

# Physician Perception of Reimbursement for Outpatient Procedures Among Managed Care Patients With Diabetes Mellitus

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**Objective:** To examine the association between physicians' reimbursement perceptions and outpatient test performance among patients with diabetes mellitus.

**Study Design:** Cross-sectional analysis.

**Methods:** Participants were physicians (n = 766) and their managed care patients with diabetes mellitus (n = 2758) enrolled in 6 plans in 2003. Procedures measured included electrocardiography, radiography or x-ray films, urine microalbumin levels, glycosylated hemoglobin levels, and Pap smears for women. Hierarchical logistic regression models were adjusted for health plan and physician-level clustering and for physician and patient covariates. To minimize confounding by unmeasured health plan variables, we adjusted for health plan as a fixed effect. Therefore, we estimated variation between physicians using only the variance within health plans.

**Results:** Patients of physicians who reported reimbursement for electrocardiography were more likely to undergo electrocardiography than patients of physicians who did not perceive reimbursement (unadjusted mean difference, 4.9%; 95% confidence interval, 1.1%-8.9%; and adjusted mean difference, 3.9%; 95% confidence interval, 0.2%-7.8%). For the other tests examined, no significant differences in procedure performance were found between patients of physicians who perceived reimbursement and patients of physicians who did not perceive reimbursement.

**Conclusions:** Reimbursement perception was associated with electrocardiography but not with other commonly performed outpatient procedures. Future research should investigate how associations change with perceived amount of reimbursement and their interactions with other influences on test-ordering behavior such as perceived appropriateness.

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For author information and disclosures, see end of text.

Ideally, physician test ordering is determined by clinical factors such as patient symptoms or disease screening recommendations. In reality, healthcare is delivered in a complex environment that exposes the physician to a wide range of nonclinical factors<sup>1-4</sup> that may influence test-ordering behavior. These competing influences may be especially strong for primary care physicians, who diagnose and treat a wide array of diseases.

Patients, patient advocates, policy makers, and healthcare organizations attempt to manage these nonclinical influences to elicit their preferred version of test-ordering behavior. One of these influences is reimbursement. Reimbursement initiatives are predicated by the assumption that if physicians perceive financial rewards for ordering a particular test, this perception will affect their test-ordering behavior.<sup>5</sup> Few studies have examined the association between primary care physicians' reimbursement perceptions and performance of particular procedures. Epstein and colleagues<sup>6,7</sup> compared test performance among fee-for-service patients with test performance among managed care enrollees. Their hypothesis was that reimbursement perceptions would be stronger in fee-for-service plans than in managed care plans and that fee-for-service patients would receive more tests. After adjustment for physician years in practice and for patient age, sex, duration of disease, and blood pressure levels, they found that tests perceived as more profitable (ie, electrocardiography) were performed more frequently by physicians in fee-for-service settings than in managed care plans. Tests perceived as less profitable, such as urinalyses and radiography, did not differ in frequency between managed care and fee for service. Therefore, perceived reimbursement seemed to have a role in test-ordering practices.

More recent studies<sup>8,9</sup> have examined actual reimbursement as opposed to perceived reimbursement. These studies have focused on procedure performance in fee-for-service versus salaried or capitated systems<sup>8</sup> and, more recently, on specific pay-for-performance initiatives.<sup>9</sup> Although such studies examine performance of procedures in different financial systems, they have usually not queried physicians about their reimbursement perceptions. Reimbursement perceptions may better predict actual test-ordering behavior because physicians may have limited awareness of actual reimbursement; in

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a survey, 16% of physicians did not know the percentage of their compensation from salary.<sup>10</sup> In other studies,<sup>11,12</sup> physicians were unaware of added reimbursement for vaccinations and cancer screening.

Since the studies by Epstein and colleagues,<sup>6,7</sup> the health-care environment has changed; the current healthcare market has higher managed care penetration,<sup>13</sup> and physician groups may contract with fee-for-service and managed care plans. In addition, pay-for-performance programs may affect more than 80% of managed care enrollees.<sup>9</sup> To our knowledge, the association between physicians' reimbursement perceptions and test performance has not been examined in this environment. Such an examination would inform our understanding of the importance of reimbursement perceptions in the clinical decision-making process. Therefore, we tested the hypothesis that the patients of physicians who perceived reimbursement for a particular procedure were more likely to have received that procedure than patients of physicians who did not perceive reimbursement for the procedure. We used detailed clinical data from Translating Research Into Action for Diabetes (TRIAD), a large cohort study of managed care enrollees with diabetes mellitus (DM) and their physicians enrolled in multiple health plans.<sup>14</sup>

## METHODS

### Setting and Study Population

A detailed description of TRIAD has been previously published.<sup>14</sup> In summary, 6 translational research centers collaborated with 10 health plans, including staff-model health maintenance organizations (HMOs), network association HMOs, point-of-service plans, and preferred provider organizations. Structural and health system factors were assessed using standardized in-person interviews of health plan and provider group medical directors and leadership personnel. These interviews assessed general organizational and financial characteristics, as well as DM-specific infrastructure and clinical activities. Patient data were obtained from surveys, medical record reviews, and administrative data. A patient survey, administered by computer-assisted telephone interview or in writing, assessed socio-demographic characteristics, recommended DM care services received, and general health status and quality-of-life measures. It also assessed access to care, patient satisfaction (Consumer Assessment of Health Plans Survey), DM education received, participation in self-care activities, disease management, and financial barriers. The medical record review in TRIAD included data abstracted from paper and electronic medical records during 18 months before the patient survey. Administrative data were derived from inpatient and outpatient claims and pharmacy and laboratory data provided by the health plans. These data

were used to establish the initial sampling frame, measure health services utilization and costs (eg, hospitalization and ambulatory care visits), and tabulate quality indicators (eg, laboratory and diagnostic tests and drug prescriptions).

Eligible patients were 18 years or older, were community dwelling, were not pregnant, had DM for at least 1 year, spoke English or Spanish, were continuously enrolled in their health plan for at least 18 months, used at least 1 service during that time, and could provide informed consent. Patients' ages and races/ethnicities varied widely across health plans.<sup>15</sup>

### Data Collection

The data herein were based on a survey of TRIAD primary care physicians (54% physician survey response rate) and their patients. Patients participated in the 2003 wave of data collection and were continuously enrolled during 12 months before the physician survey. We excluded 3 health plans for which we had only institutional claims and 1 plan that had only a single continuously enrolled patient. Physicians were enrolled in group-network or staff plans. The study included 766 physicians and their 2758 patients. When we compared patients who were continuously enrolled and their physicians versus patients who were not continuously enrolled and their physicians, their demographics were similar (data not shown).

The 12-month observation period for each study participant was immediately before the month during which the physicians filled out a survey and began anytime between August 2002 and January 2003. Patient data were collected from mailed surveys, computer-assisted telephone interviews, and medical record reviews. The interrater reliability ( $\kappa$  statistic) for the process-of-care variables at each of the 6 translational research centers ranged from 0.86 to 0.94.

### Main Outcome Measures

Procedure performance was ascertained from health plan administrative data. For each patient, we recorded any claim in the 12-month review period for each of the following procedures: electrocardiography, radiography or x-ray films, urine microalbumin monitoring, glycosylated hemoglobin (A1C) monitoring, and Pap smears for women. We dichotomized the measures because few participants had any procedure performed more than once. The only exception was measurement of A1C level, which was multiply coded for 70% of patients. Among all participants, the median numbers of procedures performed were 0 except for measurement of A1C level. Among participants who had at least 1 claim for a particular procedure, the median numbers were as follows: 1 (interquartile range [IQR], 1-2) for electrocardiography, 2 (IQR, 1-3) for radiography, 2 (IQR, 1-3) for urine microalbumin monitoring, 3 (IQR, 2-4) for A1C monitoring, and 1 (IQR,

1-1) for Pap smears. *Current Procedural Terminology* codes used to define each procedure are given in the [eAppendix](#) (available at [www.ajmc.com](http://www.ajmc.com)).

### Independent Variables

The primary independent variable was a set of dichotomous indicators for whether the physician perceived reimbursement for each procedure. The physician survey inquired, “Which of these services do you get paid to perform and/or interpret on a fee-for-service basis?” Therefore, the question assessed perception of reimbursement from several potential sources. The list of procedures included electrocardiography, radiography, urine microalbumin monitoring, A1C monitoring, and Pap smears. Other independent variables included physician sex, race/ethnicity, specialty, and years of practice, as well as patient age, sex, education, income, current smoking, body mass index, coverage by other insurance, DM treatment (diet controlled, oral agents only, oral agents and insulin, or insulin alone), and the Charlson comorbidity index.<sup>10</sup>

### Statistical Analysis

Cross-sectional associations between physician perceptions of reimbursement for each procedure and patient claims for each procedure were tested in unadjusted and adjusted models. Because we defined our outcome as the presence or absence of a procedure code, we had no missing data for our dependent variable. Distributions for variables were examined, and missing values for covariates were imputed using IVEware version 2.0 (University of Michigan, Ann Arbor).<sup>16</sup> IVEware uses sequential regression in which each covariate was predicted as a function of all other covariates. Five multiply-imputed data sets were created.

Hierarchical logistic regression models were used to account for the clustering of patients within physicians and health plans. Health plan effects were modeled as fixed and physician effects as random. An implication of this approach is that all health plan characteristics that do not vary across patients within the same health plan (eg, size, profit status, organizational type, referral management) are subsumed into these fixed effects and are implicitly controlled for in the model. All analyses were performed using SAS version 9.1.3 NLMIXED with full maximized likelihood estimation (SAS Institute, Inc, Cary, NC).

Results are presented as mean differences in marginal predicted probabilities. These represent the mean difference between the probability of having a claim for a particular procedure if fee-for-service reimbursement was perceived for that procedure and the probability of having a claim if fee-for-service reimbursement was not perceived for that procedure, holding all other factors constant at their original values.

We performed several sensitivity analyses. We sought to determine whether percentage compensation from salary confounded the association between perception of reimbursement and test ordering. The physician survey inquired, “As a primary care physician, what percent of your total compensation is based on salary as opposed to productivity or fee-for-service? Fill in the blank.” We included percentage compensation from salary as a main effect in a sensitivity analysis. This did not change the estimates (data not shown). For a subset of physicians ( $n = 144$ ), surveys were fielded between September 2003 and April 2004, but a more specific date was not available. We conducted a sensitivity analysis in which these physicians were excluded. The estimates did not change appreciably (data not shown). For another subset of physicians ( $n = 206$ ), there was a gap of at least 1 month between the last available administrative data for their patients and the date on which the physician filled out the survey. When we excluded these physicians from the analyses, the estimates were not noticeably affected (data not shown). Finally, we examined whether perceptions of reimbursement were stronger in non-staff-model plans; when we performed analyses stratifying by staff model versus non-staff model, the strata did not seem to be different (data not shown).

## RESULTS

Physician characteristics are given in [Table 1](#). When asked about reimbursement perceptions for specific procedures, physicians did not always respond to all of the items. For example, 733 physicians responded to the item inquiring about reimbursement perception for electrocardiography, with 47% of them reporting reimbursement perception for electrocardiography. However, only 659 physicians responded to the item about reimbursement perception for radiography. Therefore, [Table 1](#) lists the denominator for each procedure and the percentage of physicians reporting reimbursement perception for that procedure.

[Table 2](#) gives patient characteristics. On average, each physician who completed a survey had 3 patients included in the study. The percentage of patients who had at least 1 performance of a specific procedure ranged from 12% for Pap smears to 70% for A1C monitoring. Therefore, 559 patients had at least 1 electrocardiogram, 873 patients had at least 1 radiograph, 1319 patients had at least 1 urine microalbumin measurement, 1930 had at least 1 A1C measurement, and 328 women had at least 1 Pap smear during the study period.

[Table 3](#) gives the mean differences in marginal predicted probabilities. These differences represent the mean difference between the probability of having a claim for a particular procedure if fee-for-service reimbursement was perceived for

that procedure (unadjusted mean difference, 4.9%; 95% confidence interval [CI], 1.1%-8.9%; and adjusted mean difference, 3.9%, 95% CI, 0.2%-7.8%) and the probability of having a claim if fee-for-service reimbursement was not perceived for that procedure. In unadjusted comparisons, perception of reimbursement was associated with slightly more frequent performance of electrocardiography and A1C monitoring but not more frequent performance of radiography, urine microalbumin monitoring, and Pap smears. These patterns did not change with adjustment for other patient and physician factors. Only the difference for electrocardiography was statistically significant; perceived reimbursement was associated with a regression-adjusted predicted probability of 23.4% for electrocardiography, whereas lack of reimbursement was associated with a predicted probability of 18.7%. The significant difference of 4.7% represents a 25.0% increase compared with 18.7%.

The use of percentage compensation from salary as a main effect in a sensitivity analysis did not change the effect estimates, although the CIs widened, so the adjusted mean difference in electrocardiography performance was no longer statistically significant (4.4%; 95% CI, -0.6% to 9.5%). When we excluded physicians without an exact survey date from the analyses, the point estimates did not change significantly, although the CIs widened, so the mean difference in electrocardiography performance was no longer statistically significant (4.8%; 95% CI, -0.03% to 9.6%).

## DISCUSSION

Among a large, geographically diverse sample of managed care enrollees with DM and their physicians, we found inconsistent associations between physicians' reimbursement perceptions and procedure performance. Reimbursement perception for electrocardiography was associated with more frequent test performance, but reimbursement perceptions for other tests were not associated with test performance. We found little change in these patterns after adjustment for physician characteristics and for patient covariates. Our findings lend support to previous evidence from the 1980s suggesting that reimbursement perception is test specific and that any

associations with test performance are limited to electrocardiography.<sup>6,7</sup> Our findings are also in accord with previous work suggesting that report of compensation and performance of DM care measures (such as urine microalbumin and A1C monitoring) are not tightly linked.<sup>1,17,18</sup>

Earlier DM health services research examining associations between reimbursement and test performance consists of the following: (1) previously cited comparisons of reimbursement perceptions for outpatient tests among fee-for-service and salaried physicians,<sup>6,7</sup> (2) comparisons of DM quality of care in fee-for-service and salaried settings,<sup>1,17,18</sup> and (3) structured interventions based on financial incentives.<sup>19-21</sup> After adjustment for potential confounding characteristics of healthcare organizations, actual reimbursement does not seem to be strongly related to DM quality of care.<sup>1,17,18</sup> Comparisons of fee-for-service and salaried organizations in terms of DM measures have shown that fee-for-service organizations may provide poorer quality of DM care, suggesting that fee-for-service reimbursement for these measures may not be sufficient to increase procedure rates. We found that the association between perception of reimbursement for electrocardiography and elec-

**Table 1. Physician Characteristics**

Characteristic	Value (n = 766)
<b>Age, mean (SD), y</b>	47 (9)
<b>Duration of practice, mean (SD), y</b>	17 (10)
<b>Female sex, %</b>	31
<b>Race/ethnicity, %</b>	
Non-Hispanic white	55
African American	2
Hispanic	4
Asian or Pacific Islander	35
Other	5
<b>Specialty, %</b>	
Family or general practice	34
General internal medicine	54
Endocrinology	2
Other	8
<b>Physicians who perceived reimbursement per specific procedure, %<sup>a</sup></b>	
Electrocardiography (n = 733)	47
Radiography or x-ray films (n = 659)	14
Urine microalbumin monitoring (n = 672)	21
Glycosylated hemoglobin monitoring (n = 672)	22
Pap smears (n = 692)	32

<sup>a</sup>Percentages are calculated with the number of physician respondents as the denominator. For example, 47% of 733 physicians perceived reimbursement for electrocardiography.

■ **Table 2.** Patient Characteristics

Characteristic	Value (n = 2758)
<b>Age, mean (SD), y</b>	61 (12)
<b>Female sex, %</b>	54
<b>Race/ethnicity, %</b>	
Non-Hispanic white	37
African American	10
Hispanic	19
Asian or Pacific Islander	22
Other	12
<b>Education, %</b>	
<High school graduate	24
High school graduate	29
Some college	28
≥College graduate (≥4 y)	19
<b>Annual household income, \$, %</b>	
<15,000	29
15,000 to 40,000	31
>40,000 to 75,000	25
>75,000	15
<b>Duration of diabetes mellitus, mean (SD), y</b>	12 (11)
<b>Treatment of diabetes mellitus, %</b>	
Diet only	8
Oral medications	63
Insulin only	16
Insulin plus oral medications	12
<b>Body mass index, mean (SD)<sup>a</sup></b>	31 (7)
<b>Current cigarette smoking, %</b>	16
<b>Covered by other insurance, %</b>	31
<b>Charlson comorbidity index score, mean (SD)</b>	2.2 (1.5)
<b>Patients who received ≥1 procedure, %</b>	
Electrocardiography	20
Radiography or x-ray films	32
Urine microalbumin monitoring	48
Glycosylated hemoglobin monitoring	70
Pap smears	12

<sup>a</sup>Calculated as weight in kilograms divided by height in meters squared.

therefore, these factors are somewhat collinear. To date, structured interventions based on financial incentives, or pay-for-performance initiatives, have had minimal-to-moderate effects.<sup>19-21</sup>

Our study examined physicians' reimbursement perceptions, which may more accurately reflect physician decision making about test ordering than actual reimbursement. To our knowledge, no previous studies have examined implications of perceptions for patients with DM. In their examination of a pay-for-performance initiative, Hillman and colleagues<sup>11,12</sup> found that little association existed between physician incentives for vaccination and vaccination rates and that little association existed between physician incentives for cancer screening and cancer screening rates. They found that most physicians in the program were unaware of the initiatives; hence, the initiatives did not affect their practices.

The mean incentives to physicians in a particular group may not be the same as incentives faced by any individual physician. In addition, physicians respond to the incentives they perceive to be in effect, even if their perception is incorrect. Therefore, physicians' reimbursement perceptions may more accurately reflect reimbursement effects than actual reimbursement. By asking physicians directly whether they perceived reimbursement, we measured this influence on test ordering closest to the source.

The lack of significant associations between perception of reimbursement and procedure ordering may relate to several reasons aside from perception of reimbursement effects. Performance

of electrocardiography performance did not persist after adjustment for percentage compensation from salary. This suggests that such other aspects of healthcare organization characterized by fee-for-service versus salaried payment delivery potentially confound the association. Alternatively, if percentage compensation from salary is high, the importance of perceived reimbursement for a particular procedure should decrease;

of specific procedures (particularly A1C monitoring) was high, and in quality improvement studies, such high baseline performance can blunt the degree of improvement with any initiative and the power to detect significant differences.<sup>19-21</sup> However, the other outcomes in our study were performed at least once in less than half of the participants and may have been less susceptible to such effects. By using fixed ef-

**Table 3.** Regression-adjusted Differences in the Predicted Probability That a Patient Received a Procedure<sup>a</sup>

Outcome Measure	Difference (95% Confidence Interval), %	
	Unadjusted	Adjusted <sup>b</sup>
Electrocardiography	5.6 (1.0 to 10.4) <sup>c</sup>	4.7 (0.01 to 9.3) <sup>c</sup>
Radiography or x-ray films	-2.4 (-8.0 to 3.5)	-1.3 (-7.1 to 4.7)
Urine microalbumin monitoring	-0.8 (-6.9 to 5.2)	-0.4 (-6.5 to 5.5)
Glycosylated hemoglobin monitoring	1.5 (-4.2 to 6.5)	1.4 (-3.3 to 6.0)
Pap smears	-0.8 (-6.4 to 5.1)	-0.5 (-6.4 to 5.8)

<sup>a</sup>Values exceeding 0 indicate that the perception of reimbursement is associated with a higher predicted probability that the procedure was performed.  
<sup>b</sup>Adjusted for clustering within health plan and for patient and physician characteristics.  
<sup>c</sup>Statistically significant.

fects at the health plan level, we accounted for health plan confounders, but in doing so, we may have overadjusted and minimized perception effects because these are integrated with reimbursement delivery.

Our study has several limitations. We inquired about perceptions of reimbursement, but we did not inquire about the perceived amount of reimbursement. This may have biased our results to the null. Because we were interested in the broad category of reimbursement, we did not measure particular aspects of reimbursement such as perceived reimbursement for reading radiographs versus performing radiography versus downstream profits from ownership of radiography facilities. However, it is possible that specific subtypes of reimbursement are more closely associated with testing behavior. We did not inquire about each plan’s reimbursement policies, and it is possible that physicians tailor their test-ordering practices according to the patient’s health plan. Because physician groups often contract with several plans, we reasoned that it would be difficult for physicians to quantify the proportions of patients enrolled in a health plan and the compensation for particular procedures associated with each plan. If such tailoring occurs, it would also have biased our results toward the null. We inquired about reimbursement perceptions after the observation period, and it is possible that reimbursement schemes changed in the time between our survey and the period during which tests were performed. We measured all of the procedures ordered for a particular patient, but we only assessed perceptions of reimbursement for the primary care physician. Therefore, it is possible that physicians other than those surveyed ordered procedures, biasing our results to the null. Because few studies have examined perceptions of reimbursement, as opposed to reimbursement schemes, which may

be examined on a group level, the importance of this issue is unknown. If ordering by other physicians with different reimbursement perceptions was a significant issue, A1C and urine microalbumin monitoring should have shown larger or more significant effects than electrocardiography, but in fact the pattern of results showed the opposite. Procedures likely to be ordered by the primary care physician include those related to chronic care (such as A1C and urine microalbumin monitoring) rather than those related to acute issues. Therefore, the association for these procedures and primary care physicians’ awareness might have been stronger, but no association was observed. Conversely, electrocardiography may be ordered for acute symptom-based reasons and, less commonly, for “baseline” purposes because patients were at high risk for cardiovascular disease given their DM. Therefore, the association should be weakened by lack of perception of reimbursement but was the only significant association observed. Finally, the association between perception of reimbursement and performance of procedures may differ between study participants, who all had DM and were managed care enrollees, and patients who were not study participants.

We conclude that in managed care the perceptions of reimbursement for particular outpatient procedures have inconsistent associations with test ordering among primary care physicians who care for patients with DM. Associations may

**Take-away Points**

In managed care, perceptions of reimbursement for particular outpatient procedures have inconsistent associations with test ordering among primary care physicians who care for patients with diabetes mellitus. Previous studies have documented an association between reimbursement perceptions and performance of electrocardiography but not for other common outpatient procedures.

- Associations may exist for electrocardiography but not for recommended diabetes care measures such as urine microalbumin or glycosylated hemoglobin monitoring, screening measures such as Pap smears, or other diagnostic tests such as radiography.
- To improve performance of certain measures, additional interventions may be necessary, including greater physician detailing, levels of reimbursement, and discussion of appropriateness.

exist for electrocardiography but not for recommended DM care measures such as urine microalbumin or A1C monitoring, screening measures such as Pap smears, or other diagnostic tests such as radiography. Further research is needed to determine whether larger incentives combined with greater physician detailing have a greater effect on test ordering, how such associations vary as reimbursement levels change, and how perception of reimbursement interacts with other influences on test-ordering behavior such as appropriateness of tests and mechanisms of reimbursement.

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