Managed Care Organization and the Quality of Diabetes Care

The Translating Research Into Action for Diabetes (TRIAD) study

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OBJECTIVE — To examine the association between the organizational model and diabetes processes of care.

RESEARCH DESIGN AND METHODS — We used data from the Translating Research into Action for Diabetes (TRIAD), a multicenter study of diabetes care in managed care, including 8,354 patients with diabetes. We identified five model types: for-profit group/network, for-profit independent practice association (IPA), nonprofit group/network, nonprofit IPA, and nonprofit group/staff. Process measures included retinal, renal, foot, lipid, and HbA1c testing; aspirin recommendations; influenza vaccination; and a sum of these seven processes of care over 1 year. Hierarchical regression models were constructed for each process measure and accounted for participant age, sex, race, ethnicity, diabetes treatment and duration, education, income, health status, and survey language.

RESULTS — Participant membership in the model types ranged from 9% in nonprofit IPA models to 38% in nonprofit group/staff models. Over 75% of participants received most of the processes of care, regardless of model type. However, among for-profit plans, group/network models provided on average more processes of care than IPA models (5.5 vs. 4.7, processes of care, regardless of model type). Among for-profit plans, group/network models provided better diabetes processes of care than IPA models. Although reasons are speculative, this may be due to the clinical infrastructure available in group models that is not available in IPA models.

CONCLUSIONS — Among for-profit plans, group/network models provided better diabetes processes of care than IPA models. Although reasons are speculative, this may be due to the clinical infrastructure available in group models that is not available in IPA models.

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*A list of the members of the Translating Research into Action for Diabetes (TRIAD) Study Group can be found in the online appendix.

Additional information for this article can be found in an online appendix at http://care.diabetesjournals.org.

Abbreviations: IPA, independent practice association; TRIAD, Translating Research into Action for Diabetes.

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Organization and quality of diabetes care

RESEARCH DESIGN AND METHODS — The TRIAD study has been previously described (5). In brief, six Translational Research Centers collaborated with 10 health plans and 68 provider groups that serve ~180,000 people with diabetes. The health plans are geographically and ethnically diverse (Hawaii, California, Texas, Indiana, Michigan, New Jersey, and Pennsylvania). The study protocol was reviewed and approved by the institutional review boards at all six Translational Research Centers.

Study population
Health plan and provider group characteristics were assessed using standardized interviews of health plan and provider group medical directors and leadership personnel. These interviews assessed profit status, existing clinical infrastructure, and contracting arrangements. Based on these interviews, provider group models were classified into three types of models: group/staff models, group/network models, and IPA/direct-contracting models. Profit status was defined at the health plan level as for profit or nonprofit. In the TRIAD study, each for-profit and nonprofit model type was represented in more than one geographic area, except for the one for-profit health plan that contracted with both medical groups and IPAs in a single geographic area.

TRIAD’s study population consisted of a random sample of adults with diabetes within the 10 health plans. All participants provided informed consent. Study participants were ≥18 years of age, dwelling in the community, spoke English or Spanish, were continuously enrolled in the health plan for at least 18 months, were not pregnant, and had at least one claim for health services during the previous 18 months. Participants were sampled from provider groups that had at least 50 participants with diabetes enrolled in the health plan. Recruitment was completed in September 2001, and baseline data collection was completed in 2003. Information from participants was obtained with a survey that was administered either by computer-assisted telephone interview or in writing, by medical record reviews, and through administrative data. Of contacted eligible people, 91% responded to the survey. If individuals who were unable to contact had the same rate of eligibility as those contacted and were counted in the denominator, the survey response rate would be 69%. Survey questions assessed sociodemographic characteristics, recommended diabetes care services received, general health status, symptom and quality of life assessment, and satisfaction with care (7–9) among other variables. We examined data from the participants for whom medical records were available to document diabetes processes of care (n = 8,354). These participants were similar to the TRIAD population as a whole for the variables included in our analyses. Multiple nurse reviewers reviewed the medical records; 5% of records were abstracted in a double-blind fashion; that is, reviewers were not aware of which subjects were selected for double abstraction. Interrater reliability (κ) for the main process-of-care measures derived from medical record data ranged from 0.86 to 0.94 among sites.

Outcome measures
Quality of diabetes care was measured by seven process measures assessed over a 12-month period: dilated retinal exams, urine microalbumin/protein testing, foot exams, lipid and HbA1c testing, recommendation to take aspirin or current aspirin use, receipt of influenza vaccination, and the unweighted sum of these seven measures as a continuous variable ranging from 0 (no services delivered) to 7 (all services delivered). We also examined the levels of three intermediate outcomes: the percentage of patients with HbA1c <8%, the percentage of patients with LDL cholesterol <130 mg/dl, and the percentage of patients with systolic blood pressure <140 mmHg.

Regarding the process measures, no “gold standard” exists aside from direct observation (9), and different sources may report different performance rates for the same measure (10). For dilated retinal exams, foot exams, and recommendation to take aspirin or aspirin use, either medical record documentation or self-report was accepted. For receipt of influenza vaccinations, self-report was used. Other measures relied on documentation in the medical record alone. When we chose risk factor cutoffs, we chose cutoffs for blood pressure control and LDL that were most likely to be adopted at the time of baseline data collection and were also more likely to be achieved. Current recommendations have set these cut points lower (11). Systolic and diastolic blood pressures were highly collinear, and we chose to report on systolic blood pressure.

Statistical analysis
We examined the relationship between organizational model and processes of care by estimating the percentage-point difference between model types in the predicted probability of receiving each process of care (“risk difference”) using hierarchical logistic regression models. These models were constructed using an SAS Glimmix Macro with penalized quasi-likelihood estimation method, with random intercepts for health plans and provider groups, to account for the clustered study design (health plan, provider group, and participant levels) and the correlation among participant characteristics within health plans and provider groups. We used similar models to assess risk factor levels. When we examined the sum of the seven process measures, we used a similar hierarchical linear regression model (SAS Proc Mixed). These models allow for the simultaneous effect of profit status at the health plan level and model type at the provider group level. In adjusted models, we also included participant age, sex, race or ethnicity, income, education, current diabetes treatment and duration of diabetes, self-reported health status, and language of the survey (English or Spanish).

Missing values for covariates from the patient survey were imputed singly using the transcan function in S-Plus (12). Each covariate is predicted as a function of all other covariates. No exposure-of-interest or outcome variables were imputed, i.e., no health plan, provider group, or diabetes process of care information was imputed. The imputation model used restricted cubic splines to model continuous variables, and imputed values are constrained to be in the same range as nonimputed values. We did not correct P values for multiple comparisons due to the observational nature of the study (13).

Comparison of risk differences between for-profit and nonprofit plans yielded inconsistent results that were <10 percentage points in magnitude and not statistically significant (results not shown). Due to our limited number of health plans (n = 10), we used the method described by Smith and Bates (14) to conduct a confidence limit analy-
sis to determine a limit on the likely magnitude of any actual effect between for-profit and nonprofit organizations. Such an analysis can be used in lieu of a post hoc power calculation. We found that in our sample there was a 5% probability that nonprofit plans performed any process of care at a level of 10 percentage points than for-profit plans.

RESULTS — The characteristics of participants by organizational model type and profit status are shown in Table 1. Due to significant interaction between health plan profit status and organizational model, we present model type stratified by profit status (Table 1). Among for-profit plans, participants in group/network models were older, more likely to be Hispanic, less educated, poorer, less likely to use insulin, and had lower comorbidity but worse self-reported health status than participants in IPA models (Table 1). Among nonprofit plans, participants in group/network models were younger; more likely to be women, black, less educated, and poorer; more likely to use insulin; and more likely to report worse health status than participants in other models. All group/staff models provided care for nonprofit health plans. The provision of processes of care was generally in excess of 75% across all model types (Table 2).

Fully adjusted risk differences between model types in the predicted probability (percentage points) of receiving processes of care are shown in Table 2. Results adjusted only for clustering were similar to results adjusted for clustering and participant covariates (online appendix Table 2A [available at http://care.diabetesjournals.org]). A risk difference of “10” between a group/network model and an IPA model means that out of 100

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>For-profit health plan (n = 4)</th>
<th>Nonprofit health plan (n = 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider groups (n)</td>
<td>Group/network</td>
<td>15</td>
</tr>
<tr>
<td>Managed care experience (years)</td>
<td>Group/network</td>
<td>15</td>
</tr>
<tr>
<td>Participants (n)</td>
<td>Group/network</td>
<td>1,013</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>For-profit</td>
<td>66</td>
</tr>
<tr>
<td>Women (%)</td>
<td>For-profit</td>
<td>54</td>
</tr>
<tr>
<td>Race or ethnicity (%)</td>
<td>For-profit</td>
<td>White non-Hispanic 28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black non-Hispanic 5</td>
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<tr>
<td></td>
<td></td>
<td>Hispanic 63</td>
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<tr>
<td></td>
<td></td>
<td>Asian or Pacific Islander 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other 4</td>
</tr>
<tr>
<td>Education (%)</td>
<td>For-profit</td>
<td>8th grade or less 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some high school 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High school/GED 24</td>
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<tr>
<td></td>
<td></td>
<td>Some college 23</td>
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<tr>
<td></td>
<td></td>
<td>4-year college graduate 6</td>
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<tr>
<td></td>
<td></td>
<td>&gt;4-year college degree 4</td>
</tr>
<tr>
<td>Annual household income (%)</td>
<td>For-profit</td>
<td>&lt;$15,000 46</td>
</tr>
<tr>
<td></td>
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<td>$15,000–39,999 33</td>
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<td></td>
<td></td>
<td>$40,000–74,999 16</td>
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<tr>
<td></td>
<td></td>
<td>&gt;$75,000 5</td>
</tr>
<tr>
<td>Interview conducted in Spanish (%)</td>
<td>For-profit</td>
<td>13</td>
</tr>
<tr>
<td>Diabetes duration (mean years)</td>
<td>For-profit</td>
<td>13</td>
</tr>
<tr>
<td>Diabetes treatment (%)</td>
<td>For-profit</td>
<td>Diet and exercise only 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral medication only 72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insulin only 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insulin and oral medication 12</td>
</tr>
<tr>
<td>Health status (%)</td>
<td>For-profit</td>
<td>Excellent 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very good 18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good 41</td>
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<td></td>
<td>Fair 29</td>
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<tr>
<td></td>
<td></td>
<td>Poor 6</td>
</tr>
<tr>
<td>Charlson comorbidity index (mean)</td>
<td>For-profit</td>
<td>1.8</td>
</tr>
</tbody>
</table>

*Includes IPA and direct-contracting models.
patients in each model type, 10 more patients in the group/network model will have a process of care checked than in the IPA model. More participants in for-profit group/network models received each diabetes process of care than participants in for-profit IPA models, with the exception of recommendations to take aspirin. On average, group/network models delivered diabetes processes of care to a greater proportion of their patients than IPA models (P < 0.0001). Also, the effect of the group/network model usually exceeded 10 percentage points, with the exception of aspirin recommendations and measurement of HbA1c.

Among nonprofit plans, differences in the quality of diabetes care between group and IPA models were smaller and differences in rates of performance did not reach statistical significance (Table 2). Among nonprofit plans, group/staff models did not differ from other models. When we compared similar model types by profit status, no differences existed between for-profit and nonprofit IPA models or between for-profit and nonprofit group/network models. We found no association between risk factor levels and organizational model type (Table 2).

When we constructed an adjusted model that did not include self-reported health status, we found little change in the risk differences. We used the Charlson index to adjust for comorbidity (15) in a sensitivity analysis but found little change in the results, so the Charlson index was not included as an adjuster in the final models.

**CONCLUSIONS** — Recent reports (4) of the gap between biomedical knowledge and actual health services delivery have spurred interest in the organizational determinants of superior quality of care. The process of care or quality of care may differ significantly by organizational model. Among the for-profit health plans in this sample, group/network models are more likely to deliver diabetes processes of care than IPA models, with the group/network effect often exceeding 10 percentage points. These percentage differences in process measures translate into large numbers of participants because 71 million people were enrolled in managed care in 2002 (16,17).

There are several explanations for the difference in processes of care observed between group/network and IPA models contracting with for-profit health plans. The availability and completeness of information captured by the electronic data system may be superior in group models (19). Medical groups may include multiple specialists, diabetes educators and nutritionists hired by the group, and a shared disease-management program, and these features may facilitate care that requires specialist referral, such as dilated eye exams, or access to diabetes-specific ancillary services, such as education. It is possible that higher quality care management strategies, such as diabetes disease-management programs, are more often implemented by group models than IPAs, although a recent survey (18) of provider groups found that the actual number of care-management strategies was similar between these two types of provider groups. Similarly, it is possible that group models have a more cohesive organizational culture that promotes better clinical practices, although studies (19,20) examining this association have had conflicting results.

Group/network model enrollees had a lower socioeconomic status and were more often of minority race than other model types, and these characteristics have been previously associated with poorer diabetes process of care in other reports (21,22). We expected that group/network models might be at a disadvantage due to residual confounding from these patient characteristics. Instead, we observed that risk differences between model types did not change after adjustment for characteristics, and group/network models provided superior process of care before and after adjustment. This suggests that the factors that mediate the relations between model type and process of care are effective even among traditionally disadvantaged patient populations. In our study, the difference in diabetes process of care between IPA and medical groups was observed only in for-profit health plans. Although explanations are strictly speculative, it is possible that IPAs contracting with for-
profit plans may be under greater pres-
sure to reduce costs and less motivated to
provide comprehensive diabetes care
than IPAs that contract with nonprofit
health plans.

There are several explanations as to
why relatively large differences between
model types existed for assessment of ret-
inopathy, proteinuria, lipids, and perfor-
mance of influenza vaccinations, but were
reduced for HbA1c measurement and
nonexistent for aspirin assessment. Di-
abetes management has traditionally fo-
cused on optimizing HbA1c, and this
message has been reinforced by studies
(23) documenting the benefit of superior
care (29) for type 1 diabetes. It may be
that recommendations for glucose
management had more time to dissemi-
nate than recommendations to optimize
other aspects of diabetes care; overall
rates of measurement of HbA1c were gen-
erally high. Aspirin assessment was gen-
erally lower across all model types, and
this may be due to the relatively recent
recommendations to prescribe aspirin in
patients with diabetes (24,25), along with
perceptions of decreased efficacy (26) or
increased side effects (27). There are sev-
eral explanations as to why organizational
model type was not associated with im-
proved risk factor levels. Our analysis was
cross sectional, and there may have been
inadequate time for the organizational
model to effect risk factor levels. Also, it
may be that any relationship between health
system structure and risk factor levels is
overpowered by patient-level biological
variation and adherence to medication.

Our analysis had a number of strengths compared with previous stud-
ies. We were able to use uniform methods of
data collection across multiple health
systems and to adjust for participant de-

gographics, comorbidities, and health
status. Previous examination (28) of qual-
ity-of-care indicators using Health Plan
Employer Data and Information Set data
have found that less integrated physician
organizations, such as IPAs, may provide
lower quality of care than group/staff
models. However, such databases have
few quality measures that address care for
the chronically ill (29,30), who may be
especially vulnerable to poorer quality of
care (31,32) and may be biased by selec-
tive disclosure of Health Plan Employer
Data and Information Set information and
voluntary participation (33). Compari-
sions of health plans have not always ad-
justed for the socioeconomic or health
status of individual members or data col-
collection techniques between health plans
(28,33). Other studies (31,34) examining the
organizational model have been unable
to include clinical measures of qual-
ity. Also, prior studies have focused on
group/staff versus IPA models, with little
information on group/network models.

Our analyses have several limitations.
Our sample of health plans was not ran-
donmly selected from all U.S. health plans
with diabetic patients, and thus our re-

"results may not be directly applicable to
the larger population of health plans. Al-
though our findings are applicable to pro-
tices of diabetes care in a managed care
population, they may not extend to other
chronic illnesses or to the fee-for-service
environment. Also, we only examined a
limited set of diabetes process-of-care
measures and risk factors. While accepted
by quality organizations (1), these mea-
sures have limitations in that they may not
capture management strategies (10) and
may not necessarily be appropriate for all
individuals with diabetes. For example,
performance of annual dilated eye exam-
inations in participants with excellent
HbA1c measures may not represent opti-
mal resource use (35). Finally, our work
was not able to address whether organi-
zational structure effects are mediated
through physician characteristics (such as
specialty) or other provider group charac-
teristics (such as incentives or diabetes
care strategies) because we felt that these
different research questions were beyond
the scope of the present study. This does
not invalidate the finding that model type
seems to be associated with diabetes pro-
cess of care because there may be certain
model types that are more conducive to
such important interventions, such as dis-
eease-management programs. However,
further investigation is needed on how
other health systems and physician char-
acteristics interact with organizational
structure could provide insight into the
reasons why structure appears to be asso-
ciated with specific diabetes processes of
care.

As the health care market continues
to evolve, the optimal role of market
forces and the ideal structure of health
care organization in health care delivery
will need to be reassessed. We have found
that medical groups that have contracts
with health plans may be better equipped
to provide recommended processes of
care than IPAs contracting with this same

"type of plan. Future investigations should
determine whether such associations are
mediated through health system structure
or presence of diabetes resources and
whether the association between organi-
zational model and process is confirmed
using different types of quality measures.

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Organization and quality of diabetes care

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