The Impact of Physician Bonuses, Enhanced Fees, and Feedback on Childhood Immunization Coverage Rates

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ABSTRACT

Objectives. The purpose of this study was to examine the effects on immunization coverage of 3 incentives for physicians—a cash bonus for practice-wide increases, enhanced fee for service, and feedback.

Methods. Incentives were applied at 4-month intervals over 1 year among 60 inner-city office-based pediatricians. At each interval, charts of 50 randomly selected children between 3 and 35 months of age were reviewed per physician.

Results. The percentage of children who were up to date for diphtheria, tetanus, and pertussis and *Haemophilus influenzae* type b; polio; and measles–mumps–rubella immunization in the study's bonus group improved by 25.3 percentage points ($P < .01$). No significant changes occurred in the other groups. However, percentage of immunizations received outside the participating practice also increased significantly in the bonus group ($P < .01$). Levels of missed opportunities to immunize were high in all groups and did not change over time. Physicians' knowledge of contraindications was low.

Conclusions. Bonuses sharply and rapidly increased immunization coverage in medical records. However, much of the increase was the result of better documentation. A bonus is a powerful incentive, but more structure or education may be necessary to achieve the desired results. (*Am J Public Health.* 1999;89:171–175)

In the United Kingdom, a population-based bonus for physicians has been used successfully to raise immunization coverage. Under the National Health Service bonus system, physicians receive £600 per year if immunization coverage in their entire 2-year-old population is 70% and £2400 (about $900 and $3600, respectively, at the time of this study)[1] for 90% coverage.[2] The larger bonus represents approximately 5% to 7% of an average physician's income (D. M. Salisbury, MB, FRCP, FRCPH, MFPHM, London Department of Health, written communication, May 8, 1997). This incentive, along with other interventions such as appointing immunization coordinators in every district, using computers extensively to call and recall, and distributing guidebooks on contraindications, has succeeded in raising immunization coverage levels for all antigens to the 90% goal levels.[3]

Despite their success in the United Kingdom, population-based incentives have received scant attention in this country,[3] partly because this incentive is not well suited to a fee-for-service environment where physicians do not have a designated population of patients. In a managed care setting, however, physicians do have a defined panel of patients, and population-based incentives deserve attention.

Other incentives that appear promising are enhanced fees for immunizing[4] and feedback on immunization coverage, even without financial incentives.[5,6] Enhancing immunization fees as part of New York State's Vaccines for Children program in 1994 (coupled with vaccine supplied upfront, rather than reimbursed after the fact) led to a doubling of coverage rates among inner-city providers (from less than 20% for diphtheria and tetanus toxoids and pertussis [DTP], oral polio vaccine [OPV], and measles–mumps–rubella [MMR] to 42.2%).[4] Likewise, giving physicians feedback—information about processes and outcomes for their own patients—especially when their performance is contrasted with that of their peers, has been shown to lead to converging behavior.[7–11] With respect to immunization in particular, giving physicians feedback was concomitant with a doubling of immunization coverage in Georgia clinics over an 8-year period, from less than 40% to more than 80%.[5]

The purpose of this study was to examine the effects of these 3 incentives—a financial bonus, enhanced fees for immunization services, and feedback on immunization coverage rates—on immunization performance among physicians in practices serving predominantly Medicaid enrollees in inner-city areas, which historically have had some of the lowest immunization rates in New York City.[12,13]

Methods

Design

Physicians were randomly assigned to 1 of 3 intervention groups—bonus and feedback, enhanced fee for service and feedback, and feedback only—or to a control group. Repeated cross-sectional independent samples of children were used to measure up-to-date status at 3 points at approximately

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4-month intervals ($\bar{x} = 4.0$ months, SD = 0.86) between July 1995 and July 1996. The Vaccines for Children program had been implemented in October 1994, almost a year earlier. Many effects of the program were already being felt; additional effects were constant across all groups. The interventions were applied to physicians, while the outcomes affected the children clustered within a given physician's practice. The central research question is, What is the effect on children of these interventions? Hence, the unit of analysis is the child, with a correction for clustering.

Physicians in each of the 3 intervention groups received feedback on their immunization performance at the time of data collection and, in more detail, in a letter mailed to each physician approximately 4 weeks later (mean = 3.9 weeks, SD = 2.9) along with any applicable financial award. This feedback included up-to-date coverage rates for immunizations, coverage by patient age groups, missed opportunities to immunize, comparisons with peers' performance, and hypothetical coverage rates calculated as if no opportunities had been missed and/or one more timely visit had been scheduled for vaccines due.

Physicians assigned to the bonus and feedback group were eligible to receive financial bonuses based on patients' up-to-date coverage for DTP and *Haemophilus influenzae* type b (Hib), OPV, and MMR. Bonuses were awarded for improvement as well as achievement: $1000 for a 20% improvement from baseline, $2500 for a 40% improvement from baseline, and $5000 for reaching 80% coverage irrespective of baseline performance level.

Physicians assigned to the enhanced fee for service and feedback group received $5 for each vaccine they administered within 30 days of its coming due. A fee of $15 was awarded for each visit at which more than 1 vaccine was due, and all due vaccines were administered.

Physicians in the control group received feedback on their performance with respect to blood lead and tuberculosis screenings, as well as the monitoring of anemia. This feedback included overall up-to-date screening rates, rates by patient age groups, and comparisons with peers' performance.

Sample Selection

A multistage stratified cluster sampling strategy was employed.

Nine neighborhoods in New York City with the highest rates of poverty (mean = 34% of households) and proportions of Medicaid-enrolled children (mean = 67% of children) were targeted for this study.[14] Pediatricians and family practice physicians whose primary service delivery sites were in the targeted neighborhoods and who had submitted 2500 or more Medicaid claims for children in 1992 were eligible for this study.

Multiple attempts were made to contact the 176 physicians who met these criteria. Twenty-three physicians could not be located, and another 70 were excluded because they worked in hospital-based practices, no longer practiced in a targeted neighborhood, had retired, were on disability, no longer accepted Medicaid, had never provided immunizations, or shared a practice with another eligible physician. In total, 83 physicians were invited to join the study.

All physicians were offered complete confidentiality, and written informed consent was obtained from each participant. Sixty-one physicians (73.5% of the invitees) agreed to participate. One physician dropped out of the study after the first data collection point. Data on 60 physicians were available for all 3 data collection points. Participating physicians within each neighborhood were randomly assigned to one of the study's 4 groups.

Sampling of children was in accordance with Centers for Disease Control and Prevention guidelines.[15] At each point, independent samples of randomly selected charts were chosen for review if the child was between 3 and 35 months of age at the time of the last visit, the chart showed a visit within the year prior to the chart review, and the chart made no mention of the child's moving or leaving the practice. These inclusion criteria were used to ensure that current immunization practices among active patients were reflected. A target number of 50 charts (mean = 50.3, SD = 6.3) were reviewed at each physician's office at each point. Immunization histories and data on all individual visits within the 4 months prior to review, including diagnoses and antigens administered, were collected at each data collection point.

Measures

Outcome variables. Up-to-date immunization status as reflected in the patients' medical charts constituted the primary outcome variable. Up-to-date status was defined as receipt of the vaccine by the maximum recommended age for immunization in accordance with the 1995 "harmonized" schedule approved by the Advisory Committee on Immunization Practice, the American Academy of Pediatrics, and the American Academy of Family Physicians.

The percentage of visits in the previous 4 months that were missed opportunities to immunize constituted another immunization-related outcome measure. This percentage was calculated by dividing the number of visits that were actual missed opportunities to immunize by the number of eligible visits, defined as visits at which a child was due for 1 or more vaccinations and no contraindication to vaccination was recorded.

The third immunization-related outcome measure was the percentage of vaccinations received outside the practice. A vaccine was counted as being received outside the practice if it was administered on a date when no office visit was recorded or if it occurred before the first visit to the participating physician. An increase in the percentage of "outside" vaccinations may indicate improvements in history taking and/or record keeping.

Independent variables. Intervention group membership and time were the primary independent variables of interest. Characteristics of the physicians and their practices were also measured at baseline via physician interviews. These characteristics included board certification status, any hospital admitting privileges, any participation in a managed care plan, designation as a preferred Medicaid provider, and practice size. Likewise, characteristics of the children selected were recorded, including whether the child was enrolled in Medicaid, the child's age (in months) at the time of the last visit, the child's total number of visits, and the number of months the child had been followed by the participating physician.

Statistical Analysis

Baseline physician characteristics and characteristics of eligible children were compared across the 4 groups of the study by one-way analysis of variance and χ^2 tests. Baseline immunization performance—percentage up to date, percentage of visits that were missed opportunities, and percentage of immunizations received outside the practice—was also compared across study groups by means of one-way analysis of variance and χ^2 tests.

Logistic regression models (up-to-date and missed-opportunity variables) and linear regression models (percentage of immunizations received outside the practice) were used to determine the effect of each intervention over time relative to the control group. Two sets of equations were used, comparing baseline performance with performance 4 months later and comparing baseline performance with performance 8 months later. Dichotomous indicators of group assignment (bonus and feedback, enhanced fee for service and feedback, and feedback only), a dichotomous indicator of time (preintervention/postintervention), and interactions between group indicators and time (bonus × time, enhanced fee for service × time, and feedback × time) were entered concurrently. A statistically significant interaction term would indicate significant change over time in that group relative to the control group. Unadjusted percentages and means, rather than regression coefficients, are presented here. No other covariates were used.

Weights were created to adjust for different patient population sizes of the various physicians, consistent with using the child as the unit of analysis. Weights are the reciprocal of the estimated sampling fraction, scaled by dividing by the mean of these values.

Participants' practices served as the clusters within which children were randomly selected for analysis. This cluster sampling approach yields an effective sample size that is smaller than the number of charts actually reviewed.[16] The design effect for up-to-date status at baseline was 2.94. Standard errors were estimated with SUDAAN software[17] to correct for this clustering effect.

Sample Characteristics

The characteristics of the practices from which sample children were drawn did not vary significantly across groups of the study. On average, participating physicians had 324 preschool-aged children in their active patient populations. Eighty-three percent of the physicians had hospital admitting privileges, and slightly more than half were board certified (55%), participated in 1 or more managed care plans (57%), and had been designated Medicaid preferred providers (52%).

Likewise, the characteristics of the children sampled did not differ across groups of the study. The children were overwhelmingly enrolled in Medicaid (93%). On average, they were 17 months old at the time of their last visit and had almost 6 total visits over the 7.5 months they had been followed up by the participating physician.

The 3 measures of immunization performance, however, did vary significantly at baseline. Although no intervention group differed from the control group, the enhanced fee-for-service group appeared different from the other intervention groups. Children in the enhanced fee-for-service group were more likely to be up to date for DTP/Hib, OPV, and MMR at baseline (46.2%; Table 1, column 1) than were children in the bonus group (29.1%, $P < .01$) or those in the feedback-only group (31.4%, $P < .05$). Likewise, the number of missed opportunities for immunization was lower in the enhanced fee-for-service group than in the feedback-only group (81.7% vs 88.9%, $P < .05$; Table 2, column 1). In addition, fewer children in the bonus group had documented immunizations given outside the practice than children in the control group (46.3% vs 60.1%, $P < .05$; Table 3, column 1). These differences were controlled for in the subsequent analyses.

TABLE 1—Up-to-Date Immunization Coverage (% of Patients) for Diphtheria, Tetanus, Pertussis, and *Haemophilus Influenzae* Type b; Polio; and Measles–Mumps–Rubella, by Study Group: Inner-City Physicians in New York City, July 1995–July 1996

Group	Baseline (n = 2948)	Time 2 (n = 3085)	Time 3 (n = 3019)	Percentage-Point Change
Bonus and feedback	29.1	43.9*	54.4*	+25.3
Enhanced fee for service and feedback	46.2	47.2	50.5	+4.3
Feedback only	31.4	36.8	44.0	+12.6
Control	34.6	38.0	40.7	+6.1

Note. Data are weighted for child population representation. *P* value denotes change over time that is significantly different from that observed in the control group (the intervention × time interaction terms), based on adjusted odds ratios, corrected to account for the use of cluster sampling techniques.
*$P < .01$.

Results

As shown in Table 1, the percentage of children whose charts showed them to be up to date for DTP/Hib, OPV, and MMR improved significantly ($P < .01$) within the bonus group, relative to the control group, within 4 months after the intervention was initiated, and the upward trend continued from time 2 to time 3 ($P = .058$). Eight months after baseline, the percentage of children whose charts showed them to be up to date for these vaccines had increased by 25.3 percentage points, from 29.1% to 54.4% ($P < .01$; Table 1). No significant changes over time, relative to the control group, were observed in any other group in the study.

To determine the factors responsible for the observed increase in coverage, we examined missed opportunities and immunizations received outside the practice. As shown in Table 2, missed opportunities to immunize were high at baseline, ranging from 82% to 89% of the eligible visits, with none of the observed decreases over time significant relative to that in the control group. Physicians' responses to questions about contraindications for immunization showed a general misunderstanding of the conditions under which it is appropriate to immunize children. Many of the physicians believed a variety of mild illnesses to be contraindications, even though they are not considered contraindications according to the Standards for Pediatric Immunization Practices set forth by the National Vaccine Advisory Committee.[18] For example, 47% of the physicians believed that otitis media was a contraindication, 55% believed this of bronchitis, and 53% believed it of temperatures above normal but below 101.5°F. This is particularly striking given that in this study, sick visits accounted for the majority of all visits (73.8% at baseline).

The bonus group showed a significantly larger increase, relative to the control group, in percentage of immunizations received outside the participating practice throughout the course of the study (Table 3). The increase was significant after 4 months but then stayed essentially level at the 8-month data collection point. The overall increase was 14 percentage points in 8 months (from 46.3% to 60.3%, $P < .01$; Table 3). Percentage of immunizations received outside the practice increased significantly in the enhanced fee-for-service and feedback group as well, but the overall increase was smaller and took the full 8 months to occur (from 53.0% to 59.9%, $P < .05$).

Calculation of hypothetical up-to-date status showed that coverage for all groups would have been considerably higher (approximately 25 percentage points higher in all groups) had there been no missed opportunities for immunization. In addition, hypothetical coverage would have increased over this value by approximately 5 percentage points if children had been called back for one more immunization visit.

Discussion

The bonus succeeded in sharply and rapidly increasing coverage as reported in the medical records. However, although the bonus "worked" as an incentive, the major action it produced was better documentation of past immunizations for children in the bonus

TABLE 2—Percentage of Visits in the 4 Months Prior to Review That Were Missed Opportunities to Immunize, by Study Group: Inner-City Physicians in New York City, July 1995–July 1996

Group	Baseline (n = 1947)	Time 2 (n = 2157)	Time 3 (n = 2047)	Percentage-Point Change
Bonus and feedback	88.5	82.4	81.0	−7.5
Enhanced fee for service and feedback	81.7	82.3	82.1	−0.6
Feedback only	88.9	85.4	80.4	−8.5
Control	83.7	84.2	82.8	−0.9

Note. Data are weighted for child population representation.

TABLE 3—Percentage of Immunizations Received Outside the Participating Practice Among Children with One or More Immunizations, by Study Group: Inner-City Physicians in New York City, July 1995–July 1996

Group	Baseline (n = 1901)	Time 2 (n = 2187)	Time 3 (n = 2249)	Percentage-Point Change
Bonus and feedback	46.3	65.8*	60.3*	+14.0
Enhanced fee for service and feedback	53.0	53.7	59.9**	+6.9
Feedback only	49.5	58.4	53.7	+4.2
Control	60.1	63.5	57.7	−2.4

Note. Data are weighted for child population representation. *P* values denote change over time that is significantly different from that observed in the control group (the intervention × time interaction terms), based on adjusted odds ratios, corrected to account for the use of cluster sampling techniques.
*$P < .01$; **$P < .05$.

group. That percentage of immunizations received outside the practice increased significantly for these children attests to this fact, as does the bonus-group physicians' report that they made more of an effort to get patients' immunization history. Anecdotal evidence also supports this claim. Several physicians became more aggressive in asking patients for their immunization records, and at least one bought a photocopier for the purpose of copying them. It may be that the rapid increases in observed coverage rates are related to documentation and that improvements in active vaccination behavior take more time. Another recent study (with no control group) that rexported a rapid increase in up-to-date coverage in response to a substantial financial incentive also found that the increase was primarily due to documentation.[19]

It is clear from our calculations of hypothetical coverage rates that immunization coverage could have been raised considerably (e.g., to 76.2% in the bonus group at time 3) if immunizations had been given at every opportunity. This demonstrates that better immunization coverage could be achieved even in these inner-city offices where episodic care is the norm.[12] However, these inner-city physicians apparently do not realize that they can give immunizations in the presence of many of the mild illnesses that bring children to the doctor's office, and children appear to go to these physicians primarily when they are sick (73.8% of all visits are sick visits). Although the very high rate of missed opportunities (from 80% to 90% in all groups in our study) indicates that more than misunderstanding of contraindications may be at work here, it also highlights the need for more education in this area. It may be that physicians are improving their documentation in response to the offer of a bonus, but not changing immunizing behavior, because they are unsure of what actions are appropriate.

Improved documentation, however, is important in its own right. Physicians need to take 3 actions to improve coverage among their patients: ask about immunization status, document current status, and vaccinate. Until very recently, Medicaid reimbursement for immunization was so low that physicians in these largely Medicaid practices neglected all aspects of immunization, including inquiring about and recording patients' current status.[12,13] Bringing medical records in line with reality is a necessary, but not sufficient, step toward improving true coverage.

Furthermore, the fact that the bonus effected some, but not all, of the desired behavior should not overshadow the finding that a population-based cash bonus was a powerful motivator. Not only did overall coverage increase significantly in the bonus group, but by the end of the study more than two thirds of the physicians in this group had improved enough to earn a bonus (i.e., they had improved by 20 percentage points or reached 80% up-to-date coverage). Only 2 of the physicians in the enhanced fee-for-service group and 2 of the physicians in the feedback-only group improved as much.

The failure of feedback alone to produce significant improvement deserves attention, especially since recent studies have reported dramatic improvement with feedback alone.[5,20] It may be that the 8-month time period was not long enough for feedback alone to produce large changes in behavior. For instance, in one well-publicized study (with no control group) it took 7 years for dramatic improvement to occur; average improvement for a 1-year period was approximately 5 percentage points, comparable to the gain of the feedback group in the present study.[5] Furthermore, in the other studies feedback was accompanied by a number of other nonfinancial incentives, such as plaques for attainment of goals, annual meetings at which clinic personnel presented their successful projects, and publishing of rank-order listings of up-to-date coverage scores.[5,20,21]

Limitations of this study include the fact that the number of participating physicians was small, given the number of interventions tested. With only 15 physicians per group, random assignment produced groups that differed somewhat at baseline. However, these baseline differences were controlled for in the analysis. Furthermore, the potential adverse effect of the difference—that the initially higher-performing group may improve less because it has less room for improvement—is lessened by the fact that all groups had considerable room for improvement.

A second limitation is that the data collectors were not blinded to the physician's study-group assignment. The interventions were administered at the time of data collection; therefore, the data collectors served 2 roles in the study. Under these circumstances, it was impossible to keep all data collectors blinded. To assess the extent to which this situation may have created bias, a random subsample of 303 charts was duplicate-entered by "blinded" chart reviewers who had no knowledge of the interventions. Differences between up-to-date coverage calculated from blinded reviews and that calculated from regular reviews did not vary across groups in the study ($P = .78$).

It appears that a population-based bonus worked as an incentive, but that more time, more structure (e.g., rewarding population-based reductions in missed opportunities in addition to simple coverage), more education of physicians (e.g., on true contraindications to immunization), or all 3 are needed to bring about the necessary behavioral changes. The policy implications of a population-based bonus are particularly important at this juncture, when more of the Medicaid population is in managed care. In a managed care setting, physicians have a defined panel of patients for whom they are responsible. Thus, incentives that encourage improved health care for the entire population need to be examined. □

Contributors

Gerry Fairbrother and Karla Hanson were primarily responsible for designing the study, analyzing the data, and writing the report. Stephen Friedman conceptualized the study design and made clinical decisions for determining coverage level and missed opportunities. Gary Butts oversaw questions related to primary care and medical home. Drs Friedman and Butts contributed guidance and criticism to all phases of the study, including design, analysis, and writing. All authors are guarantors for the integrity of the data.

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