**Supplementary files**

**Supplementary File S1 Search strategy output for CRD database**

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| --- | --- |
| **Database**  | Centre for Reviews and Dissemination (CRD)  |
| **Host**  | http://www.york.ac.uk/inst/crd/  |
| **Date of search**  | January 2012-June 2014 last search date: 26/6/14  |
| **Years covered**  | 1990-June 2014 (no date restrictions)  |
| **Search Strategy**  | Key word search: Financial incentives, Pay for performance, Performance based financing (Pay for performance) OR (financial incentives) OR (performance based financing) IN DARE, NHSEED, HTA  |
| **Language restrictions**  | None  |
| **Number of citations**  | 70  |
| **Number of relevant reviews**  | 8: Huang et al., 2013, Reda et al., 2012, Chaix-couturier et al., 2012, Hamilton et al., 2013, Witter et al., 2012, Scott et al., 2011, Petersen et al., 2006, Houle et al., 2012   |

**Supplementary File S2 Search strategy output for Cochrane database**

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| **Database** | **Cochrane**  |
| **Host** | http://onlinelibrary.wiley.com/cochranelibrary/ |
| **Date of search** | January 2012-June 2014 last date searched: 26/6/14 |
| **Years covered** | 1990-2014 no date restrictions |
| **Search Strategy** | Key word search: Financial incentives, Pay for performance, Performance based financingThere are 20 results from 8524 records for your search on 'financial incentive or pay for performance or performance based financing in Title, Abstract, Keywords in Cochrane Reviews'There are 12 results from 30299 records for your search on 'financial incentive or pay for performance or performance based financing in Title, Abstract, Keywords in Other Reviews'There are 3 results from 16096 records for your search on 'financial incentive or pay for performance or performance based financing in Title, Abstract, Keywords in Economic Evaluations' |
| **Language restrictions** | None  |
| **Number of citations** | 35 |
| **Relevant reviews**  | 8: Huang et al., 2013, Gillam et al., 2012, Reda et al., 2012, Chaix-couturier et al., 2012, Hamilton et al., 2013, Witter et al 2012, Scott et al 2011, Petersen et al 2006, |

**Supplementary File S3 Search output for the updating the review by Van Herck et al. (2010)**

|  |  |
| --- | --- |
| Database | **Medline** |
| Host | <http://www.ncbi.nlm.nih.gov/sites/entrez> (Pubmed) |
| Date of search | 25/04/2016 |
| Years covered | 01/07/2009 to 25/04/2016 |
| Search Strategy | ("Salaries and Fringe Benefits"[Majr] OR "Reimbursement, Incentive"[Majr] OR "Fees and Charges"[Majr] OR p4q OR p4p OR pay\* OR incentive\* OR bonus\*) AND ("Treatment Outcome"[Majr] OR "Medical Errors"[Majr] OR "Quality Control"[Majr] OR "Cost-Benefit Analysis"[Majr] OR "Safety"[Majr] OR "Health Services Accessibility"[Majr] OR quality OR outcome\* OR performance OR error\* OR safety\* OR access\* OR equity OR effectiveness) AND ("Hospitals"[Majr] OR "Physicians"[Majr] OR hospital\* OR physician\* OR practitioner\*) AND (hasabstract[text] AND ("2009/07/01"[EDat]:"2014/07/28"[EDat]) AND (Humans[Mesh]) AND (Clinical Trial[ptyp] OR Randomised Controlled Trial[ptyp] OR Case Reports[ptyp] OR Clinical Trial, Phase I[ptyp] OR Clinical Trial, Phase II[ptyp] OR Clinical Trial, Phase III[ptyp] OR Clinical Trial, Phase IV[ptyp] OR Comparative Study[ptyp] OR Controlled Clinical Trial[ptyp] OR Evaluation Studies[ptyp] OR Technical Report[ptyp] OR Validation Studies[ptyp])) |
| Language restrictions | None |
| Number of citations | 1437 |

**Supplementary File S4 Search strategy output for PubMed database**

|  |  |
| --- | --- |
| **Database** | **Medline** |
| **Host** | <http://www.ncbi.nlm.nih.gov/sites/entrez> (Pubmed) |
| **Date of search** | January 2012-April 2016 last date searched: 25/04/16 |
| **Years covered** | 1990-June 2014 (no date restrictions) |
| **Search Strategy** | 1. Search **(((((((financial incentive\*) OR performance based financing) OR pay for performance) OR paying for performance) OR incentive\*) AND Review[ptyp] AND Humans[Mesh] AND English[lang])) AND health**
 |
| **Language restrictions** | None  |
| **Number of citations** | 1453 |
| **Relevant reviews**  | 12: Van Herck P et al 2010, de Bruin SR, et al 2011, Witter et al 2012, Scott et al 2011, Petersen et al 2006, Eijkenaar 2012, Christianson et al 2008, Reda et al., 2012, Hamilton et al., 2013, Houle et al., 2012, Gillam et al., 2012, Andrew D Oxman and Atle Fretheim, 2009 |

**Supplementary File S5 Summary of identified reviews**

| **Reviews**  | **Objectives**  | **Search strategy and studies included** | **Quality of included studies and evaluation design**  | **Results and limitations**  | **Grade of evidence (Amstar score)**  |
| --- | --- | --- | --- | --- | --- |
| Oxman and Fretheim, 2009 | The authors undertook a critical appraisal of selected evaluations of incentive (PBF) schemes in the health sector in low and middle-income countries (LMIC) | Key informants were interviewed to identify literature relevant to the use of PBF in the health sector in LMIC, key examples, evaluations, and other key informants. 13 studies were identified but only 4 met their inclusion criteria (which was not explicitly stated in the paper) and were included in the review: two single country cases and two multi-country studies | Quality of studies included in this review was not assessed. | The authors found very limited evidence of PBF having a positive impact and it was impossible to disentangle the effects of financial incentives as one element of PBF.They concluded that when PBF schemes are used, they should be designed carefully, including the level at which they are targeted, the choice of targets and indicators, the type, and magnitude of incentives.In addition, PBF schemes should be monitored for possible unintended effects and evaluated using rigorous study designs | **4/11** |
| Canavan et al., 2008 | The authors explored incentive based approaches adopted in developing countries over the past decade | Search strategy was not described.5 programs from 5 countries (Democratic Republic of Congo, Rwanda, Burundi, Haiti, Afghanistan), from 8 studies  | Quality of included primary studies was not assessed.  | The authors found that PBF results showed remarkable improvements in health indicators (utilization, coverage and emergency referral) with associated enhanced quality of health provider performance. They also noted the ambiguity among researchers regarding the extent of attribution of success, which calls for more rigorous evaluations of these programs.  | **5/11** |
| Chaix-couturier et al., 2002 | The authors’ objectives were to identify all the types of financial incentives that have been provided to health care professionals and, when possible, to assess the effects of these incentives on the costs, process or outcomes of health care.  | 6 databases were searched from January 1993 to May 1999 for English and French publications: MEDLINE, EMBASE, the Health Planning and Administration database, Pascal, International Pharmaceutical Abstracts, and the Cochrane Library. Additional papers were retrieved from the bibliographies of selected articles.It was stated that 89 papers were included in the review, whereas only 36 appeared to directly address the review question | The quality of each study was assessed according to the criteria described by the Cochrane Effective Practice and Organization of Care Group, but the results were not reported in the review.  | The authors concluded that financial incentives could be used to reduce the use of health care resources, improve compliance with practice guidelines or achieve a general health target. It may be effective to use combinations of incentives, depending on the target set for a given health care programme. The authors however stated that few studies used the same methodology to assess the impact of the same incentive, thus limiting the external validity of their conclusions. | **6/11** |
| Christianson et al., 2008 | This paper reviews evaluations of recent pay for- performance initiatives instituted by health plans or by provider organizations in cooperation with health plans.  | The authors conducted electronic searches of MEDLINE, EMBASE, Cochrane Database of Systematic Reviews, Database of Reviews of Effects, Econlit, the Agency for Healthcare Research and Quality, the Organisation for Economic Co-operation and Development, and the World Health Organization. Nine studies were included in this review | Quality of included primary studies was not assessed in a standardized way. The authors however stated that most of the studies included in this review were low quality studies (no adequate control groups).  | The review found that there were improvements in some quality measures, but it was not clear the degree of contribution of pay for performance to these improvements; the incentives typically were implemented in conjunction with other quality improvement efforts, or there was not a convincing comparison group.  | **5/11** |
| de Bruin SR, et al., 2011  | This review assessed the effectiveness of P4P schemes used to stimulate delivery of chronic care through disease management with regards to quality and costs.   | Only one database was searched (PubMed). In addition to the electronic database search, relevant papers were identified through reference tracking and through a manual literature search on the internet from relevant websites, such as those of health insurers and Ministries of Health.Eight PBF schemes were identified 6 in the USA, 1 in Germany and 1 in Australia. Five of the P4P schemes were part of a larger scheme of interventions to improve quality of care, whereas the other three was implemented as ‘standalone’ schemes. | Primary studies were not assessed in a standardized way. | Most studies showed positive effects of P4P on healthcare quality. However, there was only one database was searched, and no attempt to identify unpublished literature, important studies that might have influenced the conclusion might have been missed.They authors also found variation in incented entities and the basis for providing incentives. Information about motivation, certainty, size, frequency, and duration of the financial incentives was generally limited. | **6/11** |
| Eijkenaar, 2012 | This review systematically compared pay for performance initiatives in the USA to other countries in terms of specific design choices that might contribute to success of PBF programs. | The author searched Medline through PubMed and searched the Internet via Google and Google Scholar. The authors also consulted country-specific experts and searched reference list for relevant studies. The author identified 13 programs initiated in 9 countries. Seven programs were regional while six have been implemented nationally.  | Since this was not an impact evaluation review per se, and included studies were used to identify program descriptions, the quality of the studies was not assessed. | The paper found variations in design and contextual factors between the identified programs. The author concluded that the designs of these schemes are likely to affect the effectiveness of the schemes. However, the designs of these schemes are lacking in several respects and might be as a result of the limited knowledge about “what works” in P4P.This study has several limitations: some relevant programs were not identified as a result of English language restriction in the search strategy, the study suffers from publication bias as some studies were specifically not included because sufficient information was not found on the programs. | **6/11** |
| Gillam et al., 2012 | The authors review the growing evidence for the impact of the framework on the quality of primary medical care (QOF) in the United Kingdom. | The authors searched 3 databases: MEDLINE, EMBASE, and PsycINFO. They also searched the reference lists of published reviews and articles. Ninety-four studies were included in the review. | Quality of primary studies were assessed using a modified Downs and Black rating scale for observational studies and a Critical Appraisal Skills Programme rating scale for qualitative studies.The authors however did not report the quality assessment in this paper. | The authors found that:Quality of care for incentivized conditions during the first year of the framework improved at a faster rate than the pre-intervention trend and subsequently returned to prior rates of improvement. There were modest cost-effective reductions in mortality and hospital admissions in some domains. Achievement for conditions outside the framework was lower initially and has worsened in relative terms since inception. The person-centeredness of consultations and continuity were negatively affected. Patients’ satisfaction with continuity declined, with little change in other domains of patient experience.The conclusions of this study was limited by lack of adequate control groups | **9/11** |
| Hamilton et al., 2013 | The authors set out to evaluate the effectiveness of providing financial incentives to healthcare professionals for smoking cessation activities. | 7 databases were searched till May 2011: MEDLINE, EMBASE, PsycINFO, Cochrane Database of Systematic Reviews, DARE, Cochrane Central Register of Controlled Trials (CENTRAL) and Web of Science. The authors also searched to GreyNet International and Open Grey for grey literature. Reference lists of retrieved articles and relevant reviews were also checkedEighteen studies were included in the review: three RCTs and 15 observational studies. | Primary study quality was assessed using the Downs and Black guidelines for randomised and non-randomised studies of healthcare interventions. Scores ranged from 1 (poor) to 4 (excellent).Included primary studies were considered to be mid-range for quality | The Authors found that financial incentives improved some process indicators such as recording smoking status, advice and referrals but not for outcome measures such as smoking quit rates.Studies of QOF program in the UK reported improvements in recording smoking status. One RCT also reported improvements in incentive clinics in the USA.Smoking advice or referral: QOF studies reported an increase in smoking advice.The QOF studies should however be interpreted with caution because of the lack of adequate control groupsOther studies reported mixed findings: two studies reported no differences for financial incentives and some studies reported improvements.Quit rates: Two studies reported no improvements in quit rates as a result of incentives and one study reported mixed effects for outcomes.The authors concluded that financial incentives appeared to improve recording of smoking status and increase provision of cessation advice and referrals to stop smoking services. There was however insufficient evidence to show that financial incentives led to reductions in smoking rates.Limitation: although this review is one of the well-conducted reviews, most data were retrieved from observational studies, which are prone to multiple biases. The authors noted that most studies did not account for secular changes during study periods (such as new guidelines for smoking cessation or recent fiscal policy or legislation) | 9/11 |
| Houle et al., 2012 | This review assessed the effect of Pay-for-Performance remuneration, for individual health care practitioners, on the patient care outcomes. | PubMed, EMBASE, The Cochrane Library, OpenSIGLE, the Canadian Evaluation Society's; Unpublished Literature Bank, and the Grey Literature Collection of the New York Academy of Medicine's Library were searched up to June 2012. Reference lists were also manually searched.Thirty studies were included in the review. Four were RCTs, five were interrupted time series, three were controlled before-and-after studies, one was a non-randomized controlled study, 15 were uncontrolled before-and-after studies, and two were uncontrolled cohort studies. | The primary studies included were assessed, according to the Cochrane risk of bias scale, which included criteria for allocation concealment, similar baseline characteristics, complete outcome reporting, and protection against contamination.The quality of the studies was generally low to moderate; only RCTs had comparable baseline characteristics and only one study had adequate patient allocation concealment (full results were reported). | The authors, taking into consideration the limitations of the uncontrolled studies and the inability to draw reliable conclusions from them; concluded that Pay-for-Performance modestly improved preventive activities, such as immunization rates, but there was little evidence that it was effective for other activities such as mammography referrals and cancer screening. | **10/11** |
| Huang et al., 2013 | The authors’ objectives were to review and synthesize published evidence of pay-for-performance (P4P) effects on management of diabetes. | Four databases were searched: Ovid MEDLINE, EMbase, PubMed, The Cochrane Library (Issue 3, 201212 interrupted time series studies, 7 controlled before-after studies, and 2 cross-sectional studies were included. Additionally, 12 studies were further included for quantitative analysis. | The quality of included primary studies was assessed using Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system.The authors reported that most studies included in the review were low quality studies. | Results of meta-analysis showed that P4P produced generally positive effects in most indicators (e.g. patients with records of total cholesterol or blood pressure). However, these results were inconsistent. The percentage of patients with HbA1c ≤ 7% or 53 mmol/mol showed a pooled odds ratio of 0.98 in patients, but a pooled mean difference of 19.71% in the physician groups. The odds ratios of receiving tests/reaching an outcome level were also diverse in patients (odds ratios ranged from 0.98 to 3.32). The authors also found that process indicators had higher rates of improvement than outcome indicators.Limitations: the authors concluded that because of the low quality of included studies, the results of the review should be interpreted with caution.  | **8/11** |
| Petersen et al., 2006,  | This review assessed the effects of explicit financial incentives for improving performance on health care quality measures.  | The search was limited to studies written in English.Seventeen studies were included in the review: 9 randomized controlled trials, 4 controlled trials with before-and-after data and 4 cross-sectional surveys. | The studies were assessed according to a published methodological quality checklist (by Downs and Black) and graded on a scale of 1 (poor) to 4 (excellent). Six studies were assigned a quality grade of 3, six were assigned a grade of 2, and five were assigned a grade of 1. | The authors found that of the 2 studies that evaluated financial incentives provided at the payment-system level, one found a positive effect on access to care while the other found a negative effect on access to care for the sickest patients.Of the 9 studies that evaluated the use of financial incentives directed to provider groups, two reported improvements for all quality of care measures, five were classified as partial improvement studies, and two showed no effect of the intervention compared with the control group.Of the 6 studies that evaluated the effects of financial incentives at the physician level, two reported a positive effect of the intervention and three reported some positive effects (partial studies).The authors concluded that incentives at the physician, provider group and payment-system levels have some positive effects, but further research is needed. This review was flawed because only one database was searched and the search was limited to English language papers, which suggests that relevant studies might have been missed. Although an attempt was made to obtain unpublished data, publication bias was not assessed. Measures were taken to reduce the risk of bias in study selection. | **7/11**  |
| Reda et al., | The primary objective of this review was to assess the impact of reducing the costs of providing or using smoking cessation treatment through healthcare financing interventions on abstinence from smoking.  | The authors searched the Cochrane Tobacco Addiction Group Specialized Register in April 2012. Eleven studies were included.Of the eleven included studies, six randomly assigned the individual participants to the treatment group and one or two control groups (and three randomly assigned medical practices The two other studies were controlled natural experiments with two and four different benefit groups, respectively. | The quality of primary studies was assessed by The risk of bias of the included studies was assessed using criteria from the Cochrane Collaboration included in the Review Man- ager software.The Authors reported that most of the included studies had moderate to high risk of bias.  | The authors found there was no evidence of an effect on smoking cessation from the results of pooling two trials of financial incentives directed at healthcare providers (RR 1.16, CI 0.98 to 1.37, I² = 0%). Limitations: Only one database was searched and potentially important studies could have been missed. In addition, the two primary studies pooled together have relatively different incentive designs (heterogeneity) that were not accounted for. | 10/11 |
| Scott et al., 2011  | This review assessed the effect of financial incentives on the quality of health care provided by primary care physicians.  | The authors searched the Cochrane Effective Practice and Organisation of Care (EPOC) Trials Register, Cochrane Central Register of Controlled Trials (CENTRAL) and Cochrane Database of Systematic Reviews (CDSR) (The Cochrane Library), MEDLINE, HealthSTAR, EMBASE, CINAHL, PsychLIT, and ECONLIT. Searches of Internet-based economics and health economics working paper collections were also conducted. Finally, studies were identified through the reference lists of retrieved articles, websites of key organisations, and from direct contact with key authors in the field. Articles were included if they were published from 2000 to August 2009.Seven studies were included in this review.  | Quality of included studies was assessed using the Epoc risk of bias guideline. The authors reported that there was high risk of bias (low quality) in most of the studies due to poor study designs  | Six of the seven studies included in this review showed positive but modest effects on a minority of the measures of quality of care included in the study.The authors concluded that there is insufficient evidence to support or not support the use of financial incentives to improve the quality of primary health care.Implementation should proceed with caution and incentive schemes should be more carefully designed before implementation. In addition to basing incentive design more on theory, there is a large literature discussing experiences with these schemes that can be used to draw out a number of lessons that can be learned and that could be used to influence or modify the design of incentive schemes. | **9/11** |
| Van Herck P et al., 2010,  | This review summarizes evidence, obtained from studies published between January 1990 and July 2009, concerning P4P effects, as well as evidence on the impact of design choices and contextual mediators on these effects.  | The authors looked at papers from 1990- July 2009. They searched the following databases: Cochrane Library, EconLit, Embase, Medline, PsychINFO, and Web of Science. They also screened references, forward citation tracking, and expert consultation to identify studies. Studies that evaluated P4P effects in primary care or acute hospital care medicine were included. They included One hundred twenty-eight evaluation studies  | The vast majority of identified studies was not randomized (only nine were) and roughly 75 studies were either cross-sectional or employed a simple before-and- after design.  | The authors concluded that P4P programs result in the full spectrum of possible effects for specific targets, from absent or negligible to strongly beneficial and that the effects of P4P interventions varied according to design choices and characteristics of the context in which it was introduced.This study was however limited because they excluded studies based on quality and this may have produced an overly restrictive analysis.  | **11/11** |
| Witter et al., 2012 | This review assessed the current evidence on the effects of pay for performance on the provision of health care and health outcomes in low and middle-income countries. The studies assessed a mix of both patients’ targeted incentives and incentives targeted at health care professionals.  | Over 15 databases were searched till June 2011. This includes: the Cochrane Effective Practice and Organisation of Care Group Specialised Register, CENTRAL, MEDLINE, Ovid, EMBASE, EconLit, the Social Sciences Citation Index, ISI Web of Science. They also searched the websites and online resources of numerous international agencies, organisations and universities to find relevant grey literature and contacted experts in the field. Nine studies were included in the review. There was one randomized trial; six controlled before-after studies and two interrupted time series studies. | The quality of included studies was assessed using the GRADE Working Group grades of evidence. The authors reported that almost all the studies identified had a high risk of bias. Sources of bias in the primary studies include non-random allocation of interventions, additional funds/structures (other than the PBF schemes) that might have been responsible for the improvements seen, other confounders (e.g. contextual differences between intervention and non-intervention groups), and lack of rigorous evaluations. | The authors concluded that the evidence base was too weak to draw general conclusions due to validity issues.Only one study out of the nine studies was considered to have low risk of bias, one had a moderate risk of bias and the remaining seven had a high risk of bias.The high and moderate quality study found mixed results: some indicators improved while there was no improvement in others. Two of the studies showed significant improvement for the intervention group, while two showed no significant difference.  | 11/11 |

**Supplementary file S6 Extraction of data from all 96 relevant primary studies**

| **Program**  | **Author/Evaluation design** | **Objectives /clinical area** | **Results** **Effect size**  |
| --- | --- | --- | --- |
| Advancing Quality United kingdom2008 | Sutton et al, 2012Pre/postCompared with national average (difference in difference analysis) | Outcomes/clinical/chronic care30 days in hospital mortality: combined (heart failure, pneumonia, acute myocardial infarction)  | General combined results: Risk-adjusted, absolute mortality for the conditions included in the pay-for-performance program decreased significantly, with an absolute reduction of 1.3 percentage points (95% confidence interval [CI], 0.4 to 2.1; P = 0.006) significant impact  |
| Outcome 30 days in hospital mortality for patients admitted for Pneumonia | The largest reduction, for pneumonia, was significant (1.9 percentage points; 95% CI, 0.9 to 3.0; P<0.001) significant impact (positive) |
| Outcome 30 days in hospital mortality for patients admitted for myocardial infection | non-significant reductions for acute myocardial infarction (0.6 percentage points; 95% CI, −0.4 to 1.7; P = 0.23)  |
| 30 days in hospital mortality for patients admitted for Heart failure | Non-significant reduction 0.6 percentage points; 95% CI, −0.6 to 1.8; P = 0.30). [positive impact but not significant) |
| ClalitIsrael, 1998 | Gross et al. 2008 pre/post design from 1998 to 2005) | Cost containment (process) | Clinics have managed to reduce 10 percent of budget expenses |
| Mammography rates (process) | Mammography rates had risen from 40 percent to 65 percent |
| Patient satisfaction (outcome) | Patient satisfaction had risen from about 76 percent to 85 percent of members reporting high satisfaction. |
| Diabetes control measures (process) | Diabetes control measures have improved from 35 percent to 48 percent  |
| Clinical Practice Improvement Pay (CPIP)Australia, Queensland (started 2008) | Clinical Practice Improvement Centre (2008, 2010), Queensland Health (2010)Before and after (no control group) | Mental health Sixteen mental health services across Queensland participated and were provided with the opportunity to receive incentive payments during the period between January 2009 and June 2011. Data collection was conducted Using information available on existing Queensland Health databases.  | State-wide results showed steady and continual improvement in the indicator over the reporting period. |
| MACCABIIsrael 2001 | Friedman, 2006Before and after (pre-post) no control group |  Mammography rates (process) | Mammography rates had risen from 52 percent in 2002 to 64 percent in 2004 |
| Balanced diabetes patients (Intermediate outcome) | An increase in the percentage of balanced diabetes patients (Hba1c , 7) was also noted  |
| Vaccination flu rates (process) | Flu vaccination rates had risen from 35 percent to 47 percent |
| National Health Insurance P4P (NHI-P4P)Taiwan 2004 | Chang et al., 2008Logistic regression/pre/post (no control group)One year | Smoking cessation visits (process) | Odds Ratio (95% CI) Financing policy2004\* 2005 0.96 (0.87 to 1.06)This policy increased the annual number of cessation visits per patient. |
| Tsai et al., 2010: Pre-post design compared with control (non-PBF) for 3 years | Tuberculosis treatment default rate (process) | The treatment default rate after “P4P on TB” was 11.37% compared with the 15.56% before “P4P on TB” implementation. The treatment default rate in P4P hospitals was 10.67% compared to 12.7% in non-P4P hospitals.  |
| Kuo et al., 2011Pre-post with controls (4 years follow up) | Breast cancer care (BC-P4P) in Taiwan on care quality (process) | BC-P4P enrollees received higher-quality care than nonenrollees (*P* \_ .001).  |
| Breast cancer care (BC-P4P) in Taiwan on patient survival (outcome) | BC-P4P enrollees had better 5-year overall survival (odds ratio, 0.167; *P* \_ .001) |
| Breast cancer care (BC-P4P) in Taiwan on recurrence (outcome) | Less recurrence (odds ratio, 0.370; *P* \_ .002) |
| Li et a.l, 2010Pre-post compared with controls: 4 years | Tuberculosis cure rate (intermediate outcome) | Cure rate: Number cured (cure rate) p4p:18 377 (68.1) non p4p: 2778 (42.4) <0.01 (%) p4p:N 26 977 (80.4) non p4p 6559 (19.6) P4P hospital 0.2911 1.338 (1.159–1.544) <0.0001 cure rate odds ratio 95% CI |
| Lee at al., 2010One year: Pre-post design with control groups | Diabetes care (diabetes specific tests and exams) (process) | Patients in the P4P program (received significantly more diabetes-specific exams and tests after enrolment (3.8 vs 6.4, P <.001) than patients not enrolled in the program (3.5 vs 3.6, P <.001).  |
| Physician visits for diabetes (process) | Patients in the intervention group had an average of 2 more physician visits for diabetes than those in the comparison group (P <.001). |
| Diabetes related hospitalizations (intermediate outcome) | Conversely, the intervention group had fewer diabetes-related hospitalizations (−0.027, P = .003).  |
| Primary care P4P (PC-P4P) Netherlands | \*Kirschner et al 2013Pre-post design evaluation after one year` with control group | Mean score diabetes (9 process indicators) | 10.4\* (\*=significant, p less than 0.05) |
| Blood pressure controlled  | 5.9\* |
| Total cholesterol controlled | 8.8\* |
| HbA1c controlled(≤7.0%) (Intermediate outcome) | 7.7\* |
| Asthma management (4 process indicators) | 11.5\* |
| Asthma outcome  | 4.4 |
| Mean score COPD (5 process indicators)  | 8.1\* |
| COPD outcome  | 2.5 |
| Influenza vaccination (process) | -1.2 (negative impact although not significant) |
| Cervical cancer screening (process) | 0.6 (no significant impact) |
| CRVM process | 14.7\*\* |
| CRVM outcomes  | 8.4\*\* |
| Primary Care Renewal Models (PCRM)Canada OntarioStarted 2007 | Li et al., 2010Difference in difference estimatesCross sectional design /time series(with control group)data collected from 1998-2008 | Pap smear | 0.003\*\*\* pless than 0.005 |
| Influenza vaccination | 0.009 |
| Mammograms | 0.073\*\*\* |
| Childhood immunizations | -0.008 |
| Colorectal screening | 0.092\*\*\* |
| Physician Integrated Network (PIN)Canada Manitoba2004 | PIN evaluation report, 2012.Pre post design (no control group) | Colon cancer screening | 38.7% |
| Dyslipidaemia screening | 35.4% |
| Cervical cancer screening | 11.1% |
| Breast cancer screening | 12.3% |
| Nephropathy screening | 29.6% |
| Lipid profile | 22% |
| Obesity screening | 14.8% |
| HGBA1C screening | 12.5% |
| Blood pressure test | 5% |
| Renal dysfunction test | 11.5% |
| Practice Incentive Program (PIP)Australia 1998 | PIP Audit report No 5 2010-2011Before and after (with control group) | Diabetes | 20%points |
| Prescribing | No significant effect |
| Information technology | No significant effect |
| Quality and Outcomes Framework (QOF) | Calvert et al., 2009Retrospective cohort design (no control group) | Diabetes managementChange in HbA1c levels >10%Reduction Intermediate outcome | The introduction of the quality and outcomes framework did not lead to improvement in the management of patients with type 1 diabetes, nor to a reduction in the number of patients with type 2 diabetes who had HbA1c levels greater than 10%. |
| HbA1c levels of ≤7.5%Intermediate outcome | Odds ratio 1.05 (95% confidence interval 1.01 to 1.09; P=0.02). |
| Campbell et al., 2007Adequate control | Coronary heart diseaseMean Difference(95% CI) P ValueIntermediate outcome |  0.53 (−0.01 to 1.08) 0.054 |
| AsthmaIntermediate outcome | 0.03 (−0.45 to 0.51) 0.904 |
| Type 2 diabetes managementIntermediate outcome | 0.08 (−0.32 to 0.49) 0.682 |
| Taggart et al., 20122000-2008Before and after: no control group | Smoking cessation adviceprocess | Rapid increases in recording smoking status and advice occurred around the QOF’s introduction in April 2004. Subsequently, compliance to targets has been sustained, although rates of increase have slowed. |
| Millet et al., 2009Before and after with no control group | Achievement of diabetes treatment targets for blood pressure (< 140/80 mm Hg), HbA1c (# 7.0%) and cholesterol(# 5 mmol/L).Intermediate outcome | Patients with co-morbidity remained significantly more likely to meet treatment targets for cholesterol and HbA1c than those without after the introduction of pay for performance |
| MacBride-Stewart, et al,. 2008Before and after ITSAdequate control | Changes in prescription patternProcess | QOF significant reduction in prescribing pattern compared to a non-significant increase in prescribing pattern for the Non QOF control group. |
| Doran et al., 2011Time series, Longitudinal analysis | Measurement indicatorsPrescription indicatorsProcesses  | Change in Mean for measurement indicators= 1.9 (1.4 to 2.5) p=0.001Change in mean for Prescribing indicators= 2.6 (1.8 to 3.3) p=0.002 |
| Strong et al., 2009Before and after with no control group | Accurate spirometry in the management of COPDprocess | There was no association between quality, as measured by adherence to BTS spirometry standards, and either QOF COPD9 achievement (Spearman's rho = -0.11), or QOF COPD10 achievement (rho = 0.01). |
| Vaghela et al,. 2008Before and after: no control group | A1C <or=7.5%, | The estimated annual increase in percent of diabetes subjects achieving targets was 3.03% (95% CI 2.95–3.10; P 0.001) for the A1C target |
| Blood pressure <or=145/85 mmHgProcess  | The estimated annual increase in percent of diabetes subjects achieving targets was 3.26% (3.18–3.34; P 0.001) for the blood pressure target |
| Cholesterol <or=5 mmol/l was determined.Process  | The estimated annual increase in percent of diabetes subjects achieving targets was 3.99 % (3.92– 4.07; P 0.001) for the cholesterol target. |
| Tahrani et al., 2007 Before and after with no control groupPCTs | Process indicators | 95% CI April 2004- March 2006 all p values less than < 0.001 |
| BMI Record | -19.2 to -14.5 |
| Smoking record  | -54.7 to -47.3 |
| HBA 1c Record | -22.5 to -15.0 |
| Retinal screening record | -42.9 to -32.5 |
| Peripheral pulses record | -63.6 to -52.7 |
| Neuropathy testing record | -64.2 to -53.2 |
| BP record | -10.8 to -8.2 |
| Micro albumin testing record | -74.8 to -65.9 |
| Creatinine record | -15.0 to -11.2 |
| Cholesterol record | -17.3 to -13.6 |
| Outcome indicators | 95% CI April 2004- March 2006 all p values less than < 0.001 |
| Smoking cessation advice | -15.2 to -9.2 |
| HbA1c< 7.4 | -24.1 to -16.2 |
| HbA1c< 10 | -22.6 to -16.4 |
| BP< 145/85mmHg | -20.3 to -15.9 |
| TC<5 | -25.9 to -22.0 |
| Influenza vaccine | -24.6 to -18.1 |
| Serumaga et al., 2011Design Interrupted time series. | Blood pressure monitoring (no change)process | After accounting for secular trends, no changes in blood pressure monitoring (level change 0.85, 95% confidence interval −3.04 to 4.74, P=0.669 and trend Change −0.01, −0.24 to 0.21, P=0.615), control (−1.19, −2.06 to 1.09, P=0.109 and −0.01, −0.06 to 0.03, P=0.569) |
| Treatment intensity (no change)process | Treatment intensity (0.67, −1.27 to 2.81,P=0.412 and 0.02, −0.23 to 0.19, P=0.706)Good quality of care for hypertension was stable or improving before pay for performance was introduced. Pay for performance had no discernible effects on processes of care or on hypertension related clinical outcomes. |
| Cupples et al., 20082004-2006Cross-sectionalStudyControl group  | Blood pressure, | More RoI than NI participants had systolic blood pressure >140 mm Hg (37% vs 28%, P =0.01)  |
| Cholesterol  | More RoI than NI participants had cholesterol >5 mmol/L (24% vs 17%, P = 0.02) |
| Medications  | 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 (83%; 77%) |
| Smoking status 1 | -62.1 (-67.0 to -56.3) |
| Smoking status 2 | -22.7 (-26.4 to -19.0) |
| Smoking status 3 | 3.5 (-1.8 to 8.6) |
| Smoking status 4 | -3.1(-8.4 to 1.8) |
| Coleman, 20071990-2005Retrospectivelongitudinalsurvey | Smoking status recording  | 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)  |
| Brief advice to smokers  | Compared with the first quarter of 2003, and in brief advice to smokers increased up to (RR = 3.03; 95% CI, 2.98–3.09), |
| Campbell, et al., 20091998-2007Before and after studyInterrupted time series  | Coronary heart disease  | Mean change in rate of improvement -0.250, 95% CI, -0.401 to 0.100, pvalue=0.001 |
| Asthma  | Mean change in rate of improvement -0.468, 95% CI, -0.748 to -0.187, pvalue=0.001 |
| Diabetes  | Mean change in rate of improvement -0.220, 95% CI, -0.313 to -0.127, pvalue=0.001 |
| Continuity of care  | Mean change in rate of improvement 0.091, 95% CI, 0.025 to 0.157, pvalue=0.001 |
| Hippisiley-cox, et al., 20072001-2006Interruptedtime seriesHowever, absolute mean changes were reported  | Coronary heart disease  | This is equivalent to a relative increase of 50% (95% CI 37%-63%) over the five year study period as shown in the graph below |
| Stroke patients with cholesterol < 5 mmol | 356% relative increase (95% CI 182-637%) in the percentage of stroke patients with cholesterol < 5 mmol/l in the preceding 15 months |
| Stroke patients with a blood pressure reading < 150/90 mm hg | There was a 68% relative increase (95% CI 55-83%) in the percentage of patients with a blood pressure reading < 150/90 mm hg in the preceding 15 months |
| Diabetes recorded prevalence  | Using the new 2006/7 definitions, there was a 117% (95% CI 115-120) relative increase in the recorded prevalence of diabetes (Diabetes1). |
| percentage of diabetes patients with cholesterol < 5 mmol/ | there was a 132% relative increase (95% CI 95-176%) in the percentage of diabetes patients with cholesterol < 5 mmol/l in the preceding 15 months. |
| Diabetics with a blood pressure reading < 145/85 mm hg | There was a 56% relative increase (95% CI 47-66%) in the percentage of patients with a blood pressure reading < 145/85 mm hg in the preceding 15 months. |
| Diabetic High blood pressure recorded  | There was a 35% (95% CI -41 - 209) relative increase in the recorded prevalence of hypertension (BP1). |
| Diabetic High blood pressure controlled  | There was a 65% (95% CI 51-79%) relative increase in the percentage of patients with controlled blood pressure levels |
| Chronic kidney disease chronic kidney disease and blood pressure recorded | there was a 20% relative increase (95% CI 3-32%) in the percentage of patients with chronic kidney disease and blood pressure recorded in preceding 15 months. |
| Chronic Kidney disease percentage of patients with a blood pressure reading < 140/85 | There was an 89% relative increase (95% CI 59-124%) in the percentage of patients with a blood pressure reading < 140/85 mm hg in the preceding 15 months. |
| Magee, 2010Interrupted time series | Nephropathy prevalence | Nephropathy prevalence was 15.1% and 11.5%, respectively.  |
| The median ACR testing rate | The median ACR testing rate was 82% compared with a historic figure of 41% in 2001/2002 |
| Milliet, et al.,20072003-2005Longitudinalcross-sectionalsurvey | Record of smoking status  | Significantly more patients with diabetes had their smoking status ever recorded in 2005 than in 2003 (98.8% vs 90.0%, P <.001). |
| Smoking cessation advise  | The proportion of patients with documented smoking cessation advice also increased significantly over this period, from 48.0% to 83.5% (P <.001).  |
| Prevalence of smoking/quit rates  | The prevalence of smoking decreased significantly from 20.0% to 16.2% P <.001) |
| McGovern, 2008200-2005: serial cross sectional study |  | Recording and prescribing increased by mean 17.1% after the introduction of the GMS contract |
| Oluwatowoju, et al., 20102006-2008Retrospectiveretrieval ofcomputer-heldbiochemicalmeasurements | Diabetes HbA1c <7.5%); | In 2006, 39.7% of adults had glycemic control within the QOF threshold (HbA1c <7.5%); by 2008, this proportion had risen to 52.1% (P <.001). |
| Diabetes HbA1c >10.0% | In 2006, 11.8% of subjects had poor glycemic control (HbA1c >10.0%); by 2008, this proportion had decreased to 10.1% (P <.001).  |
| Diabetes (both HbA1c<7.5% and total cholesterol ≤5.0 mmol/L) | The proportion of subjects achieving HbA1c and cholesterol targets (both HbA1c <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) |
| Srirangalingam et al.,(2006)Before and after cross sectional study  | Diabetes  | Increase in referrals for poor glycaemic control, and the glycaemic threshold for referral with poor glycaemic control has reduced (9.7% vs 10.6%, P= .006, mean difference = 0.9%, 95% CI, 0.4-1.3%). |
| Simpson et al., 2010 Before and after  | Smoking status reporting  | The proportion of people with smoking status recorded increased by 32.9% (from 46.6% in2001/2 to 79.5% in 2006/7, OR 4.45, 95% CI 4.43 to 4.46) |
| Smoking cessation advise  | There was a large increase in provision of smoking cessation advice (43.6% in 2001/2, 84%in 2006/7, OR 6.75, 95% CI 6.66 to 6.85) |
| Smoking cessation referral  | The proportion of patients referred to stop smoking clinics increased (from 0.95% to 6.56%, OR 7.32, 95% CI 6.92 to 7.73) |
| Quit rates  | The proportion of people recorded as being a smoker reduced from 28.4% in 2001/2 to 22.4% in 2006/7 (OR 0.73, 95% 0.72 to 0.73) |
| Simpson et al., 2011No control group | Hypertension  | Increasing treatment for hypertension (absolute difference [AD] 9.2%; 95% confidence interval [CI] = 9.0 to 9.5) occurred throughout the study period. |
| Gulliford, et al., 2007 | Diabetes  | HbA1c≤7.4% Among 26 practices in South London, the median practice-specific proportion of patients achieving HbA1c≤7.4% each year increased: 2000,22%; 2001, 32%; 2002, 37%; 2003, 38% and in 2005 from QOF, 57%. |
| Kontopantelis et al., 2012Interrupted time series analysisAdequate control | Diabetes  | Recorded quality of care improved for all subgroups in the pre-incentive period. In the first year of the incentives, composite quality improved over-and-above this pre-incentive trend by 14.2% (13.7–14.6%).  |
| By the third year the improvement above trend was smaller, but still statistically significant, at 7.3% (6.7–8.0%).  |
| Western New York Physician Incentive Program (WNY-PIP)USA | Beaulieu ND and Horrigan DR (2005) 8months pre-post with a control groupEven though they stated that there was a control group, the results presented are absolute so I will treat as no control group | Diabetes control:HbA1c test (process) | HbA1c test (1) no significant differenceSignificance: p<0.0001 (for all) |
| Lipid test (process) | Lipid test: significant increase |
| HbA1c < 9.5 (intermediate outcome) | HbA1c < 9.5: significant increase  |
| LDL <130 (Intermediate outcome) | LDL <130: significant increase |
| Diabetes control:HbA1c test (process) | HbA1c test (1) no significant differenceSignificance: p<0.0001 (for all) |
| Kouides et al., 1998Rochester, New York, USA | PBF vs. non PBFBefore PBF vs. After PBFControl group | Influenza immunization rates | Absolute increase in immunization rates (from 1990 [baseline] to 1991) was 6.8%; *P* \_ 0.03 Change in immunization rates (1991-1990) intervention:10.3% , control: 3.5% p=0.3 |
| Ashworth et al., 2004UK 2004 | Before and after incentive (no control group) | Change in use of prescription budget (overspent/underspent) of primary care organization (PCO) | PCO prescribing budgets were, on average, overspent by 4.5 per cent in the first year and marginally under spent by 0.6 per cent in the second year. Many PCOs had successfully turned a first year prescribing overspend into a second year under spend. PCOs that successfully reversed their overspend (49 out of 84; 58 per cent)  |
| Cattaneo et al., 2001Italy 1998-1999 | Before and after study(no control) | Change in breast feeding rates (intermediate outcome)  | Significant increase in breast feeding rates |
| Fairbrother et al., 1999New York12 months | Before and after study with control groupJuly 1995-July 1996 | Childhood immunization coverage rates (process) | Bonus group improved significantly in documented up-to-date immunization status, with an overall change of 25.3% (P \_ 0.01), |
| Fairbrother et al., 2001USA16 months | Comparison of Preventive Care in Medicaid Managed Care and Medicaid Fee for Service in Institutions and Private PracticesControl group | Change in documentation of up-to-date immunization status.  | The bonus group improved significantly in documented up-to-date immunization status, with an overall change of 5.9% (*P* \_ 0.05) compared with the control group.N=57 physicians (24 bonus; 12 FFS; 21 control) |
| Grady et al., 1997USA | Mammography referral rates (process) | Mammography referral rates (process) | No significant difference between the two groups  |
| Hillman et al., 1998 | RCT2 years | Cancer screening: breast, cervical and colorectalMean compliance score | No significant difference between the intervention and control groups for pap test  |
| No significant difference between the intervention and control groups for colorectal screening  |
| No significant difference between the intervention and control groups for mammography  |
| No significant difference between the intervention and control groups for breast exam  |
| Larsen et al., 2003 | Four years pre-post: no control group | Diabetes care:LDL < 130 | Significant difference p<0.001 from 1998-200239.9% To 69.8% pvalue less than 0.001 |
| Average HbA1c | Reduction of 8.1-7.3 |
| HbA1c>9.5 | Reduction of 34.6-21.4 |
| HbA1c < 7(Intermediate outcome) | 33.5%%To 52.8% |
| Annual HbA1c | 78.5-90.5% |
| Bi annual LDL | Increase of 65.9-91.7 |
| Annual eye exam | From 52-62% |
| LeBaron et al., 1999USA | Before and after (no control group) | Childhood immunization coverage rates | Mean change +3 percentage points From 1994-199675 (74-76)- 78 (77-79) (95% CI)) |
| Ritchie et al., 1991Scotland: UK | Before and after studyStudy period: one year no control group | Percentage immunized by practice/ immunization rates | Percentage of children aged 5 years given preschool boosters in Grampian region, 1987-91 rose from 78- 93% (p<0-0001). All 95 general practices in Grampian region (313 general practitioners). Those aged 5 years on the first day of the relevant quarter, with an average population of 6600 |
| Rooski et al., 2003USA  | RCT 12 Months (unbalanced) | Adherence to smoking cessation clinical practice guidelines and patients’ smoking cessation behaviours. | Percentage of patients, tobacco use status identified in the last visit (Process) 14.1 vs 6.2(incentive vs control) |
| Percentage of smokers who received advice to quit in the last visit (Process)24.2 vs 18.3 (incentives vs control) |
| Percentage of smokers who were offered assistance to quit in the last visit (Outcome) 14.3 vs 8.8 (incentives vs control) |
| Quitting rates did not differ statistically significantly between the experimental conditions. |
| Harries et al., 2005Malawi National Tuberculosis Control Programme(four year program/0  | before and after study with control groups | Tuberculosis control and other outcome measure. | Percentage of patients documented as smear-positive in the laboratory register that are subsequently registered for treatment in the TB register. Target set at or above 90% |
| Percentage of patients aged 15 years and above registered in the TB register as smear-negative PTB patients who have had Sputum smears examined (data from laboratory register).Target set at or above 85%. |
| Percentage of new smear-positive PTB patients who default from treatment/transfer out or who complete treatment with no smears examined. Target set at or below 10%. |
| Percentage of relapse smear-positive PTB patients for whom sputum specimens arrived at the mycobacterial central reference laboratory, Lilongwe, for culture and drug sensitivity testing. Target set at or above 60%. |
| Chien et al., 2012 Hudson Health Plan's P4P program in New York  | Four years(2003–2007)Design: case-comparison difference-in-difference study using plan-level administrative data; (2) a patient-level claims data analysis; and (3) a cross-sectional survey(control group) | Lipid testing (process) | +4%points |
| HbA1c <9 | +8%points |
| Hba1c testing (process) | +2%points |
| Hillman et al., 1999USA | RCT18MONTHSRCT (3 arms);1993 to 1995;49 PC sites (19 FB\_I; 15 FBO; 15 controls) | Rate of paediatric immunization:randomly assigned primary care sites serving children in a Medicaid HMO to one of three groups: a feedback group (where physicians received written feedback about compliance scores), a feedback and incentive group (where physicians received feedback and a financial bonus when compliance criteria were met), and a control group. They evaluated compliance with paediatric preventive care guidelines through semi annual chart audits during the years  | However, no significant differences were observed between either intervention group and the control group, for compliance scores  |
| However, no significant differences were observed between either intervention group and the control group, for immunization rates  |
| Christensen et al., 2000USA | RCT (2 arms);February 1994 to September 1995200 pharmacies (110 interventions; 90 control) | Dosage with CS | Student *t*-test Mean rate, 1.59 interventions per 100 Medicaid prescriptions (study pharmacies) vs. 0.67 (controls); *P* \_ 0.001Pharmacists practicing in 110 study (financial incentive) and 90 control community pharmacies.Study pharmacists documented an average of 1.59 CS interventions per 100 prescriptions over a 20-month period, significantly more than controls, who documented an average of 0.67 interventions (P < .05) per 100 prescriptions. |
| Hillman et al., 1998USA | RCT (2 arms);1993 to 1995;52 PC sites (26 intervention; 26 control) | Compliance with cancer screening for women age >50 y; aggregate compliance scores and improvement in scores over time | Repeated-measures ANOVA Absolute increase in total mean compliance scores for intervention group from baseline was 26.3%; control group was 26.4%.No significant differences between the groupsAggregate compliance scores and improvement in scores over time. |
|  Gavagan, et al., 2010USA | A retrospective review of administrative data (2003-2007) was done to evaluate a natural quasi-experimentWith a control group | Rates of Papanicolaou screening | Overall, there was no clinically significant effect of incentives on performance |
| Rates of mammography | Overall, there was no clinically significant effect of incentives on performance |
| Rates of child immunizations | Overall, there was no clinically significant effect of incentives on performance |
| An et al., 2008USA  | RCT Clinical randomized trial? Compared with what: non PBF, standalone scheme Intervention clinics | Smoking cessation referral rates | Intervention clinics referred a mean of 11.4% (95% CI, 8.0%-14.9%) of their smokers compared with 4.2% (95% CI, 1.5%-6.9%) of smokers visiting usual care clinics (t47=3.45; P=.001) significant difference |
| Glickman et al.,2007USACMS Premier program | Patients were treated between July 1, 2003, and June 30, 2006, at 54 hospitals in the CMS program and 446 control hospitals 3 yearspre-post with control group  | Aspirin prescription rate | Pvalue of comparison of intervention group to control group0.12 |
| Smoking cessation counselling rates | 0.05 |
| In hospital mortality  | 0.21 |
| Aspirin at discharge  | 0.04 |
| Beta blockers at arrival | 0.91 |
| Beta blockers at discharge  | 0.98 |
| ACE inhibitor at discharge  | 0.51 |
| CMS composite score  | 0.16 |
| Levin et al., 2006USA | Two year programPre-post design with control group | HbAIC screening | PCHI’s performance in HbAIC screening in the index health plan improved over 2 years by 7 percentage points, compared with a statewide improvement of 4.9 percentage points (*p* < .05).  |
| Eye exams | For diabetic eye exams, PCHI’s performance improved 18.7 percentage points, compared to a slight decline in statewide performance (*p* < .05).  |
| LDL screening | For diabetic LDL screening, PCHI improved by 13.2 percentage points, almost twice that of the state average (*p* < .05), |
| Nephropathy screening | Nephropathy screening rate improved by 15.2 percentage points, over twice the state-wide improvement (*p* < .05).  |
| Paediatric asthma controller use  | (PCHI improvement 1.7 percentage points, state improvement 3.9 percentage points, *p* > .05), 3.8\* mean change (process drug). |
| [Mandel](http://www.ncbi.nlm.nih.gov/pubmed?term=Mandel%20KE%5BAuthor%5D&cauthor=true&cauthor_uid=17606827) et al., 2007Cincinnati USA | Between October 1, 2003,andNovember30,2006No control group but interrupted time series desing. Good quality, so will count as control | Asthma improvement in childrenInfluenza vaccination rates | all-payer asthma population receiving “perfect care” increased from 4% to 88%, with 18 of 44 practices (41%) achieving a perfect care percentage of 95% or greater influenza vaccine increased from 22% at baseline (2003- 2004 season [September 1 through March 31]) to 41% for the 2004-2005 season, to 62% for the 2005-2006 season, with 7 of 44 practices (16%) achieving an influenza vaccination percentage of 80% or greater for the 2005- 2006 season. |
| Lindenauer et al., 2007CMSUSA | 2 yearsNatural experiment: pre-post with control.multivariable modeling to estimate the improvement attributable to financial incentivesp4p implementedd with public reporting | Aspirin on arrival  | Percentage change 3.3\*\* |
| Aspirin on discharge  | 0.9 |
| ACE inhibitor  | 9.9\*\* |
| Beta blocker on arrival  | 2.8\*\* |
| Beta blocker on discharge  | 2.8\*\* |
| LV assessment  | 5.1\*\* |
| Ace inhibitor for LVSD | 2.0 |
| Antibiotic timing for pneumonia patients  | 4.3\*\* |
| Vaccination for pneumonia patients | 10.9\*\* |
| Oxygen assessment  | 0.6 |
| Appropriate care for MI | 7.5\*\* |
| Appropriate care for heart failure  | 6.0\*\* |
| Appropriate care for pneumonia  | 7.1\*\* |
| Composite process scores all 10 measures | 4.3\*\* |
| Greenberg et al., 2008 | Before and after design with no control group | Smoking cessation referral rates |  Staff referrals increased with program incentives (P=.008), with a total of 150 interventions occurring in the 3-month span.  |
| Yao H et al., 2008China  | Implemented with a demand side interventionPre-post design with control groupOne year period evaluation | TB case detection and treatment | The project achieved its case detection target: the total number of new smear-positive TB cases identified in the intervention counties during the whole project period (November 2004–October 2005) was 7736, which was 136% of the project target established in the proposal, according to the baseline data of the intervention group. However, no improvement on TB case finding and case holding was found in the intervention group compared with the control group (Table 2). At baseline, the intervention group had a significantly higher case notification rate (P < 0.01).  |
| Fagan et al., 2010 | 2004-2007Quasi experimental 9before after and control group) | Influenza vaccine | Odds ratio1.79 (1.37-2.35) |
| Haemoglobin testing  | 0.44 (0.33-0.65) |
| Eye exam | 0.98(0.61-1.58) |
| Ldl test  | 0.62(0.44-0.86) |
| Nephropathy test | 0.96(0.62-1.46) |
| Management of hypertension with diabetes  | 1.11(0.58-2.13) |
| Chien et al., 2010USA  | Study Design. Case-comparison and interrupted times series 2003–2007 | Childhood Vaccination rates  | Hudson Health Plan members or by private practices were also significantly more likely to be immunized (Table 2, high number of Hudson enrolleesOR 5 1.65–1.73, po.001 |
| Jha et al., 2012CMS | Pre-post with control group. | Premier vs non premierMortality rates for different conditions30-day mortality | The rates of decline in mortality per quarter at the two types of hospitals were also similar (0.04% and 0.04%, respectively; difference, −0.01 percentage points; 95% CI, −0.02 to 0.01),  |
| and mortality remained similar after 6 years under the pay-for-performance system (11.82% for Premier hospitals and 11.74% for non-Premier hospitals; difference, 0.08 percentage points; 95% CI, −0.30 to 0.46). 0.36 for interaction) |
| We found that the effects of pay for performance on mortality did not differ significantly among conditions for which outcomes were explicitly linked to incentives: acute myocardial infarction |
| CABG |
| Congestive heart failure |
| Pneumonia |
| Lynch et al.,1995 | 1990 general practitioners contract | Uptake of childhood immunizations | While this has led to an increase in the number of general practitioners providing the services |
| Sussman et al., 2000 Boston, MassachusettsUSA | Before and after study (no control group) | Percentage of the wRVU productivity- | After the first year of operation of this plan, there was an overall 20% increase in PCP productivity. |
| Norton et al.,1992  | RCT (2 arms);November 1980 to April 1983; 36 SNFs (18study facilities; 18 control facilities)Up to 4 years  | Improvement in health status | Patients in experimental homes were more likely to be discharged to home or to an ICF and had less likelihood of hospital admission or death (*P* \_ 0.001) |
| Shen et al., 2003 Maine, USA | CBA; FY 1991 to 1995 | Substance abuse treatment | The percentage of OSA outpatient clients classiﬁed as most severe users dropped by 7 percent ( po50.001) after the innovation of performance based contracting compared to the increase of 2 percent for Medicaid clients |
| Werner et al., 2012 CMS USA | Pre-post design with control group5 years  | In house mortality rates  | The performance of the hospitals in the project initially improved more than the performance of the control group: More than half of the pay-for performance hospitals achieved high performance scores, compared to fewer than a third of the control hospitals. However, after five years, the two groups’ scores were virtually identical. Improvements were largest among hospitals that were eligible for larger bonuses, were well financed, or operated in less competitive markets |
| Basinga et al., 2011Rwanda |  Pre-post with control groups | Any prenatal care | 0·002 p= 0•875 |
| Four or more prenatal care visits | 0·008 p= 0•875 |
| Institutional delivery | 0·081 p= 0•017 |
| Tetanus vaccine during prenatal visit | 0·051 p= 0•057 |
| Standardised total quality score | 0·157 p= 0•020 |
| Younger than 23 months preventive visit, previous 4 weeks | 0·119 p= 0•004 |
| 24–59 months preventive visit, previous 4 weeks | 0·111 p= 0•000 |
| 12–23 months fully immunised | −0•055 p= 0•390 |
|  Canavan A. and Swai G. (2008)Tanzania |  Pre-post with control groups3 years | In patient department  | IPD RR: 0.82 (0.76-0.86) P<0.00001 |
| Change in utilization | Utilization in health facilities RR: 0.94 (0.83 to 1.08) p>0.40) |
| Sulku, 2011Turkey | Pre-post with control group 5 years | Mortality rates | Hospital mortality rates (increased non significantly: 0.01-0.012 p>0.05) |
| Mean outpatient visits | Mean outpatient visits increase by 78% significantly p<0.01 |
| Vergeer and Chansa, 2008.Zambia |  Pre-post with control group. | ANC | No significant change in ANC, 4. No significant difference in intervention and control hospitals in relation to IPD/OPD. Variety of patterns across facilities |
| Ssengooba et al., 2012.Uganda  |  Pre-post with control group | Maternal and child health process measures | After 21⁄2 years and three survey rounds, the study found no discernable impact of bonuses on the provision of health services by the PNFP providers (group C). Twenty-two out of 23 facilities receiving performance bonuses did reach at least one performance target, and 12 reached all three, but service levels at group B institutions similarly improved. If anything, facilities in the bonus group performed slightly worse than the facilities receiving only the untied base grant and about as well as the facilities in the control group. |
| Cutler et al., 2007 USA (California P4P) | Retrospective study: before and after (with control group) | Diabetes testing  | The LDL-C testing rate for patients in the CDCM programwas 91.5% versus 67.8% for the routine care group). The LDL-C goal attainmentrate for the CDCM program was 78.2%, significantly higher thanthe 55.7% rate for the routine care group (*P* < 0.001 |
|
| Rosenthal et al., 2005USA California p4p |  | Cervical screening  | Compared with physician groups inthe Pacific Northwest, the California network demonstrated greater quality improvement after the pay-for-performance intervention only in cervical cancer screening (a 3.6% difference in improvement [P=.02]).  |
| Mammography  | Difference in difference result not significant  |
| Haemoglobin  | Difference in difference result not significant |
| Gilmore et al., 2007Hawaii Medical Services Association  | Before and after with control group | Patient satisfaction on recommended care | We found a consistent, positive association between having seen only program-participating providers and receiving recommended care for all 6 years with odds ratios ranging from 1.06 to 1.27 (95 percent confidence interval: 1.03–1.08, 1.09–1.40) |
| Young et al., 2007 | Before and after with control group/similar to an interrupted time series design  | Diabetes measures | Based on the absence of a significant interaction term for each measure in this context, the post-intervention trends were not different from the pre-intervention trends, indicating that the overall pattern of performance did not change after program  |
| Twardella and Brenner, 2007 | RCT | Smoking cessation  | Self-reported smoking abstinence obtained at 12 months follow-up and validated by serum cotinine. In intention-to-treat analysis, smoking abstinence at 12 months follow-up as 3% (2/74), 3% (5/ 144), 12% (17/140) and 15% (32/219) in the usual care, and interventions |
| Scott et al., 2009PIP | Before and after with control group  | Diabetes test HbA1c test  | Model (1) of Table II shows a statistically significant effect of 20% (1% level) for*Treatment group 1*. This marginal effect suggests that the average GP working in an average practice of the sample that joined the PIP program is more than 20 percentage points more likely to order an HbA1c test than a comparable GP in a practice that has not joined |
| Schauffler et al., 1999CaliforniaUSA | Before and after (no control group) | CHILDHOOD IMMUNIZATIONS | The majority of the HMOs exceeded their negotiated targets for most of the quality-of care measures However, they fell considerably short on childhood immunizations, and nearly half missed their targets on mammograms and Pap smears as well. Eight plans missed their targets for childhood immunizations, falling short by 3–12 percent. The five plans that met their targets exceeded them on average by 9.3 percent, with individual plans exceeding it by 2–19 percent. Only four plans missed their targets for cesarean section rates, and they were only about 0.7 percent off target. |
| CESAREAN SECTIONS. |
| MAMMOGRAPHIES. |
| PAP SMEARS |
| PRENATAL CARE |
| Kouides et al., 1993 | RCT | Immunization rates | For practices in the incentive group, the mean immunization rate was 68.6% (SD 16.6%) compared with 62.7% (SD 18.07 o ) in the control group practices (P = .22). The median practice-specific improvement in immunization rate was +10.3% in the incentive group compared with +3.5% in the control group (P = .03). |
| St Jacques et al., 2004 | Before and afterNo control group N= 31 anaesthesiologists, | percentage of first cases of the day in the room at or before the scheduled in-room time | shows that the percentage of first cases of the day meeting the goal of being in the OR at or before their scheduled start time was significantly higher during the sixth month of the study (19 ± 15% vs. 61 ± 19%, p < 0.01),  |
|  percentage of cases with an anesthesia prep time less than a target | and that the percentage of cases meeting the goal of an anesthesia preparation time of less than 15 minutes increased over the study period (57 ± 18 vs. 73 ± 14, p < 0.01). |
|  percentage of cases delayed due to waiting for an anesthesiology patient evaluation  | delays from waiting for an anesthesia attending were not significantly changed, whereas delays from lengthy anesthesia preparation or emergence time were decreased (14 ± 9 vs. 3 ± 3, p < 0.01) during the study period. |
| Salize et al., 2009  | Cluster-randomised smoking cessation trial. Main outcome was cost-effectiveness but abstinence rates also compared with mixed logistic regression | Smoking cessation  | The TI intervention was not effective compared with TAU. The point prevalence of abstinence at 12 months was 3.5% vs 2.7%, OR 1.29, 95% CI 0.25 to 6.84, p=0.75 |
| McMenamin et al., 2003 | Cross-sectional survey Control group  | Numbers of HMOs providing smoking cessation advice and other interventions such as self help materials and NRT | OR 3.63 (95% CI 1.70 to 7.76, p<0.001), providing NRT starter kit OR 2.75 (95% CI 1.33 to 5.65, p=0.006), providing written materials: on pharmacotherapy OR 2.13 (95% CI 1.04 to 4.33, p=0.034), counselling OR 3.11 (95% CI 1.50 to 6.44, p=0.002), self-help OR 2.33 (95% CI 0.93 to 5.84) |
| Chee et al, 2007GAVI Incentives for national governments | the evaluators utilized a regression model for 52 countries that received ISS funds from 1995 to 2005 and in-depth qualitative studies in six countries (3 matched pairs of countries with similar circumstances and starting baseline coverage and different results). |  | A relationship was found between ISS funding and in- creased immunization coverage. |
| Eichler et al., 2007Haiti: RBF for NGO | Before and after with no control group  | Immunization coverage for children  | 6.2%  |
| Percentage of pregnant women receiving at least 3 prenatal care visits | 2.2%  |
| Percentage of deliveries assisted by a trained attendant | 3% |
| Percentage of women receiving a postnatal care visit | 7.8% |
| CORT 2007 | The program was evaluated using a mix of quantitative (survey) and qualitative (interviews) methodsBefore and after with no control group  | Institutional deliveries  | The proportion of institutional deliveries increased from 32.5% to 65.1% and the number of institutional deliveries in the public sector in Rajasthan state increased by 36% the year after the JSY was established compared to a slight decrease (−0.25%) the previous year ( |
| Armour et al., 2004 | Before and after: no control group. | Cancer screening  | Results: From 2000 to 2001, CRC screening use increased from23.4% to 26.4% (P < .01). Results from the multivariate logistic regression analysis revealed that the probability that a patient received a CRC screening was approximately 3 percentage points higher in the bonus year, 2001 (P < .01). |
| Chen et al., 2010 | Longitudinal study with control groups  | Diabetes care | Patients with diabetes who saw P4Pparticipating physicians were more likely to receive quality care than those who did not (odds ratio, 1.16; 95% confidence interval, 1.11-1.22; P <.001).  |
| Patients with diabetes who received quality care were less likely to be hospitalized than those who did not (incident rate ratio, 0.80; 95% confidence interval, 0.80-0.85; P <.001). |
| During 1 year, there was no difference in hospitalization rates between patients with diabetes who saw P4P-participating physicians versus those who did not.  |
| However, patients with diabetes who saw P4P-participating physicians in 3 consecutive years were less likely to be hospitalized than those who did not (incident rate ratio, 0.75; 95% confidence interval, 0.61-0.93; P <.01). |
| Greene et al., 2004  | Before and after with control groupStated that they had used a historical control but reported results for before and after studies N= approximately 900 credentialed primary care physicians as of December 1999, October 2000, and December 2001.  | Proper hospital care  | A statistical process control chart showed a shift toward recommended treatment patterns after our intervention. The rate of exceptions per episode of acute sinusitis decreased 20%, from 326 exceptions per 1000 episodes between January 1, 1999, and October 31, 2000, to 261 between November 1, 2000, and December 31, 2001. P < .005. |
| Decreased use of less effective or inappropriate antibiotics accounted for most of the change (199 to 136 exceptions per 1000 episodes [32% change]). Azithromycin use decreased 30%, from 97 to 68 prescriptions per 1000 episodes. P < .005. |
| Firstline antibiotic (amoxicillin and doxycycline) use increased 14%, from 451 to 514 prescriptions per 1000 episodes.  |
| Inappropriate radiology use decreased 20%, from 15 to 12 per 1000 episodes. These changes were significant at P < .005. |
| Bardach et al., 2014 | Rct Participating practices (n=42 for each group) had similar baseline characteristics, witha mean (median) of 4592 (2500) patients at the incentive group practices and 3042 (2000) at thecontrol group practices. | Aspirin therapy, withIVD or DM | Odds ratio 1.28 (1.10 to 1.50) Pvalue= .001 |
| Blood pressure controlNo IVD or DM | 1.23 (1.05 to 1.44) Pvalue=.01 |
| Blood pressure control IVD | 0.71 (0.40 to 1.24) Pvalue=0.23 |
| Blood pressure control DM | 1.52 (1.12 to 2.07) Pvalue=.007 |
| Blood pressure control IVD or DM | 1.37 (1.07 to 1.75) Pvalue=.01 |
| Cholesterol control | 0.86 (0.67 to 1.09) Pvalue=.22 |
| Smoking cessation intervention | 1.30 (1.04 to 1.63) Pvalue= .02 |
| Bischoff et al, 2012  | Before and after No control group N=123 residents  | Completion of discharge summary  | With implementation of the bundle, the average time from patient discharge to completion of the discharge summary fell from 3.5 to 0.61 days (p<0.001).  |
| Percentage of summaries completed on day of discharge  | The percentage of summaries completed on the day of discharge rose from 38% to 83% (p<0.001)  |
| The percentage of summaries that included all recommended elements | The percentage of summaries that included all recommended elements increased from 5% to 88% (p<0.001). |
| Boland et al., 2010 | Before and after no control group N=81 radiologist | Radiologist report turnaround time | The mean C–F times for all radiologists significantly decreased from the baseline (42.7 hours) to the immediate period (31.6 hours) to the post period (16.3 hours) (p < 0.0001).  |
| Similarly the mean C–P time also declined for all three periods from 20.0 hours at baseline to 19.0 hours at the immediate period to 11.9 hours during the post period (p < 0.0001).  |
| Kruse et al., 2013 | Before and after with control group | Smoking status documentation | Documentation increased from 48% of 207,471 patients before P4P to 71% of 227,574 patients after P4P. Improvement occurred both among P4P-eligible patients, 56% to 83%(AOR, 3.6; 95% CI, 2.9 to 4.5) and the comparable subset of non-P4P-eligible patients, 56% to 80% (AOR, 3.0; 95% CI, 2.3 to 3.9). The difference in improvement between groups was significant (AOR, 1.3; 95% CI, 1.1 to 1.4, p=0.009). |
| Peabody et al., 2011 | Controlled trialN = 10 for both populations | Composite scores of about 4 process measures  | at thirty-six months after the intervention, bonus sites were 9.7 percentage points higher than baseline (p < 0:001). |

**Supplementary file S7 P4P Typology tool (Ogundeji, 2015)**

|  |
| --- |
| **Who received the incentive (Did Individuals or Groups receive the incentive)?** |
| Criteria for judging **Individuals** | * If the incentives are paid directly to individual health workers/clinicians/doctors only
* If individual health worker/clinician/doctor’s income is supplemented as a result of the incentive (e.g. reflected in the rise of personal income) only
 |
| Criteria for judging **Groups (including schemes where individuals and groups are paid bonuses)** | If the incentive is paid to a group or an organization in which individual clinicians may or may not benefit from the incentive directly Groups include any of the following * Hospital
* Clinical team
* General physician (GP) practice
* NGO
* Levels of government
* Faith based organizations
 |
| **Type of incentive (Was the incentive in the form of Fines or Bonuses)?** |
| Criteria for judging **Fines** | If the incentive is negative in the form of reduction in expected payments, penalty, punishment etc.In some cases, bonuses may or may not be paid as well |
| Criteria for judging **Bonuses** | If incentive is in the form of increase in payments, bonus, gifts etc. with NO fines levied |
| **Size (Was the size of the incentive small or large)?** |
| Criteria for judging **Small** | If the incentive in the P4P programme is smaller than 5% of any one of the following:* Salary of individual clinician/health worker/doctor
* Anticipated payments (to the health facility/hospital/clinical team) such as budgets (total budget or budget for the particular intervention in question), fee for service (FFS) and capitation
 |
| Criteria for judging **Large** | If the incentive in the P4P programme is 5% and above of any one of the following:* Salary of individual clinician/health worker/doctor
* Anticipated payments (to the health facility/hospital/clinical team) such as budgets (total budget or budget for the particular intervention in question), fee for service (FFS) and capitation
 |
| **Timing of payment after achieving targets (time lag): was it short or long?** |
| Criteria for judging **short** | If incentive payment (or penalty) is received not more than 4 months after measurement and confirmation of performance  |
| Criteria for judging **long** | If incentive payment (or penalty) is received more than 4 months after measurement and confirmation of performance  |
| **Domain of performance measured (Was the domain of performance measure within clinicians control or out of clinicians’ control)?** |
| Criteria for judging **within clinicians control** | If incentive payments to health service providers are **mostly/only** based on processes and structures e.g. number of children immunized, routine measurement of blood pressure of patients every month, number of referrals made, rate of cancer screening |
| Criteria for judging **out of clinicians control** | If incentive payments to health service providers depend on achieving a change in health outcomes e.g. reduction in mortality rates from a specific disease, blood pressure reduction, patient experience etc. |
| **Performance measure (payment scale) Absolute or relative measure?** |
| Criteria for judging **Absolute measure**  | If incentive is paid (fine levied) to the health service provider that based on their performance, not relative to how other health providers perform. For example, * Improvement in performance typically improvement from some baseline measure, using performance score/ performance points achieved
* Achieving performance at/above a predetermined target
* e.g. incentive paid per patient immunized, or 70% improvement from baseline
 |
| Criteria for judging **Relative measure** | If incentive payment is based on the performance of health service providers, relative to that of other providers.For example,* If bonuses are paid for to health service providers in a specific performance rank e.g. the providers above the top quartile of performance.
* And/or
* If fines are levied on health service providers in certain ranks usually the bottom ranks e.g. the providers below the lower quartile of performance
 |
| **Risk: High risk or low risk? (based on judgements from Performance measure, Time lag, and Domain of performance measure** |
| Criteria for judging **High risk** | If the P4P programme has 2 or more of the following features* If incentive payment (or penalty) is made **after 4 months after measurement and confirmation of performance (long time lag)**
* If the domain of performance measure was **mostly out of clinicians control**
* If the perofmance measure (payment scale) is a **relative measure**
 |
| Criteria for judging **Low risk** | If the P4P programme has 2 or more of the following features* If incentive payment (or penalty) is made before or at 4 months after measurement and confirmation of performance **(short time lag)**
* If the domain of performance measure was mostly **within the clinicians control**
* If the performance measure (payment scale) is an **absolute measure**
 |

**Supplementary file S8 Formulas and calculations used to convert effect estimates of P4P to standardized mean difference**

**Formulas**

**Conversion from percentage or number of events to odds ratio**

Where sample size (N) and percentages or number of events were reported we estimated odds ratio (OR) and associated standard errors (SE), using the formulas below:

OR = (Nei /Ni- Nei) / (Nec/Nc- Nec)

Where:

* Nei = number of events in intervention group
* Ni = total sample size in intervention group
* Nec= number of events in control group
* Nc= total sample size in control group

SE (logOR)= √{ (1/ Nei) + (1/ Ni- Nei) + (1/Nec ) + (1/ Nc- Nec)}

**Conversion from odds ratio (OR) or mean difference (MD) to standardized mean difference (d)**

d = logoddsratio \* √3/ π

Varianced = Variance of log odds \* 3/ π2

d= mean difference/SD

SEd= √Varianced

SEd= SE\*√3/ π

**Combining effect sizes for multiple outcomes within a study**

Summary effect for two outcomes in a study



Variance

****

Or

Summary effect for more the two outcomes in a study



Variance



Where v= mean of all variance, r= mean of all correlations.

Variance inflation factor (VIF)= Variance \* VIF



Where m is the number of outcomes and r is the correlation

**Other important formulas used in the conversion**

If a 95% confidence interval is available for an absolute measure of intervention effect (e.g. SMD, risk difference, rate difference), then the standard error can be calculated as

SE = (upper limit CI – lower limit CI) / 3.92.

Variance =SE2

SE = √Variance

Standard deviation (SD) = √N \* (upper CI limit-lower CI limit)/3.92 (FOR 95% CI)

SD= √N \* SE

**Supplementary File S9 List of identified primary studies**

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**Supplementary File S10 List of excluded studies**

**Reason for exclusion: Studies that did not evaluate the effects of P4P on healthcare quality/cost/performance/outcomes e.g. implementation studies or studies exploring the take up of p4p**

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**Reason for exclusion: Poor /unclear reporting of outcomes**

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**Reason for exclusion: Qualitative studies**

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**Supplementary file S11 Characteristics of included studies**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Recipient of incentive**  | **Size of incentive**  | **Risk**  | **Evaluation design**  | **Type**  |
| **Individuals** | **Groups**  | **Small**  | **Medium**  | **Large**  | **Low**  | **High** | **No control** | **Quasi-experimental**  | **RCT** | **A** | **B** | **C** |
| **Outcomes with statistically significant positive effect (N=190)****n (%)**  | 33 (17.3) | 156 (81.7) | 29 (16) | 43 (23.8) | 109 (60.2) | 147 (78.2)  | 41 (21.8) | 93 (48.9) | 86 (45.3) | 11 (5.8) | 102 (57.3) | 49 (27.5) | 27 (15.2) |
| **Other outcomes (N=80)** * **no statistically significant effect**
* **statistically significant negative effect**
* **negative effect**

**n (%)** | 12 (15) | 68 (85) | 21 (27) | 12 (15.4) | 45 (57.6) |  79 (75.2) |  26 (24.8) | 5 (6.3) | 62 (77.5) | 13 (16.2) | 37 (47.5) | 26 (33.3) | 15 (19.2) |
| **Total** **number of outcomes (270)** **n (%)** | 45 (16.7) | 224 (83.3) | 50 (19.3) | 55 (21.2) | 154 (59.5) | 226 (77.1) | 67 (22.9) | 98 (36.3) | 148 (55.2) | 24 (8.5) | 139 (54.8) | 75 (29) | 42 (16.2) |

**\*type A-schemes with high chance of success, type B-schemes with medium chance of success, type C- schemes with low chance of success \*number of studies= 96**

**Supplementary file S12 List of included studies in the meta- analyses**

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18. Li YH, Tsai WC, Khan M, et al. The effects of pay-for-performance on tuberculosis treatment in Taiwan. *Health policy and planning* 2010; **25**(4): 334-41.
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**Supplementary file S13 Extraction of additional data for studies included in meta-analyses**

| **Program** | **Study**  | **Effect type** | **Outcome**  | **Intervention** **Data** | **Control** **Data** | **Reported effect size** | **LCI** | **UCI** | **d Standardized mean difference)**  | **Vd****Standardized variance)**  | **SEd** **Standardized standard error**  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Kouides et al 1998 | Kouides et al 1998  | % Change  | Immunization rates in the elderly  | The mean immunization rate was 68.6% (SD 16.6%) N=53 | 62.7% (SD 18.0%) in the control group practices (P = .22).N=82 |  |  |  | 0.197 |  | 0.243 |
| An et al., 2008 | An et al., 2008 | %Change  | Smoking cessation referral rates  | 11.4% (95% CI, 8.0%-14.9%)N=25 | 4.2% (95% CI, 1.5%-6.9%)N=24 |  |  |  | 0.059 |  | 0.089 |
| Premier program  | Glikman et al., 2007 | Odds ratio | CMS composite measure  | 0.91(95% CI 0.84-0.99)N=54 | 0.97(95% CI 0.94-0.99)N=446 |  |  |  | -0.015 |  | 0.022 |
| California P4P | Cutler et al., 2007 | % Change | Diabetes care ldl test | 72.8% N=165  | 55.7%N=1694 |  |  |  | 0.180 |  | 0.100 |
| Rosenthal et al., 2005 | Mean difference  | Cervical screening  |  | N=300 | 3.6  |  |  | 0.115 | 0.003 | 0.058 |
| Mammography  | 1.7  | 0.065 | 0.003r estimated at 0.5Vd= 0.001 | 0.058SEd =0.032 |
| St Jacques, et al, 2004 | St Jacques, et al, 2004 | % change  | percentage of first cases of the day in the room at or before the scheduled in-room time | 61 ± 19%, (SD)±6.5% (CI)N-1439 | 19 ± 15% (SD)±4.5% (CI)N= 1261 |  |  |  | 0.454 | 0.002 | 0.049 |
|  percentage of cases with an anesthesia prep time less than a target | 73 ± 14% (SD)±5.1% (CI)N-1439 | 57 ± 18% (SD)±5.3% (CI) N= 1261 |  |  | 0.171 | 0.002 | 0.045 |
| percentage of cases delayed due to waiting for an anesthesiology patient evaluation  | 3 ± 3% (SD)±1% (CI)N-1439 | 14 ± 9%% (SD)±2.9% (CI)N= 1261 |  |  | 0.399Dtotal= 0.341 | 0.009r= 0.75Vd total =0.0008 | 0.096SE d= 0.029 |
| Bischoff et al, 2012 | Bischoff et al, 2012 |  (%)Before and after data | Percentage of summaries completed on day of discharge  | 38%N=563 | 83%N=2560 |  |  |  | 0.497 | 0.003 | 0.056 |
| Inclusion of all recommended elements on summary  | 5%N=80 | 88%N=80 |  |  | 1.03Dtotal=0.76 | 0.101VD= 0.077 | 0.3180.227 |
| National Health Insurance P4P (NHI-P4P)Taiwan  | Lee et al., 2010 | Mean difference  | Essential diabetes exams and tests | All patients in the P4P program (n = 12,499). | Comparison group (n = 26,172)  | 2.450  |  |  | 0.655 |  | 0.005 |
| Rwanda PBF program  | Basinga et al., 2011 | Mean difference | Any prenatal care | N=80 | N=86 | 0·002  | −0•021  | 0•025 | 0.013 | 0.006 | 0.079 |
| Four or more prenatal care visits | 0·008  | −0•063  | 0•079 | 0.017 | 0.005 | 0.077 |
| Institutional delivery | 0·081  | 0·015  | 0·146 | 0.035 | 0.005 | 0.077 |
| Tetanus vaccine during prenatal visit | 0·051  | −0·002  | 0·103 | 0.148 | 0.006 | 0.078 |
| Standardized total quality score | 0·157  | 0·026  | 0·289 | 0.188 | 0.006 | 0.078 |
| Younger than 23 months preventive visit, previous 4 weeks | 0·119  | 0·041  | 0·198 | 0.243 | 0.006 | 0.078 |
| 24–59 months preventive visit, previous 4 weeks | 0·111  | 0·059  | 0·162 | 0.178 | 0.006 | .079 |
| 12–23 months fully immunized | −0·055  | −0·184  | 0·074 | -0.065d=0.095 | 0.006r=0.50.002 | 0.0780.041 |
| QOF | Campbell et al., 2009 | Mean difference  | Coronary heart disease  |  |  | -0.250n=42 | -0.401  | 0.100 |  -0.302 | 0.024 | .155 |
| Asthma  | -0.468n=42 | -0.748  | 0.187 | . -0.302 | 0.024 | .154 |
| Diabetes  | -0.220n=42 | -0.313  |  -0.127 | -0.717 | 0.023 | 0.153 |
| Continuity of care | 0.091n=42 | 0.025 | 0.157 | 0.413d=-0.227 | 0.023r=0.50.053 | 0.1530.229 |
| AQ | Sutton et al, 2012 | Percentage points | 30 day Mortality for CABG and other heart related diseases  | N 134435 Percentage change -1.8% | N 722139Percentage change -0.9% | 1.3  | 0.4 | 2.1 | 0.166 |  | 0.013 |
| Premier  | Jha et al., 2012 | Percentage points  | 30 day Mortality for CABG and other heart related diseases | 11.82%N= 137287 | 11.74%Control=1094034 | 0.08 | −0.30 | 0.46 | 0.002 |  | 0.005 |
| Premier  | Lindenauer et al., 2007 | Percentage points | Composite measure of process indicators | N= 116613 | N=192381 | 4.3  | 3.0 | 5.7 | 0.155 |  | 0.008 |
| QOF | Doran et al. 2011 | Mean difference  | Composite measure of process indicators | N=653 500 | N=653 500 | 1.9  | 1.4 | 2.5  | 0.008 |  | 0.154 |
| QOF  | Kontopantelis et al. 2012 | Percentage points  | Composite quality score on diabetes in the first year | 67.3% | Ntotal= 23,78060% | 7.3 | 6.7 | 8.0 | 0.270 |  | 0.011 |
| QOFBefore and afterQOF design | Simpson et al., 2011 | OR | Blood pressure below target <150/90 | 1.11 (1.04 to 1.19) | 0.74 (0.67 to 0.82) | N=315 |  |  | 0.097 |  | 0.030 |
| QOF  | Srirangalingam et al., 2006 | Percentage points  | Number with HbA1c >7.4% (%) | No (%)32, 296 9.7%0.031 0.003 | No (%)34, 285 10.6%0.029 0.004 | 0.9 | - 0.4, | 1.3 | 1.1040.259d=0.024 |  | 0.143 |
| QOF | Cupples et al., 2014 | Percentage points  | Smoking status documentation | No (%)76 (16.9) N=44976/449-76=0.2040.013, 0.003 | N (%) 40 (13.4)N=29940/229-40=0.2120.025 0.005 | 3.5 | -1.8 | 8.6 | OR=0.962.Se= 0.214D= -0.009 |  | 0.118 |
| QOF | Vaghela et al, 2008 | Percentage points  | Diabetes outcome target A1C <or=7.5%, | N =2087478N reaching target=1186695 | N =1764063N reaching target=845522 |  |  |  | 0.086 | 0.0012 | 0.001 |
| Blood pressure <or=145/85 mmHg | N =2087478N reaching target=1518780 | N =1764063N reaching target=1064995 |  |  |  | 0.134 | 0.0012 | 0.001 |
| Cholesterol <or=5 mmol/l was determined | N =2087478N reaching target=1545301 | N =1764063N reaching target=1092954 | 3.99  | 3.92  | 4.07 | 0.134d=0.118 | 0.00120.000002 | 0.0010.001 |
| National Health Insurance P4P (NHI-P4P)Taiwan  | Chang et al, 2008 | OR | Smoking cessation  | N= 3446 | N=1823 |  0.96 | 0.87 | 1.06 | SMD= -0.010SE of log odds=0.048 |  | SE (d)= 0.026 |
| National Health Insurance P4P (NHI-P4P)Taiwan  | Kuo et al., 2011 | OR  | Quality of care of breast cancer  (enroless vs non enrollees) | 0.70N= 4,528 patients in total | 0.63 | 0.062 | 0.050 | 0.074 | 0.664 |  | 0.003 |
| National Health Insurance P4P (NHI-P4P)Taiwan  | Li et al., 2010 | OR | TB cure rate in the first 12 months  | N= 25754 | N= 33536 | 1.338 | 1.159 | 1.544 | **0.070**SE=0.098  |  | 0.054 |
| Hawaii medical group | Gilmore et al., 2007 | OR | Recommended care (a composite score from 11 indicators) | N was not reported |  | 1.27  | 1.09 | 1.40 | **0.057****SE = 0.079** |  | 0.044 |
| Hudson health plan | Chien et al., 2010 | OR | Childhood vaccinations | N=155  | N=16 | 1.65  |  |  | **0.120**SE= 0.24 |  | 0.132 |
| McMenamin et al, 2003 | McMenamin et al, 2003 | OR | Smoking cessation advise |  |  | 3.63N=1104 | 1.7 | 7.76 | 0.309SE= 1.546 |  | 0.852 |
| Salize et al 2009 | Salize et al 2009 | OR | Smoking abstinence | N=20We might need patient sample here | N=21 | 1.28 | 0.25 | 6.48 | 0.059SE= 1.589 |  | 0.876 |
| Twardella and Brenner, 2007 | Twardella and Brenner, 2007 | OR | Smoking cessation |  | Participants: 577 patients in 82 practices | 1.26N=557 | 0.65 | 2.43 | 0.055SE= 0.454 |  | 0.250 |
| Kruse et al., 2013 | Kruse et al., 2013 | OR | Smoking status Documentation | N =227574 | N 207,471  | 1.3 | 1.1 | 1.4 | 0.062SE= 0.077 |  | 0.042 |
| Chen et al., 2010 | Chen et al., 2010 | OR | Quality of diabetes care | 19,193 | 32,365 | 1.16 | 1.11 | 1.22 | 0.035SE= 0.028 |  | 0.015 |
| QOF | Coleman et al., 2007 | OR | Brief advise to smokers | No N |  | 3.03 | 2.89 | 3.09 | 0.265SE= 0.051 |  | 0.028 |
| QOF | Calvert et al., 2009 | OR | HbA1c levels of ≤7.5% |  | N=147  | 1.05 | 1.01 | 1.09 | 0.011SE= 0.020 |  | 0.011 |
| QOF | Simpson et al., 2010 | OR | Smoking status reporting  | Total N= 525R=0.75 |  |  4.45  | 4.43  | 4.46 | 0.357 | 0.0042 | 0.004 |
| Smoking cessation advise  | 6.75 | 6.66  | 6.85 | 0.457 | 0.0262 | 0.026 |
| Smoking cessation referral  | 7.32  | 6.92  | 7.73 | 0.467 | 0.013 | 0.114 |
| Quit rates  | 0.73  | 0.72 | 0.73 | -.075d=0.3015 | 0.0012r= 0.750.013 | 0.0010.115 |
| Bardach et al, 2014Fagan et al., 2010. | Bardach et al, 2014 | OR | Aspirin therapy, withIVD or DM | N=42R=0.75 | N=42 | 1.28 | 1.10 | 1.50 | 0.059 | 0.003 | 0.056 |
| Blood pressurecontrolNo IVD or DM | 1.23 | 1.05 | 1.44 | 0.050 | 0.003 | 0.055 |
| Blood pressurecontrolIVD | 0.71 | 0.4 | 1.24 | -0.82 | 0.014 | 0.118 |
| Blood pressurecontrolDM | 1.52 | 1.12 | 2.07 | 0.100 | 0.018 | 0.134 |
| Blood pressurecontrolIVD or DM | 1.37 | 1.07 | 1.75 | 0.075 | 0.009 | 0.096 |
| Cholesterol control | 0.86 | 0.67 | 1.09 | -0.36 | 0.003 | 0.059 |
| Smoking cessationintervention | 1.30 | 1.04 | 1.63 | 0.063mean d=-0.119 | 0.0070.033 | 0.0830.183 |
| Fagan et al., 2010 | OR | Influenza vaccine | N= 1587Around diabetes= 0.75 | N=19356 | 1.79  | 1.37 | 2.35 | 0.139 | 0.019 | 0.138 |
| Hemoglobin testing  | 0.44  | 0.33 | 0.65 | -0.196 | 0.031 | 0.176 |
| Eye exam | 0.98 | 0.61 | 1.58 | -0.005 | 0.285 | 0.534 |
| Ldl test  | 0.62 | 0.44 | 0.86 | -0.114 | 0.053 | 0.231 |
| Nephropathy test | 0.96 | 0.62 | 1.46 | -.010dtotal= -0.0372 | 0.184r=0.750.366 | 0.4290.605 |
| Gavagan et al, 2010 | Gavagan et al, 2010 | 0R | Pap smears  |  |  |  |  |  | 0.162 | 0.043 | 0.208 |
| Mammograms  |  |  | 0.093 | 0.096 | 0.309 |
| Pediatric immunization  |  |  | 0.426r=0.5dtotal= 0.187 | 0.7210.382 | 0.8490.618 |
| Larsen et al , 2003  | Larsen et al , 2003  | % change  | Diabetes care  | N=943652.85 | N= 578533.5% |  |  |  | 0.190 |  | 0.019 |
| Tsai et al., 2010 | Tsai et al., 2010 | % change | Tb treatment  | N= 1643489.96% no default in treatment  | N= 63887.30% no default in treatment  |  |  |  | 0.047 |  | 0.067 |

**Supplementary file S14 Funnel plot and contour enhanced funnel plot for all 37 studies included in the meta-analysis**

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**Supplementary file S15 Forest plot showing subgroup analyses by quasi-experimental evaluation design**



Supplementary file S16 Random effects parameters of the multilevel logistic regression model

|  |  |  |  |
| --- | --- | --- | --- |
| **Random-effects parameters** | **Estimate**  | **Standard error** | **95% CI** |
| P4P scheme sd(\_cons) | 3.51e−08 | 0.62 | 0.00-0.00 |
| P4P study sd(\_cons) | 1.83 | 0.45 | 1.12-2.96 |

**sd(\_cons): standard deviation at each level**

**Supplementary file S17 Sensitivity analyses results for change in correlation values to account for multiple outcomes within schemes in the meta-regression model**

|  |  |  |
| --- | --- | --- |
| **Explanatory variables****(Number of studies=36)** | **SMD (univariate model)****[95% CI]**  | **SMD****(Multivariate model) [95% CI]**  |
| **Who receives the incentive: payment to groups compared to payment to individuals** | 0.002 (-0.184, 0.193) P= 0.989 | -0.009 (-0.200, 0.184) P= 0.925 |
| **Size of incentive: large incentive compared to small incentive**  | 0.101 (-0.064, 0.272) P=0.220 | 0.116 (-0.077, 0.309) P=0.229 |
| **Perceived risk of not earning the incentive (Risk): low risk compared to high risk** | 0.009 (-0.146, 0.163) P=0.930 | 0.002 (-0.202, 0.139) P= 0.693**Evaluation**: -0.020 (-0.173, 0.142) P=0.834 |

**Outcome variable: P4P effect estimate (standardized mean difference)**

**Supplementary file S18 sensitivity analyses results for change in categorisation of binary outcomes in the multilevel logistic regression model**

|  |  |  |
| --- | --- | --- |
| **Explanatory variables****(Number of studies=96)**  | **OR (univariate model) (95% CI)**  | **OR multivariate model) (95% CI)** |
| **Who receives the incentive: payment to groups compared to payment to individuals** | 1.25 (0.31- 5.89)P=0.756 | 1.98 (0.72-6.88)P=0.350 |
| **Size of incentive: large incentive compared to small incentive**  | 4.24 (1.02- 17.66)P=0.049 | 3.36 (1.09-10.88)P=0.039 |
| **Perceived risk of not earning the incentive (Risk): low risk compared to high risk** | 2.95 (0.78-9.86)P=0.113 | 0.68 (0.22-1.94)P=0.369 |
| **Evaluation design: No adequate control group compared to RCTs or quasi-experimental studies** | 23.22 (6.28-85.73)P<0.0001 | 24.09 (6.31-90.76)P<0.0001 |