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Individual performance-based incentives for health care workers in organization for economic co-operation and development member countries: A systematic literature review

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ABSTRACT

In response to rising costs and growing concerns about safety, quality, equity and affordability of health care, many countries have now developed and deployed performance-based incentives, targeted at facilities as well as individuals. Evidence of the effect of these efforts has been mixed; it remains unclear how effective strategies of varying design and magnitude (relative to provider salary) are at incentivizing individual-level performance. This study reviews the current evidence on effectiveness of individual-level performance-based incentives for health care in organization for Economic Co-operation and Development countries, which are relatively well situated to implement, monitor and evaluate performance-based incentives programs. We delineate the conditions under which sanctions or rewards – in the context of gain-seeking, loss aversion, and increased social pressure to modify behaviors – may be more effective. We find that programs that utilized positive reinforcement methods are most commonly observed – with slightly more overall bonus incentives than payment per output or outcome achieved incentives. When comparing the outcomes from negative reinforcement methods with positive reinforcement methods, we found more evidence that positive reinforcement methods are effective at improving health care worker performance. Overall, just over half of the studies reported positive impacts, indicating the need for care in designing and adopting performance-based incentives programs.

1. Introduction

Globally, there is a growing interest in a broad range of strategies to achieve better health outcomes through ameliorating weak or inefficient performance by providers in health systems [1]. Some of these aim to address knowledge and capacity gaps, others the work environment for providers, but a third group focus on increasing the effort that providers make in undertaking their work [2]. Health care workers (HCWs) are individuals with formal training or experience who provide care and services to the sick or ailing. These skilled workers include doctors, nurses, midwives, paramedics, medical or nursing students, and laboratory technicians. Performance based incentives (PBI) that are targeted at HCWs is one intervention that aims to address weak provider incentives to expend effort on public priority areas. In PBI schemes, health care providers receive incentives – financial or non-financial – based on specific performance measures and targets that may relate to clinical quality, resource utilization, and patient outcomes [3]. Examples include interventions such as providing bonus payments for each fully immunized child, health and wellness retreat for teams meeting the organizational targets, or payment of quarterly bonus checks based on achievement of quality indicators. The mechanism by which PBI interventions seek to modify the behavior of HCWs is grounded in associative learning processes. Operant

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Abbreviations

HCW	health care worker
OECD	organization for Economic Co-operation and Development
PBI	performance-based incentives
P4P	pay for performance
QOF	quality outcomes framework

conditioning describes how purposeful behavior operates upon the environment to generate consequences [80]. In this context subjects learn or change their behavior by creating an association between a behavior and a consequence. In doing so, reinforcement increases the frequency of a behavior, while punishment decreases the frequency of the behavior.

The organization for Economic Co-operation and Development (OECD) member countries – a cohort of democratic countries that support free-market economies – have deployed a range of PBI strategies in health care. This group of 38 countries is relatively wealthy, accounting for around 50% of global gross domestic product (GDP) [4]. Simultaneously, these countries are facing aging populations, with individuals living longer and birth rates declining, leading to higher public expenditures while experiencing a slowdown in labor force growth – thus labor shortages – and lower economic growth [5].

Health systems in OECD countries are under stress from rising costs of care, reluctance to pay more, and growing concerns about safety, quality, equity and affordability. In response, many OECD countries have now developed and implemented national pay for performance (P4P) systems, a form of PBI based on financial incentives, targeted at facilities as well as individuals. Nevertheless, evidence of the effect of these efforts has been mixed [6–8]. Specifically for OECD countries, a review published in 2016 found that P4P programs in the inpatient sector of 14 OECD countries showed only moderately positive effects [9]. Equally, a recent systematic review of P4P in low and middle income countries found mixed evidence, particularly when adjusting for additional resources introduced by P4P programs [10]. Few studies have concentrated on individual-level incentives exclusively, and rather report the total effect of a P4P program on an organization as a whole, including teams, departments, and individuals. However, more clarity on the direct effect of P4P programs on individual HCWs – excluding indirect impacts passed down from a P4P intervention on non-individual targets to individuals – is necessary. Furthermore, understanding how direct effect relates to the overall effect of the intervention provides better clarity of the contagious spillover effect from individuals upon a group or hospital. It remains unclear how effective different financial PBI strategies of varying design and magnitude (relative to provider salary) are at incentivizing individual-level performance, or under what conditions negative and positive reinforcements specified by PBI strategies are effective at achieving desired outcomes.

This study aims to review the current evidence on the effectiveness of PBIs, focusing on individual-level financial PBIs for health care in OECD countries. These countries are relatively well able to implement, monitor and evaluate PBI programs, thus allowing us to draw lessons for other settings where they are under consideration. We focus on delineating the conditions under which sanctions or rewards – in the context of gain-seeking, loss aversion, and increased social pressure to modify behaviors – may be more effective. A systematic understanding of which strategies are successful at improving healthcare in varying contexts may contribute to decision-makers designing and implementing effective policies and achieving systems' goals.

2. Methods

2.1. Study design

The review was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting standards [11]. We searched the following databases in July 2021 for studies evaluating individual level performance-based incentives in OECD member countries: MEDLINE, Scopus, Embase, Web of Science, CINAHL, and Google Scholar. Reference lists of all full-text articles were searched, and any additional relevant articles were added. A sample of Cochrane search terms. The full search strategy is included in Box 1.

Box 1. : Cochrane Search Terms

("Health personnel"[Mesh] OR "health worker?"[tw] OR "healthcare worker?"[tw] OR "medical worker?"[tw] OR "hospital worker?"[tw] OR "nursing worker?"[tw] OR "social worker?" OR "health professional?" OR "healthcare professional?" OR "medical professional?" OR "hospital professional?" OR "nursing professional?" OR "health worker personnel" OR "healthcare personnel" OR "medical personnel" OR "hospital personnel" OR "nursing personnel" OR "health worker manpower" OR "healthcare manpower" OR "medical manpower" OR "hospital manpower" OR "nursing manpower" OR "health worker staff" OR "healthcare staff" OR "medical staff" OR "hospital staff" OR "nursing staff" OR "human resources" OR "human resources for health" OR "human resource for health" "doctor?" OR "physician?" OR "nurse?" OR "midwife" OR "midwives" OR "midwifery" OR "mid-wife" OR "mid-wifery" OR "mid-wives" OR "paramedic?" OR "medic?" OR "pharmacist?" OR "medical officer?" OR "clinical officer?" "medical student?" OR "nursing student?" OR "medical resident?" OR "medical graduate?" OR "nursing graduate?" OR "birth attendant?" OR "lab technician?" OR "laboratory technician?" [tw])
AND
("Reimbursement, Incentive" [Mesh] OR "performance based incentive"[tw] OR "performance based incentives" [tw] OR "pay-for-performance" [tw] OR "P4P" [tw] OR "pay for performance" [tw] OR "performance based pay" [tw] OR "performance based payment" [tw] OR "performance based financing" [tw] OR "results based financing" [tw] OR "performance based contracting" [tw] OR "performance related pay" [tw])
AND
("organization for Economic Co-Operation and Development"[Mesh] OR "OECD member?" [tw] OR "OECD country"[tw] OR "Australia" [tw] OR "Austria" [tw] OR "Belgium" [tw] OR "Canada" [tw] OR "Chile" [tw] OR "Colombia" OR "Czech Republic" OR "Denmark" OR "Estonia" OR "Finland" OR "France" OR "Germany" OR "Greece" OR "Hungary" OR "Iceland" OR "Ireland" OR "Israel" OR "Italy" OR "Japan" OR "Korea" OR "Latvia" OR "Lithuania" OR "Luxembourg" OR "Mexico" OR "Netherlands" OR "New Zealand" OR "Norway" OR "Poland" OR "Portugal" OR "Slovak Republic" OR "Slovenia" OR "Spain" OR "Sweden" OR "Switzerland" OR "Turkey" [tw] OR "United Kingdom" [tw] OR "United States" [tw])

2.2. Eligibility criteria

Studies were eligible for inclusion if they (1) described an intervention in an OECD member country; (2) assessed a financial incentive intervention which measures and rewards individual health worker performance directly; (3) used a quantitative analysis study design; (4) were in English, Spanish, or French; and (5) were published between 1 January 2010 and 7 July 2021. We restricted

Table 1
Key definitions used in the review.

Term	Definition
Performance-based incentive	Extra compensation granted or withheld for reaching pre-established goals or benchmarks.
Individual-level	Measuring or rewarding individual performance directly, either alone or as part of a team. This includes instances where team level measurements have consequences for individual compensation. Studies, where rewards cannot be awarded or shared at an individual-level, were excluded.

our review to the past 11 and a half years to capture data well equipped to inform contemporary decision making. For systematic findings on studies prior to 2011 please see the systematic review of systematic reviews on the effect of pay for performance by Eijkenaar et al. (2013) [3].

Quantitative study designs included but were not limited to: randomized control trials, cluster-randomized trials, interrupted time series analyses, cost-benefit analyses, cost-utility analyses, and cost-effectiveness analyses. Literature reviews were not included in our final review as they did not employ quantitative methods, however their references lists were searched for potentially appropriate studies. Quantitative studies that fall under the descriptive category were further evaluated and only were considered for inclusion only if they used acceptable methods for causal inference (i.e., studies that explicitly describe and leverage a research design and/or statistical method to determine the independent effect of a particular variable on a dependent variable).

Studies without empirical data, conference abstracts, posters, or protocols were excluded from the review. We followed definitions of key terms in determining the eligibility of studies (Table 1).

Any studies which did not include explicit statements on how recognition or performance was measured were excluded from this review. For example, a few studies assessed the impact of magnet hospital status on health outcomes [12–15]. Receiving a credential, such as a magnet hospital status, could be construed as an incentive awarded based on the performance of HCWs at the hospital and a reputational honor and reward for the HCWs who work at the site. However, without indicating that this recognition or how it was measured, we are unable to extract comparable estimates from these studies.

Furthermore, studies which did not explicitly mention measuring or rewarding individual performance were excluded. For example, we encountered numerous studies which assessed the UK Quality Outcomes Framework (QOF) but failed to clarify how the scheme interacted with individual providers. In theory, providers stand to benefit from rewards paid to their larger practice or hospital, and in many cases, providers should have some level of awareness for such rewards; but without details on how a reward is translated to measurable individual-level incentives, such type of indirect influence was excluded from our review. Similarly, we excluded studies for which data related to the incentive parameters, attributes and outcomes were missing as the results from these studies, which lack any understanding of the incentive structure, would not be comparable with the rest of our findings.

Duplicate studies were removed using Microsoft Excel (Microsoft Corporation, Redmond, Washington USA) [16]. Following PRISMA guidelines, two reviewers independently assessed studies for eligibility first by title and abstract, removing those that did not meet the criteria. Full texts of the remaining articles were then retrieved and screened again using the inclusion criteria. The risk of bias was assessed by the reviewers using the Mixed Methods Appraisal Tool (MMAT) [17]. Scores of this exercise can be found in Online Appendix Table 1. The reviewers set a benchmark and considered studies which met less than 75% of the quality criteria to be of low quality and excluded them from our review. Reviewers checked all within-publication references to identify additional sources. As this was a desk-based review, no ethical approval was sought.

2.3. Data extraction and analysis

Reviewers abstracted data elements from each included study and compiled them using an extraction sheet. The following information was extracted: country of data origin, study design, setting, who was incentivized, what is incentivized (incentive disease and incentive acitivity), incentive magnitude, and results. A summary of these details can be found in Online Appendix Table 2. Attempts were made to capture additional variables such as; intervention, study population, how performance is verified, negotiated, and set, incentive attributes such as frequency and timing of incentives, any complementary measures, and unintended effects. However most of these were very poorly reported, limiting the reporting of these details.

Using the matrix, data were first summarized descriptively into tables by country of origin, study design, type of HCW targeted by the incentives, disease addressed, and activity incentivized. Studies with reported odds-ratios were compiled in a forest plot to summarize the direction of effects observed on performance and clarify variation between the individual studies. The remaining data were qualitatively synthesized, with consensus on key themes (Table 2) reached via discussion between the two reviewers.

We leverage a framework from behavior psychology and specifically operant conditioning to identify four major groups of reinforcement used in the PBI interventions included in our review. These groups include two types of negative reinforcement, where something is taken away (e.g. portion of salary being withheld pending performance target achievement or penalties) and two types of positive reinforcement, where something is added (reimbursement per achievement or overall bonus) [81]. We provide an overview in Table 2.

2.4. Limitations

There are a few important limitations to our study. Publication bias may favor studies with positive results, although at least a third of included studies in our review found that PBI interventions are associated with no significant change in outcomes. Studies had a strong geographical bias towards North American and European settings. This is reflective of OECD member countries; however, it may limit the generalizability of our findings to other settings. Many studies yielded interesting and promising results but given that we aimed to extract and document comparable results derived from statistical analyses, there were studies we were unable to incorporate into our final synthesis. Although still included in our final review, the lack of comparability hindered our capacity to draw definitive conclusions in some areas. For example, several studies met our inclusion criteria and passed our risk bias assessment; however, in-depth reading conducted by reviewers suggests that some critical information (e.g., amount of incentives, magnitude of incentives) were missing – preventing comparability amongst studies. Many qualitative studies provide useful information on the context that may facilitate the efficacy of PBI, but these qualitative studies often do not allow for hypothesis testing

Table 2
Overview of behavior modification approach by area of targeted improvement.

		Individual patients	Overall improvement at hospital/ clinic/ practice
Negative reinforcement	*Portion of salary withheld*	e.g. 0.1% of salary withheld during each of 10 successive months (evaluation period) unless the asthma order set was used in managing 90% or more of eligible asthma patients [22].	e.g. Five percent of individual radiologists' salary withheld and only distributed at the end of each quarter upon achieving the performance targets [65].
		e.g. reduced base salary which physicians earn back through performing targeted number of encounters per annum and documented select procedures per encounter [42].	
	Penalties for not meeting thresholds	e.g. penalty payments of 50 euros taken off of reimbursement in the case of at least one quality criterion not being reached [25].	
Positive reinforcement	*Reimbursement per achievement/ output*	e.g. $125 and $250 for each patient who reaches 50% and 100% respectively of blood pressure target respectively [53].	e.g. $50 for each month demonstrated competence in treatment delivery and $200 for each patient who received a specified number of treatment procedures and sessions at the practice site [52]
		e.g. Once achieving 25% of target, bonus received is an increasing function of the number of patients treated by guidelines and the rate of achievement of the targets [74].	e.g. points awarded whether practice offers certain services such as ante natal care and screening [41].
	Overall bonus for meeting specified targets	e.g. Providers earned $1000 if at least 50% of their patients had completed all colorectal, breast, prostate and cervical cancers screening and an additional $2000 if at least 80% of their patients had completed screenings [78].	e.g. Reducing excess use of Arterial blood gas testing (ABGs), chest radiographs (CXRs) and red blood cell transfusions (RBCs) in ICUs [44].
		e.g. 15% premium on specified service codes and $200 fee for patient follow up within 30 days after discharge from psychiatric hospital admission [28].	e.g. (1) daily performance of spontaneous breathing trial in eligible mechanically ventilated patients, (2) rate of central line–associated bloodstream infections and (3) rate of ventilator-associated pneumonia. 19

and determining and comparing efficacy systematically. Therefore, these studies were excluded from our final analysis. PBI is often part of a broader, multifaceted strategy for performance improvement. Therefore, results may be biased by impact of the wider strategy, including other interventions that may not be incentive-based. It was not always clear if an individual-level or a practice-level performance was being assessed and if incentive payments made at a practice-level would be paid and distributed to individual providers. As a result, we strictly excluded all studies that did not explicitly mention measuring or incentivizing individuals. Although, this decision allowed us to capture with greater certainty the impact of PBI on individuals, this strategic choice has resulted in the loss of approximately 6% of the data from full text review. In removing these papers, we are not able to assess some potential variations in how individuals are incentivized in relation to their practice and the effect such interaction may have on the success of PBI interventions. Lastly, our presentation of heterogeneous study results via forest plot only incorporates studies that reported odds ratios and is not typical of papers without meta-analyses; we opted to present this finding as it allows us to provide some indication of interventions the literature that suggest most benefit from PBI.

3. Results

From our initial search, 4866 studies were identified, 1553 duplicates were removed, resulting in 3313 studies that were reviewed as title and abstracts. After the title and abstract review, 2725 studies were excluded. We identified 588 potentially eligible full-text articles: 172 did not use a quantitative study design of which 35 were literature reviews, 113 did not focus on individual-level incentives, 57 were not about PBI, 16 did not use data from an OECD member country, 11 were published in a language outside of our inclusion list, eight were unrelated to health care, and 122 papers were unavailable in full text including 60 available as abstracts only and 62 titles which were unavailable on explored online databases. Of the 588 articles, 29 studies were removed due to low quality (high chance of risk bias). In addition, we searched the references list of all studies included after full-text review and risk of bias vetting stages. This process identified three additional studies that were added to our review. See Fig. 1. We included 63 studies in our final review.

3.1. Study characteristics

A majority of the studies used data from North America, particularly the United States (n = 31) and Canada (n = 11). European countries were also well represented, including studies from the United Kingdom (n = 8), France (n = 4), Italy (n = 3), Germany (n = 1), Portugal (n = 1), and Sweden (n = 1). Two studies assessed interventions in Australia and a single study came from Asia, using data from South Korea. See Table 2 in Online Appendix.

Most studies were quasi-experimental, using retrospective data to assess the impact of natural experiments. This group of studies included 11 interrupted time-series analyses [18–28], eight difference-in-differences analyses [29–36], and 12 retrospective cohort studies [37–47]. There were also ten randomized control trials [48–57] and one non-randomized controlled trial [58] included in our final list of studies. The remaining studies used the following designs: cross-sectional (n 0= 14) [59–72], prospective cohort (n = 6) [73–78], and one microeconomic model [79].

Nearly all studies assessed incentives that targeted physicians, including those which focus specifically on general practitioners (n = 10) [20,35,41,47,50,71,74–76,79], although many studies did not specify physician type (n = 38). Two studies assessed the impact of incentives on therapists [52,58]. One study incorporated incentives for each of the following specialists: hospitalists [72],

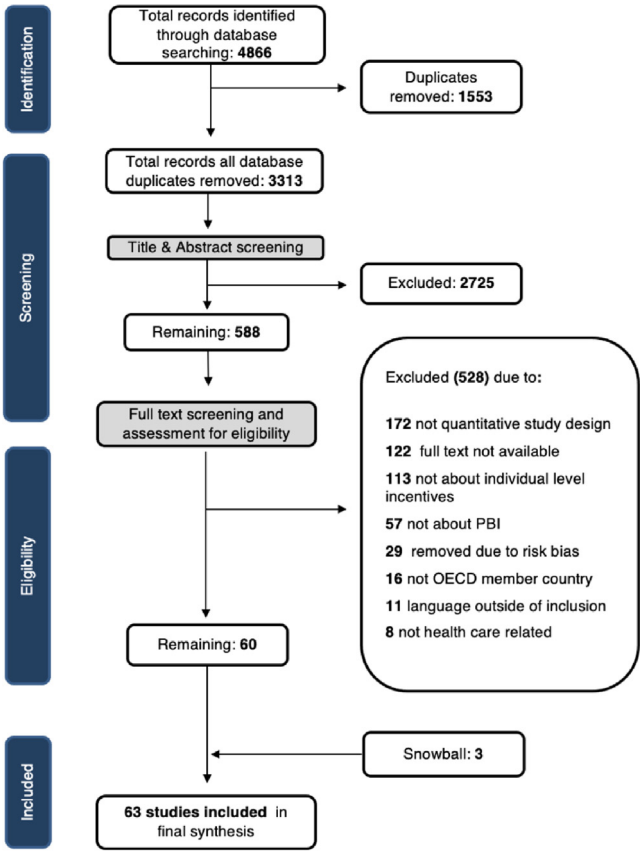

Fig. 1. PRISMA Diagram of included studies.

psychiatrists [28], radiologists [65], nephrologists [23], pharmacists [53], and internal medicine residents [64].

Six studies focused on incentives targeted to non-clinical HCWs, including practice owners and hospital chief executive officers ($n = 2$) [21,45], health plan providers ($n = 1$) [33], academic hospital faculty ($n = 1$) [22], and drug misuse treatment providers ($n = 1$) [36]. Two studies targeted incentives towards small hospitals or practices ($n = 2$). [29,60]

A total of 22 distinct health conditions were targeted using incentive interventions included in this review. Studies primarily targeted chronic disease care including care for: diabetes ($n = 10$), unspecified or bundled chronic disease care ($n = 6$), hypertension ($n = 5$), cardiovascular disease ($n = 3$), and asthma ($n = 2$) [22,75]. Additional studies focused on interventions in children's health ($n = 4$), primary care ($n = 3$), and preventative health initiatives ($n = 3$). Three studies addressed sexual and reproductive health issues and six studies incentivized care related to cancer. [62,69,70,75,78,79] Two studies focused on the care of hospitalized or ventilated patients and three focused on critical care, on substance abuse disorders ($n = 3$) and mental health ($n = 3$). Three studies investigated issues related to geriatric care, including hip fractures and cataract surgery.

Size of incentives offered in the included ranged widely – from a modest $50 one-off payment to a bonus of 25% of total annual provider income. It is difficult to compare these values systematically as the frequency in payment delivery varied, including annual ($n = 12$), semi-annual ($n = 2$), quarterly ($n = 2$) or monthly ($n = 2$) payments. Furthermore, distinctive measures were used to calculate the total size of the incentive to be paid, including volume components (number of activities per time period) and quality components (documented select procedures per encounter). Although the maximum amount of incentives provided by the scheme were reported, total payouts – whether absolute or relative to income – were reported in only five studies [47,55–57,72].

Few studies explicitly mentioned how performance indicators were negotiated or set. The use of consensus process or negotiation with physicians, or groups representing physicians' interests, was mentioned in six studies [26,38,51,67,76,77]. Since many papers assessed national level performance schemes, more often than not, indicators were unilaterally fixed by the insurance fund or body responsible for reimbursing providers, although only four studies mentioned this explicitly [20,47,50,79]. In one case, flexibility was given to apply local designs to a scheme that adhered to a national outcomes framework [36].

In many articles, there was a level of ambiguity regarding the details of incentive activities; however, we strived to extract systematic information when possible. Improvements in the quality of care was the most frequently incentivized activity ($n = 12$), followed by the volume of screening and testing ($n = 9$), accordance to guidelines ($n = 8$), achievement of specified health outcomes ($n = 7$), provision of a comprehensive managed care plan ($n = 5$), prescribing patterns ($n = 5$), and fulfillment of appointments ($n = 4$). One study was dedicated to each of the following activities: timely care, immunizations, infection control, surgical treatment, and medication reconciliation. Effect size for eight studies which included odds ratios, grouped by outcome variable, is reported in Fig. 2.

Although it was not possible to combine information to produce a single overall estimate of effect due to study heterogeneity, Fig. 2 depicts the direction and magnitude of the overall effects on care improvement across individual studies. An odds ratio above 1 shows that improvement in performance for the incentivized group was greater than the improvement for the non-incentivized group. The plot indicates most studies reporting odds ratios pointed towards significant improvements in care.

The majority of the studies found statistically significant results, with a PBI scheme improving intended outcomes ($n = 36$), albeit six of these studies noted very small positive outcomes. Of note, nearly a third of the studies detected no statistically significant changes from implemented incentive schemes ($n = 19$) and another four reported mixed results. Finally, four studies reported adverse outcomes – where a PBI scheme worsens the intended outcome it set out to improve. Examples include increasing marginally effective activities at the expense of more effective activities [68], negative impacts on quality of care [33], reduction in the number of patients treated [41] and reducing the probability of patients complete drug misuse treatment while also increasing the proportion patients declining to continue with treatment [36].

3.2. Negative reinforcements

Negative reinforcement utilizes aversive stimulus or takes away undesirable elements when goals are achieved. This approach was cited less frequently ($n = 8$) than positive reinforcement, where desirable stimulus following correct behaviors ($n = 55$). In our review, aversive stimulus involved either withheld portions of salary or penalties reducing the reimbursement for delivering the services.

Portions of salary withheld. Six interventions hinged on removing negative stimulus following correct behavior by withholding portions of salary until targets were achieved. In some cases, salary was withheld based on overall improvement at the hospital or clinic level, such as optimal diabetes care, optimal vascular disease care, and cancer screening. In our included studies, none of the interventions involved withholding the entirety of provider salary; only a portion of their salary, ranging from 5% to 40%, was withheld.

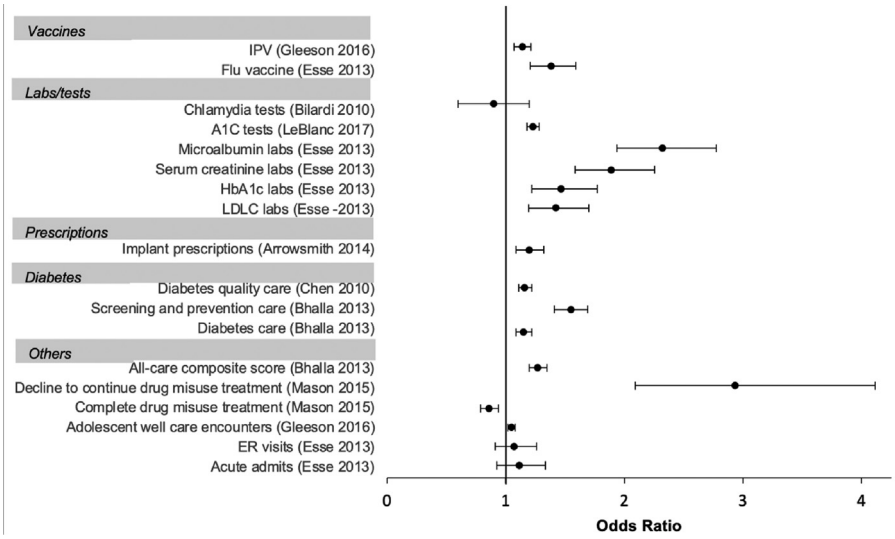

Fig. 2. Effect of PBI interventions on various outcome variables based on reported odds ratios
Abbreviations: IPV, inactivated polio vaccine; LDL-C, low-density lipoprotein cholesterol; HbA1c, hemoglobin A1c, ; A1C, glycated hemoglobin; ER, emergency room.

Malus payments. Malus payments, or penalties of fixed deductions per missed target, were the least common aspect of PBI in our review ($n = 2$), and in only one case were they used exclusively. In the study where a penalty was used as a sole intervention, information about actual penalty size is lacking. However this study found that penalties improve prescription of narrow-spectrum antibiotics by 1.8 percentage points [30]. Interventions where penalties were used with other types of reinforcements or complementary measures are discussed below.

3.3. Positive reinforcements

Two main types of desirable stimulus were identified in our review—the distribution of payment per achieved goals and the delivery of an overall bonus payment for achieving a target.

Payment per achievement (output or outcome). Delivering incentives or payments per each targeted outcome or output achieved, such as specific procedures or participating in particular quality activities, constituted the primary incentive method in our review ($n = 30$). For example, one program offered an additional payment for each patient with diabetes managed according to the care plan in the previous year, as reported by the physicians claiming the incentive [31]. Another made payments for each enrolled patient meeting quarterly goals [48]. In Canada, the number of billable sessions per year was increased, using additional fee codes which made these services (that were previously not billable) now billable through public funding [27,46]. This resulted in an increase of 3.3 percentage points of the percentage of individuals who received counseling or psychotherapy. Guideline compliance was a common target for reimbursement per achieved goals.

Overall bonus. Among the included studies, 25 interventions incorporated overall bonus incentives. This included bonuses as percentage of premiums and annual fees [28], or for achieving various benchmarks of cervical cancer screening [62]. In other cases progressively increasing percentages of the incentive were earned as compliance increased from 80 to 100% for venous thromboembolism prophylaxis [72]. One intervention used a bonus in the form of a single $50 gift card, awarded to the resident with the lowest average discharge-to-dictation time at the end of each month [64].

Four of these did not result in significant changes in patient management or spending on patients with diabetes and chronic obstructive pulmonary disease [26], access to follow-up care for patients after discharge from psychiatric hospital [28], or consultation length [26]. Mixed results were observed in the case of increased spontaneous breathing trial rates, where hospitals with already high rates saw no change while hospitals with low baseline completion were associated with increases, although without consistent improvements in outcome [19]. One study noted positive but modest effects on the provision of four of the five targeted services with a PBI scheme that used a combination of overall bonus and reimbursement per achievement [35].

Effects of financial incentives on achievement of the targets set under the program are summarized by incentive design category in Table 3.

While we use these categories to organize the literature, these approaches are not used exclusively. Some interventions used a combination of negative and positive reinforcement. For example Herbst et al. (2018) assessed a PBI scheme for quality care in ophthalmology in Germany that used bonus payments and penalty payments; the results did not indicate a better quality of care [25]. Similarly some counties in Sweden used a combination of penalties and bonuses, linearly related to deviations from the target level

Table 3
Summary matrix of outcome success by behavior modification approach and area of targeted improvement.

Negative reinforcement	*Portion of salary withheld*	$n = 6$ 100% successful (6/6)
	Penalties	$n = 2$ 50% successful (1/2) ½ no change
Positive reinforcement	***Reimbursement per achievement***	$n = 30$ 46% successful (14/30) (10/30 no change, 4/30 mixed results, 2/30 negative results)
	Overall bonus	$n = 24$ 54% successful (13/24) (8/24 no change, 1/24 mixed results, 2/24 negative results)
	Both reimbursement per achievement and overall bonus	$n = 1$ 100% successful(1/1) (1/1 positive results)

or performance to stimulate appropriate use of antibiotics, significantly increasing the share of narrow-spectrum antibiotics being prescribed [30].

In addition to utilizing negative and positive reinforcement conjointly, many studies reported the use of varying complementary measures along with the primary intervention. Of the studies included in our review, 13 studies reported the use of complementary measures alongside performance incentives. These ranged from public reporting [59], provision of care plan templates [26], monthly audit and feedback reports [44,77], performance dashboard [72], training [46,58] or orientation to new processes [64], webinars [56], and frequent reminders [64]. The use of complementary measures may be critical to the success of incentive programs. This pattern is further confirmed by our findings that a larger proportion of studies which detailed the use of complementary measures reported improving intended outcomes (77%, $n = 10$) relative to our overall review findings (57%). One study in particular tested the use of an individualized physician dashboard in the UK and found that while, on average, providers improved in compliance by 4% (95% CI: 3, 5; $p<0.001$), the addition of the pay-for-performance program resulted in an additional 4% (95% CI: 3, 5; $p<0.001$) improvement [72]. Indicators targeted both physician behavior ($n = 61$) or patient-dependent variables ($n = 6$).

It is reasonable to suspect bigger incentives representing a larger proportion of HCW pay may influence the success of PBI programs. However, due to the heterogeneity of PBIs covered, the evidence in this review does not substantiate an association between the size of incentive and success of the scheme. Almost half (29 out of 63) of the included studies did not report on the size of the intervention. Only 16 studies reported the proportion which incentives represented relative to HCW salaries or fees, which ranged from 0.50% up to 40% of annual compensation. In one case, incentives representing 25% of total GP income were found to have no discernable effect on care or clinical outcomes, while other programs impacting only 5% of income found measurable improvements in care [20,65]. A more robust understanding of the association between size of incentives and success is greatly needed.

4. Discussion

This systematic review described and summarized the body of literature pertaining to PBI interventions in OECD member countries. We identified studies that examine the value of individual-level incentives. This literature review indicated that PBI might be successful in improving the process of care measures and health outcomes in specific conditions, but the results remain mixed across the board. Nearly a third of our studies reported no change in outcomes despite significant financial investment for implementing PBI schemes to improve performance.

Our review indicates there is substantial heterogeneity in the structure of how PBI is delivered. It is notable that a few studies included in our review investigated the impact of this structural variation on the effectiveness of incentive programs. Chung et al. (2011) found that the frequency of payments did not change physicians' response to the intervention [37]. Petersen et al. (2014) conducted a randomized control trial to compare individual-level financial incentives to practice-level incentives, finding that only incentives delivered at the individual-level resulted in improved health outcomes [56]. Kantaveric and Kralj (2013) found that physicians in a blended capitation model are more responsive to a PBI program than physicians in an enhanced fee-for-service model [34]. When comparing physician financial incentives, patient incentives, or shared physician and patient incentives, Asch et al. (2015) found that only shared incentives achieved significant control in reducing levels of low-density lipoprotein cholesterol (LDL-C) among patients with high cardiovascular risk [48]. Clearly, the extent to which outcomes require modification of patient behavior as well as physician behavior is one factor to be taken into account in designing PBIs.

Furthermore, incentives have the possibility of detracting effort from areas of unincentivized care. Gravelle (2010) found that incentive schemes also lead to gaming of exception reporting, where practices may exclude eligible patients, such as those who cannot be prescribed due to side-effects or contra-indications, from indicators [41]. In the UK primary care schemes, Fleetcroft et al. (2012) identified that financial incentives were not always aligned to maximizing health gains, resulting in the support of clinical activities which are only marginally effective over more effective activities which reap lower incentives [68]. Similarly, Guthrie (2010) found that a scheme to increase health plan competition for Medicaid enrollees based on performance not only did not improve the quality of care but also showed evidence of negative impact on areas of care without incentives [33]. In the recent systematic review of P4P in low and middle income settings, negative unintended effects were not widely reported, but the design of the P4P programmes, which typically target a wide range of essential services, may have reduced this risk [10].

Multiple studies identified the potential risk for PBI programs to deepen existing disparities in the delivery of health care, especially in schemes that allow physicians to exclude patients from performance programs. Patients excluded from performance programs disproportionately come from disadvantaged groups and are less likely to achieve treatment goals [60]. As a secondary finding, Kiran et al. (2014) determined that disparities in cancer screening related to neighborhood income in Ontario persisted even after the introduction of payment incentives [70]. Other studies added further detail, describing gender [27,32], selection bias [55] and other key characteristics of populations participating in incentive schemes. However, Petersen et al. (2017) found that incentives to improve blood pressure control did not produce risk selection for black patients [55] and Puyat and Kazanjian (2020) found that incentives provided no change to existing gender disparities in the receipt of counseling/ psychotherapy sessions [27]. Bhalla (2013) found that aside from heart failure care in Hispanic/Latino and Spanish language preferring patients, improvements were observed for all patients regardless of ethnic demographics [73]. PBI interventions seem to effect little change in the current health care disparities.

Results are representative of particular settings, remuneration schemes, and health systems, resulting in notable heterogeneity which limits the generalizability of these findings. Many descriptive studies which highlighted key characteristics of PBI interventions design [82], such as the impact of existing high-value care culture [83], the association between patient behaviors effect on compensation and provider-patient relationships [84], and prior prescribing compliance, or starting level of indicators impact on PBI success [85] were identified in early stages of our review. However, these studies fall beyond the main purpose of our systematic review. The results of these studies would be important to take into consideration when designing performance incentive interventions and future studies should look to further explore these issues carefully. Furthermore, HCWs who provide critical services in the health systems beyond physicians, such as nurses, particularly those who deliver primary and chronic disease care, may significantly impact the quality of care and health outcomes and have not been much targeted to date by schemes identified in our review.

When considering implementing a PBI intervention, decision makers should note that in the context of OECD countries, there is more evidence to support the impact of positive reinforcement methods (rather than negative reinforcement). There is evidence to suggest that PBIs maybe more impactful in prevention and testing

strategies; this may be an area where decision makers can leverage a PBI intervention to improve quality of care. Although, overall, we found that approximately half of the included studies reported positive impacts of PBI, suggesting that decision makers should pilot test, roll out at a smaller scale, modify, and refine PBI interventions to ensure the intervention is relevant, context-specific, and effective – before large-scale implementation. Instead of adopting a PBI from a one-size fits all approach, one should consider whether an intervention will lead to gain-seeking or loss aversion behavior in one's healthcare context.

5. Conclusion

This article categorized studies on the impact of PBI programs on HCW performance and evaluated evidence related to individual-level performance-based incentives in OECD member countries. Employing a behavioral psychology framework, we categorized PBI programs included in our review into four distinct reinforcement groups, including negative reinforcements for individual-level behavior (per output/outcome or overall targets) as well as positive reinforcement for individual-level behavior (per output/outcome or overall targets). In general, there was a level of ambiguity regarding the details of incentive activities and many studies did not present comparable results, but we strived to extract systematic information when possible, and compared and contrast odds ratios when available. We found PBI programs that utilized positive reinforcement methods are most commonly observed in OECD countries – with slightly more overall bonus incentives than payment per output or outcome achieved incentives. When comparing the outcomes from negative reinforcement methods with positive reinforcement methods, we found more evidence that positive reinforcement methods are effective at improving health care worker performance. Overall, just over half of the studies reported positive impacts, indicating the need for care in designing and adopting PBIs. Moreover, we caution that most studies are context-specific and information regarding the context for the intervention and process measures, such as whether the intervention led to gain-seeking or loss aversion behavior are often lacking. Future studies should diligently outline the context to enable cross-study comparison, information extraction, and intervention replication.

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Declaration of Competing Interest

The authors declare no conflicts of interest.

CRediT authorship contribution statement

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Supplementary materials

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