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Online Supplementary Material

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Supplemental Table 1. Impact of Quality and Outcomes Framework (QOF) on Effective Care: Description of Studies Reviewed

Study	Condition	Study Period, Design	Data Source	Sample Size, Setting	Results
Ashworth (2006)[1]	Deprivation	2004-2005 Cross-sectional study	QOF data for each practice in England and linked these with census-derived data	General practices England	Three characteristics were independently associated with higher QOF scores: training practices, group practices, and practices in less socially deprived areas. In a regression model, these 3 factors explained 14.6% of the variation in QOF score. Higher list sizes per GP, turnover of registered patients, chronic disease prevalence, proportions of elderly patients or patients born in a developing country did not contribute to lower QOF scores in the final model
Ashworth (2008)[2]	Blood pressure	2005-2007 Retrospective longitudinal survey	QOF data	8,515 General practices England	In 2005, 82.3% of adults (n = 52.8m) had an up-to-date blood pressure recording; by 2007, this proportion had risen to 88.3% (n = 53.2m).
Ashworth (2011)[3]	Multiple: all QOF conditions	2005-2008 Observational cohort	QOF data, social deprivation (IMD 2007), ethnicity (2001 census), general practice characteristics	8,515 Practices England	Practices with low QOF scores were more likely to be singlehanded (odds ratio [OR], 13.8), nontraining practices (OR, 3.9) and located in deprived areas (OR, 2.6; most vs least deprived quintiles). GPs in these practices were more often aged ≥65 years (OR, 7.3; mean GP age ≥65 years vs < 45 years), male (OR = 2.0), UK qualified (OR = 2.0) with small list sizes (OR = 3.2; list size < 1,000 vs 1,500-2,000 patients)
Bottle (2008)[4]	Diabetes	2004-2005 Ecological cross-section	QOF, HES, IMD 2004	1,760,898 Persons with diabetes registered with 8,441 family practices England	10-Fold variation in admissions for diabetes. In patients aged ≥60 years: significant but weak inverse associations between glycemic control and admissions (correlation coefficient –0.21 ($P < .001$), and neighborhood socioeconomic status was correlated with admissions ($r = 0.45$; $P < .001$)
Bottle (2008)[5]	CHD	2003, 2004, 2005 Ecological cross-sectional study	QOF, hospital admissions, and census data	All 303 PCTs England	No significant association between the quality of CHD care, as measured by the QOF, and rates of elective or unplanned hospital admission for CHD by PCT in England

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Calvert (2009)[6]	Diabetes	2002-2007 Retrospective cohort study	Doctors' independent network (DIN)-LINK (from iSOFT (previously TOREX). Age-sex similar to UK but practices in south of England and higher socioeconomic groups are over-represented	147 General practices UK	Significant improvements in process and intermediate outcome measures were observed during the 6-year period, with consecutive annual improvements observed before the introduction of incentives. After the introduction of the quality and outcomes framework, existing trends of improvement in glycemic control, cholesterol levels, and blood pressure were attenuated
Campbell (2007 and 2009)[7,8]	Multiple: 3 conditions	1998-2007 Longitudinal cohort study	Primary data collection	42 General practices England	Difference between 2005 observed score and mean predicted score for 2005 on basis of 1998-2003 trend: CHD 4.3% Diabetes 8.2% Asthma 12% Mean difference between transformed observed score and predicted score for 2005: CHD 0.22% (95% CI, –0.02 to 0.45) Diabetes 0.68 (0.27 to 1.1) Asthma 0.44 (0.27 to 0.62) (CHD, asthma, diabetes)
Carey (2009)[9]	Ischaemic heart disease, stroke, hypertension	2000-2005 Interrupted time series	DIN-LINK GP database. Read codes indicating prescriptions for antihypertensive drugs	236,467 Patients UK	Systolic blood pressure fell: 36% had a systolic blood pressure of >150 mm Hg in 2000-2001, and only 19% in 2004-2005
Coleman (2007)[10]	Smoking	1990-2005 Retrospective longitudinal survey	THIN	10.8 Million patients in general practices in 1990 rising to 1.6m in 2004 UK	Compared with the first quarter of 2003, recording of smoking status increased up to the first quarter of 2004 in (rate ratio = 1.88; 95% CI, 1.87–1.89) and in brief advice to smokers (RR = 3.03; 95% CI, 2.98–3.09), which was sustained until the first quarter of 2005
Cupples (2008)[11]	CHD	2004-2006 Cross-sectional study	Blood pressure, cholesterol, medications; validated questionnaires for diet (DINE), exercise (Godin Leisure-Time Exercise Questionnaire), and quality of life (SF-12); health care usage	16 Randomly selected general practices in Northern Ireland (NI); 32 randomly selected general practices in Republic of Ireland (RoI) 903 patients (mean age 67.5 years;	More RoI than NI participants had systolic blood pressure >140 mm Hg (37% vs 28%, P = 0.01) and cholesterol >5 mmol/L (24% vs 17%, P = 0.02). RoI mean systolic blood pressure was higher (139 vs 132 mm Hg). More RoI participants reported a high-fiber intake (35% vs 23%), higher levels of physical activity (62% vs 44%), and better physical and mental health (SF-12); they also had more GP (5.6 vs 4.4) and fewer nurse visits (1.6 vs 2.1) in the previous year. Fewer participants in the RoI (55% vs 70%) were prescribed β-blockers. ACE inhibitor prescribing was similar for both groups (41%; 48%); high proportions were prescribed statins (84%; 85%) and aspirin

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				69.9% male)	(83%; 77%)
Doran (2006)[12]	Multiple: 10 conditions	2004-2005 Cross-sectional survey	NHS QMAS	8,105 General practices England	Median of 96.7% of the available points for clinical indicators (Asthma, cancer, CHD, COPD, diabetes mellitus, epilepsy, hypertension, hypothyroidism, severe mental health, stroke)
Doran (2008)[13]	Multiple: 10 conditions	2005-2006 Cross-sectional survey	NHS QMAS	8,105 General practices England	Median 5.3% of patients excluded (IQR = 4.0-6.9. (Asthma, cancer, CHD, COPD, diabetes mellitus, epilepsy, hypertension, hypothyroidism, severe mental health, and stroke).
Doran (2008)[14]	Multiple: 11 conditions	2004-2007 Retrospective longitudinal survey	NHS QMAS	7,637 General practices England	Median overall reported achievement was 85.1% (IQR = 79.0%-89.1%) in year 1, 89.3% (86.0%-91.5%) in year 2, and 90.8% (88.5%-92.6%) in year 3 (Asthma, cancer, CHD, heart failure, COPD, diabetes mellitus, epilepsy, hypertension, hypothyroidism, severe mental health, and stroke)
Doran (2011)[15]	Multiple conditions: 42 activities (23 included in incentive scheme, 19 not included) selected from 428 quality indicators	2000-2007 Longitudinal analysis	QOF data	148 General practices (653,500 patients) England	Achievement rates improved for most indicators in the preincentive period. Increases in rate of improvement in the first year of the incentive scheme (2004-2005) were significant for 22 of the 23 incentivized indicators. Achievement for these indicators reached a plateau after 2004-2005, but quality of care in 2006-2007 remained higher than that predicted by preincentive trends for 14 incentivized indicators. No overall effect on rate of improvement for nonincentivized indicators in first year of the scheme, but by 2006-2007 achievement rates were significantly lower than those predicted by preincentive trends
Downing (2007)[16]	Multiple: 6 conditions	2004-2005 Ecological cross-sectional study	QOF data, emergency hospital admissions, and all-cause mortality	All general practices in 2 PCTs England	The associations between QOF scores and emergency admissions and mortality were small and inconsistent (asthma, cancer, COPD, CHD, diabetes, stroke, and "all other conditions")
Fleetcroft (2008)[17]	Multiple: all QOF conditions	2005-2006 Cross-sectional study	QOF data	8,407 Practices England	The mean pay-performance gap for the 65 clinical indicators was 13.3% (range = 2.9%-48%); 52% of this gap (6.9% of eligible patients) was attributable to thresholds being set at < 100%, and 48% to patients being exception reported
Fleetcroft (2010)[18]	Multiple	2004-2006 Retrospective longitudinal	Multiple, including QRESEARCH database	General practices England	The 2004 contract potentially reduced mortality by 11 lives per 100,000 people (lower-upper estimates 7-6) over 1 year, as performance improved from baseline to the target for full incentive payment. If all eligible patients were treated above the target, 56 (29-81) lives per 100,000 might have been saved. For the 2006 contract, mortality reduction was effectively zero, because new baseline performance for a typical practice had already

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					exceeded the target performance for full payment.
Gemmell (2009)[19]	Workload	2003-2005 Interrupted time series	Practice profile questionnaires and staff workload diaries	42 Practices England	The number of practice staff increased with greater increases observed for nursing staff than doctors. No change in the average number of hours worked per week by nursing staff or doctors, but nurse visit rates increased while doctors' rates decreased. The proportion of presenting problems described as chronic or preventative increased for doctors ($\chi^2 = 8.54$, $df = 1$, $P < .004$) but was unchanged for nursing staff. Nursing staff dealt with more complex visits in 2005 compared with 2003 ($\chi^2 = 30.70$, $df = 3$, $P < .001$) but there was no change for doctors
Gulliford (2007)[20]	Diabetes	2000-2005 Retrospective cohort study	Primary data collection	26 Practices South London, England	Proportion of patients achieving HbA_{1c} ≤7.4% each year increased: 2000,22%; 2001, 32%; 2002, 37%; 2003, 38% and in 2005 from QOF, 57%
Hippisley-Cox (2007)[21]	Multiple: 6 conditions	2001-2006 Interrupted time series	QRESEARCH database	498 General practices England	There was an increase in percentage achievement of all the quality indicators. Range of absolute increase in achievement of quality indicators in each condition: CHD: 28.3%-42.1% Stroke: 33.8%-47.9% Diabetes mellitus: 4.1%-42.0% Epilepsy: 68.8% (only 1 quality indicator) Hypertension: 15.7-28.5% Chronic kidney disease: 16.1%-38.4% (CHD, stroke, diabetes mellitus, epilepsy, hypertension, chronic kidney disease)
Khunti (2007)[22]	Diabetes	1999-2006 Systematic review	Published observational studies of quality of diabetes care in primary care in the UK	6 Studies UK	Improvement in both process and outcome of care. The quality of care reported in QOF was greater than that found in other published studies
MacBride-Stewart (2008)[23]	Multiple, 8 conditions	2002-2006 Retrospective observational study	Prescribing Information System for Scotland	92 Practices Lothian, Scotland	The prescribing of QOF drugs increased significantly faster than the non-QOF drugs both before and after the introduction of the latest GMS contract, but the rate of increase for the QOF drugs slowed significantly after April 2005, unlike prescribing of non-QOF drugs. Increases in prescribing per month for QOF and non-QOF drugs during the 2-year periods before and after April 2005: QOF 1.32 before, 1.01 after, $P < .001$; non-QOF 0.23 before, 0.32 after, $P = .09$ (CHD, heart failure, stroke, hypertension, diabetes mellitus, chronic obstructive airways disease, epilepsy, and asthma)
Magee (2010)[24]	Diabetes	2004-2008 Interrupted	QOF data	364 Practices North Ireland	The adult diabetes prevalence was 4.1% in 2007 compared with 3.8% in 2004, while diabetic nephropathy prevalence was 15.1% and

Study	Condition	Study Period, Design	Data Source	Sample Size, Setting	Results
		time series			11.5%, respectively. The median ACR testing rate was 82% compared with a historic figure of 41% in 2001/2002. Since the introduction of the QOF in 2004, there has been a dramatic rise in testing for diabetic nephropathy
McElduff (2004)[25]	Cardiovascular disease	2003 Modeling study	Literature review	Modeling study England and Wales	The greatest health gain in those aged 45 to 84 years would come from reaching cholesterol reduction targets, which could prevent 15 events per 10,000 per 5 years in people with CHD, 7 events in those with a history of stroke, and 7 events in those with diabetes. Achieving blood pressure control targets in hypertensive patients without the above conditions could prevent 15 cardiovascular events. Achieving other targets would have smaller impacts because high levels of care are already being achieved or because of the low prevalence of conditions or associated event risk
McGovern (2008)[26]	CHD	2004-2005 Serial cross-sectional study	SPICE	310 General practices Scotland	Recording and prescribing increased by mean 17.1% after the introduction of the GMS contract
McLean (2007)[27]	CHD, stroke, hypertension, and diabetes	2004-2005 Cross-sectional analysis	QOF data	10,064 General practices England, Scotland, Wales, and North Ireland	Prevalence varies by up to 28% between the 4 UK countries, which is not reflected in resource distribution between countries, and penalizes practices in the high prevalence countries (Wales and Scotland). Wales has consistently lower quality of care. Scotland has generally higher quality than England and Northern Ireland is most consistently the highest quality
Millett (2007)[28]	Diabetes	2003-2005 Longitudinal cross-sectional survey	Wandsworth Prospective Diabetes Study	32 General practices Wandsworth, England	Significantly more patients with diabetes had their smoking status ever recorded in 2005 than in 2003 (98.8% vs 90.0%, $P < .001$). The proportion of patients with documented smoking cessation advice also increased significantly over this period, from 48.0% to 83.5% ($P < .001$). The prevalence of smoking decreased significantly from 20.0% to 16.2% ($P < .001$)
Jaiveer (2006)[29]	Diabetes	2004-2005 Longitudinal cross-sectional survey	Primary data collection	13 Practices North Warwickshire, England	Diabetes indicator performance improved range from 6.6%-42.8% with time
McGovern (2008)[30]	Diabetes	2004-2005 Serial cross-sectional study	SPICE	310 General practices Scotland	54.2% relative increase in the number of patients recorded as having diabetes. Measurement of HbA_{1c}, blood pressure, serum creatinine, and cholesterol significantly increased ($P < .05$)
Millett (2009)[31]	Diabetes	1997-2005 Cohort study	General Practice Research Database (GPRD)	422 General practices UK	The percentage of diabetes patients with comorbidity reaching blood pressure and cholesterol targets exceeded that predicted by the underlying trend during the first 2 years of pay for performance (by 3.1% [95% CI, 1.1-

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					5.1] for blood pressure and by 4.1% [95% CI 2.2-6.0] for cholesterol among patients with ≥5 comorbidities in 2005). The percentage of patients meeting the HbA_{1c} target in the first 2 years of this program was significantly lower than predicted by the underlying trend in all patients, with the greatest shortfall in patients without comorbidity (3.8% [95% CI 2.6-5.0] lower in 2005)
Murray (2010)[32]	CHD	1998-2007 Longitudinal study	General practice data extracted from electronic patient records	3,200 Patients in 29 general practices Wandsworth, South-West London	From 1998 to 2007, the proportion of patients with CHD who had their blood pressure recorded rose from 33.2% to 93.9% and cholesterol from 21.7% to 83.5%. Over this period, mean blood pressure decreased from 140/80 to 133/74 mm Hg ($P < .001$). There was a reduction in mean cholesterol from 5.2 to 4.3 mmol/L ($P < .001$). Reductions in mean blood pressure and cholesterol occurred across all ethnic groups
Oluwatowoju (2010)[33]	Diabetes	2006-2008 Retrospective retrieval of computer-held biochemical measurements	Data on age, sex, HbA_{1c} and plasma lipids	8,997 Adults Hampshire, UK	In 2006, 39.7% of adults had glycemic control within the QOF threshold ($HbA_{1c} < 7.5\%$); by 2008, this proportion had risen to 52.1% ($P < .001$). In 2006, 11.8% of subjects had poor glycemic control ($HbA_{1c} > 10.0\%$); by 2008, this proportion had decreased to 10.1% ($P < .001$). The proportion of subjects achieving HbA_{1c} and cholesterol targets (both $HbA_{1c} < 7.5\%$ and total cholesterol ≤5.0 mmol/L) was 30.2% in 2006; in 2008 this proportion had increased to 43.7% ($P < .001$)
Purdy (2011)[34]	CHD	2005-2006 Cross-sectional study	QOF data, hospital episode statistics	All General practices, adjusted for age and sex England	There were 80,377 admissions for angina and 62,373 admissions for MI for individuals aged ≥45 years. Characteristics positively associated with admission were deprivation (angina IRR = 1.084 [95% CI, 1.052-1.117] per quartile increase, MI IRR = 1.018 [95% CI, 1.009-1.028]), practice prevalence of CHD, and smoking. Higher overall clinical QOF score was negatively associated with the risk of admission for angina. Practice size and condition-specific quality markers for CHD were not associated with the risk of admission
Serumaga (2011)[35]	Hypertension	2000-2007 Interrupted time series	THIN database	470,725 Patients UK	After accounting for secular trends, no changes in blood pressure monitoring (level change 0.85, 95% CI, −3.04 to 4.74; $P = .669$; and trend change −0.01, −0.24 to 0.21; $P = .615$), control (−1.19, −2.06 to 1.09; $P = .109$; and −.01, −0.06 to 0.03; $P = .569$), or treatment intensity (0.67, −1.27 to 2.81; $P = .412$; and 0.02, −0.23 to 0.19; $P = .706$) were attributable to pay for performance. Pay for performance had no effect on the cumulative incidence of stroke, myocardial infarction, renal failure, heart failure, or all-cause mortality in both treatment experienced

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					and newly treated subgroups
Simpson (2006)[36]	Stroke or transient ischemic attack	2004-2005 Serial cross-sectional study	SPICE	310 General practices Scotland	Documentation of quality indicators increased over time, with absolute increases for individual indicators ranging from 1.3%-52.1%
Smith (2008)[37]	COPD	2003-2005 Interrupted time series	THIN database	279 General practices UK	Prevalence of COPD was 1.27% in 2003 and 1.45% in 2005. Recorded spirometry increased from 18% in 2003 to 62% in 2005. The use of combination inhalers in people with moderate to severe COPD also increased markedly during the study
Srirangalingam (2006)[38]	Diabetes	2003-2004 Serial cross-sectional study (before, after)	Primary data collection	Referrals to Barts and The London NHS Trust England	Increase in referrals for poor glycemic control, and the glycemic threshold for referral with poor glycemic control has reduced (9.7% vs 10.6%, $P = .006$, mean difference = 0.9%, 95% CI, 0.4-1.3%).
Steel (2007)[39]	Multiple: 4 conditions (2 in QOF, 2 not in QOF)	2003-2005 Retrospective observational cross-sectional study	Primary data collection	18 General practices England	A significant increase occurred for the 6 indicators linked to incentive payments: from 75% achieved in 2003 to 91% in 2005 (change = 16%, 95% CI, 10%-22%, $P < .01$). A significant increase also occurred for 15 other indicators linked to incentivized conditions: 53%-64% (change = 11%, 95% CI, 6%-15%; $P < .01$) The nonincentivized conditions started at a lower achievement level, and did not increase significantly: 35%-36% (change = 2%, 95% CI, −1% to 4%; $P = .19$) (asthma, hypertension, depression, and osteoarthritis)
Strong (2009)[40]	COPD	2004-2005 Cross-sectional	Practice data	38 General practices Rotherham, England	Spirometry as assessed by clinical records was to BTS standards in 31% of cases (range at practice level = 0%-74%). The categorization of airflow obstruction according to the most recent spirometry results did not agree well with the clinical categorization of COPD recorded in the notes (Cohen's $\kappa = 0.34$, 0.30-0.38). 12% of patients on COPD registers had FEV_1 (% predicted) results recorded that did not support the diagnosis of COPD. There was no association between quality, as measured by adherence to BTS spirometry standards, and achievement of QOF COPD quality indicators
Sutton (2009)[41]	Risk factors	2000-2001 to 2005-2006 Interrupted time series	Individual patient records	315 General practices UK	The effect on incentivized factors was substantially larger on the targeted patient groups (+19.9%) than on the untargeted groups (+5.3%). There was no obvious evidence of effort diversion, but there was evidence of substantial positive spillovers (+0.9%) onto incentivized factors for the targeted groups
Tahrani (2007)[42]	Diabetes	2004-2006 Observational	National Diabetes Audit and QOF data	66 Practices Shropshire,	Significant improvements in the percentage of patients achieving targets for all quality indicators ($P < .001$); range = 9.2%-40.9%

Study	Condition	Study Period, Design	Data Source	Sample Size, Setting	Results
		retrospective cross-sectional study	from Shropshire PCTs	England	(lower and upper CI for different indicators)
Tahrani (2008)[43]	Diabetes	2004-2006 Observational retrospective cross-sectional study	National Diabetes Audit and QOF data from Shropshire PCTs	66 Practices Shropshire, England	All quality indicators showed significant improvement following the QOF. Significant improvement in achieving glycemic control targets after implementation in both large and small practices ($P < .001$ for $HbA_{1c} \leq 7.4\%$ and 10%)
Tsimtsiou (2009)[44]	Anxiolytic and hypnotic prescription	2004-2005 Cross-sectional study	Prescribing volume data, QOF data, practice descriptors, Index of Multiple Deprivation 2004, ethnicity data (2001 UK Census)	All general practices England	Higher prescribing practices were located in more deprived areas (standardized $\beta = 0.31$), but also in areas with a lower proportion of ethnic minorities (black or black British, $\beta = -0.22$; Asian or Asian British, $\beta = -0.12$). Higher volumes were also prescribed by practices with lower QOF scores ("Clinical Care" domain $\beta = -0.12$; "Organisational" domain $\beta = -0.08$)
Vaghela (2009)[45]	Diabetes	2004-2008 Longitudinal cross-sectional survey	QOF data from Information Centre for Health and Social Care	8,192-8,423 General practices England	HbA_{1C} target at the median practice increased from 59.1% (IQR = 51.7%–65.9%) in 2004–2005 to 66.7% (IQR = 60.6%–72.7%) in 2007–2008, blood pressure from 70.9% in 2004–2005 to 80.2% in 2007–2008, and cholesterol from 72.6% in 2004–2005 to 83.6% in 2007–2008. In 2004–2005, 57% of practices were low performing (range by region = 42.4%–69.9%). In 2007–2008, 26% of practices were low performing (range 11.6%–37.5%)
Whalley (2008)[46]	Working lives	2004-2005 Longitudinal questionnaire survey	Questionnaire	2,105 GPs in 2004 and 1,349 in 2005 England	Mean overall job satisfaction increased from 4.58 of 7 in 2004 to 5.17 in 2005. Mean reported hours worked fell from 44.5 to 40.8. Mean income increased from an estimated £73,400 in 2004 to £92,600 in 2005. Most GPs reported that the new contract had increased their income (88%) but decreased their professional autonomy (71%), and increased their administrative (94%) and clinical (86%) workloads. After the introduction of the contract, doctors were more positive than they had anticipated about its impact on quality of care
Wilkinson (2010)[47]	Diabetes	2004 and 2007 Retrospective audits of primary care records	QOF data	707 Patients across 18 general practices Luton, Leicester, and West London, England	Indo-Asian patients were 9 to 10 years younger and had lower systolic blood pressure than white Europeans at diagnosis in both years (136.1 vs 141.4 mm Hg, $P = .000$) in 2004 and 134 vs 142.3 mm Hg, $P = .000$) in 2007. Monitoring of most variables associated with diabetes and related complications increased across both patient groups between 2004 and 2007
Williams (2006)[48]	Stroke	Nov 2004 Cross-sectional	Primary data collection from practice records	2 General practices, 1 in each location	Higher QOF quality points did not reflect better adherence to RCP guidance. There remains considerable scope for improvement in

Study	Condition	Study Period, Design	Data Source	Sample Size, Setting	Results
		survey		Southwest London and Surrey, England	computer data quality before they can be used to measure adherence to best practice

ACE = angiotensin-converting enzyme ACR = albumin creatinine ratio; BTS = British Thoracic Society; CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease; DINE = Dietary Instrument For Nutrition Education; DIN-LINK = doctors' independent primary care network database in the UK; FEV_1 = forced expiratory volume; GMS = General Medical Services; GP = general practitioner; HbA_{1c} = glycated hemoglobin; HES = hospital episode statistics; IMD = index of multiple deprivation; IQR = interquartile range; IRR = incidence rate ratio; MI = myocardial infarction; NHS = National Health Service; PCT = Primary Care Trust; QMAS = Quality Management and Analysis System; QOF = Quality and Outcomes Framework; QRESEARCH = a UK general practice database; RCP = Royal College of Physicians; SF-12 = 12-item Short-Form Health Survey; SPICE = Scottish Programme for Improving Clinical Effectiveness; THIN = The Health Improvement Network; UK = United Kingdom.

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