.0648	0.0664	0.1524	0.1314
2006-07	3.3199	0.1450	0.1946	0.0907	0.2296	0.1359
2007-08	1.0276	0.0989	0.1127	0.1077	0.2185	0.1564
2008-09	0.7139	0.0732	0.1125	0.0918	0.2414	0.1674
2009-10	0.7244	0.0850	0.1212	0.0952	0.2543	0.1774
2010-11	0.6708	0.1293	0.1258	0.0905	0.2783	0.1843
2011-12	0.6849	0.1254	0.1093	0.0805	0.2954	0.1973

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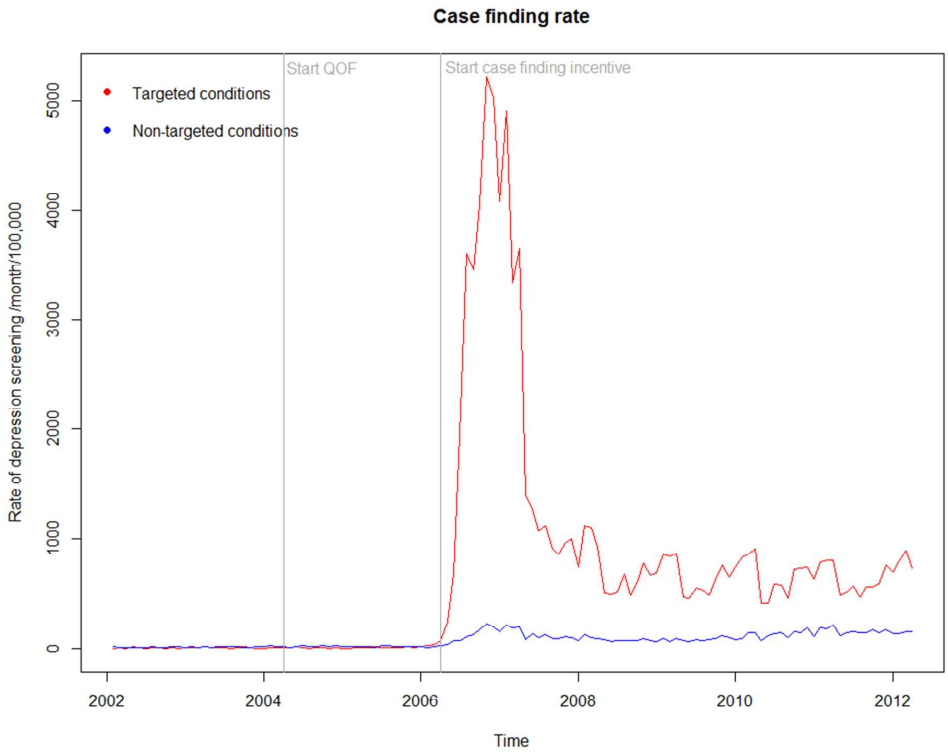
~~*Figure 1 Rates of coded case finding for depression in patients with targeted and non-targeted conditions over 2002-12*~~



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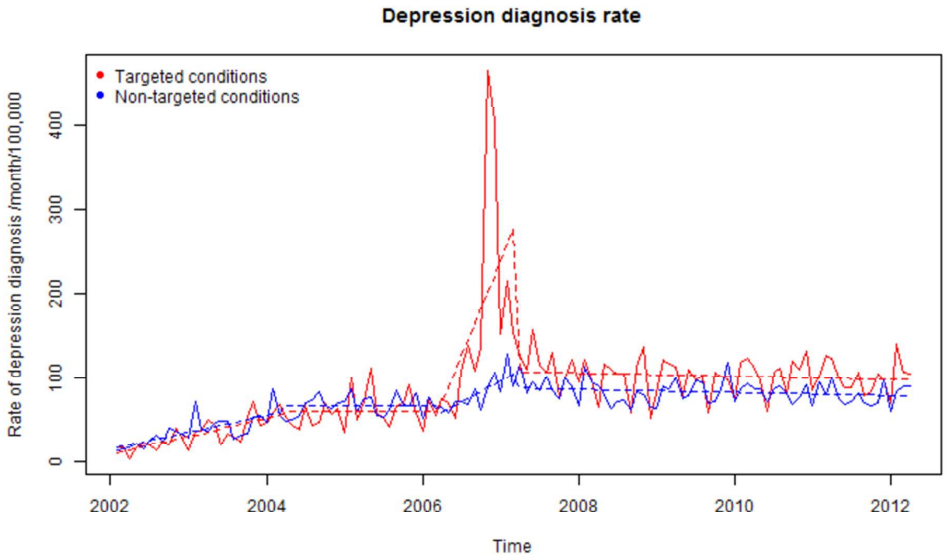
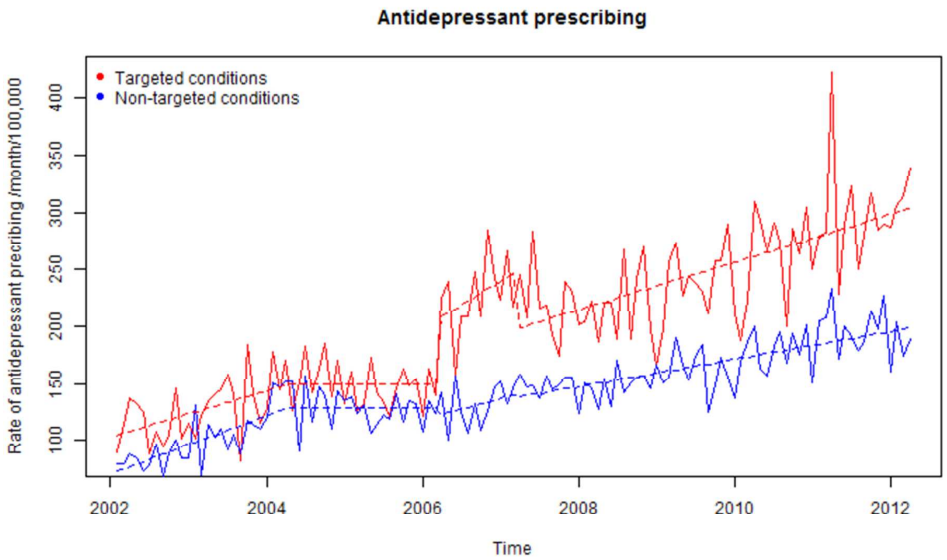
~~*Figure 2 Rates of coded diagnosis in patients with targeted and non-targeted conditions over 2002-12*~~



~~*Figure 3 Rates of antidepressant prescribing in patients with targeted and non-targeted conditions over 2002-12*~~



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Electronic Web Appendix; clinical codes for each outcome measure

Table 1

Clinical codes for the diagnosis of depression recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
[X] Depression recurrent: [unspecified] or [monopolar NOS]	Eu33z
[X](Depressn: [episode unsp][NOS (& react)][depress dis NOS]	Eu32z
[X]Depress with psych sympt: [recurr: (named vars)][endogen]	Eu333
[X]Depression: [oth episode][atypic][single epis masked NOS]	Eu32y
[X]Depressive episode, unspecified	XE1Zb
[X]Depressn, no psych symp: [recurr: (named var)]/[endogen]	Eu332
[X]Mild depressive episode	Eu320
[X]Moderate depressive episode	Eu321
[X]Other depressive episodes	XE1Za
[X]Recurr depress disorder cur epi severe without psyc sympt	XE1Zd
[X]Recurrent depress disorder cur epi severe with psyc symp	XE1Ze
[X]Recurrent depressive disorder, current episode moderate	Eu331
[X]Recurrent depressive disorder, unspecified	XE1Zf
[X]Sev depress epis + psych symp:(& singl epis [named vars])	Eu323
[X]Sev depress epis, no psych: (& single [agit][maj][vital])	Eu322
[X]Severe depressive episode with psychotic symptoms	XE1ZZ
[X]Severe depressive episode without psychotic symptoms	XE1ZY
[X]Single episode agitated depressn w'out psychotic symptoms	XaCHr
[X]Single episode major depression w'out psychotic symptoms	XaCHs
Agitated depression	X00SQ
Atypical depressive disorder	E11y2
Chronic depression	E2B1.
Cotard syndrome	XSKr7
Depression NOS	XaB9J
Depression: [reactive (neurotic)] or [postnatal]	XE1aY
Depression: [single maj episode][agit][endogen (& 1st epis)]	E112.
Depressive disorder	X00SO
Depressive disorder NEC	E2B..

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Endogenous depression	X00SR
Endogenous depression - recurrent	XM1GC
Endogenous depression first episode	X00SS
Major depressive disorder	XSEGJ
Masked depression	X00SU
Mild depression	XaCIs
Mild major depression	XSGok
Mixed anxiety and depressive disorder	X00Sb
Moderate depression	XaCIt
Moderate major depression	XSGol
Post-schizophrenic depression	X00S8
Reactive depression	XE1YC
Reactive depressive psychosis	E130.
Recurrent brief depressive disorder	Xa0wV
Recurrent depression	E1137
Recurrent depression: [major episode] or [endogenous]	E113.
Recurrent major depressive episode NOS	E113z
Recurrent major depressive episodes	XE1Y1
Recurrent major depressive episodes, in full remission	E1136
Recurrent major depressive episodes, mild	E1131
Recurrent major depressive episodes, moderate	E1132
Recurrent major depressive episodes, severe, no psychosis	E1133
Recurrent major depressive episodes, severe, with psychosis	E1134
Recurrent major depressive episodes, unspecified	E1130
Recurrent major depressive episodes,partial/unspec remission	E1135
Seasonal affective disorder	X761L
Severe depression	XaCIu
Severe major depression with psychotic features	XSGon
Severe major depression without psychotic features	XSGom
Single major depressive episode	XE1Y0
Single major depressive episode NOS	E112z
Single major depressive episode, in full remission	E1126
Single major depressive episode, mild	E1121
Single major depressive episode, moderate	E1122
Single major depressive episode, partial or unspec remission	E1125
Single major depressive episode, severe, with psychosis	E1124

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Single major depressive episode, severe, without psychosis	E1123
Single major depressive episode, unspecified	E1120

Table 2

Clinical codes for the diagnosis of depression not recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
Anxiety with depression	Y5448
Depressed mood	XE0re
Symptoms of depression	XaLmU
C/O - feeling depressed	XM0CR
O/E - depressed	2257
[X]Recurrent depressive disorder	XE1Zc
Depression medication review	XaK6e
Depression annual review	XaK6d
Depression interim review	XaK6f
On depression register	XaJWh
Depression monitoring administration	XaMGL
Depression monitoring first letter	XaMGN
Depression monitoring second letter	XaMGO
Depression monitoring third letter	XaMGP
Patient given advice about management of depression	XaKEz
Depression worse in morning	761J
Depression management programme	Xaltx
Depression screen	Y6303
Depression screening	6891.
[X]Other mood affective disorders	Eu3y.
[X]Other persistent mood affective disorders	Eu34y
[X]Other recurrent mood affective disorders	XE1Zh
[X]Other single mood affective disorders	XE1Zg
[X]Other specified mood affective disorders	Eu3yy
[X]Persistent mood affective disorder, unspecified	Eu34z
[X]Persistent mood affective disorders	Eu34.
[X]Unspecified mood affective disorder	XE1Zi

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Adjustment reaction with anxious mood	E2924
Crying associated with mood	XM0Ar
Cyclic mood swings	XaAyL
Blunting of mood	Xa00z
Diurnal variation of mood	X761I
Dysphoric mood	XaKUk
Mood disorder	XE1Xy
Moody	Xa3Xf
Moody after illness	Y4284
Moody before illness	Y4236

Table 3

Antidepressant drugs

Drug Class	**Drugs included in search**	**Drugs excluded from search (and rationale)**
Selective serotonin reuptake inhibitors (SSRIs)	Citalopram Escitalopram Fluoxetine Fluvoxamine Paroxetine Sertraline	
Tricyclic and related antidepressants	Clomipramine Dosulepin Doxepin Lofepramine Trimipramine	Amitriptyline (neuropathic pain) Nortriptyline (neuropathic pain) Imipramine (nocturnal eneuresis)
Monoamine oxidase inhibitors (MAOIs)	Phenelzine Isocarboxazid Tranylcypromine Moclobemide	
Other antidepressant	Mirtazipine	Duloxetine (Stress incontinence or

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drugs	Venlafaxine Agomelatine Tryptophan Reboxetine	diabetic neuropathy) Flupentixol (psychoses)

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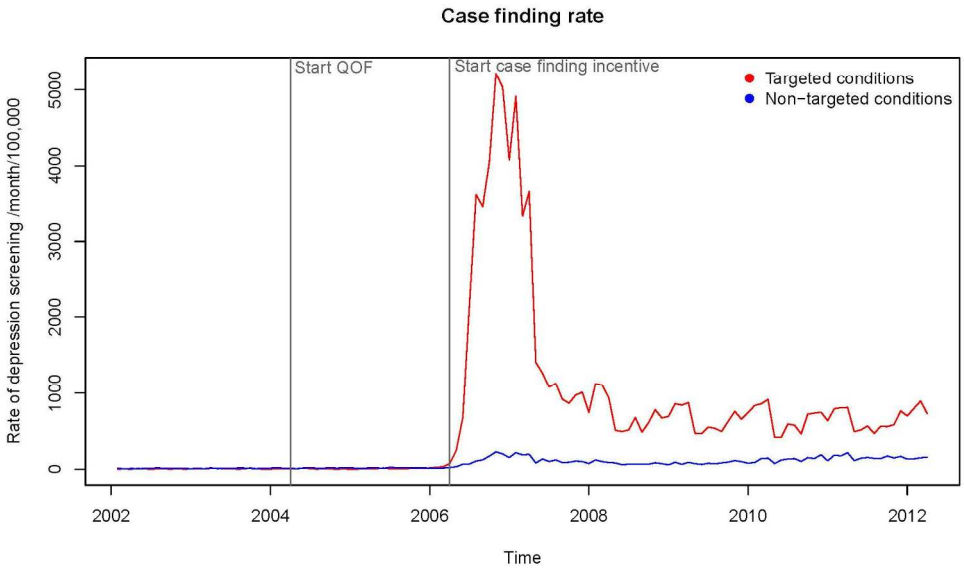

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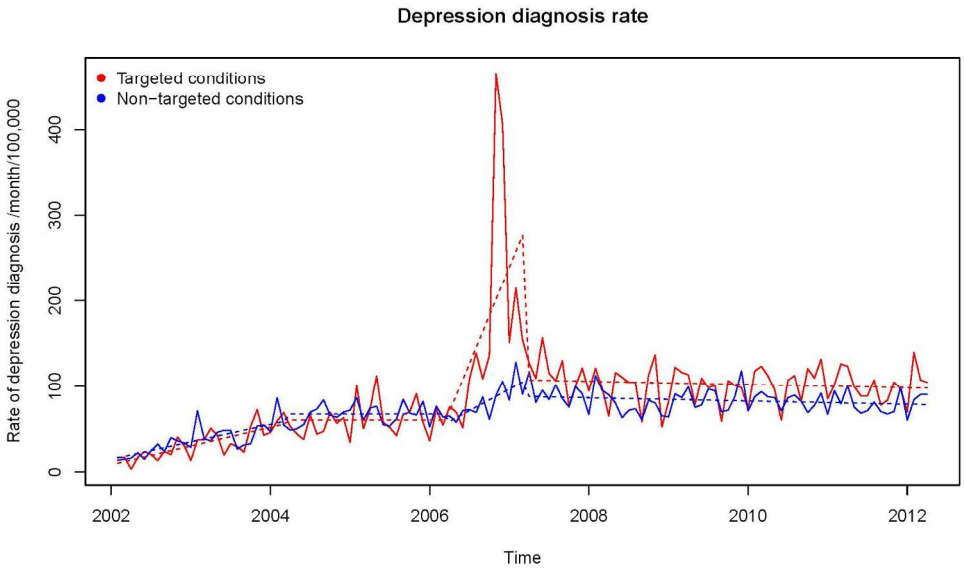

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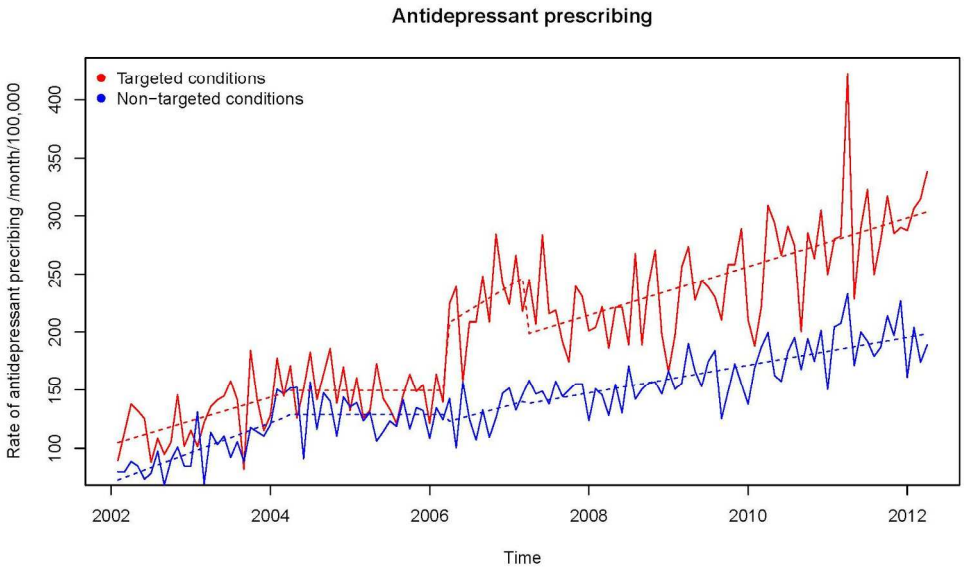

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BMJ Open

The effects of financial incentives for case finding for depression in patients with diabetes and coronary heart disease: interrupted time series analysis

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The effects of financial incentives for case finding for depression in patients with diabetes and coronary heart disease: interrupted time series analysis

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Abstract

Objectives

To evaluate the effects of Quality and Outcomes Framework (QOF) incentivised case finding for depression on diagnosis and treatment in targeted and non-targeted long-term conditions.

Design

Interrupted time series analysis

Setting

General practices in Leeds, United Kingdom (UK).

Participants

Sixty-five (58%) of 112 general practices shared data on 37,229 patients with diabetes and coronary heart disease (CHD) targeted by case finding incentives, and 101,008 patients with four other long-term conditions not targeted (hypertension, epilepsy, chronic obstructive pulmonary disease (COPD) and asthma).

Intervention

Incentivised case finding for depression using two standard screening questions.

Main Outcome Measures

Clinical codes indicating new depression-related diagnoses and new prescriptions of antidepressants. We extracted routinely recorded data from February 2002 through April 2012. The number of new diagnoses and prescriptions for those on registers was modelled with a binomial regression which provided the strength of associations between time periods and their rates.

Results

New diagnoses of depression increased from 21 to 94 per 100,000 per month in targeted patients between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). The rate

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increased from 27 to 77 per 100,000 per month in non-targeted patients (OR 1.53; 1.46 to 1.62). The slopes in prescribing for both groups flattened to zero immediately after QOF was introduced but before incentivised case finding ($p<0.01$ for both). Antidepressant prescribing in targeted patients returned to the pre-QOF secular upward trend (Wald test for equivalence of slope, $z=0.73$, $p=0.47$); the slope was less steep for non-targeted patients ($z=-4.14$, $p<0.01$).

Conclusions

Incentivised case finding increased new depression-related diagnoses. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants which resumed following the introduction of incentivised case finding. Prescribing trends are of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

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Article summary

Strengths and limitations of this study

Strengths

- Rigorous quasi-experimental design demonstrating policy effects on patient populations within a sample of general practices which appears broadly representative on key parameters.
- Further insights gained from comparison of trends in patient populations targeted and non-targeted by intervention

Limitations

- Relatively high ‘signal to noise’ ratio inherent in use of routinely recorded data may have diminished the magnitude of observed effects
- The absence of a control population of practices, making it hard to rule out possibility that concurrent national and local initiatives contributed to observed trends
- Lack of data on patient outcomes, such as recovery from depression or the appropriateness of treatment

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Background

Long-term physical conditions are associated with a high prevalence of depression; people with diabetes or CHD have a two to three-fold increased lifetime risk.[1 2] Such co-morbidity can make depression hard to recognise,[3 4] worsens the prognosis of both conditions [1 5 6] and increases healthcare and societal costs.[1 7]

The UK National Institute for Health and Care Excellence (NICE) recommends case finding for depression in people with long-term physical conditions.[8 9] The Quality Outcomes Framework (QOF) for general practice was established in 2004 and correspondingly rewarded case finding for depression in all patients with a diagnosis of CHD or diabetes over 2006-13 (QOF years three to nine). This indicator was known as 'QOF DEP1' and defined as, "the percentage of patients on the diabetes register and/or the CHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions."[10] A designated clinical code indicating the use of these questions was recorded in the patient record whenever the Patient Health Questionnaire-2 (PHQ2) was administered, irrespective of the responses. Practices were reimbursed according to the proportion of patients with a record of case finding in the preceding 15 months. Payment thresholds were set at achievements of 40-90% of eligible patients until 2012, and 50-90% 2012-13. The indicator had a value of eight points from 2006-10 and six points from 2010-13. Each point was worth £133.76 in 2012-13, the final year of incentivisation. This incentivised case finding has now been withdrawn from the QOF because of doubts over benefits.[11]

The impact of this policy has been uncertain. The effectiveness of financial incentives in changing clinical behaviour is limited[12] and pay-for-performance schemes often have unintended adverse consequences.[13] More specifically, a systematic review concluded advances in quality of care for long-term conditions included in UK QOF were modest.[14] There are few rigorous evaluations of the effects of pay-for-performance, given that

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controlled comparisons are rarely acceptable to policy-makers. Two interrupted time series evaluations of QOF have not shown any sustained effects on processes of care or clinical outcomes.[15 16] Whilst there are no coded data prior to the introduction of the case finding indicator, at face value the QOF did incentivise a change in practice given that around 86% of patients with diabetes and CHD have been coded as screened at least every 15 months since its inception.[17] Yet there is no evidence that case finding for depression, whether in the presence[18] or absence of coordinated care systems, [19 20] improves patient outcomes. A cohort study found a greater likelihood of a new diagnosis of depression and initiation of antidepressant treatment in the 28 days following QOF-incentivised case finding;[21] the longer term effects on the whole population eligible for case finding are unknown. There may be further unintended effects on populations with other long-term conditions not targeted by incentivised case finding. Examining quality of care across a number of conditions Doran et al found that improvements associated with QOF incentives occurred at the expense of small detrimental effects on aspects of non-incentivised care.[22]

We evaluated the effects of incentivised case finding on new depression-related diagnoses and new prescriptions of antidepressants in patient populations with long-term conditions targeted or not by financial incentives.

Methods

Study design

We used an interrupted time series design to evaluate the effects of incentivised case finding whilst accounting for underlying secular trends. We also compared trends in depression diagnosis and treatment between those patient populations targeted by incentivised case finding (diabetes and CHD) and other patient populations with long-term physical conditions not targeted by incentivised case finding (hypertension, epilepsy, COPD and asthma). Our rationale was that we would not expect outcomes in the non-targeted group to diverge from underlying secular trends.

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Practices and participants

We invited all 112 general practices in Leeds to share anonymised patient data via the Information in General Practice Team of the then National Health Service (NHS) primary care trust. No distinction was made between users of different electronic records systems. Compared with English indicators the physical health of people in Leeds is generally worse and levels of deprivation are higher.[23] Recorded depression in adults is similar (both around 11%)[24] as is performance on the QOF incentivised case finding indicator in our final year of data collection (87% for Leeds over 2011-12 compared to England average of 86%).[17 25] We sought data on patients with diabetes and CHD targeted by case finding and data from other patients with the four comparator and non-target, long-term physical conditions from QOF registers. Patients with conditions in both targeted and non-targeted groups were excluded from non-targeted group analysis to avoid double counting. Therefore, any change in outcomes in the non-targeted group could not be attributable to individuals being screened because they had a targeted condition.

Data Collection

We collected retrospective, electronic data from February 2002 through April 2012 for patients aged 18 years and over. Data were extracted through Morbidity Information Query and Export Syntax (MIQUEST) software, used for collecting data from general practice clinical computing systems in a consistent and comparable way. The tool utilises a query language, which incorporates security and confidentiality safeguards; pseudoanonymisation supports the extraction of patient level information but ensures it is not attributable to individual patients.[26] Participating practices consented to the extraction of anonymised patient data and did not need to take any further action.

We recognised that the diagnosis of depression was likely to be under-recorded in clinical records because of factors such as diagnostic uncertainty and patient preference. The recording of certain diagnostic Read Codes, such as ‘depressive disorder,’ automatically triggers alerts for further assessments required by QOF. Failure to meet these targets

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reduces practice income and hence coding behaviour may have changed. We therefore also searched for use of more sensitive but less specific Read codes such as 'low mood' or 'depressed mood' which are not assessed by the QOF and included these in our main outcome of diagnosis. We excluded codes related to postnatal depression.

Data on the prescription of licensed antidepressant drugs listed in British National Formulary section 4.3 were collected, with the exception of antidepressants judged by clinicians involved in the project (RF, AH, SA, KM) to be more commonly prescribed for other indications (e.g. amitriptyline and nortriptyline for neuropathic pain).[27]

A complete list of clinical codes for each outcome measure is available as an electronic web appendix.

Data analysis

The denominators comprised the numbers of patients on practice registers for each financial year (starting 1st April) targeted by incentivised case finding (diabetes and CHD) and those not targeted (hypertension, epilepsy, COPD and asthma). We assumed that registered long-term condition populations would be relatively stable over each year. We took the number of registered long-term condition populations per practice as constant over each QOF year. This permitted a more parsimonious model to facilitate interpretation.

For each targeted and non-targeted patient group, we analysed trends in new depression-related diagnoses and antidepressant prescribing. We also examined the uptake of case finding for depression. We recognised that these trends could relate to changes in coding as well as clinical practice; we mainly used their outputs to guide interpretation of the main outcomes. Data were aggregated by month for each of the 65 practices so that each time series is 123 months long (February 2002 to April 2012). Analysis was carried out at the practice level using a binomial regression based on the calculated numerators and the available denominators. Discontinuities were modelled at key dates: April 2004 for the

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introduction of QOF; and April 2006 for the introduction of incentives for case finding for depression. A further discontinuity was introduced at April 2007 to isolate exceptional behaviour noted during the QOF year April 2006 through March 2007. Our focus and interest was on the long-term sustained effect seen after the introduction of case finding incentives rather than the immediate change. To avoid bias from this first year (2006/7) rates were permitted to be different in that year, so isolating it from the sustained effect we sought to assess. For each time period (February 2002 to March 2004; April 2004 to March 2006; April 2006 to March 2007; April 2007 to April 2012) the model has an overall constant and slope. Specific slope terms were dropped when they were found not to be statistically significant from zero at the 5% level.

Fitting seasonal effects improved the model but added complexity. As reference and intervention periods were integer multiples of complete years, there would be no perturbation of level or slope if explicit seasonality terms were not included, but rather seasonality was encompassed within the error term. Since the profile of seasonality appeared to change from the reference period to the intervention period and vary in the group with targeted interventions compared to the group for other long-term conditions, this option was selected to yield the clearest effect in the model. The model can be expressed as:

Let Y_{Tit} and Y_{Nit} be random variables representing the number of diagnoses at practice i in month t for targeted and non-targeted patients respectively. Then

$$\Pr\ (Y_{Tit}=y_{Tit}) = \binom{n_{Tit}}{y_{Tit}}\ \pi_{Tit}^{y_{Tit}}\ (1-\pi_{Tit})^{(n_{Tit}-y_{Tit})} \qquad (1)$$

where $y_{Tit} \in \{0, 1, \dots, n_{Tit}\}$, n_{Tit} is the relevant denominator for practice i in month t, and π_{Tit} is the corresponding rate of diagnosis. Using a logit link function in the generalised regression, we model the rate π_{Tit} with

$$\log\left(\frac{\pi_{Tit}}{1-\pi_{Tit}}\right) = \mu_{T0} + m_{Ti} + \beta_{T1}\ 1_{t\in 2006} + \beta_{T2}\ 1_{t>2006} \qquad (2)$$

and

$$m_i \in N\ (0, \sigma^2) \qquad (3)$$

where $1_{t \in 2006}$ is an indicator variable for the year 2006/2007 and $1_{t>2006}$ is an indicator for the intervention period, that is after the year 2006/2007. Note that a random intercept m_{Ti} is included to account for clustering within practices. Slope terms were also added where appropriate. The open source software R 2.12.0 64 bit version was used for all statistical analysis.[28]

Results

We recruited 65 (58%) of 112 Leeds practices. Their 2012 QOF registers indicated that they served 37,229 patients with diabetes and CHD targeted for case finding for depression and 101,008 patients with other long-term conditions not targeted. Table 1 provides data on all English practices and compares characteristics of recruited and not-recruited practices.

Overall, the practices recruited were larger; however, we found no significant differences in Indices of Multiple Deprivation or, total QOF scores. The majority of practices used one clinical computing system by the end of data collection. Tables 2 and 3 summarise the annual incidences of case finding, depression-related diagnoses and prescription of antidepressants by count and rates per 100,000 patients, for targeted and non-targeted patients.

Practice-level analysis found significant increases in new coded case finding following the initiation of incentives, also reflected in aggregated city-wide level trends (Figure 1). The exceptional rise in 2006 reflects first coding in patients with existing diagnoses of diabetes and CHD. Comparing the period April 2004 to March 2006 with April 2007 to March 2012, rates of case finding increased in the targeted population from 0.07 to 7.45 per 1000 per

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month (OR 99.76; 95% confidence interval 83.15 to 119.68) and in the non-targeted population increased from 0.1 to 0.78 per 1000 per month (OR 7.54; 6.91 to 8.24).

Binomial regression of the practice level data confirmed statistically significant rate increases in new depression-related diagnoses in both patient populations. In targeted patients, the diagnosis rate increased from 21 to 94 per 100,000 per month between the periods 2002-4 and 2007-12 (OR 2.09; 1.92 to 2.27). In non-targeted patients, the rate increased from 27 to 77 per 100,000 per month (OR 1.53; 1.46 to 1.62). In neither of these periods was the slope statistically significant from zero: that is the rates can be assumed to be constant during these periods. Figure 2 shows these trends aggregated at a city level with fitted constants and slopes, indicated by dashed lines. Figure 3 shows the city-level trends for new antidepressant prescribing with fitted constants and slopes. Rates of prescribing increased over the full period of observation. During the period after QOF was introduced but before incentives (April 2004 to March 2006), the slopes for both populations flattened to zero ($p<0.01$ for both groups). For targeted patients, the slopes before the introduction of QOF and after the exceptional year were similar (Wald test for equivalence of slope, $z=0.73$, $p=0.47$). For non-targeted patients the slope for the latter period was less steep (Wald test for slope, $z=-4.14$, $p<0.01$). All Wald tests for slopes were undertaken using practice level data.

Discussion

Incentivised case finding increased rates of new depression-related diagnoses in patients with CHD and diabetes and, to a lesser extent, in those with non-targeted long-term conditions. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants; these resumed following the introduction of incentivised case finding, although there was a modest deceleration in antidepressant prescribing for non-targeted conditions. Rates of new prescriptions for antidepressants exceeded those for depression-related diagnoses.

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Quasi-experimental evaluations of QOF have found no sustained effects for other clinical indicators.[14-16] Financial incentives in primary care tend to have modest effects on relatively simple clinical behaviours such as risk factor recording or test ordering.[12] The nature of targeted clinical behaviours is likely to influence the effectiveness of incentives.[29 30] Given that the QOF incentives directly rewarded case finding, we sought and found evidence of changed clinical practice 'downstream' to case finding. Previous research has found associations between case finding for depression and both new diagnoses and antidepressant prescribing.[21 31] However, our analysis of longitudinal data demonstrates policy effects at a population level and highlights the importance of accounting for secular trends and additional insights from comparative data.

The mechanisms by which rates of depression-related diagnoses increased remains unclear. The spike in diagnoses immediately following incentivisation probably reflects coding patterns before general practitioners began to realise they would trigger alerts for further assessments required by QOF when recording depression related diagnoses. Similar phenomena have been observed in first years of new QOF indicators.[32] Following the introduction of incentivised case finding, rates of new depression-related diagnoses rose in non-targeted long-term conditions, coincident with only a modest rise in recorded case finding in these patients. Incentivised case finding may have directly affected pathways of care or, more generally, increased awareness of the higher risk of depression in all patients with long-term conditions. A combination of these explanations seems likely for two reasons. First, we found strong evidence of seasonality for coded case-finding but not for new diagnoses or prescribing. Second, our parallel ethnographic study of general practices demonstrated the absence of a systematic approach to following up and managing screen-positive cases.[33] It remains uncertain how the QOF and other payment for performance systems work.[34]

The interpretation of prescribing trends is more challenging. Taking pre-QOF trends into account, new prescriptions of antidepressants in patients with long-term conditions

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plateaued following the introduction of QOF before resuming the underlying trend in targeted conditions when incentivised case finding for depression was introduced. This plateau effect appears compatible with a view that the initial introduction of QOF diverted attention from psychosocial aspects of long-term condition care towards achieving biomedical targets.[35] It is also consistent with a longitudinal analysis of QOF in English general practice which found lower overall achievement rates for non-incentivised indicators compared to predicted values than for incentivised indicators.[22] Arguably, this might not represent a detrimental unintended consequence in the case of a potentially over-medicalised condition such as depression.[36]

The causes of on-going secular increases in antidepressant prescribing have been debated.[37 38] Hypotheses include poor compliance with clinical guidelines which do not recommend prescribing in the more commonly encountered mild to moderate depression,[39-41] an increase in duration of antidepressant prescribing in line with clinical guidelines rather than an increase in the number of patients prescribed for,[42] and the intensifying effect of QOF on prescribing patterns.[43] Our data included only the first prescription of any antidepressant for each patient, indicating that our observed trends are attributable to greater numbers of patients being treated rather than extended periods of prescribing. Therefore, our analysis supports the explanation that incentivised case finding perpetuated the rise in antidepressant prescribing because of a perceived need for clinical action over and above referral for counselling or watchful waiting.

The rate of antidepressant prescribing in this study exceeded the rate of diagnosis of depression in targeted and non-targeted groups, this trend was also reported by Burton and colleagues.[21] The limited use of clinical codes in the diagnosis of depression is recognised. Rather than a lack of diagnostic accuracy, it probably reflects how clinical coding is not always a part of routine practice and how GPs pragmatically prescribe according to symptoms and responses to treatment rather than diagnostic categories.[44 45]

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Whilst we drew upon published guidance in conducting this interrupted time series, [46 47] we identified seven main limitations. First, the high 'signal to noise' ratio inherent in the use of routinely recorded data may have diminished the magnitude of observed effects.[48] Second, the true denominator for the binomial regression varies monthly as patients as patients exit the denominator population after undergoing incentivised case finding. There are also variations due patients dying and leaving the practice. We used annual QOF reports for the denominator values and took them to be constant for that year. Since the denominator is large compared to the number screened, the error of the model will be small. Third, we were unable to examine patient outcomes, such as recovery from depression, nor the appropriateness of treatment. We explored the use of routinely collected referral data but these were unreliably recorded and prone to temporal changes in coding practices. Fourth, targeted patients with diagnoses of diabetes and CHD may include individuals with a greater number of comorbidities than non-targeted patients.[49] Depression is more prevalent in patients with a greater number of physical comorbidities,[50 51] suggesting we were more likely to identify depression related diagnoses in this group. Fifth, our analysis is based upon one geographical area with a response rate of 58%. However, the characteristics of practices participating in the study were broadly similar to those for England and the non-participating practices. Sixth, observed trends may also have been related to changes in practice computerised record systems. Leeds practices began migrating to The Phoenix Partnership (TPP) SystmOne after 2006 until it became the majority provider in 2012 (Table 1). The choice of clinical computing system is associated with variations in practice QOF performance.[52] Seventh, given the absence of a control population of practices, it is possible that concurrent national and local initiatives may have contributed to our observed trends. NICE issued a clinical guideline on depression in 2004, which was subsequently revised in 2009;[53] even allowing for delayed diffusion or anticipatory effects, it is unlikely to explain any changes we observed from 2006 onwards. Nor do the introduction of the Improving Access to Psychological Therapies programme in Leeds from 2008-09 onwards or publication of the NICE clinical guideline on depression in adults with a chronic physical health problem in

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2009 offer plausible alternative explanations.[54 55] Furthermore, the isolation of the exceptional year when case finding incentives were first introduced permits us to infer with confidence that we observed sustained higher rates of diagnosis.

Given the sustained promotion of case finding for depression across a range of long-term conditions and for carers,[8 9 56] there is a need for clearer guidance to optimise the pathway and outcomes of care for case finding-detected depression, including limiting antidepressant prescribing to patients most likely to benefit. Any effects of incentivised case finding need to be considered alongside costs. Based on payments offered under the 2012-13 UK QOF contract and without considering opportunity costs, we estimate that case finding for depression in CHD and diabetes cost over £6 million per annum[57] in the context of the £1 billion total estimated cost of QOF each year. These costs, the limited benefits we found, and the withdrawal of incentivised case finding for depression demonstrate the risk of rolling out policies in the absence of rigorous supporting evidence. Although policy-makers express frustration when debates about evidence appear to hold back service improvement,[58] there are hazards in following assumptions about how and whether apparently simple but deceptively complex interventions such as incentivised case finding work.[59]

The impact of the withdrawal of QOF incentivised case finding for depression is not yet known. A retrospective longitudinal study suggested levels of performance remain stable across a range of clinical activities following the removal of QOF incentives, although all indicators studied were indirectly or partly linked to activities which remained incentivised.[60] The longer term effects of completely withdrawing an incentive, such as case finding for depression, on clinical behaviour is unknown and merits further research.

What is already known on this topic
• Patients with long term conditions are at a higher risk of depression

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• There is limited knowledge about the population effects of incentivised case finding for depression in patients with long term conditions
What this study adds
• Incentivised case finding increased new depression-related diagnoses in people with long term conditions, including those not targeted by incentives. • The establishment of QOF disrupted rising trends in new prescriptions of antidepressants, which returned to earlier rates of increase in targeted conditions whilst modestly decelerating in non-targeted conditions • The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

Competing Interests Statement

All authors report grants from National Institute for Health Research under its Research for Patient Benefit Programme, during the conduct of the study.

Ethics Approval

This study was approved by the East Midlands - Derby 2 Research Ethics Committee (reference 11/EM/0144).

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(including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency Declaration

Dr Kate McLintock, the lead author (the manuscript's guarantor), affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Data sharing statement

Full dataset and statistical code available from the corresponding author at k.l.mclintock@leeds.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

Contributorship Statement

RF and AH conceived the project. RF was principal investigator. KM and SA designed the study. KM and AR were responsible for running the project. RW was responsible for statistical analyses. All authors interpreted the data and findings. KM wrote the first draft of the manuscript. RF commented on the first draft and all authors commented on further revisions. KM is guarantor of the paper.

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Figure Legends

Table 1 Characteristics of general practices in England and those in Leeds which did and did not share data for the study based upon data published in 2012.

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Table 2 Annual numbers of case finding, new depression-related diagnoses and new prescriptions of antidepressants in Leeds over 2001-12 for conditions targeted or not by incentivised case-finding.

Table 3 Annual incidences of case finding, new depression-related diagnoses and new prescriptions of antidepressants (per 100,000 patients) in Leeds over 2001--12, for conditions targeted or not by incentivised case-finding.

Figure 1 Rates of coded case finding for depression in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 2 Rates of new depression-related coded diagnoses in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 3 Rates of new antidepressant prescribing in patients with conditions targeted or not by incentivised case-finding, 2002-12.

References

1. R D Goldney, P J Phillips, L J Fisher, et al. Diabetes, Depression and Quality of Life. Diabetes Care 2004;27:1066-70.
2. S J C Davies, P R Jackson, J Pokotar, et al. Treatment of anxiety and depressive disorders in patients with cardiovascular disease. BMJ 2004;328:939.
3. H Lester, A Howe. Depression in Primary Care: three key challenges. Postgrad Med J 2008;84(996):545-48.
4. J R T Davidson, S E Meltzer-Brody. The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion. J Clin Psychiatry 1990;60 (supplement 7):4-9.
5. R M Carney, K E Freedland, G E Miller, et al. Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. J Psychosom Res 2002;53:897-902.
6. M A Whooley, P de Jonge, E Vittinghoff, et al. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA 2008;300(20):2379-88.
7. G E Simon, W J Katon, E H B Lin, et al. Diabetes complications and depression as predictors of health service costs. Gen Hosp Psychiatry 2005;27(5):344-51.
8. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90, 2009:8.
9. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009:8.

For peer review only

10. The NHS Information Centre for Health & Social Care. QOF clinical domain: depression. Secondary QOF clinical domain: depression 2013. https://mqi.ic.nhs.uk/IndicatorDefaultView.aspx?ref=1.07.04.
11. National Institute for Health and Clinical Excellence Special Health Authority Primary Care Quality and Outcomes Framework Indicator Advisory Committee. Confirmed minutes of the June 2011 QOF Advisory Committee: National Institute for Health and Clinical Excellence, 2011:23-24.
12. A Scott, P Sivey, D Ait Ouakrim, et al. The effect of financial incentives on the quality of health care provided by primary care physicians (Review). Cochrane Database of Systematic Reviews 2011;9.
13. L A Petersen, L D Woodard, T Urech, et al. Does Pay-for-Performance Improve the Quality of Health Care? Ann Intern Med 2006;145(4):265-72.
14. S Gillam, N Siriwardena, N Steel. Pay-for-performance in the UK: the impact of the quality and outcomes framework - a systematic review. Ann Fam Med 2012;10(5):461-68.
15. B Serumaga, D Ross-Degnan, A Avery, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ 2011;342:d108.
16. E Kontopantelis, D Reeves, J M Valderas, et al. Recorded quality of primary care for patients with diabetes in England before and after the introduction of a financial incentive scheme: a longitudinal observational study. BMJ Qual Saf 2013;22:53-64.
17. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, England level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9548&q=qof+depression&sort=Relevance&size=10&page=1#top.
18. Thombs B, Ziegelstein R, Roseman M, et al. There are no randomized controlled trials that support the United States Preventive Services Task Force guideline on screening for depression in primary care: a systematic review. BMC Medicine 2014;12(1):13.
19. S M Gilbody, T A Sheldon, A O House. Screening and case-finding instruments for depression: a meta-analysis. CMAJ 2008;178:997-1003.
20. E A O'Connor, E P Whitlock, T L Beil, et al. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Int Med 2009;151(11):793-803.
21. C Burton, C Simpson, N Anderson. Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study. Psychol Med 2013;43(3):529-37.
22. T Doran, E Kontopantelis, J M Valderas, et al. Effect of Financial Incentives on Incentivised and Non-incentivised Clinical Activities: Longitudinal Analysis of Data from the UK Quality and Outcomes Framework. BMJ 2011;342:d3590
23. Public Health Observatories of England. Health Profile 2012; Leeds. Health Profiles 2012. http://www.apho.org.uk/resource/view.aspx?RID=50215&SEARCH=L* (accessed 18 February 2014).
24. Public Health Observatories of England. Community Mental Health Profiles. 2013. www.nepho.org.uk/cmhp (accessed 18 February 2014).
25. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, PCT level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9592&q=qof+depression&sort=Relevance&size=10&page=1#top.
26. V Hammersley, A Meal, L Wright, et al. Journal of Informatics in Primary Care. 1998(November):3-7.
27. British National Formulary. 4.7.3 Neuropathic Pain. 2014; (7 February 2014). http://www.medicinescomplete.com/mc/bnf/current/PHP2814-neuropathic-pain.htm.

For peer review only

28. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. 2010. http://www.R-project.org/.
29. C Arditi, M Rège-Walther, J C Wyatt, et al. The effect of automatically generated reminders delivered to providers on paper on professional practice. Cochrane Database of Systematic Reviews 2012;12.
30. T Custers, J Hurley, N S Klazinga, et al. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv Res 2008;8:66.
31. B D Jani, D Purves, S Barry, et al. Challenges and implications of routine depression screening for depression in chronic disease and multimorbidity: a cross sectional study. PLoS ONE 2013;8(9):e74610.
32. D J O'Donoghue. Going Upstream: The implication and opportunities of early detection. Journal of Renal Care 2009;35:3-7.
33. S L Alderson, A Russell, K McLintock, et al. Incentivised screening for depression in patients with chronic heart disease and diabetes: an ethnographic study. (bmjopen-2014-005146R2, in preparation) 2014.
34. B Guthrie, D R Morales. What happens when pay for performance stops? BMJ 2014;348:g1413.
35. K Checkland, S Harrison. The impact of the Quality and Outcomes Framework on practice organisation and service delivery: summary of evidence from two qualitative studies. Qual Prim Care 2010;18:139-46.
36. C Dowrick, A Frances. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ 2013;347:f7140.
37. D Spence, I Reid. Head to Head: Are antidepressants overprescribed? BMJ 2013;346:f190.
38. T Kendrick. Letters: Where next for QOF? Killing the Quality and Outcomes Framework won't decrease prescribing for depression. BMJ 2013;346:f2742.
39. R C Kessler, P Berglund, O Demler, et al. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). JAMA 2003;289(23):3095-105.
40. H Dumesnil, S Cortaredona, H Verdoux, et al. General practitioners' choices and their determinants when starting treatment for major depression: a cross sectional, randomized case-vignette survey. PLOS ONE 2012;7:e52429
41. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:9.
42. M Moore, H M Yuen, N Dunn, et al. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. BMJ 2009;339:b3999.
43. S P MacBride-Stewart, R Elton, T Walley. Do quality incentives change prescribing patterns in primary care? An observational study in Scotland. Fam Pract 2008;25(1):27-32.
44. G Rait, K Walters, M Griffin, et al. Recent trends in the incidence of recorded depression in primary care. Br J Psychiatry 2009;195:520-254.
45. K J Joling, H W van Marwijk, E Piek, et al. Do GPs' medical records demonstrate a good recognition of depression? A new perspective on case extraction. J Affect Disord 2011;133:522-257.
46. Cochrane Effective Practice and Organisation of Care Group. Data Collection Checklist. In: Cochrane Effective Practice and Organisation of Care Group, ed. EPOC Resources. Ottawa, Ontario, Canada: University of Ottawa, 2002.
47. C R Ramsay, L Matowe, R Grilli, et al. Interrupted time series designs in health technology assessment: Lessons from two systematic reviews of behavior change strategies. Int J Technol Assess Health Care 2003;19(4):613-23.

For peer review only

48. C Brown, T Hofer, A Johal, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care 2008;17:170-77.
49. K Barnett, S W Mercer, M Norbury, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. The Lancet 2012;380(9836):37-43.
50. J M Gunn, D R Ayton, K Densley, et al. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Soc Psychiat Epidemiol 2012;47(2):175-84.
51. S Moussavi, S Chatterji, E Verdes, et al. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet 2007;370(9590):851-58.
52. E Kontopantelis, I Buchan, D Reeves, et al. Relationship between quality of care and choice of clinical computing system: retrospective analysis of family practice performance under the UK's quality and outcomes framework. BMJ Open 2013;3:e003190.
53. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009.
54. IAPT Programme. IAPT. Improving Access to Psychological Therapies. 2013. http://www.iapt.nhs.uk/ (accessed 18 February 2014).
55. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009.
56. Royal College of General Practitioners. Supporting Carers: An action guide for general practitioners and their teams. Second ed. London, 2013:26.
57. Health and Social Care Information Centre. Quality and Outcomes Framework - 2012-13: England level data. Secondary Quality and Outcomes Framework - 2012-13: England level data 2013. http://www.hscic.gov.uk/article/2021/Website-Search?productid=12972&q=quality+outcomes+framework+2012-13&sort=Relevance&size=10&page=1&area=both#top.
58. J Oldham. Reform reform: an essay by John Oldham. BMJ 2013;347:f6716.
59. P Craig, P Dieppe, S Macintyre, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
60. E Kontopantelis, D Springate, D Reeves, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. BMJ 2014;348:g330

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Table 1

Practice characteristics	All England	Recruited	Not-recruited	p
Practices, n[a]	8323	65	47	
List Size (patients, median)[a]	5987	**7182**	**4694**	**0.03**
Under 18 years (%)	20.5	20.7	20.2	0.29
65 years and over (%)	16.2	14.5	15.8	0.05
Number of GPs in the practice (mean)[b]	4.4	5.3	**4.2**	**0.04*†**
Male	2.4	2.5	2.2	0.28*†
Female	2	**2.8**	**1.9**	**0.02*†**
Inidices of Multiple Deprivation[a]	23.9	28.5	28.9	0.88
Rural/Urban Classification (% urban)[c]*	84.9	96.9	97.9	0.93
Patient Survey (%)[a]				
Would Recommend	85.9	83.2	82.8	0.8
Have a Chronic Disease	53.4	52.5	53.7	0.17
Carers	18.2	**17.1**	**18.9**	**0.04**
Working	60.1	61.7	58.9	0.13
Unemployed	5.2	5.76	6.42	0.91
Clinical Computing System[d]*				
TPP SystmOne	1494	42	33	-
EMIS (combined LV, PCS, Web)	4649	22	11	-
Other	2231	1	3	0.25‡
QOF (%)[a]				
Total Score	98.5	98.8	98.7	0.99
Exception Rate	5.1	5.4	4.7	0.08
Chronic Disease Prevalence (%)[a]				
CHD	3.4	**3.6**	**4.1**	**0.03**
Hypertension	13.9	**13**	**13.8**	**0.04**
Diabetes	4.7	4.4	4.6	0.48
Asthma	5.9	6	5.9	0.81
COPD	1.6	**1.7**	**2**	**0.02**
Depression	8.7	8.7	7.8	0.35
Epilepsy	0.6	**0.6**	**0.7**	**0.04**
Dementia	0.4	0.5	0.5	0.69

Data published 2012, except *2011. Averages are median unless otherwise stated. Comparison with Kruskall-Wallis test except †Student's T-test when comparison of means was more appropriate, and ‡Fisher's exact where comparison was between proportions. Comparison is between recruited and not-recruited practices, there is no comparison to 'All England' as the local practices are also in this group and cannot be compared to a group containing themselves.

[a] Public Health England. Fingertips. National Public Health Profiles. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://fingertips.phe.org.uk/

[b] Health and Social Care Information Centre. NHS Staff - 2001-2011, General Practice. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.

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[c] Health and Social Care Information Centre. Indicator Portal. [Online]. 2011. [Accessed 6 May 2014]. Available from: https://indicators.ic.nhs.uk/

[d] Direct enquiry to Health and Social Care Information Centre, May 2014. Reference NIC-270580-S0V6P. The total number of practices for these data (2011) differ from the Practices, n denominator (2012) due to the different year of data collection.

Table 2

Year	Counts					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	1	20	11	36	99	199
2002-03	14	99	97	323	406	864
2003-04	18	121	165	477	526	1163
2004-05	17	144	218	687	575	1324
2005-06	68	169	260	706	604	1312
2006-07	13363	1555	705	927	909	1429
2007-08	4242	1089	438	985	871	1594
2008-09	2741	800	423	860	925	1752
2009-10	2809	1080	420	1003	1028	1921
2010-11	2801	1691	458	979	1244	2195
2011-12	2830	1755	435	937	1306	2319

Table 3

Year	Rates per 100,000 patients					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	0.0010	0.0058	0.0061	0.0138	0.1050	0.0662
2002-03	0.0038	0.0072	0.0279	0.0286	0.1118	0.0794
2003-04	0.0039	0.0088	0.0366	0.0441	0.1257	0.1057
2004-05	0.0032	0.0103	0.0557	0.0710	0.1565	0.1354
2005-06	0.0210	0.0121	0.0648	0.0664	0.1524	0.1314
2006-07	3.3199	0.1450	0.1946	0.0907	0.2296	0.1359
2007-08	1.0276	0.0989	0.1127	0.1077	0.2185	0.1564
2008-09	0.7139	0.0732	0.1125	0.0918	0.2414	0.1674
2009-10	0.7244	0.0850	0.1212	0.0952	0.2543	0.1774
2010-11	0.6708	0.1293	0.1258	0.0905	0.2783	0.1843
2011-12	0.6849	0.1254	0.1093	0.0805	0.2954	0.1973

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The effects of financial incentives for case finding for depression in patients with diabetes and coronary heart disease: interrupted time series analysis

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Abstract

Objectives

To evaluate the effects of Quality and Outcomes Framework (QOF) incentivised case finding for depression on diagnosis and treatment in targeted and non-targeted long-term conditions.

Design

Interrupted time series analysis

Setting

General practices in Leeds, United Kingdom (UK).

Participants

Sixty-five (58%) of 112 general practices shared data on 37,229 patients with diabetes and coronary heart disease (CHD) targeted by case finding incentives, and 101,008 patients with four other long-term conditions not targeted (hypertension, epilepsy, chronic obstructive pulmonary disease (COPD) and asthma).

Intervention

Incentivised case finding for depression using two standard screening questions.

Main Outcome Measures

Clinical codes indicating new depression-related diagnoses and new prescriptions of antidepressants. We extracted routinely recorded data from February 2002 through April 2012. The number of new diagnoses and prescriptions for those on registers was modelled with a binomial regression which provided the strength of associations between time periods and their rates.

Results

New diagnoses of depression increased from 21 to 94 per 100,000 per month in targeted patients between the periods 2002-4 and 2007-11 (OR 2.09; 1.92 to 2.27). The rate

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increased from 27 to 77 per 100,000 per month in non-targeted patients (OR 1.53; 1.46 to 1.62). The slopes in prescribing for both groups flattened to zero immediately after QOF was introduced but before incentivised case finding (p<0.01 for both). Antidepressant prescribing in targeted patients returned to the pre-QOF secular upward trend (Wald test for equivalence of slope, z=0.73, p=0.47); the slope was less steep for non-targeted patients (z=-4.14, p<0.01).

Conclusions

Incentivised case finding increased new depression-related diagnoses. The establishment of QOF disrupted rising trends in new prescriptions of antidepressants which resumed following the introduction of incentivised case finding. Prescribing trends are of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

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Article summary

Strengths and limitations of this study

Strengths

- Rigorous quasi-experimental design demonstrating policy effects on patient populations within a sample of general practices which appears broadly representative on key parameters.
- Further insights gained from comparison of trends in patient populations targeted and non-targeted by intervention

Limitations

- Relatively high ‘signal to noise’ ratio inherent in use of routinely recorded data may have diminished the magnitude of observed effects
- The absence of a control population of practices, making it hard to rule out possibility that concurrent national and local initiatives contributed to observed trends
- Lack of data on patient outcomes, such as recovery from depression or the appropriateness of treatment

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Background

Long-term physical conditions are associated with a high prevalence of depression; people with diabetes or CHD have a two to three-fold increased lifetime risk.[1 2] Such co-morbidity can make depression hard to recognise,[3 4] worsens the prognosis of both conditions [1 5 6] and increases healthcare and societal costs.[1 7]

The UK National Institute for Health and Care Excellence (NICE) recommends case finding for depression in people with long-term physical conditions.[8 9] The Quality Outcomes Framework (QOF) for general practice was established in 2004 and correspondingly rewarded case finding for depression in all patients with a diagnosis of CHD or diabetes over 2006-13 (QOF years three to nine). This indicator was known as 'QOF DEP1' and defined as, "the percentage of patients on the diabetes register and/or the CHD register for whom case finding for depression has been undertaken on one occasion during the previous 15 months using two standard screening questions."[10] A designated clinical code indicating the use of these questions was recorded in the patient record whenever the Patient Health Questionnaire-2 (PHQ2) was administered, irrespective of the responses. Practices were reimbursed according to the proportion of patients with a record of case finding in the preceding 15 months. Payment thresholds were set at achievements of 40-90% of eligible patients until 2012, and 50-90% 2012-13. The indicator had a value of eight points from 2006-10 and six points from 2010-13. Each point was worth £133.76 in 2012-13, the final year of incentivisation. This incentivised case finding has now been withdrawn from the QOF because of doubts over benefits.[11]

The impact of this policy has been uncertain. The effectiveness of financial incentives in changing clinical behaviour is limited[12] and pay-for-performance schemes often have unintended adverse consequences.[13] More specifically, a systematic review concluded advances in quality of care for long-term conditions included in UK QOF were modest.[14] There are few rigorous evaluations of the effects of pay-for-performance, given that

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controlled comparisons are rarely acceptable to policy-makers. Two interrupted time series evaluations of QOF have not shown any sustained effects on processes of care or clinical outcomes.[15 16] Whilst there are no coded data prior to the introduction of the case finding indicator, at face value the QOF did incentivise a change in practice given that around 86% of patients with diabetes and CHD have been coded as screened at least every 15 months since its inception.[17] Yet there is no evidence that case finding for depression, whether in the presence[18] or absence of coordinated care systems, [19 20] improves patient outcomes. A cohort study found a greater likelihood of a new diagnosis of depression and initiation of antidepressant treatment in the 28 days following QOF-incentivised case finding;[21] the longer term effects on the whole population eligible for case finding are unknown. There may be further unintended effects on populations with other long-term conditions not targeted by incentivised case finding. Examining quality of care across a number of conditions Doran et al found that improvements associated with QOF incentives occurred at the expense of small detrimental effects on aspects of non-incentivised care.[22]

We evaluated the effects of incentivised case finding on new depression-related diagnoses and new prescriptions of antidepressants in patient populations with long-term conditions targeted or not by financial incentives.

Methods

Study design

We used an interrupted time series design to evaluate the effects of incentivised case finding whilst accounting for underlying secular trends. We also compared trends in depression diagnosis and treatment between those patient populations targeted by incentivised case finding (diabetes and CHD) and other patient populations with long-term physical conditions not targeted by incentivised case finding (hypertension, epilepsy, COPD and asthma). Our rationale was that we would not expect outcomes in the non-targeted group to diverge from underlying secular trends.

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Practices and participants

We invited all 112 general practices in Leeds to share anonymised patient data via the Information in General Practice Team of the then National Health Service (NHS) primary care trust. No distinction was made between users of different electronic records systems. Compared with English indicators the physical health of people in Leeds is generally worse and levels of deprivation are higher.[23] Recorded depression in adults is similar (both around 11%)[24] as is performance on the QOF incentivised case finding indicator in our final year of data collection (87% for Leeds over 2011-12 compared to England average of 86%).[17 25] We sought data on patients with diabetes and CHD targeted by case finding and data from other patients with the four comparator and non-target, long-term physical conditions from QOF registers. Patients with conditions in both targeted and non-targeted groups were excluded from non-targeted group analysis to avoid double counting. Therefore, any change in outcomes in the non-targeted group could not be attributable to individuals being screened because they had a targeted condition.

Data Collection

We collected retrospective, electronic data from February 2002 through April 2012 for patients aged 18 years and over. Data were extracted through Morbidity Information Query and Export Syntax (MIQUEST) software, used for collecting data from general practice clinical computing systems in a consistent and comparable way. The tool utilises a query language, which incorporates security and confidentiality safeguards; pseudoanonymisation supports the extraction of patient level information but ensures it is not attributable to individual patients.[26] Participating practices consented to the extraction of anonymised patient data and did not need to take any further action.

We recognised that the diagnosis of depression was likely to be under-recorded in clinical records because of factors such as diagnostic uncertainty and patient preference. The recording of certain diagnostic Read Codes, such as ‘depressive disorder,’ automatically triggers alerts for further assessments required by QOF. Failure to meet these targets

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reduces practice income and hence coding behaviour may have changed. We therefore also searched for use of more sensitive but less specific Read codes such as 'low mood' or 'depressed mood' which are not assessed by the QOF and included these in our main outcome of diagnosis. We excluded codes related to postnatal depression.

Data on the prescription of licensed antidepressant drugs listed in British National Formulary section 4.3 were collected, with the exception of antidepressants judged by clinicians involved in the project (RF, AH, SA, KM) to be more commonly prescribed for other indications (e.g. amitriptyline and nortriptyline for neuropathic pain).[27]

A complete list of clinical codes for each outcome measure is available as an electronic web appendix.

Data analysis

The denominators comprised the numbers of patients on practice registers for each financial year (starting 1st April) targeted by incentivised case finding (diabetes and CHD) and those not targeted (hypertension, epilepsy, COPD and asthma). We assumed that registered long-term condition populations would be relatively stable over each year. We took the number of registered long-term condition populations per practice as constant over each QOF year. This permitted a more parsimonious model to facilitate interpretation.

For each targeted and non-targeted patient group, we analysed trends in new depression-related diagnoses and antidepressant prescribing. We also examined the uptake of case finding for depression. We recognised that these trends could relate to changes in coding as well as clinical practice; we mainly used their outputs to guide interpretation of the main outcomes. Data were aggregated by month for each of the 65 practices so that each time series is 123 months long (February 2002 to April 2012). Analysis was carried out at the practice level using a binomial regression based on the calculated numerators and the available denominators. Discontinuities were modelled at key dates: April 2004 for the

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introduction of QOF; and April 2006 for the introduction of incentives for case finding for depression. A further discontinuity was introduced at April 2007 to isolate exceptional behaviour noted during the QOF year April 2006 through March 2007. Our focus and interest was on the long-term sustained effect seen after the introduction of case finding incentives rather than the immediate change. To avoid bias from this first year (2006/7) rates were permitted to be different in that year, so isolating it from the sustained effect we sought to assess. For each time period (February 2002 to March 2004; April 2004 to March 2006; April 2006 to March 2007; April 2007 to April 2012) the model has an overall constant and slope. Specific slope terms were dropped when they were found not to be statistically significant from zero at the 5% level.

Fitting seasonal effects improved the model but added complexity. As reference and intervention periods were integer multiples of complete years, there would be no perturbation of level or slope if explicit seasonality terms were not included, but rather seasonality was encompassed within the error term. Since the profile of seasonality appeared to change from the reference period to the intervention period and vary in the group with targeted interventions compared to the group for other long-term conditions, this option was selected to yield the clearest effect in the model. The model can be expressed as:

Let Y_{Tit} and Y_{Nit} be random variables representing the number of diagnoses at practice i in month t for ~~targetted~~targeted and non-~~targetted~~targeted patients respectively. Then

$$\Pr\ (Y_{Tit}=y_{Tit}) = \binom{n_{Tit}}{y_{Tit}}\ \pi_{Tit}^{y_{Tit}}\ (1-\pi_{Tit})^{(n_{Tit}-y_{Tit})} \qquad (1)$$

where $y_{Tit} \in \{0, 1, \dots, n_{Tit}\}$, n_{Tit} is the relevant denominator for practice i in month t, and π_{Tit} is the corresponding rate of diagnosis. Using a logit link function in the generalised regression, we model the rate π_{Tit} with

$$\log\left(\frac{\pi_{Tit}}{1-\pi_{Tit}}\right) = \mu_{T0} + m_{Ti} + \beta_{T1}\ 1_{t\in 2006} + \beta_{T2}\ 1_{t>2006} \qquad (2)$$

and

$$m_i \in N\ (0, \sigma^2) \qquad (3)$$

where $1_{t\in 2006}$ is an indicator variable for the year 2006/2007 and $1_{t>2006}$ is an indicator for the intervention period, that is after the year 2006/2007. Note that a random intercept m_{Ti} is included to account for clustering within practices. Slope terms were also added where appropriate. The open source software R 2.12.0 64 bit version was used for all statistical analysis.[28]

Results

We recruited 65 (58%) of 112 Leeds practices. Their 2012 QOF registers indicated that they served 37,229 patients with diabetes and CHD targeted for case finding for depression and 101,008 patients with other long-term conditions not targeted. Table 1 provides data on all English practices and compares characteristics of recruited and not-recruited practices.

Overall, the practices recruited were larger; however, we found no significant differences in Indices of Multiple Deprivation or, total QOF scores. The majority of practices used one clinical computing system by the end of data collection. Tables 2 and 3 summarise the annual incidences of case finding, depression-related diagnoses and prescription of antidepressants by count and rates per 100,000 patients, for targeted and non-targeted patients.

Practice-level analysis found significant increases in new coded case finding following the initiation of incentives, also reflected in aggregated city-wide level trends (Figure 1). The exceptional rise in 2006 reflects first ~~coding in~~coding in patients with existing diagnoses of diabetes and CHD. Comparing the period April 2004 to March 2006 with April 2007 to March 2012, rates of case finding increased in the targeted population from 0.07 to 7.45 per 1000

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per month (OR 99.76; 95% confidence interval 83.15 to 119.68) and in the non-targeted population increased from 0.1 to 0.78 per 1000 per month (OR 7.54; 6.91 to 8.24).

Binomial regression of the practice level data confirmed statistically significant rate increases in new depression-related diagnoses in both patient populations. In targeted patients, the diagnosis rate increased from 21 to 94 per 100,000 per month between the periods 2002-4 and 2007-12 (OR 2.09; 1.92 to 2.27). In non-targeted patients, the rate increased from 27 to 77 per 100,000 per month (OR 1.53; 1.46 to 1.62). In neither of these periods was the slope statistically significant from zero: that is the rates can be assumed to be constant during these periods. Figure 2 shows these trends aggregated at a city level with fitted constants and slopes, indicated by dashed lines. Figure 3 shows the city-level trends for new antidepressant prescribing with fitted constants and slopes. Rates of prescribing increased over the full period of observation. During the period after QOF was introduced but before incentives (April 2004 to March 2006), the slopes for both populations flattened to zero ($p<0.01$ for both groups). For targeted patients, the slopes before the introduction of QOF and after the exceptional year were similar (Wald test for equivalence of slope, $z=0.73$, $p=0.47$). For non-targeted patients the slope for the latter period was less steep (Wald test for slope, $z=-4.14$, $p<0.01$). All Wald tests for slopes were undertaken using practice level data.

Discussion

Incentivised case finding increased rates of new depression-related diagnoses in patients with CHD and diabetes and, to a lesser extent, in those with non-targeted long-term conditions. ~~The spike in diagnoses immediately following incentivisation probably reflects coding patterns before general practitioners began to realise they would trigger alerts for further assessments required by QOF when recording depression related diagnoses.~~ The establishment of QOF disrupted rising trends in new prescriptions of antidepressants; these resumed following the introduction of incentivised case finding, although there was a modest

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deceleration in antidepressant prescribing for non-targeted conditions. Rates of new prescriptions for antidepressants exceeded those for depression-related diagnoses.

Quasi-experimental evaluations of QOF have found no sustained effects for other clinical indicators.[14-16] Financial incentives in primary care tend to have modest effects on relatively simple clinical behaviours such as risk factor recording or test ordering.[12] The nature of targeted clinical behaviours is likely to influence the effectiveness of incentives.[29 30] Given that the QOF incentives directly rewarded case finding, we sought and found evidence of changed clinical practice 'downstream' to case finding. Previous research has found associations between case finding for depression and both new diagnoses and antidepressant prescribing.[21 31] However, our analysis of longitudinal data demonstrates policy effects at a population level and highlights the importance of accounting for secular trends and additional insights from comparative data.

The mechanisms by which rates of depression-related diagnoses increased remains unclear. The spike in diagnoses immediately following incentivisation probably reflects coding patterns before general practitioners began to realise they would trigger alerts for further assessments required by QOF when recording depression related diagnoses. Similar phenomena have been observed in first years of new QOF indicators.[32] Following the introduction of incentivised case finding, rates of new depression-related diagnoses rose in non-targeted long-term conditions, coincident with only a modest rise in recorded case finding in these patients. Incentivised case finding may have directly affected pathways of care or, more generally, increased awareness of the higher risk of depression in all patients with long-term conditions. ~~A combination of these explanations seems likely given that our parallel ethnographic study of general practices demonstrated the absence of a systematic approach to following up and managing screen positive cases.[32]~~ A combination of these explanations seems likely for two reasons. First, we found strong evidence of seasonality for coded case-finding but not for new diagnoses or prescribing. Second, our parallel ethnographic study of general practices demonstrated the absence of a systematic approach

to following up and managing screen-positive cases.[33] It remains uncertain how the QOF and other payment for performance systems work.[34]

The interpretation of prescribing trends is more challenging. Taking pre-QOF trends into account, new prescriptions of antidepressants in patients with long-term conditions plateaued following the introduction of QOF before resuming the underlying trend in targeted conditions when incentivised case finding for depression was introduced. This plateau effect appears compatible with a view that the initial introduction of QOF diverted attention from psychosocial aspects of long-term condition care towards achieving biomedical targets.[35] It is also consistent with a longitudinal analysis of QOF in English general practice which found lower overall achievement rates for non-incentivised indicators compared to predicted values than for incentivised indicators.[22] Arguably, this might not represent a detrimental unintended consequence in the case of a potentially over-medicalised condition such as depression.[36]

The causes of on-going secular increases in antidepressant prescribing have been debated.[37 38] Hypotheses include poor compliance with clinical guidelines which do not recommend prescribing in the more commonly encountered mild to moderate depression,[31 39-41] an increase in duration of antidepressant prescribing in line with clinical guidelines rather than an increase in the number of patients prescribed for,[42] and the intensifying effect of QOF on prescribing patterns.[43] Our data included only the first prescription of any antidepressant for each patient, indicating that our observed trends are attributable to greater numbers of patients being treated rather than extended periods of prescribing. Therefore, our analysis supports the explanation that incentivised case finding perpetuated the rise in antidepressant prescribing because of a perceived need for clinical action over and above referral for counselling or watchful waiting.

The rate of antidepressant prescribing in this study exceeded the rate of diagnosis of depression in targeted and non-targeted groups, this trend was also reported by Burton and colleagues.[21] The limited use of clinical codes in the diagnosis of depression is recognised. Rather than a lack of diagnostic accuracy, it probably reflects how clinical coding is not

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always a part of routine practice and how GPs pragmatically prescribe according to symptoms and responses to treatment rather than diagnostic categories.[44 45]

Whilst we drew upon published guidance in conducting this interrupted time series, [46 47] we identified seven main limitations. First, the high 'signal to noise' ratio inherent in the use of routinely recorded data may have diminished the magnitude of observed effects.[48] Second, the true denominator for the binomial regression varies monthly as patients as patients exit the denominator population after undergoing incentivised case finding. There are also variations due patients dying and leaving the practice. We used annual QOF reports for the denominator values and took them to be constant for that year. Since the denominator is large compared to the number screened, the error of the model will be small. Third, we were unable to examine patient outcomes, such as recovery from depression, nor the appropriateness of treatment. We explored the use of routinely collected referral data but these were unreliably recorded and prone to temporal changes in coding practices. Fourth, targeted patients with diagnoses of diabetes and CHD may include individuals with a greater number of comorbidities than non-targeted patients.[49] Depression is more prevalent in patients with a greater number of physical comorbidities,[50 51] suggesting we were more likely to identify depression related diagnoses in this group. Fifth, our analysis is based upon one geographical area with a response rate of 58%. However, the characteristics of practices participating in the study were broadly similar to those for England and the non-participating practices. Sixth, observed trends may also have been related to changes in practice computerised record systems. Leeds practices began migrating to The Phoenix Partnership (TPP) SystmOne after 2006 until it became the majority provider in 2012 (Table 1). The choice of clinical computing system is associated with variations in practice QOF performance.[52] Seventh, given the absence of a control population of practices, it is possible that concurrent national and local initiatives may have contributed to our observed trends. NICE issued a clinical guideline on depression in 2004, which was subsequently revised in 2009;[53] even allowing for delayed diffusion or anticipatory effects, it is unlikely to explain any

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changes we observed from 2006 onwards. Nor do the introduction of the Improving Access to Psychological Therapies programme in Leeds from 2008-09 onwards or publication of the NICE clinical guideline on depression in adults with a chronic physical health problem in 2009 offer plausible alternative explanations.[54 55] Furthermore, the isolation of the exceptional year when case finding incentives were first introduced permits us to infer with confidence that we observed sustained higher rates of diagnosis.

Given the sustained promotion of case finding for depression across a range of long-term conditions and for carers,[8 9 56] there is a need for clearer guidance to optimise the pathway and outcomes of care for case finding-detected depression, including limiting antidepressant prescribing to patients most likely to benefit. Any effects of incentivised case finding need to be considered alongside costs. Based on payments offered under the 2012-13 UK QOF contract and without considering opportunity costs, we estimate that case finding for depression in CHD and diabetes cost over £6 million per annum[57] in the context of the £1 billion total estimated cost of QOF each year. These costs, the limited benefits we found, and the withdrawal of incentivised case finding for depression demonstrate the risk of rolling out policies in the absence of rigorous supporting evidence. Although policy-makers express frustration when debates about evidence appear to hold back service improvement,[58] there are hazards in following assumptions about how and whether apparently simple but deceptively complex interventions such as incentivised case finding work.[59]

The impact of the withdrawal of QOF incentivised case finding for depression is not yet known. A retrospective longitudinal study suggested levels of performance remain stable across a range of clinical activities following the removal of QOF incentives, although all indicators studied were indirectly or partly linked to activities which remained incentivised.[60] The longer term effects of completely withdrawing an incentive, such as case finding for depression, on clinical behaviour is unknown and merits further research.

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What is already known on this topic
• Patients with long term conditions are at a higher risk of depression • There is limited knowledge about the population effects of incentivised case finding for depression in patients with long term conditions
What this study adds
• Incentivised case finding increased new depression-related diagnoses in people with long term conditions, including those not targeted by incentives. • The establishment of QOF disrupted rising trends in new prescriptions of antidepressants, which returned to earlier rates of increase in targeted conditions whilst modestly decelerating in non-targeted conditions • The continued rise in antidepressant prescribing is of concern given that it may include people with mild to moderate depression unlikely to respond to such treatment.

Competing Interests Statement
All authors report grants from National Institute for Health Research under its Research for Patient Benefit Programme, during the conduct of the study.

Ethics Approval
This study was approved by the East Midlands - Derby 2 Research Ethics Committee (reference 11/EM/0144).

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the article for publication. All authors, external and internal, had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency Declaration

Dr Kate McLintock, the lead author (the manuscript's guarantor), affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Data sharing statement

Full dataset and statistical code available from the corresponding author at k.l.mclintock@leeds.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

Contributorship Statement

RF and AH conceived the project. RF was principal investigator. KM and SA designed the study. KM and AR were responsible for running the project. RW was responsible for statistical analyses. All authors interpreted the data and findings. KM wrote the first draft of the manuscript. RF commented on the first draft and all authors commented on further revisions. KM is guarantor of the paper.

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Figure Legends

Table 1 Characteristics of general practices in England and those in Leeds which did and did not share data for the study based upon data published in 2012.

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Table 2 Annual numbers of case finding, new depression-related diagnoses and new prescriptions of antidepressants in Leeds over 2001-12 for conditions targeted or not by incentivised case-finding.

Table 3 Annual incidences of case finding, new depression-related diagnoses and new prescriptions of antidepressants (per 100,000 patients) in Leeds over 2001--12, for conditions targeted or not by incentivised case-finding.

Figure 1 Rates of coded case finding for depression in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 2 Rates of new depression-related coded diagnoses in patients with conditions targeted or not by incentivised case-finding, 2002-12.

Figure 3 Rates of new antidepressant prescribing in patients with conditions targeted or not by incentivised case-finding, 2002-12.

References

1. R D Goldney, P J Phillips, L J Fisher, et al. Diabetes, Depression and Quality of Life. Diabetes Care 2004;27:1066-70.
2. S J C Davies, P R Jackson, J Pokotar, et al. Treatment of anxiety and depressive disorders in patients with cardiovascular disease. BMJ 2004;328:939.
3. H Lester, A Howe. Depression in Primary Care: three key challenges. Postgrad Med J 2008;84(996):545-48.
4. J R T Davidson, S E Meltzer-Brody. The under recognition and under treatment of depression: What is the breadth and depth of the problem? Discussion. J Clin Psychiatry 1990;60 (supplement 7):4-9.
5. R M Carney, K E Freedland, G E Miller, et al. Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. J Psychosom Res 2002;53:897-902.
6. M A Whooley, P de Jonge, E Vittinghoff, et al. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA 2008;300(20):2379-88.
7. G E Simon, W J Katon, E H B Lin, et al. Diabetes complications and depression as predictors of health service costs. Gen Hosp Psychiatry 2005;27(5):344-51.
8. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90, 2009:8.
9. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009:8.

For peer review only

10. The NHS Information Centre for Health & Social Care. QOF clinical domain: depression. Secondary QOF clinical domain: depression 2013. https://mqi.ic.nhs.uk/IndicatorDefaultView.aspx?ref=1.07.04.
11. National Institute for Health and Clinical Excellence Special Health Authority Primary Care Quality and Outcomes Framework Indicator Advisory Committee. Confirmed minutes of the June 2011 QOF Advisory Committee: National Institute for Health and Clinical Excellence, 2011:23-24.
12. A Scott, P Sivey, D Ait Ouakrim, et al. The effect of financial incentives on the quality of health care provided by primary care physicians (Review). Cochrane Database of Systematic Reviews 2011;9.
13. L A Petersen, L D Woodard, T Urech, et al. Does Pay-for-Performance Improve the Quality of Health Care? Ann Intern Med 2006;145(4):265-72.
14. S Gillam, N Siriwardena, N Steel. Pay-for-performance in the UK: the impact of the quality and outcomes framework - a systematic review. Ann Fam Med 2012;10(5):461-68.
15. B Serumaga, D Ross-Degnan, A Avery, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ 2011;342:d108.
16. E Kontopantelis, D Reeves, J M Valderas, et al. Recorded quality of primary care for patients with diabetes in England before and after the introduction of a financial incentive scheme: a longitudinal observational study. BMJ Qual Saf 2013;22:53-64.
17. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, England level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9548&q=qof+depression&sort=Relevance&size=10&page=1#top.
18. Thombs B, Ziegelstein R, Roseman M, et al. There are no randomized controlled trials that support the United States Preventive Services Task Force guideline on screening for depression in primary care: a systematic review. BMC Medicine 2014;12(1):13.
19. S M Gilbody, T A Sheldon, A O House. Screening and case-finding instruments for depression: a meta-analysis. CMAJ 2008;178:997-1003.
20. E A O'Connor, E P Whitlock, T L Beil, et al. Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Int Med 2009;151(11):793-803.
21. C Burton, C Simpson, N Anderson. Diagnosis and treatment of depression following routine screening in patients with coronary heart disease or diabetes: a database cohort study. Psychol Med 2013;43(3):529-37.
22. T Doran, E Kontopantelis, J M Valderas, et al. Effect of Financial Incentives on Incentivised and Non-incentivised Clinical Activities: Longitudinal Analysis of Data from the UK Quality and Outcomes Framework. BMJ 2011;342:d3590
23. Public Health Observatories of England. Health Profile 2012; Leeds. Health Profiles 2012. http://www.apho.org.uk/resource/view.aspx?RID=50215&SEARCH=L* (accessed 18 February 2014).
24. Public Health Observatories of England. Community Mental Health Profiles. 2013. www.nepho.org.uk/cmhp (accessed 18 February 2014).
25. The Health and Social Care Information Centre. Quality and Outcomes Framework - 2011-12, PCT level: Clinical domain, depression data tables. 2012; (18 February 2014). http://www.hscic.gov.uk/searchcatalogue?productid=9592&q=qof+depression&sort=Relevance&size=10&page=1#top.
26. V Hammersley, A Meal, L Wright, et al. Journal of Informatics in Primary Care. 1998(November):3-7.
27. British National Formulary. 4.7.3 Neuropathic Pain. 2014; (7 February 2014). http://www.medicinescomplete.com/mc/bnf/current/PHP2814-neuropathic-pain.htm.

For peer review only

28. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. 2010. http://www.R-project.org/.
29. C Arditi, M Rège-Walther, J C Wyatt, et al. The effect of automatically generated reminders delivered to providers on paper on professional practice. Cochrane Database of Systematic Reviews 2012;12.
30. T Custers, J Hurley, N S Klazinga, et al. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv Res 2008;8:66.
31. B D Jani, D Purves, S Barry, et al. Challenges and implications of routine depression screening for depression in chronic disease and multimorbidity: a cross sectional study. PLoS ONE 2013;8(9):e74610.
32. D J O'Donoghue. Going Upstream: The implication and opportunities of early detection. Journal of Renal Care 2009;35:3-7.
33. S L Alderson, A Russell, K McLintock, et al. Incentivised screening for depression in patients with chronic heart disease and diabetes: an ethnographic study. (In preparation).
34. B Guthrie, Morales DR. What happens when pay for performance stops? BMJ 2014;348:g1413.
35. K Checkland, S Harrison. The impact of the Quality and Outcomes Framework on practice organisation and service delivery: summary of evidence from two qualitative studies. Qual Prim Care 2010;18:139-46.
36. C Dowrick, A Frances. Medicalising unhappiness: new classification of depression risks more patients being put on drug treatment from which they will not benefit. BMJ 2013;347:f7140.
37. D Spence, I Reid. Head to Head: Are antidepressants overprescribed? BMJ 2013;346:f190.
38. T Kendrick. Letters: Where next for QOF? Killing the Quality and Outcomes Framework won't decrease prescribing for depression. BMJ 2013;346:f2742.
39. R C Kessler, P Berglund, O Demler, et al. The Epidemiology of Major Depressive Disorder: Results From the National Comorbidity Survey Replication (NCS-R). JAMA 2003;289(23):3095-105.
40. H Dumesnil, S Cortaredona, H Verdoux, et al. General practitioners' choices and their determinants when starting treatment for major depression: a cross sectional, randomized case-vignette survey. PLOS ONE 2012;7:e52429
41. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009:9.
42. M Moore, H M Yuen, N Dunn, et al. Explaining the rise in antidepressant prescribing: a descriptive study using the general practice research database. BMJ 2009;339:b3999.
43. S P MacBride-Stewart, R Elton, T Walley. Do quality incentives change prescribing patterns in primary care? An observational study in Scotland. Fam Pract 2008;25(1):27-32.
44. G Rait, K Walters, M Griffin, et al. Recent trends in the incidence of recorded depression in primary care. Br J Psychiatry 2009;195:520-254.
45. K J Joling, H W van Marwijk, E Piek, et al. Do GPs' medical records demonstrate a good recognition of depression? A new perspective on case extraction. J Affect Disord 2011;133:522-257.
46. Cochrane Effective Practice and Organisation of Care Group. Data Collection Checklist. In: Cochrane Effective Practice and Organisation of Care Group, ed. EPOC Resources. Ottawa, Ontario, Canada: University of Ottawa, 2002.
47. C R Ramsay, L Matowe, R Grilli, et al. Interrupted time series designs in health technology assessment: Lessons from two systematic reviews of behavior change strategies. Int J Technol Assess Health Care 2003;19(4):613-23.

For peer review only

48. C Brown, T Hofer, A Johal, et al. An epistemology of patient safety research: a framework for study design and interpretation. Part 3. End points and measurement. Qual Saf Health Care 2008;17:170-77.
49. K Barnett, S W Mercer, M Norbury, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. The Lancet 2012;380(9836):37-43.
50. J M Gunn, D R Ayton, K Densley, et al. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Soc Psychiat Epidemiol 2012;47(2):175-84.
51. S Moussavi, S Chatterji, E Verdes, et al. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. The Lancet 2007;370(9590):851-58.
52. E Kontopantelis, I Buchan, D Reeves, et al. Relationship between quality of care and choice of clinical computing system: retrospective analysis of family practice performance under the UK's quality and outcomes framework. BMJ Open 2013;3:e003190.
53. National Institute for Health and Clinical Excellence. Depression in adults: The treatment and management of depression in adults. NICE Clinical Guideline 90. 2009.
54. IAPT Programme. IAPT. Improving Access to Psychological Therapies. 2013. http://www.iapt.nhs.uk/ (accessed 18 February 2014).
55. National Institute for Health and Clinical Excellence. Depression in adults with a chronic physical health problem: Treatment and management. NICE Clinical Guideline 91. 2009.
56. Royal College of General Practitioners. Supporting Carers: An action guide for general practitioners and their teams. Second ed. London, 2013:26.
57. Health and Social Care Information Centre. Quality and Outcomes Framework - 2012-13: England level data. Secondary Quality and Outcomes Framework - 2012-13: England level data 2013. http://www.hscic.gov.uk/article/2021/Website-Search?productid=12972&q=quality+outcomes+framework+2012-13&sort=Relevance&size=10&page=1&area=both#top.
58. J Oldham. Reform reform: an essay by John Oldham. BMJ 2013;347:f6716.
59. P Craig, P Dieppe, S Macintyre, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ 2008;337:a1655.
60. E Kontopantelis, D Springate, D Reeves, et al. Withdrawing performance indicators: retrospective analysis of general practice performance under UK Quality and Outcomes Framework. BMJ 2014;348:g330

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Table 1

Practice characteristics	All England	Recruited	Not-recruited	p
Practices, n[a]	8323	65	47	
List Size (patients, median)[a]	5987	**7182**	**4694**	**0.03**
Under 18 years (%)	20.5	20.7	20.2	0.29
65 years and over (%)	16.2	14.5	15.8	0.05
Number of GPs in the practice (mean)[b]	4.4	5.3	**4.2**	**0.04*†**
Male	2.4	2.5	2.2	0.28*†
Female	2	**2.8**	**1.9**	**0.02*†**
Inidices of Multiple Deprivation[a]	23.9	28.5	28.9	0.88
Rural/Urban Classification (% urban)[c]*	84.9	96.9	97.9	0.93
Patient Survey (%)[a]				
Would Recommend	85.9	83.2	82.8	0.8
Have a Chronic Disease	53.4	52.5	53.7	0.17
Carers	18.2	**17.1**	**18.9**	**0.04**
Working	60.1	61.7	58.9	0.13
Unemployed	5.2	5.76	6.42	0.91
Clinical Computing System[d]*				
TPP SystmOne	1494	42	33	-
EMIS (combined LV, PCS, Web)	4649	22	11	-
Other	2231	1	3	0.25‡
QOF (%)[a]				
Total Score	98.5	98.8	98.7	0.99
Exception Rate	5.1	5.4	4.7	0.08
Chronic Disease Prevalence (%)[a]				
CHD	3.4	**3.6**	**4.1**	**0.03**
Hypertension	13.9	**13**	**13.8**	**0.04**
Diabetes	4.7	4.4	4.6	0.48
Asthma	5.9	6	5.9	0.81
COPD	1.6	**1.7**	**2**	**0.02**
Depression	8.7	8.7	7.8	0.35
Epilepsy	0.6	**0.6**	**0.7**	**0.04**
Dementia	0.4	0.5	0.5	0.69

Data published 2012, except *2011. Averages are median unless otherwise stated. Comparison with Kruskall-Wallis test except †Student's T-test when comparison of means was more appropriate, and ‡Fisher's exact where comparison was between proportions. Comparison is between recruited and not-recruited practices, there is no comparison to 'All England' as the local practices are also in this group and cannot be compared to a group containing themselves.

[a] Public Health England. Fingertips. National Public Health Profiles. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://fingertips.phe.org.uk/

[b] Health and Social Care Information Centre. NHS Staff - 2001-2011, General Practice. [Online]. 2012. [Accessed 6 May 2014]. Available from: http://www.hscic.gov.uk/article/2021/Website-Search?productid=4869&q=gp+numbers+2011&sort=Relevance&size=10&page=1&area=both#top.

For peer review only

[c] Health and Social Care Information Centre. Indicator Portal. [Online]. 2011. [Accessed 6 May 2014]. Available from: https://indicators.ic.nhs.uk/

[d] Direct enquiry to Health and Social Care Information Centre, May 2014. Reference NIC-270580-S0V6P. The total number of practices for these data (2011) differ from the Practices, n denominator (2012) due to the different year of data collection.

Table 2

Year	Counts					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	1	20	11	36	99	199
2002-03	14	99	97	323	406	864
2003-04	18	121	165	477	526	1163
2004-05	17	144	218	687	575	1324
2005-06	68	169	260	706	604	1312
2006-07	13363	1555	705	927	909	1429
2007-08	4242	1089	438	985	871	1594
2008-09	2741	800	423	860	925	1752
2009-10	2809	1080	420	1003	1028	1921
2010-11	2801	1691	458	979	1244	2195
2011-12	2830	1755	435	937	1306	2319

Table 3

Year	Rates per 100,000 patients					
	New episodes of case finding		New depression related diagnoses		New prescriptions for antidepressants	
	Targeted	Non-targeted	Targeted	Non-targeted	Targeted	Non-targeted
2001-02	0.0010	0.0058	0.0061	0.0138	0.1050	0.0662
2002-03	0.0038	0.0072	0.0279	0.0286	0.1118	0.0794
2003-04	0.0039	0.0088	0.0366	0.0441	0.1257	0.1057
2004-05	0.0032	0.0103	0.0557	0.0710	0.1565	0.1354
2005-06	0.0210	0.0121	0.0648	0.0664	0.1524	0.1314
2006-07	3.3199	0.1450	0.1946	0.0907	0.2296	0.1359
2007-08	1.0276	0.0989	0.1127	0.1077	0.2185	0.1564
2008-09	0.7139	0.0732	0.1125	0.0918	0.2414	0.1674
2009-10	0.7244	0.0850	0.1212	0.0952	0.2543	0.1774
2010-11	0.6708	0.1293	0.1258	0.0905	0.2783	0.1843
2011-12	0.6849	0.1254	0.1093	0.0805	0.2954	0.1973

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Electronic Web Appendix; clinical codes for each outcome measure

Table 1

Clinical codes for the diagnosis of depression recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
[X] Depression recurrent: [unspecified] or [monopolar NOS]	Eu33z
[X](Depressn: [episode unsp][NOS (& react)][depress dis NOS]	Eu32z
[X]Depress with psych sympt: [recurr: (named vars)][endogen]	Eu333
[X]Depression: [oth episode][atypic][single epis masked NOS]	Eu32y
[X]Depressive episode, unspecified	XE1Zb
[X]Depressn, no psych symp: [recurr: (named var)]/[endogen]	Eu332
[X]Mild depressive episode	Eu320
[X]Moderate depressive episode	Eu321
[X]Other depressive episodes	XE1Za
[X]Recurr depress disorder cur epi severe without psyc sympt	XE1Zd
[X]Recurrent depress disorder cur epi severe with psyc symp	XE1Ze
[X]Recurrent depressive disorder, current episode moderate	Eu331
[X]Recurrent depressive disorder, unspecified	XE1Zf
[X]Sev depress epis + psych symp:(& singl epis [named vars])	Eu323
[X]Sev depress epis, no psych: (& single [agit][maj][vital])	Eu322
[X]Severe depressive episode with psychotic symptoms	XE1ZZ
[X]Severe depressive episode without psychotic symptoms	XE1ZY
[X]Single episode agitated depressn w'out psychotic symptoms	XaCHr
[X]Single episode major depression w'out psychotic symptoms	XaCHs
Agitated depression	X00SQ
Atypical depressive disorder	E11y2
Chronic depression	E2B1.
Cotard syndrome	XSKr7
Depression NOS	XaB9J
Depression: [reactive (neurotic)] or [postnatal]	XE1aY
Depression: [single maj episode][agit][endogen (& 1st epis)]	E112.
Depressive disorder	X00SO
Depressive disorder NEC	E2B..

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Endogenous depression	X00SR
Endogenous depression - recurrent	XM1GC
Endogenous depression first episode	X00SS
Major depressive disorder	XSEGJ
Masked depression	X00SU
Mild depression	XaCIs
Mild major depression	XSGok
Mixed anxiety and depressive disorder	X00Sb
Moderate depression	XaCIt
Moderate major depression	XSGol
Post-schizophrenic depression	X00S8
Reactive depression	XE1YC
Reactive depressive psychosis	E130.
Recurrent brief depressive disorder	Xa0wV
Recurrent depression	E1137
Recurrent depression: [major episode] or [endogenous]	E113.
Recurrent major depressive episode NOS	E113z
Recurrent major depressive episodes	XE1Y1
Recurrent major depressive episodes, in full remission	E1136
Recurrent major depressive episodes, mild	E1131
Recurrent major depressive episodes, moderate	E1132
Recurrent major depressive episodes, severe, no psychosis	E1133
Recurrent major depressive episodes, severe, with psychosis	E1134
Recurrent major depressive episodes, unspecified	E1130
Recurrent major depressive episodes,partial/unspec remission	E1135
Seasonal affective disorder	X761L
Severe depression	XaCIu
Severe major depression with psychotic features	XSGon
Severe major depression without psychotic features	XSGom
Single major depressive episode	XE1Y0
Single major depressive episode NOS	E112z
Single major depressive episode, in full remission	E1126
Single major depressive episode, mild	E1121
Single major depressive episode, moderate	E1122
Single major depressive episode, partial or unspec remission	E1125
Single major depressive episode, severe, with psychosis	E1124

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Single major depressive episode, severe, without psychosis	E1123
Single major depressive episode, unspecified	E1120

Table 2

Clinical codes for the diagnosis of depression not recognised by the UK Quality and Outcomes Framework

Descriptor	Clinical code
Anxiety with depression	Y5448
Depressed mood	XE0re
Symptoms of depression	XaLmU
C/O - feeling depressed	XM0CR
O/E - depressed	2257
[X]Recurrent depressive disorder	XE1Zc
Depression medication review	XaK6e
Depression annual review	XaK6d
Depression interim review	XaK6f
On depression register	XaJWh
Depression monitoring administration	XaMGL
Depression monitoring first letter	XaMGN
Depression monitoring second letter	XaMGO
Depression monitoring third letter	XaMGP
Patient given advice about management of depression	XaKEz
Depression worse in morning	761J
Depression management programme	Xaltx
Depression screen	Y6303
Depression screening	6891.
[X]Other mood affective disorders	Eu3y.
[X]Other persistent mood affective disorders	Eu34y
[X]Other recurrent mood affective disorders	XE1Zh
[X]Other single mood affective disorders	XE1Zg
[X]Other specified mood affective disorders	Eu3yy
[X]Persistent mood affective disorder, unspecified	Eu34z
[X]Persistent mood affective disorders	Eu34.
[X]Unspecified mood affective disorder	XE1Zi

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Adjustment reaction with anxious mood	E2924
Crying associated with mood	XM0Ar
Cyclic mood swings	XaAyL
Blunting of mood	Xa00z
Diurnal variation of mood	X761I
Dysphoric mood	XaKUk
Mood disorder	XE1Xy
Moody	Xa3Xf
Moody after illness	Y4284
Moody before illness	Y4236

Table 3

Antidepressant drugs

Drug Class	**Drugs included in search**	**Drugs excluded from search (and rationale)**
Selective serotonin reuptake inhibitors (SSRIs)	Citalopram Escitalopram Fluoxetine Fluvoxamine Paroxetine Sertraline	
Tricyclic and related antidepressants	Clomipramine Dosulepin Doxepin Lofepramine Trimipramine	Amitriptyline (neuropathic pain) Nortriptyline (neuropathic pain) Imipramine (nocturnal eneuresis)
Monoamine oxidase inhibitors (MAOIs)	Phenelzine Isocarboxazid Tranylcypromine Moclobemide	
Other antidepressant	Mirtazipine	Duloxetine (Stress incontinence or

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drugs	Venlafaxine Agomelatine Tryptophan Reboxetine	diabetic neuropathy) Flupentixol (psychoses)

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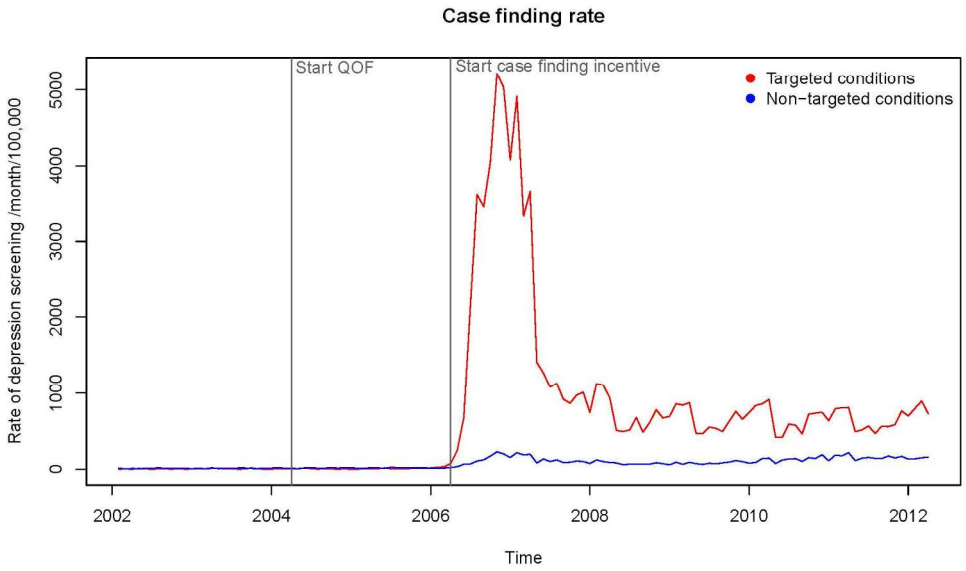

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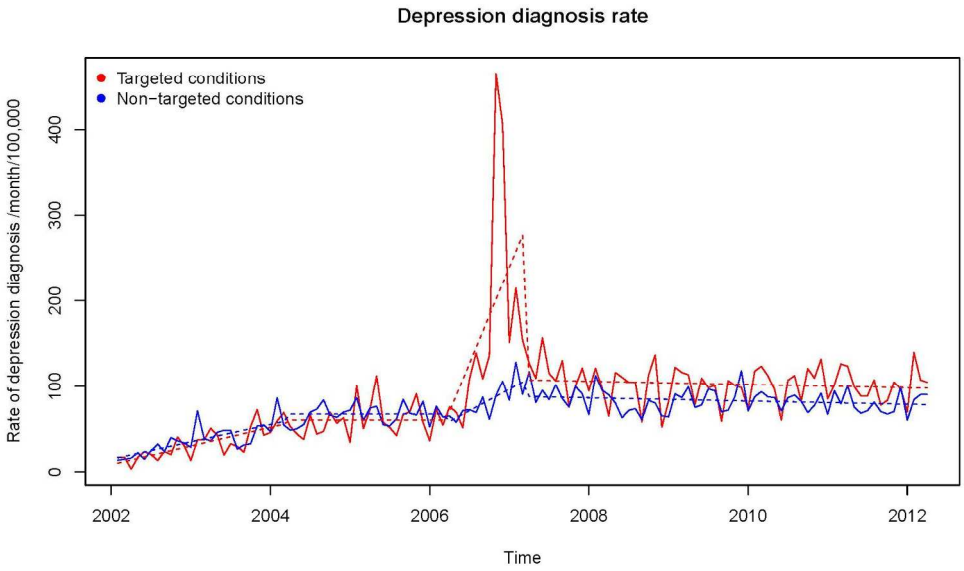

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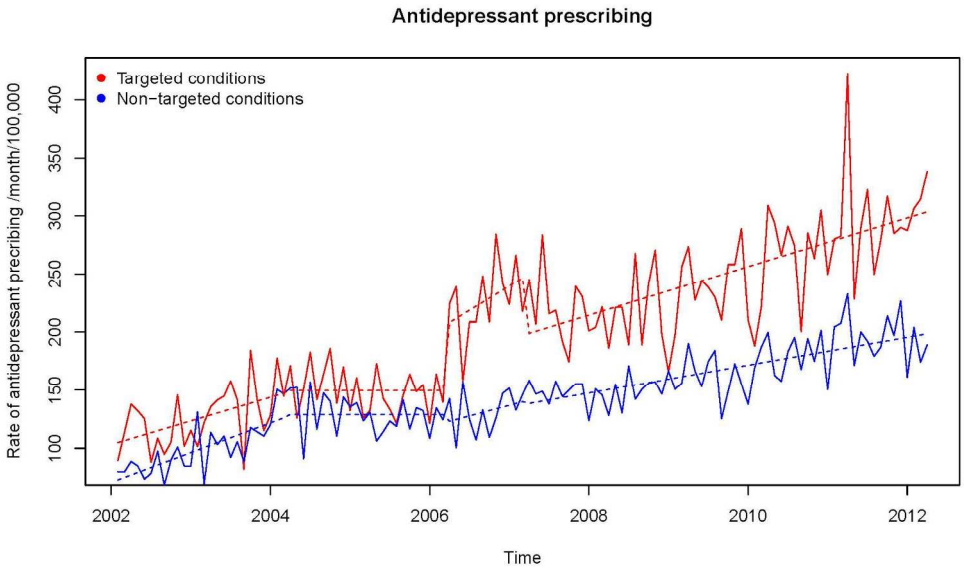

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