Does Pay-for-Performance Improve the Quality of Health Care?

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Background: Most physicians and hospitals are paid the same regardless of the quality of the health care they provide. This produces no financial incentives and, in some cases, produces disincentives for quality. Increasing numbers of programs link payment to performance.

Purpose: To systematically review studies assessing the effect of explicit financial incentives for improved performance on measures of health care quality.

Data Sources: PubMed search of English-language literature (1 January 1980 to 14 November 2005), and reference lists of retrieved articles.

Study Selection: Empirical studies of the relationship between explicit financial incentives designed to improve health care quality and a quantitative measure of health care quality.

Data Extraction: The authors categorized studies according to the level of the incentive (individual physician, provider group, or health care payment system) and the type of quality measure rewarded.

Data Synthesis: Thirteen of 17 studies examined process-of-care quality measures, most of which were for preventive services. Five of the 6 studies of physician-level financial incentives and 7 of the 9 studies of provider group–level financial incentives found partial or positive effects on measures of quality. One of the 2 studies of incentives at the payment-system level found a positive effect on access to care, and 1 showed evidence of a negative effect on access to care for the sickest patients. In all, 4 studies suggested unintended effects of incentives. The authors found no studies examining the optimal duration of financial incentives for quality or the persistence of their effects after termination. Only 1 study addressed cost-effectiveness.

Limitations: Few empirical studies of explicit financial incentives for quality were available for review.

Conclusions: Ongoing monitoring of incentive programs is critical to determine the effectiveness of financial incentives and their possible unintended effects on quality of care. Further research is needed to guide implementation of financial incentives and to assess their cost-effectiveness.

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In the report Crossing the Quality Chasm (1), the Institute of Medicine called attention to the poor quality of health care in the United States. The Institute identified numerous factors contributing to poor quality, including the structure of the present health care payment system. The Institute found that, for certain clinical situations, health care payment arrangements may actually produce disincentives for quality.

The largely untapped potential of the health care payment system to change physician and health care system behavior has stimulated interest in both the scientific literature (2, 3) and the popular press (4–6) for linking payments to performance on quality measures. Several health plans (3, 7) and the Centers for Medicare & Medicaid Services are using explicit financial incentives for quality (8, 9). The effectiveness of these programs has not been systematically evaluated, and despite enthusiasm about the potential for aligning financial incentives with high-quality health care, many fundamental questions about their optimal design, effectiveness, and implementation remain unanswered. For example, what types of clinical conditions or health care services should be the target of financial incentives to improve quality: chronic diseases, acute care, or preventive care services? How effective (and cost-effective) are financial incentives for quality? What are the optimum magnitude, frequency, and duration of financial incentives for quality? Should we reward achievement of an absolute threshold of performance, improvement over baseline performance, payment for each instance of a service regardless of the overall performance, or some combination of these? To whom should such incentives be directed: the patient (10), the health care provider, the provider group or hospital, or all of these parties? What types of quality measures should be rewarded: processes of care, outcomes, or both (11)? Are financial incentives for not providing inappropriate care (such as antibiotics for uncomplicated acute upper respiratory illnesses) effective? What is the optimum "package" of nonfinancial interventions (if any) to include with financial incentives for quality, for example, audit and feedback, recognition, clinical reminders, academic detailing, or information technology support (12, 13)? Can we expect the effect of financial incentives to persist after they are stopped? Because any effective intervention will have some unanticipated effects, will important patient care activities that are not rewarded financially be neglected?

The purpose of this paper is to assess the relationship between explicit financial incentives and the provision of high-quality health care by systematically reviewing empirical studies. Because the evidence regarding the relationship between the financial incentives embedded in fee-for-service and capitation arrangements and the quality of health care has been thoroughly reviewed in previous work (14),

See also:

Web-Only
Appendix Table
Conversion of figure and tables into slides

we focused our review on literature that addresses explicit financial rewards for improving health care quality.

Methods

Study Identification and Selection

We conducted a systematic search of the English-language literature in PubMed to find articles published between 1 January 1980 and 14 November 2005 whose main objective was to assess the use of explicit financial incentives to improve health care quality. Our search algorithms combined Medical Subject Heading (MeSH) terms and text words. We used the following MeSH terms: *quality of health care*; *insurance, health, reimbursement*; *physician incentive plans*; and *reimbursement, incentive*. We designated words and word phrases as text word terms in our search algorithms to ensure that all words in the title, abstract, MeSH terms, and MeSH subheadings that matched our words were extracted from the electronic database (15). We indicated the following words and phrases as text word terms in our search: *quality*, *quality of care*, *payment*, *payment system*, *reimbursement*, *risk adjustment*, *physicians*, *financial incentives*, *financing*, *incentive*, *health care*, *bonus*, *insurance*, *performance-based*, and *fees*.

We reviewed additional publications found in bibliographies of retrieved articles, and we contacted experts about missing or unpublished studies. We included only English-language studies that reported original data. We were interested in identifying studies of explicit financial incentives directed at individual physicians and provider groups, as well as incentives at the level of the payment system, such as performance-based contracting. Eligible studies assessed the use of financial incentives as the independent variable and a measure of quality (such as immunization or cancer screening) as the dependent variable. Quality of care was defined as "the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (16). The domains of quality were defined as access to care, structure of care, process of care, outcomes of care, and patient experience of care. *Access to care* is the patient's attainment of timely and appropriate health care. *Structure of care* is a feature of a health care organization or clinician relevant to the provision of health care. *Process of care* is a health care service provided to or on behalf of a patient. *Outcome of care* is a health state of a patient resulting from health care. *Experience of care* is the individual's or population's report concerning health care (17).

Study Inclusion Criteria

Studies were eligible for review if they were original reports providing empirical results and assessed the relationship between the explicit financial incentive and a quantitative measure of health care quality (17). Reviewers assessed articles in an unblinded, standardized manner (18, 19). At least 2 authors reviewed the title and keywords of articles' PubMed citations to identify empirical studies. At least 2 authors then reviewed the abstracts of those studies to determine eligibility. All authors then abstracted and reviewed the full articles that addressed the objective of the review. When there were discrepancies, all authors met to discuss and reach consensus about article inclusion. There were no instances of disagreement in which consensus could not be reached.

We excluded eligible studies if there was no concurrent comparison group or if there was no baseline, preintervention analysis of the groups on the quality measure. Concurrent comparison groups are important because some studies of quality may show dramatic improvement over time but no statistically significant differences between intervention and comparison groups. We included randomized, controlled trials and controlled before-and-after studies. Because of the paucity of literature on this topic, we also included observational studies that, although not studying a specific intervention, nevertheless examined the relationship between financial incentives and quality in a cross-sectional analysis. We categorized the results of each study according to the effect of the financial incentive on the measure or measures of quality. Positive studies were those for which all measures of quality demonstrated a statistically significant improvement with the financial incentive. Studies with partial effects showed improved performance on some measures of quality but not others. Negative studies were those for which all measures of quality demonstrated a statistically significant decrease in quality with the financial incentive. The final category was for studies demonstrating no effect.

We used a checklist for methodologic quality published by Downs and Black (20). After we assessed the checklist for each article, a grade of 1 (poor) to 4 (excellent) was assigned to each included article. We did not use formal meta-analytic techniques because the included studies used many different measures of effect.

Role of the Funding Sources

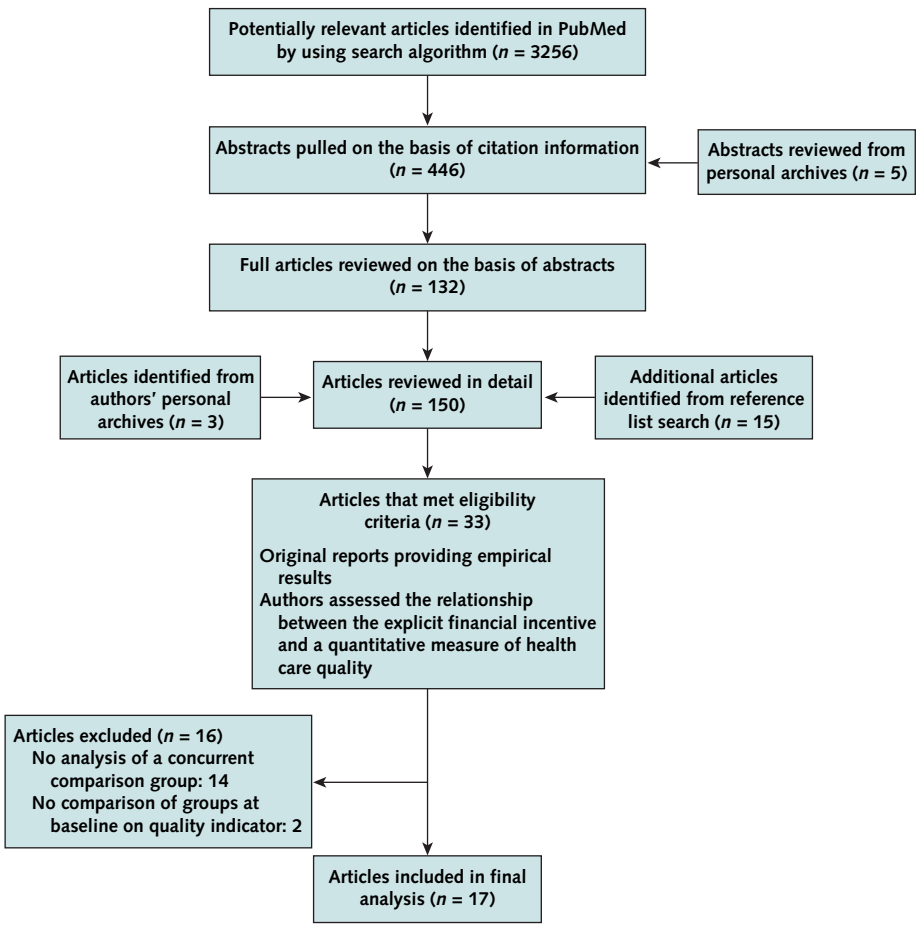
The Veterans Health Administration, the Robert Wood Johnson Foundation, the American Heart Association, and the National Institutes of Health supported this study but had no role in design, conduct, or reporting or in the decision to submit the paper for publication.

Results

Search Results

Our search for eligible studies is summarized in the **Figure**. Most of the articles were descriptions and not evaluations. Sixteen articles (21–36) that met the eligibility criteria were subsequently excluded because a concurrent comparison group was not analyzed or groups were not compared at baseline on the quality indicator (**Table 1**). The **Appendix Table** (available at www.annals.org) summarizes the 17 included studies. Two studies reported the effect of payment-system level financial incentives (37, 38).

Figure. **Studies published between 1 January 1980 and 14 November 2005 and evaluated for inclusion in the systematic review of explicit financial incentives for health care quality.**



The remaining 15 studies evaluated financial incentives directed to the provider group (39–47) or individual physician (48–53).

Financial Incentives at the Payment System Level

We found 2 studies of financial incentives provided at the payment system level (37, 38). For example, Norton (37) studied the effectiveness of an incentive to improve access to health care for nursing home patients with debilitating acute and chronic conditions. The program included incentives to admit severely dependent patients, incentives for attainment of health status goals, and an incentive to discharge clinically appropriate patients. The intervention sites admitted statistically significantly more severely ill patients than nursing homes in the control group.

Despite the administrative and incentive costs of the program, the author's Markov model estimated an average cost savings to the Medicaid program of $3000 per nursing home stay over time. This was principally due to shorter stays. Therefore, the author asserted that the incentive and administrative costs were small compared with potential gains in improved health and lower overall health care expenditures.

Financial Incentives at the Provider Group Level

Nine studies (39–47) evaluated the use of financial incentives directed to provider groups. Of these, 7 found partial or positive effects of financial incentives on measures of quality, although effect sizes of some studies were small. In 2 studies (42, 44), the provider group–level incentive resulted in a statistically significant improvement in the measure of quality of care (**Appendix Table**, available at www.annals.org). In 5 other studies (41, 43, 45–47), the financial incentive had a partial effect. For example, Rosenthal and colleagues (47) found a small improvement in rates of cervical cancer screening between the intervention and comparison groups after the quality incentive program (difference, 3.6%; $P = 0.02$). Improvements in mammography screening rates and hemoglobin A_{1c} testing were not statistically significant. In 2 randomized trials (39,

Table 1. **Excluded Articles and Reason for Exclusion***

No analysis of a concurrent comparison group
- Amundson et al., 2003 (21)
- Armour et al., 2004 (22)
- Burns et al., 1991 (23)
- Cameron et al., 1999 (24)
- Commons et al., 1997 (25)
- Fairbrother et al., 1997 (26)
- Fanning and de Alteriis, 1993 (27)
- Fox and Phua, 1995 (28)
- Geron, 1991 (29)
- Greene et al., 2004 (31)
- Lu et al., 2003 (33)
- Lynch, 1994 (34)
- Morrow et al., 1995 (35)
- Ritchie et al., 1992 (36)

No comparison of groups at baseline on quality indicator
- Grabowski, 2002 (30)
- Kouides et al., 1993 (32)

* Numbers in parentheses are reference numbers.

40), the group-level incentives for preventive health services had no effect compared with the control group.

Financial Incentives at the Physician Level

Five of 6 studies (48–50, 52, 53) found partial or positive effects of incentives directed at individual physicians. In a randomized trial, Fairbrother and colleagues (48) tested 2 types of incentives for immunizations in a pediatric population. Sixty physicians were randomly assigned to 1 of 3 intervention groups or a control group. The interventions were 1) bonus and feedback ($1000 for a 20% improvement from baseline, $2500 for a 40% improvement from baseline, and $5000 for reaching 80% up-to-date coverage regardless of baseline performance level); 2) enhanced fee-for-service and feedback ($5 for each vaccine administered within 30 days of its due date and $15 for each visit at which >1 vaccine was due and all due vaccines were administered); and 3) feedback only. The bonus group improved significantly in documented up-to-date immunization status, with an overall change of 25.3%, but none of the other groups improved statistically significantly compared with controls. However, with only 15 physicians per group, the power of the study was limited.

By the end of the study, more than two thirds of the physicians in the bonus group had improved enough to earn a bonus. Only 2 of the physicians in the enhanced fee-for-service group and 2 in the feedback-only group improved as much as those in the bonus group.

Unintended Effects of Incentives

Shen (38) examined the effect of performance-based contracting on access to care among the most severely ill patients in a group being treated for substance abuse. Under performance-based contracting, achieving or failing to achieve predetermined quality measures affects funding in the following year. Providers not meeting the performance expectations had "special conditions" attached to the reimbursement contracts; in some cases, the subsequent contract period was shortened.

Shen hypothesized that the incentive (better pay for improving measured performance) would provide an unintended incentive to avoid the most severely ill patients, thereby restricting access to care for this group. This is termed *adverse selection*. Shen measured the proportion of outpatient clients classified as being the most severely ill before and after the introduction of performance-based contracting. The comparison group was Medicaid patients treated for substance abuse in the same years. Under performance-based contracting, the likelihood of a participant in the program being in the most severely ill group decreased ($P \leq 0.01$), suggesting that adverse selection was occurring in response to the financial incentive.

In the article by Norton (37), the author noted that nursing homes had several strong incentives to "game the system," that is, manipulate the program to increase payment. For example, there was an incentive for nursing homes to claim that they were admitting extremely disabled patients who then "miraculously" recovered over a short period. In both trials by Fairbrother and colleagues (48, 49), the authors were careful to note that improvement was due primarily to improved documentation of up-to-date immunization status rather than actual vaccines given at the practice and that missed opportunities to vaccinate (that is, visits where vaccines were due but no vaccine was given) did not change. Roski and colleagues (41) examined the effect of bonus payments on identifying patients with tobacco use disorders and providing tobacco cessation advice in large multispecialty group practices. Similarly, the incentive was associated with an increased documentation of tobacco use status but not provision of advice to quit smoking. These studies again highlight the problem of gaming behavior, whereby the incentive produces improvements in documentation rather than a change in the quality of health care delivered to patients.

Design of Performance Targets

The issue of whether the incentive target should be designed as an absolute performance goal (that is, a defined threshold, such as 75% of patients with up-to-date immunization status), a relative performance goal (for example, 30% improvement from baseline), or a payment for each instance of a service regardless of the overall performance is an important question. We found 4 studies (41, 42, 47, 51) that used an absolute performance target, 2 (39, 40) that used relative performance targets, and 3 (48, 49, 53) that used a combination of relative and absolute performance targets. Two studies showed that individuals or groups with the lowest baseline performance improved the most (47, 53); however, if threshold performance targets are used, they may garner the least performance pay (47).

Discussion

In this systematic review, we found 17 eligible studies that addressed the question of whether explicit financial incentives improve the quality of health care (**Appendix Table**, available at www.annals.org). Thirteen (39–42, 44–49, 51–53) of these examined process-of-care measures, most of which were for preventive services. Five studies (37, 38, 43, 47, 53) assessed care of patients with chronic diseases. Only 6 studies (48–53), 2 by the same investigative team and assessing pediatric immunizations, assessed physician-level financial incentives, and only 2 (48, 49) compared the type of incentive (bonus vs. enhanced fee-for-service). Five of 6 studies of physician-level financial incentives and 7 of 9 studies of provider group–level financial incentives found partial or positive effects of financial incentives on measures of quality. One of the 2 studies of incentives at the payment-system level found a positive effect on access to care, while the other showed evidence of gaming behavior or adverse selection, suggesting a negative effect on access to care. The cross-sectional surveys (45, 46, 50, 52) gave some information about the relationship between incentives and quality, but generalizability was limited by lack of specificity about incentives as well as by the observational design. Four studies (38, 41, 48, 49) suggested unintended effects of incentives. We found no studies evaluating the optimal duration of financial incentives for quality or persistence of their effects. We found only 1 study (37) that addressed cost-effectiveness and no studies that assessed incentives for not providing care (such as incentives for withholding antibiotics for simple upper respiratory illness or uncomplicated bacteriuria). Therefore, for several reasons, generalization from the existing studies is limited.

Despite these limitations, a few very preliminary conclusions can be drawn. Incentives require very careful design. Three studies showed that documentation, rather than actual use of the preventive service, improved statistically significantly with a financial incentive (41, 48, 49). Shen (38) showed that adverse selection may have occurred with performance-based contracting in settings where providers can avoid sicker patients. These findings are important because they suggest that there is a response to incentives, although not necessarily the desired one. The challenge, then, is to design incentives with the intended goal in mind.

The observation that those with the lowest baseline performance may improve the most (47, 53) yet garner the smallest amount of performance pay if threshold performance targets are used (47) highlights the need to consider combined incentives for both overall improvement and achievement of a threshold. Policymakers should consider whether their goal is improving performance at the lower end of the spectrum, maintaining best performance, or both.

In designing performance measures for incentive programs, several issues should be noted. The best process-of-care measures are those for which evidence shows that better performance leads to better outcomes (1). Also, it is important to note that process-of-care measures may be more sensitive to quality differences than are measures of outcomes, because a poor outcome does not necessarily occur every time there is a quality problem. Therefore, one way to change behavior so that both quality and documentation improve may be to base the incentive on the combination of a process-of-care measure (for example, documentation of smoking cessation advice) and the outcome of interest (for example, tobacco quit rates). This approach may avoid the pitfalls of process-of-care measures alone that encourage gaming, as well as the disadvantage of basing incentives solely on outcomes that may be relatively rare or difficult to achieve and somewhat beyond the control of the provider. Thus, a combined approach capitalizes on the advantages and complementary nature of both types of quality-of-care measures.

Size of the bonus is probably also important. Possible explanations for the lack of effect or small effect in some studies may include the small size of the bonus (39, 40, 42, 51). One qualitative study suggested that a bonus of at least 5% of a physician's capitation income may influence behavior (54). In contrast, the maximum bonus in the study by Grady and colleagues (51) was only $100. Similarly, when providers are paid by multiple insurers, the incentive may affect too few patients, effectively diluting the size of the incentive (40).

The last design issue to consider is that "end-of-year" compensation may not influence physician behavior as much as a concurrent fee or intermittent bonus. This is because lack of awareness of the intervention (40) and infrequent performance feedback seem to be substantial potential barriers to incentive effectiveness (41).

We cannot conclude from a single study that financial incentives are cost-effective. Norton (37) showed that using a combination of various types of incentives to improve both access to nursing home care and patient outcomes of nursing home care saved an estimated $3000 per stay in a Markov model. Because of the way the payment system is structured, however, these savings may not accrue to the Medicaid program that paid for the incentives, highlighting the importance of considering the "business case" (whether there is a return on investments made to improve quality) for quality improvement (55). Of course, more work in this area is urgently needed so that limited resources for improving health care quality can be targeted at the most effective interventions.

Most of the effect sizes of the provider group–level incentives were small (**Appendix Table**, available at www.annals.org). This should not be surprising, because with hospital-level or provider group–level incentives, physicians cannot collect the full returns on their individual efforts to improve quality (56). Thus, the potential for some to "free-ride" on the efforts of others may reduce the

Table 2. **Proposed Research Agenda for Studying Explicit Financial Incentives in Health Care**

How effective are financial incentives for quality?
Are pay-for-performance programs cost-effective?
What types of clinical conditions or health care services should be the target of financial incentives to improve quality: chronic diseases, acute care, or one-time preventive care services?
Within what types of payment structures (e.g., fee-for-service, salaried, capitation, blended arrangements) are financial incentives most effective? What proportion of health care payments should be dependent on performance?
Within what types of practice settings (e.g., multispecialty group practice, hospital-based setting) are financial incentives most effective?
What are the optimum magnitude, frequency, and duration of financial incentives for quality?
To whom should such incentives be directed: the patient, the health care provider, the provider group, the hospital, or all of these?
What types of quality measures should be rewarded: process of care, outcomes, or both?
Are financial incentives to prevent the overuse of services (e.g., antibiotics for uncomplicated upper respiratory illness) effective?
Should performance targets be designed as an absolute threshold (i.e., 75% of patients with up-to-date immunization status), a relative performance goal (e.g., 30% improvement from baseline), payment for each instance of a service regardless of the overall performance, or some combination?
What is the optimum "package" of nonfinancial interventions (if any) to include with financial incentives for quality (e.g., audit and feedback, recognition, clinical reminders, academic detailing, or information technology support)?
Can we expect that the effect of financial incentives may persist after they are stopped?
Because any effective intervention will have some unanticipated effects, will important patient care activities that are not rewarded financially be neglected?

efforts of all. Alternatively, the problem with rewarding physicians and not provider groups or hospitals is that the required institutional cooperation may not be present, implying that incentives are missing for an important element of the team delivering health care. For example, studies evaluating the chronic care model suggest that multidisciplinary teams produce better patient outcomes (57–59). Provider group–level or payment-system level incentives (if substantial enough) may provide the impetus to create infrastructure changes that are absent from traditional practice (60).

Most of the articles retrieved for this search were descriptions rather than evaluations. Our systematic review may be affected by negative publication bias because health care executives may have some disincentive to publish negative or ambiguous findings of pay-for-performance programs.

It seems intuitive that paying more money for higher-quality services will improve health care, but health care does not operate like a classic free market. The physician–patient dyad is a type of principal–agent relationship (61–63) from the economic literature on incentive contracts. Principal–agent theory addresses relationships where one individual (the patient) cannot directly observe or know the level of skill or effort expended by the other individual (the physician) doing the contracted work. Because patients do not have perfect knowledge of their medical condition, their need for care, or the expected outcome of health care services, they are willing to have physicians act as their agents in providing information and services. Because patients have asymmetric information about the need for and outcomes of health care, patient demand for health care may be unresponsive to technical quality. Therefore, one theoretical advantage of performance pay is that explicit financial incentives are provided even when patient demand for health care is unresponsive to quality. Physician effort in providing high quality is rewarded, regardless of whether patients recognize it.

It is important to note that financial incentives and the health care payment system have an important, although not exclusive, influence on the provision of quality. In economic terms, physicians are viewed as maximizing their utility function (56). (Utility can be defined as well-being.) Important factors included in the utility function, besides income, are professional and social status, altruistic concerns, the cost of the effort to provide care, and the uncertainty of the clinical effectiveness of treatment (64–66). It is generally accepted that professionals are motivated by the satisfaction of doing their jobs well (intrinsic motivation) (67). Indeed, it is doubtful whether some valued-but-difficult-to-observe dimensions of quality (such as empathy or listening in the medical encounter) would be provided at all if physicians were solely interested in income. Thus, physicians have both nonmonetary (that is, personal ethics, professional norms, regulatory control, clinical uncertainty) and monetary (from the payment system) incentives, all of which affect effort. This review addresses only the financial aspect of this complex issue and does not address the possibility that financial incentives may dilute physicians' intrinsic motivation.

Most physicians and hospitals are paid the same regardless of the quality of the health care they provide, producing no financial incentives for quality and, in some cases, disincentives. Thus, there is increasing enthusiasm for the idea of linking payment to performance. Despite widespread implementation, we found few informative studies of explicit financial incentives for quality. This literature review suggests some positive effects of financial incentives at the physician level, the provider group level, and the health care payment system level. The findings also suggest that ongoing monitoring of incentive programs is critical to determine whether incentives are having unintended effects on quality of care. A suggested research agenda for moving the field ahead is provided in **Table 2**. Rigorous research, including randomized, controlled trials and observational studies with concurrent control groups, is needed to guide implementation of explicit financial incentives for health care quality and to assess their cost-effectiveness.

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Appendix Table. **Articles Identified as Assessing Explicit Financial Incentives and Health Care Quality from a Systematic Review of the Literature after Applying Study Inclusion and Exclusion Criteria***

Study, Year (Reference)	Study Design	Incentives	Domains of Quality	Analysis and Results	Overall Effect†	Methodologic Strength‡
Norton, 1992 (37)	RCT (2 arms); November 1980 to April 1983; 36 SNFs (18 study facilities; 18 control facilities)	Level: payment system Type: bonus Duration: admission incentive up to 4 y; outcome and discharge incentives 1 to 2 y Admission incentive: per diem bonus for type D ($5) and E ($3 to $28) patients (vs. $36 reimbursement) Outcome incentive: improved health status within 90 d (measured by ADL classification); $126 to $370 per case (range of bonus) Discharge incentive: timely discharge and resident did not return within 90 d; $60 to $230 (range of bonus); type A patients not eligible Payment frequency: NS	Access; outcome	Markov model Experimental homes admitted more type D and E patients (sicker patients) than control homes Patients in experimental homes were more likely to be discharged to home or to an ICF and had less likelihood of hospital admission or death ($P < 0.001$)	Positive	3
Shen, 2003 (38)	CBA; FY 1991 to 1995; 5552 clients (2367 OSA clients; 3185 Medicaid clients)	Level: payment system Type: PBC Duration: FY 1993 to 1995 Description: additional funds based on efficiency, effectiveness, and service to special populations Efficiency: minimum service delivery (% of contracted amount); minimum service to primary clients (% of units delivered) Effectiveness: abstinence/drug-free 30 d before termination; reduction of use of primary substance abuse problem; maintaining employment; employability; employment improvement; reduction in number of problems with employer; reduction in absenteeism; not arrested; participation in self-help during treatment; reduction of problems with spouse/family members Special populations: female; age 0 to 19 y; age ≥50 y; corrections; homeless; concurrent psychological problems; history of IV drug use; polydrug use Payment frequency: yearly	Access	Probit specification (regression) Significant decrease in the likelihood that an OSA patient was a "most severe user" after PBC implementation compared with the likelihood of a Medicaid (control) patient; coefficient = −0.74; t-value = 3.26; $P \leq 0.01$	Negative	2
Clark et al., 1995 (43)	CBA; July 1992; 7 CMHCs; 185 clients (95 in TCM and 90 in CTT)	Level: provider group Type: enhanced FFS Duration: NA Description: CMHCs received $15.75 per 15 min spent in community settings delivering MIMS Payment frequency: FFS	Access	Student t-test for paired comparisons; MANOVA Student t-test: average weekly time spent in community treatment per client increased after the payment change (30.71 min vs. 38.61 min; $P < 0.05$) Office-based case management weekly time per client decreased (32.96 min vs. 23.31 min; $P < 0.001$) Total case manager average weekly time per client was not significantly different (63.68 min vs. 61.93 min) MANOVA: after the payment change, center-based treatment time decreased (F-value = 10.41; $P = 0.001$). The increase in community minutes had an F-value of 3.72 ($P = 0.055$). Program type and Medicaid status were not associated with change in time in community vs. mental health center	Partial effect	2

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Appendix Table—**Continued**

Hillman et al., 1998 (39)	RCT (2 arms); 1993 to 1995; 52 PC sites (26 intervention; 26 control)	Level: provider group Type: bonus Duration: 18 mo Description: compliance with cancer screening for women age ≥50 y; aggregate compliance scores and improvement in scores over time; full and partial bonuses (20%; 10% of capitation); range of bonus per site, $570 to $1260 Payment frequency: every 6 mo	Process	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 groups	No effect	3
Kouides et al., 1998 (42)	RCT (2 arms); September to December 1991; 54 solo/group practices (27 intervention; 27 control)	Level: provider group Type: bonus Duration: 4 mo Description: influenza immunization rate ($8 standard fee); if rate >70%, bonus of $0.80 per immunization; if rate >85%, bonus of $1.60 Payment frequency: one time (end of study)	Process	Linear regression Absolute increase in immunization rates (from 1990 [baseline] to 1991) was 6.8%; $P = 0.03$	Positive	3
Hillman et al., 1999 (40)	RCT (3 arms); 1993 to 1995; 49 PC sites (19 FB+I; 15 FBO; 15 control)	Level: provider group Type: bonus Duration: 18 mo Description: pediatric immunizations; well-child visits; bonuses based on total compliance score for quality indicators; full and partial bonuses (20%; 10% of site's total 6-mo capitation for pediatric members age ≤6 y); 3 highest-scoring sites received full bonus; next 3 received partial bonus; most improved sites received partial bonus; average bonus, $2,000 (range, $772 to $4682) Payment frequency: every 6 mo	Process	Repeated-measures ANOVA Absolute increase in total mean compliance scores from baseline: FB+I, 17.2%; FBO, 22.6%; control, 22.6% Differences in compliance score improvement between groups: FB+I vs. control, 5.9%; FBO vs. control, 11.3% No significant differences between the groups	No effect	3
Christensen et al., 2000 (44)	RCT (2 arms); February 1994 to September 1995; 200 pharmacies (110 intervention; 90 control)	Level: provider group Type: enhanced FFS Duration: 20 mo Description: $4 for cognitive services interventions (<6 min); $6 for ≥ 6 min; cognitive services are judgmental or educational services provided by the pharmacist to the patient, such as consulting the prescriber about a suboptimal dose Payment frequency: FFS	Process	Student *t*-test Mean rate, 1.59 interventions per 100 Medicaid prescriptions (study pharmacies) vs. 0.67 (controls); $P < 0.001$	Positive	2
Casalino et al., 2003 (46)	Cross-sectional survey; September 2000 to September 2001; 1040 physician organizations (no patient-level data included)	Level: provider group Type: better contracts with health plans; bonuses Duration: not ascertained in survey Description: not ascertained in survey Payment frequency: not ascertained in survey	Process	Multivariate linear regression Receiving better contracts for quality was associated with an increase of 0.74 CMP implemented ($P = 0.007$) Receiving a bonus for scoring well on quality measures was not associated with CMP implementation ($P = 0.08$)	Partial effect	1

Appendix Table—**Continued**

McMenamin et al., 2003 (45)	Cross-sectional survey; September 2000 to September 2001; 1104 physician organizations	Level: provider group Type: financial incentives; additional income; better contracts with health plans Duration: not ascertained in survey Description: not ascertained in survey Payment frequency: not ascertained in survey	Process	Multivariate logistic regression Receiving financial incentives from HMOs increased the adjusted odds of having a smoking cessation intervention for 6 of the 7 organizational supports (OR, 2.13 to 14.46; $P < 0.038$) Receiving additional income from health plans for performance on quality measures: 2 of 7 organizational supports (OR, 1.49, 1.90; $P < 0.033$) Receiving better contracts with health plans was not associated with supporting smoking cessation interventions Examples of organizational supports include offering smoking cessation health promotion programs and giving providers nicotine-replacement starter kits to distribute to patients	Partial effect	1
Roski et al., 2003 (41)	RCT (3 arms); May 1999 to June 2000; 37 PC sites (13 incentive; 9 incentive + registry; 15 control)	Level: provider group Type: bonus Duration: 12 mo Description: 75% of patients with smoking status identified/documented at the last visit; 65% of patients with quitting advice documented at the last visit (targets set at approximately 15% above the average from 2 y before study); bonuses, $5000 for sites with 1–7 providers and $10 000 for sites with ≥8 providers Outcome measured: 7-d sustained abstinence from smoking (not associated with financial incentive) Payment frequency: one time (end of study)	Process	Logistic regression, clustering at the practice level Change in tobacco use status identification: incentive group increased 14.1%; incentive + registry group increased 8.1%; control group increased 6.2%; $P = 0.009$ Change in providing quitting advice to patients: incentive group increased 24.2%; incentive + registry increased 18.3%; control increased 18.3%. No significant difference across the study groups The quitting rate (7-d sustained abstinence) was 22.4% for the incentive group; 21.7% for the incentive + registry group; 19.2% for the control group. No significant difference across the study groups	Partial effect	2
Rosenthal et al., 2005 (47)	CBA; October 2001 to April 2004; 163 provider groups contracted with PacifiCare Health Systems in California (provider groups in the Pacific Northwest were the comparison group)	Level: provider group Type: bonus Duration: July 2003 to April 2004 (10 mo) Description: incentive payout based on provider's groups ability to reach or exceed target rates for cervical cancer screening, mammography, and hemoglobin A_{1c} testing for diabetic patients Incentive reward: $0.23 PMPM Payment frequency: quarterly	Process	Differences-in-differences analysis using generalized estimating equations Improvement in cervical cancer screening rates before and after the quality incentive program was statistically significant between the intervention and comparison groups (difference, 3.6%; $P = 0.02$). Improvements in mammography screening rates and hemoglobin A_{1c} testing were not statistically significant	Partial effect	2

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Appendix Table—**Continued**

Grady et al., 1997 (51)	RCT (3 arms); 1 year (NS); 61 community-based primary care practices (20 cue and reward; 18 cue; 23 control [total of 95 physicians]); cues were posters in waiting rooms and chart reminder stickers	Level: physician Type: bonus ($50 for a 50% referral rate) Duration: 6 mo Description: "token" reward, based on the percentage referred for mammography during quarterly audit Payment frequency: 1 per quarterly audit; rewards given last 2 quarters	Process	Repeated-measures ANOVA The financial incentive arm was not significantly different from the control arm	No effect	2
Fairbrother et al., 1999 (48)	RCT (4 arms); July 1995 to July 1996; 60 physicians (15 bonus; 15 enhanced FFS; 15 feedback only; 15 control)	Level: physician Type: bonus and FFS Duration: 12 mo Description: patients' up-to-date coverage for pediatric immunizations Bonuses: $1000 (20% improvement from baseline); $2500 (40% improvement); $5000 (80% up-to-date) Enhanced FFS: $5 per vaccine given within 30 d of its coming due; $15 for each visit at which >1 vaccine was due and all were given Payment frequency: every 4 mo	Process	Linear and logistic regression Bonus group improved significantly in documented up-to-date immunization status, with an overall change of 25.3% ($P < 0.01$), but none of the other groups improved significantly compared with controls	Partial effect	3
Safran et al., 2000 (50)	Cross-sectional survey; January to April, October 1996; physicians in 8 IPA/network HMOs (2761 patients)	Level: physician Type: not ascertained in survey Duration: not ascertained in survey Description: survey of health plan executives elicited information about use of financial incentives regarding patient satisfaction Payment frequency: not ascertained in survey	Patient experience	Linear regression Financial incentives concerning patient satisfaction were related to increase in score on primary care scale completed by patients on 2 of the 4 aspects of primary care assessed (access, physicians' knowledge of patients, clinician–patient communication, and interpersonal treatment) Access to care ($\beta = 2.57$; $P < 0.01$) and dimensions of comprehensiveness of care ($\beta = 2.00$ for knowledge of patient; $P < 0.05$) and preventive counseling ($\beta = 3.50$; $P < 0.05$)	Partial effect	1
Fairbrother et al., 2001 (49)	RCT (3 arms); July 1997 to July 1998; 57 physicians (24 bonus; 12 FFS; 21 control)	Level: physician Type: bonus and FFS Duration: 16 mo Description: patients' up-to-date coverage for pediatric immunizations Bonuses: $1000 (30% improvement from baseline); $2500 (45% improvement); $5000 (80% up-to-date); $7500 (90% up-to-date) Enhanced FFS: $5 per vaccine given within 30 d of its coming due; $15 for each visit at which >1 vaccine was due and all were given Payment frequency: every 4 mo	Process	Linear and logistic regression Both the bonus and the enhanced FFS groups improved significantly in documented up-to-date immunization status, with an overall change of 5.9% ($P < 0.05$) and 7.4% ($P < 0.01$), respectively, compared with the control group	Positive	3

Appendix Table—**Continued**

Beaulieu and Horrigan, 2005 (53)	CBA; April 2001 to January 2002; 21 PCPs contracted with Independent Health in upstate New York (476 diabetic patients); 600 Independent Health diabetic patients were the comparison group	Level: physician Type: bonus Duration: 8 mo Description: meeting target CS of ≥6.23; CS of ≥6.86; or overall 50% improvement in composite score. CS based on PCP's performance of process and outcome measures for diabetes care (e.g., LDL test, dilated retinal examination, LDL cholesterol level <2.59 mmol/L (<100 mg/dL) Incentive rewards: CS ≥6.86, $3.00 PMPM (Medicare), $0.75 PMPM (commercial); CS ≥6.23, $1.50 PMPM (Medicare), $0.37 PMPM (commercial); 50% improvement and CS ≤6.23, $0.75 PMPM (Medicare), $0.18 PMPM (commercial) Payment frequency: at the conclusion of the study	Process; intermediate outcome	Before-and-after comparison, specific test not described Patients treated by physicians in the demonstration project had statistically significant improvement (final − baseline performance) on the following process and outcomes measures ($P < 0.001$ unless otherwise noted): second hemoglobin A_{1c} test (25.5% difference); LDL cholesterol test (18.3% difference); diabetic retinal examination (25.6% difference); nephropathy test (37.0% difference); foot examination (45.4% difference); hemoglobin A_{1c} level < 9.5% (13.9% difference); LDL cholesterol level <2.59 mmol/L (<100 mg/dL) (10.5% difference); LDL cholesterol level <3.37 mmol/L (< 130 mg/dL) (23.5% difference); BP < 130/80 mm Hg (6.3% difference; $P < 0.05$). No significant improvement on performing 1 hemoglobin A_{1c} test	Partial effect	1
Pourat et al., 2005 (52)	Cross-sectional survey; January to May 2002; PCPs contracted with Medicaid HMOs in 8 California counties with the highest rates of *Chlamydia trachomatis* infection and Medicaid HMO enrollment	Level: physician Type: better contracts with health plans Duration: not ascertained in survey Description: HMO contracts included reimbursements for quality-of-care dimensions, including patient satisfaction or peer review Payment frequency: not ascertained in survey	Process	Chi-square, logistic regression Primary care physicians reimbursed under salary and quality of care more often adhered to annual screening of sexually active females age 15 to 19 y, compared with physicians compensated by capitation and financial performance, salary and productivity, salary and financial performance, or FFS ($P < 0.05$) Physicians with salary and quality of care incentive also more often consistently screened women age 20 to 25 y for *Chlamydia trachomatis* infection annually compared with physicians reimbursed using other payment mechanisms ($P < 0.05$)	Positive	1

* Study inclusion criteria were that the article must be an original report providing empirical results and the study must assess the relationship between an explicit financial incentive and a quantitative measure of health care quality. Articles were excluded if there was no concurrent comparison group, or if there was no baseline, preintervention analysis of the groups on the quality measure. ADL = activities of daily living; ANOVA = analysis of variance; BP = blood pressure; CBA = controlled before and after; CMHC = community mental health center; CMP = care management process; CS = composite score; CTT = continuous treatment team; FB + I = feedback and incentive; FBO = feedback only; FFS = fee for service; FY = fiscal year; HMO = health maintenance organization; ICF = intermediate care facility; IPA = independent practice association; IV = intravenous; LDL = low-density lipoprotein; MANOVA = multivariate analysis of variance; MIMS = mental illness management services; NA = not applicable; NS = not specified; OR = odds ratio; OSA = Office of Substance Abuse; PBC = performance-based contracting; PC = primary care; PCP = primary care physicians; PMPM = per member per month; RCT = randomized, controlled trial; SNF = skilled nursing facility; TCM = traditional case managers.
† Positive studies were those for which all measures of quality demonstrated a statistically significant improvement with the financial incentive. Partial effect studies showed improved performance on some measures of quality but not others. Negative studies were those for which all measures of quality demonstrated a statistically significant decrease with the financial incentive.
‡ Graded on a scale of 1 (poor) to 4 (excellent).