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Are Physician Reimbursement Strategies Associated with Processes of Care and Patient Satisfaction for Patients with Diabetes in Managed Care?

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Objective. To examine associations between physician reimbursement incentives and diabetes care processes and explore potential confounding with physician organizational model.

Data Sources. Primary data collected during 2000–2001 in 10 managed care plans.

Study Design. Multilevel logistic regressions were used to estimate associations between reimbursement incentives and process measures, including the receipt of dilated eye exams, foot exams, influenza immunizations, advice to take aspirin, and assessments of glycemic control, proteinuria, and lipid profile. Reimbursement measures included the proportions of compensation received from salary, capitation, fee-for-service (FFS), and performance-based payment; the performance-based payment criteria used; and interactions of these criteria with the strength of the performance-based payment incentive.

Data Collection. Patient, provider group, and health plan surveys and medical record reviews were conducted for 6,194 patients with diabetes.

Principal Findings. Without controlling for physician organizational model, care processes were better when physician compensation was based primarily on direct salary rather than FFS reimbursement (four of seven processes were better, with relative risks ranging from 1.13 to 1.23) or capitation (six were better, with relative risks from 1.06 to 1.36); and when quality/satisfaction scores influenced physician compensation (three were better, with relative risks from 1.17 to 1.26). However, these associations were substantially confounded by organizational model.

Conclusions. Physician reimbursement strategies are associated with diabetes care processes, although their independent contributions are difficult to assess, due to high correlation with physician organizational model. Regardless of causality, a group's use

*See Web Appendix A for complete list

of quality/satisfaction scores to determine physician compensation may indicate delivery of high-quality diabetes care.

Key Words. Provider financial incentives, reimbursement, quality of care, diabetes

Although controversial, the use of financial incentives in health care has garnered increasing interest (Berwick 1995; Miller and Sage 1999; Bailit Health Purchasing LLC and Sixth Man Consulting Inc. 2001; Institute of Medicine 2001; Rolnick 2002; Fernandopulle et al. 2003; Maio et al 2003). For example, in a recent major initiative in the U.K., primary care physicians (PCPs) have entered into a government contract that will provide incentives for high-quality care (Roland 2004). To date, however, the literature on the effects of physician reimbursement incentives has largely been limited to conceptualization of the issues (Hillman 1990; Berwick 1996; Dudley et al. 1998; Glass, Pieper, and Berlin 1999; Goldfarb 1999; Tufano, Conrad, and Liang 1999; Robinson 2001; Conrad and Christianson 2004). With at least one notable exception (Keating et al., 2004), empirical studies have focused on quantity of services delivered rather than process measures or quality of care and have yielded conflicting conclusions (Dudley et al. 1998; Armour et al. 2001; Bailit Health Purchasing LLC and Sixth Man Consulting Inc. 2001; Conrad and Christianson 2004; Rosenthal et al. 2004). This study assessed the associations between the reimbursement strategies used for PCPs and the care processes and satisfaction of their managed care patients with diabetes and examined how this relationship may be confounded by physician organizational model.

Diabetes and its complications are common, complex, and costly, presenting formidable challenges to the U.S. health system (Centers for Disease Control and Prevention 1997; American Diabetes Association 1998). Diabetes complications and comorbidities may be delayed or avoided altogether

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through timely and effective treatments, but unfortunately many of these treatments are not uniformly implemented in routine clinical practice (Marrero 1994; Martin, Selby, and Zhang 1995; Centers for Disease Control and Prevention 1997; Pan et al. 1997; Harris 2000). A better understanding of the factors influencing care processes across diverse health care systems, including the role of physician reimbursement strategies, is needed to close the gap between actual and optimal care. To that end, this study tested three hypotheses based on the theoretical and empirical literature previously cited.

The first hypothesis is that processes of care are better, and hence satisfaction greater, among managed care patients with diabetes whose PCPs total compensation depends more heavily on fee-for-service (FFS) reimbursement than on salary or capitated reimbursement, because there are no cost containment incentives in a FFS system that might restrict the care received by the patient (Dudley et al. 1998; Armour et al. 2001; Institute of Medicine 2001; Robinson 2001; Grignon et al. 2002; Kuhn 2003; Conrad and Christianson 2004). The counter-hypothesis is that capitation is associated with better care processes because capitated plans reap any (short-term) financial gains that might result from better disease management. The counter-hypothesis is more compelling if patient disenrollment is lower, as the plan might otherwise be unable to recoup investments in patient health quickly enough.

The second hypothesis is that processes of care are better, and satisfaction greater, among managed care patients with diabetes whose PCPs total compensation is based in part on quality or patient satisfaction (Bailit Health Purchasing LLC and Sixth Man Consulting Inc. 2001; Institute of Medicine 2001; Conrad and Christianson 2004). The third hypothesis is that processes of care are worse, and satisfaction lower, among managed care patients with diabetes whose PCPs total compensation depends on outpatient utilization, i.e., are paid more when their patients are less costly (Armour et al. 2001; Bailit Health Purchasing LLC and Sixth Man Consulting Inc. 2001; Institute of Medicine 2001). Again, a counter-hypothesis can be made if short-term investments in the patient's health are more than offset by longer-term reductions in cost, although such reductions seem more likely to show up in inpatient settings, where they would not contribute to the physician's compensation.

An earlier study using the same dataset (Kim et al. 2004) found associations of diabetes care processes with physician organizational model (independent practice association [IPA] versus medical group [MG]) and hypothesized that these associations could be mediated by factors such as physician reimbursement strategies, but did not examine the role played by those strategies. We sought to build on this earlier work by estimating the

association between reimbursement strategies and care processes, with and without controlling for physician organizational model.

Design and Methods

Setting and Study Population

Data were collected as part of a multisite study of managed care patients with diabetes, the Translating Research Into Action for Diabetes (TRIAD) study (see Gregg and the TRIAD Study Group 2002 for details). In TRIAD, six Translational Research Centers (TRCs) collaborated with 10 health plans that served approximately 180,000 patients with diabetes. Participating health plans included staff model health maintenance organizations (HMOs), network/IPAs, point-of-service plans, and preferred provider organizations with commercial, Medicare, and Medicaid products. Patients were eligible to participate if they were at least 18, lived in the community, were not pregnant, had diabetes for at least 1 year, spoke either English or Spanish, were continuously enrolled in their health plan for at least 18 months, used at least one service during that time, and could give informed consent.

Data Collection

Data were collected in 2000–2001 from 11,927 patients through a combination of mail surveys and computer-assisted telephone interviews. The survey response rate was 91 percent among contacted eligible people and 69 percent overall. Information on processes of care was derived from the baseline patient survey and medical record reviews for the 18 months before the survey. Multiple reviewers abstracted the medical records. Before the data collection, a detailed manual of operation was prepared and training and standardization of survey and chart review were attended to. Five percent of records were chosen for "double blind" abstraction; the interrater reliability (κ) at each of the six TRCs ranged from 0.86 to 0.94.

Information on the reimbursement strategies used for PCPs was collected from the provider group (or the health plan, if it contracted directly with the physicians) using mail surveys and telephone interviews with medical directors, chief executive officers, or their designees. The 72 physician clusters included 68 provider groups and four health plans using direct contracting and are hereinafter referred to generically as provider groups. Of these, 57 provided information on reimbursement strategies, for a 79 percent response rate. One group was excluded because medical record data were not available for

any patients. The study cohort was further limited to patients who had medical record and physician reimbursement data and who used a PCP as either their diabetes or regular physician. Seventy-six percent of those with complete data used a PCP and the final sample size was 6,194.

Dependent Variables

The process measures indicated whether the patient received each of the following care elements during the previous year: assessment of glycemic control (HbA1c), proteinuria, and lipids; dilated eye exam; foot exam during most or all visits; advice to take aspirin; and influenza immunization. Receipt of the three assessments was determined through medical record review and receipt of an influenza immunization was determined through patient self-report. Dilated eye exam, foot exam during most or all visits, and advice to take aspirin were considered to have occurred if their receipt was either reported by the patient or noted in the medical record. Patient satisfaction measures were dichotomized versions of the Consumer Assessment of Health Plans Study Version 1.0 scores for (i) whether the patient reported problems getting needed care and (ii) how well the patient felt his or her doctors communicated (Marshall et al. 2001); 1 denoted the best possible score and 0 denoted all other scores.

Provider Group-Level Covariates

For the first set of analyses, physician reimbursement measures examined were categorized as four groups of PCP compensation, depending on the major source of compensation: $\geq$60 percent of compensation from direct salary; $\geq$60 percent from fixed capitation; $\geq$60 percent FFS; and mixed methods. (Web Appendix B contains the wording of the question on which this measure was based.) Use of continuous rather than categorical measures did not alter our conclusions.

The second set of analyses focused specifically on reimbursement measures related to performance-dependent payment only, including an indicator for whether the informant (see "data collection" above) reported that any part of physicians' earnings depended on outpatient utilization (or costs); an indicator for whether the informant reported that any part of physicians' earnings depended on either the quality of care they provided or the satisfaction of their patients (in both cases, as assessed by the plan or group); a continuous proxy measure of the strength of the performance incentive, measured by dividing the percent of total compensation that is based on performance by the

number of physicians used to measure performance; and interactions between this proxy measure and the two performance indicators.

The proxy for the strength of the performance incentive takes on higher values if either a higher proportion of compensation depends on performance or if performance measurement is based on a smaller number of providers, thereby giving each provider a stronger financial stake in improving performance (Gaynor and Gertler 1995; Prendergast 1999; Armour et al. 2001; Bailit Health Purchasing LLC 2002; Conrad and Christianson 2004). For example, 20 percent performance-dependent pay could provide either a strong or a weak incentive for performance, depending on whether the performance being measured is that of the individual physician or that of a large group of physicians whose performance the individual physician cannot influence. The interactions were included because a stronger performance incentive should improve the process of care if performance is measured by patient quality and satisfaction, but worsen it if performance is measured by outpatient utilization.

To examine the extent to which these associations may be confounded with the effects of organizational model, which was previously shown to have a significant association with process of diabetes care (Kim et al. 2004), we compared the results of models that did and did not control for whether the provider group was a MG versus IPA. In sensitivity analyses, we examined additional possible confounding by (i) profit status; (ii) multispecialty (yes or no); (iii) intensity of use of referral management strategies; and (iv) number of physicians. These characteristics were selected because the literature suggested that they might be associated with both care process and financial incentives. Care management processes were not examined because a comprehensive study did not find any significant associations between physician feedback, disease registry, clinical practice guidelines, or self-management skills with whether the provider group was paid bonuses for scoring well on quality measures (Casalino et al. 2003).

Patient-Level Covariates

All models controlled for age, sex, race/ethnicity, education, household income, sources of insurance, type of diabetes treatment (insulin, oral agents, or diet only), years since diabetes diagnosis, Charlson comorbidity index, and SF-12 physical and mental component summary (PCS and MCS) scores.

Statistical Analysis

Missing values were singly imputed for the patient-level covariates (ranging from 0 to 10 percent, depending on the variable) and multiply imputed for the

physician reimbursement incentive measures (0–25 percent), using Markov Chain Monte Carlo methods (Schafer 1997). Predictors were the other incentive measures, in addition to provider group profit status and size, whether multispecialty, and a referral care management scale. All associations between the reimbursement and process measures were estimated using multilevel logistic regression models, with random intercepts for health plan and provider groups. The multilevel models accounted for the correlation of patient outcomes within provider groups and health plans. When fitting a model with only an intercept and random health plan and provider group effects, the correlation in the process measures for two individuals within the same provider group ranged from 0.03 to 0.11. Two sets of models are used for each measure: full models, which included the physician reimbursement measures and patient characteristics, and expanded models, which added physician organizational model.

The tables report mean relative risks of receiving each of the seven processes of care, along with 95 percent simulated confidence intervals (King, Tomz, and Wittenberg 2000). The relative risk is the predicted probability of the outcome based on a particular configuration of covariate values, divided by the predicted probability based on a comparison configuration. For the first set of analyses, probabilities were predicted based on PCP compensation: predominantly FFS ($\geq$60 percent, average 88 percent), predominantly direct salary ($\geq$60 percent, average 92 percent) and predominantly fixed capitation ($\geq$60 percent, average 87 percent). For the second set of analyses, probabilities were predicted based on changing each performance indicator (outpatient utilization and quality/satisfaction) from 0 to 1. The relative risks were calculated for each respondent (holding all covariates constant at their reported values except for the main regressors) and then averaged across respondents, so they do not necessarily equal the ratio of the mean predicted probabilities. Owing to the large number of comparisons, the discussion focuses on broad patterns of results rather than individually significant estimates.

RESULTS

Population Characteristics

The patient population studied was diverse in terms of gender, ethnicity, education, and income (Web Appendix C). The dominant method of compensation among the 56 physician clusters varied with the type of physician organizational model (Table 1). Among the MGs, 90 percent reported that

Table 1: Provider Group Characteristics

Characteristic	*Among Medical Groups (N= 39)*	*Among Independent Practice Associations (N= 17)*	*Total (N= 56)*
Physician payment method (%)			
≥ 60% direct salary	90	7	65
≥ 60% fixed capitation	2	60	19
≥ 60% fee-for-service (FFS)	5	20	10
Mixed methods	3	13	6
Percent of performance-dependent payment	7.70 (SD = 5.09)	1.97 (SD = 3.92)	5.96 (SD = 5.44)
Ratio of % performance-dependent payment/size of physician group used to measure performance	2.84 (SD = 5.24)	0.16 (SD = 0.62)	2.03 (SD = 4.55)
Physician's earnings depend in any part on quality of care or satisfaction (%)			
Yes	87	29	70
No	13	71	30
Physician's earnings depend in any part on outpatient utilization (or costs) (%)			
Yes	38	35	38
No	62	65	62
Average no. of physicians	84 (SD = 254)	1451 (SD = 4,322)	499 (SD = 2,463)
Average no. of patients	122 (SD = 182)	85 (SD = 70)	111 (SD = 156)

Note: The proportion of provider groups falling into each category may not yield whole numbers when multiplied by the overall sample size, due to the multiple imputation procedures used.

physicians received $\geq$60 percent of their total compensation from direct salary; among IPAs, 60 percent reported that physicians received $\geq$60 percent of their earnings from fixed capitation. Physicians often received more than one form of compensation. On average, direct salary accounted for 60 percent (SD = 43 percent) of compensation, fixed capitation to individual clinicians for 20 percent (SD = 35 percent), FFS reimbursement for 13 percent (SD = 28 percent), performance-based pay for 6 percent (SD = 5 percent), and miscellaneous reimbursement for the remainder (results not shown in table). Performance measures used to compensate physicians included quality or patient satisfaction (used by 87 percent of MGs and 29 percent of IPAs) and outpatient utilization (used by 38 percent of MGs and 35 percent of IPAs).

Relationship of PCP Payment Methodology to Process of Diabetes Care

In the regression models that did not control separately for MG versus IPA, predominantly direct salary models were associated with significantly higher probabilities of receiving assessments for glycemic control and proteinuria, eye exams, and foot exams during most or all visits, compared with predominantly FFS models (Table 2). Effects of direct salary on the remaining process and satisfaction measures were positive but not statistically significant. As an example of the magnitude of these effects, holding all else constant, the proportion of patients predicted to receive a proteinuria assessment was 83 percent (95 percent CI: 80, 85 percent) with the direct salary model and 68 percent (95 percent CI: 57, 77 percent) with the FFS model.

Direct salary models were also associated with higher rates of glycemic control and proteinuria assessments, eye and foot exams, advice to take aspirin, influenza immunizations, and patient satisfaction (RR = 1.10 percent, 95 percent CI: 1.01, 1.22 for getting needed care and RR = 1.22 percent, 95 percent CI: 1.05, 1.43 for how well doctors communicate), compared with models in which most compensation comes from capitation. For example, 83 percent (95 percent CI: 80, 85 percent) of patients were predicted to receive a proteinuria assessment under direct salary but only 66 percent (95 percent CI: 56–74 percent) under capitation. The direct salary model was associated with higher rates for the other process measures as well, but the estimates were insignificant. No significant differences were found between predominantly capitation and predominantly FFS reimbursement.

Fitting expanded models that included organizational model did not change the direction of the process results, but the magnitude of the effects were reduced, and the comparisons between salary and FFS and between

Table 2: Associations of Diabetes Process Measures with Payment Methodology

	Process Measure						
Payment Methodology	*Glycemic Control Assessed (N= 6,015) (86%)**	*Lipid Profile Assessed (N= 5,797) (69%)**	*Proteinuria Assessed (N= 6,025) (78%)**	*Dilated Eye Exam (N= 6,024) (79%)**	*Foot Exam (N= 6,024) (84%)**	*Advised to Take Aspirin (N= 6,023) (55%)**	*Influenza Immunization (N= 5,971) (67%)**
Full model							
High direct salary	**1.13**	1.03	**1.23**	**1.13**	**1.18**	1.12	1.07
(versus high FFS)	**(1.04, 1.28)**	(0.85, 1.29)	**(1.07, 1.50)**	**(1.02, 1.29)**	**(1.04, 1.41)**	(0.89, 1.44)	(0.95, 1.23)
High direct salary	**1.06**	1.14	**1.28**	**1.17**	**1.12**	**1.14**	**1.36**
(versus high capitation)	**(1.00, 1.16)**	(0.98, 1.36)	**(1.12, 1.51)**	**(1.06, 1.32)**	**(1.04, 1.25)**	**(1.00, 1.31)**	**(1.18, 1.59)**
Expanded model							
High direct salary	1.02	1.09	1.17	1.18	**1.18**	1.01	1.02
(versus high FFS)	(0.93, 1.14)	(0.80, 1.55)	(0.96, 1.47)	(1.00, 1.44)	**(0.97, 1.54)**	(0.73, 1.41)	(0.87, 1.22)
High direct salary	0.95	1.26	1.16	1.26	**1.11**	0.97	1.22
(versus high capitation)	(0.87, 1.04)	(0.86, 2.01)	(0.93, 1.57)	(1.02, 1.68)	**(0.93, 1.44)**	(0.71, 1.39)	(0.95, 1.64)

Notes: *Denotes the percentage of study participants receiving the element of care. Figures shown in table are relative risks and 95% simulated confidence intervals based on multilevel logistic regressions with random health plan and provider group intercepts. Bolded estimates denote statistical significance at the 5% level based on three decimal places. The full model controlled for whether the dominant mode of provider payment was high direct salary (≥60% of compensation from direct salary), high FFS (≥60% FFS), high capitation (≥60% from fixed capitation), or mixed methods. The expanded model added organizational model (MG versus IPA). All regressions adjusted for the sociodemographic and clinical characteristics of the patients.

FFS, fee-for-service; MG, medical group; IPA, independent practice association.

salary and capitation were significant for only one process measure (in both cases dilated eye examination). No significant associations with patient satisfaction were found.

Relationship of Performance Measurement Criteria to Process of Diabetes Care

Without controlling for organizational model, use of outpatient utilization to help determine PCP compensation was significantly associated with only one process measure—lipid profile assessment—and then in an unexpected (positive) direction (Table 3). Similarly, use of outpatient utilization was unexpectedly associated with greater satisfaction with how well doctors communicate (RR = 1.16 percent, 95 percent CI: 1.01, 1.30). The remaining estimates were in the hypothesized direction but not significant. When quality and/or patient satisfaction were used to help determine compensation, patients consistently received better process of care, with the strongest associations for influenza immunization and proteinuria assessment, and were more likely to report satisfaction with getting needed care (RR = 1.18 percent, 95 percent CI: 1.07, 1.36). For example, the regression-adjusted probability of receiving an influenza immunization was 70 percent (95 percent CI: 65, 75 percent) when compensation was based in part on quality/satisfaction, but only 58 percent (95 percent CI: 51, 65 percent) when it was not. No significant associations of process were found with either the strength of the performance incentive or its interactions.

Although the direction of the effects did not generally change in expanded models that included organizational model, the associations with the use of quality/patient satisfaction for compensation were reduced in magnitude and remained significant for only one process (lipid profile assessment).

Sensitivity Analyses

Including the percent of total compensation that is based on performance and the number of physicians used to measure performance as separate predictors in the model (along with their interaction term) did not yield different results from when their quotient was used. Using only survey data (versus survey plus medical records) to define the receipt of eye and foot exams produced point estimates that were extremely close to the original values, although the confidence intervals widened; using only medical records produced point estimates that were larger than the original ones but again less precise.

Re-estimating the models removing one TRC at a time resulted in very similar estimates, except for one TRC that accounted for about 40 percent of

Table 3: Associations of Diabetes Process Measures with Performance Measurement Criteria

	Process Measure						
Performance Measurement Criterion	*Glycemic Control Assessed (N = 5,787) (86%)*$^{+}$	*Lipid Profile Assessed (N = 5,626) (69%)*$^{+}$	*Proteinuria Assessed (N = 5,852) (78%)*$^{+}$	*Dilated Eye Exam (N = 5,851) (79%)*$^{+}$	*Foot Exam (N = 5,851) (84%)*$^{+}$	*Advised to Take Aspirin (N = 5,850) (55%)*$^{+}$	*Influenza Immunization (N = 5,799) (67%)*$^{+}$
Full model							
Outpatient utilization or costs	0.94 (0.78, 1.03)	**1.13 (1.00, 1.27)**	0.92 (0.64, 1.14)	0.98 (0.87, 1.07)	0.94 (0.76, 1.07)	0.89 (0.74, 1.03)	0.93 (0.78, 1.08)
Quality or patient satisfaction	1.06 (0.97, 1.22)	0.93 (0.77, 1.22)	**1.25 (1.03, 1.59)**	1.09 (0.98, 1.25)	1.12 (0.99, 1.32)	**1.17 (1.00, 1.41)**	**1.26 (1.06, 1.54)**
Expanded model							
Outpatient utilization or costs	0.99 (0.88, 1.05)	**1.13 (1.03, 1.24)**	1.01 (0.87, 1.11)	1.02 (0.93, 1.09)	1.01 (0.88, 1.08)	0.87 (0.71, 1.04)	1.02 (0.89, 1.14)
Quality or patient satisfaction	0.99 (0.90, 1.11)	0.86 (0.71, 1.13)	1.05 (0.90, 1.25)	1.00 (0.89, 1.14)	1.02 (0.91, 1.18)	1.19 (0.99, 1.48)	1.06 (0.90, 1.29)

Notes: $^{+}$Denotes percentage of study participants receiving the element of care. Figures shown in table are relative risks and 95% simulated confidence intervals based on multilevel logistic regressions with random health plan and provider group intercepts. Bolded estimates denote statistical significance at the 5% level based on three decimal places. The full model controlled for whether the provider group used performance-based payment, indicators for performance measurement criteria, and the strength of the performance incentive and its interactions with the performance measurement criteria. The expanded model added organizational model (MG versus IPA). All regressions adjusted for the sociodemographic and clinical characteristics of the patients.

FFS, fee-for-service; MG, medical group; IPA, independent practice association.

the groups. Excluding this TRC reduced the magnitudes and eliminated the statistical significance of the associations of process with use of quality/satisfaction as a basis for reimbursement (Table 3), although the findings regarding direct salary (Table 2) remained robust. With the earlier-noted exception of organizational model, the estimates of interest were robust after the sequential addition of the other provider group-level characteristics. Sample sizes did not permit controlling simultaneously for all possible confounders.

DISCUSSION

Despite the interest in, as well as controversy sparked by, the use of financial incentives for health care providers, the literature describing the empirical effects of such incentives has been limited. In this study, after adjusting for differences in patient characteristics and accounting for the clustering of patients within provider groups and health plans, but before adjusting for physician organizational model, rates of receiving several elements of diabetes care and patient satisfaction were predicted to be significantly higher among managed care patients whose physicians received compensation predominantly through direct salary rather than through either FFS or direct capitation. In addition, adjusted rates of receiving several elements of diabetes care, as well as of reporting satisfaction with getting needed care, were predicted to be significantly higher when quality or patient satisfaction were used as a basis for compensating PCPs. Rates of lipid profile assessments and satisfaction with communication were actually higher among patients of physicians paid partly on the basis of outpatient utilization, perhaps supporting the counter-hypothesis. Care processes and satisfaction were not consistently associated with the strength of the performance-based payment incentive. Thus evidence consistent with the second, but not the first or third, study hypothesis was found.

The interpretation of these associations is limited, however, by the high correlation between physician payment methodology and organizational model (as seen in Table 1). Most of these associations were substantially confounded with how the physicians were organized. For example, a high proportion of compensation accounted for by direct salary may be a marker for MGs (versus IPAs). Although the associations of process with direct salary models remained positive after controlling for physician organizational model, a broad pattern of statistical significance could no longer be discerned. In results not shown here, the converse was also true; controlling for physician

reimbursement strategies diminished the significance and to some extent the magnitude of the effects of physician organizational model. Thus it appears that high correlations between provider group-level factors reduce the precision of their estimated effects to the extent that reliable conclusions about the independent effects of reimbursement strategy and organizational model cannot be drawn. This is a common problem in the literature, given the limited sample sizes that are typically available at the provider or provider group level. In the absence of larger studies, it is perhaps more valid to make comparisons between "bundles" of characteristics (e.g., MGs paying direct salary versus IPAs paying on a capitated basis) than to try to identify the influence of individual factors. Although we cannot rule out the possibility that physician reimbursement strategy per se accounts for only part of the overall associations, it nonetheless can be interpreted as a marker for the jointly determined characteristics of provider groups that influence process.

Most of the earlier research on financial incentives focused on associations with quantity, rather than with process or outcomes of care, and provided mixed evidence with regard to whether financial incentives to contain costs are associated with lower utilization (Hillman, Pauly, and Kerstein 1989; Bateman et al. 1996; Conrad, Maynard, and Cheadle 1998). Financial incentives have been associated with other outcomes, such as physician satisfaction (Grumbach 1998), patient satisfaction (Escarce et al. 2003), and patient trust (Kao et al. 1998). The implications of financial incentives for processes and quality of care have only recently begun to be explored (Hillman, Pauly, and Kerstein 1989; Dudley et al. 1998). In a new study, Keating et al. (2004) used data from 652 diabetic patients enrolled in three health plans in Minnesota to examine the influence of practice management strategies and financial arrangements on a quality score combining 6 process and intermediate outcome measures. Our findings, which are based on similar process measures but a larger and more geographically representative patient sample, are similar to the conclusions of Keating et al. (2004), who found modest evidence that salaried physicians provided higher quality of diabetes care than those paid on a FFS basis. They also found that quality scores were higher among physicians whose compensation was influenced by patient satisfaction or quality, but that the associations were small in magnitude. In the Keating et al. study, these associations were statistically insignificant even before regression adjustment.

Other literature in this area is sparse and focuses primarily on immunizations. Performance-based financial incentives such as cash bonuses increased immunization rates among children and influenza immunization rates among the elderly (Hemenway 1995; Kouides et al. 1998; Fairbrother et al.

1999, 2001). In a broader study, performance-based bonuses were associated with increases in the use of ACE inhibitors and HbA1c assessments, but not childhood immunizations (Chung et al. 2003). In another study by Hanchak (1997), bonus payments based on "quality" of patient care led to improvements in certain performance measures, e.g., lower Cesarean section rates, but patient satisfaction did not increase, perhaps because the performance measures used were better proxies for cost containment than quality, as argued by Armour et al. (2001). A literature review concluded that quality of care does not differ significantly between FFS and HMO settings (Dudley et al. 1998).

Our study suggests that physician compensation method may be associated with processes of care, either directly or in conjunction with organizational model. The finding that reliance on direct salary rather than FFS reimbursement may be associated with a greater likelihood of receiving certain key elements of diabetes care is surprising, because FFS is usually hypothesized to encourage utilization (Burns, Chilingerian, and Wholey 1994; Armour et al. 2001) or even overutilization, through "provider-induced demand" (Fuchs 1978; Dudley et al. 1998; Institute of Medicine 2001; Robinson 2001; Grignon et al. 2002). In turn, higher utilization could facilitate better process of care, as defined by the receipt of certain services, unless the price incentives distort treatment patterns (Kuhn 2003). Young physicians who were paid on a FFS basis or who received salary with incentive bonuses reported their financial incentives to provide services to be stronger than those receiving straight salary (Mitchell et al. 2000), which is what economic theory would predict. However, the same study showed that compensation method had a relatively small impact on the perceived financial incentives of physicians (Mitchell et al. 2000).

Furthermore, the finding that salary may be associated with better process of diabetes care than FFS reimbursement is not unexpected, to the extent that providers paid FFS are not compensated for activities such as writing referrals, ordering lab tests, examining feet, and giving advice about aspirin. The incentives inherent in the FFS system are to provide more reimbursed services, possibly at the expense of nonreimbursed services that may improve diabetes care. Unlike capitated physicians, who are paid a fixed amount per patient, salaried physicians do not have financial incentives to take on more patients at the expense of seeing each patient less often, which in turn leads to fewer opportunities to deliver the process measures examined (Berwick 1996; Dudley et al. 1998; Tufano, Conrad, and Liang 1999; Institute of Medicine 2001; Robinson 2001; Grignon et al. 2002; Escarce et al. 2003; Kuhn 2003). Our conclusions regarding capitation are consistent with an earlier study sug-

gesting that capitation is perceived by physicians to discourage the provision of services (Mitchell et al. 2000).

Another finding to emerge from our study was the significant association of several processes of diabetes care with the reported use of quality or patient satisfaction as a performance criterion when we did not control for organizational model. The magnitude of this association did not increase with the strength of the performance-based payment incentive, however, perhaps because physicians think of performance-based payment as a dichotomy rather than a continuum. For example, they might order more tests for all of their patients with diabetes because they know this will affect their compensation, but they do not try to calculate exactly how much their pay will increase and adjust their behavior accordingly. Alternatively, it may not have been possible to detect such an effect because there was little variation in the observed range for this variable (0–20 percent).

For several reasons, the results for the quality/satisfaction indicator must be interpreted with caution. As discussed above, it is not possible to distinguish reliably between the effects of organizational model and the reported use of quality/satisfaction as a performance measurement criterion, given the modest sample size and confounding with organizational model. The pattern of significant findings was eliminated after controlling separately for whether physicians were organized as MGs or IPAs. Furthermore, the significance of the findings was driven by one TRC that accounted for almost half of the provider groups, so this result may generalize less well than the other study findings.

It should also be reiterated that the finding that the process of diabetes care is better when PCPs are compensated on the basis of quality/satisfaction reflects an association, not necessarily a causal effect. Provider groups for which patient quality and satisfaction were already high priorities may have been more likely to introduce financial incentives to support the goal of improving process. Thus implementing such incentive systems in new groups may not result in better process of diabetes care. Still, this finding has important implications. Patients with diabetes could use information about physician reimbursement methodology to make better-informed decisions about which provider group to join. Whether a group takes quality or patient satisfaction into account in compensating its physicians might be viewed as a marker of better process of diabetes care, regardless of the causality in this relationship. Although patients could look directly at quality indicators, they cannot be compared across groups without adequate risk adjustment, and patients would also have to distill information from numerous sources. The use of quality or

patient satisfaction as a basis for physician reimbursement may directly affect process, but even if it does not (and the association is due to reverse causality or confounding with organizational model), it is still a good proxy for the group's motivation to improve care and hence can inform patient choices.

This study is observational and subject to limitations such as modest sample size at the level of measuring physician reimbursement incentives and a potential lack of generalizability to the national population of managed care patients with diabetes. Even so, these analyses are among the first to empirically study the associations between physician reimbursement incentives and process of care, and our study population is more geographically diverse than those in earlier studies. In conjunction with the findings of Kim et al. (2004), our results are suggestive that reimbursement strategy and physician organizational model might both play a role in determining processes of care for diabetes, although further studies that include a larger number of provider groups are needed to determine the independent contributions of each.

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SUPPLEMENTARY MATERIAL

The following supplementary material for this article is available online:

APPENDIX A. The Translating Research into Action for Diabetes (TRIAD) Study Group.

APPENDIX B. Survey Question Regarding Payment Methodology.

APPENDIX C. Patient-Level Characteristics of TRIAD Sample ($N = 6,194$).