Background: Case managers are employed in medical homes to coordinate care for clinically complex patients.

Objective: To measure the association of patient perceptions of case manager performance with overall satisfaction and subsequent health care utilization.

Design: Retrospective cohort study.

Setting: Integrated health system in Pennsylvania.

Patients: Members of the health system–owned health plan who 1) received primary care in the health system’s clinics, 2) were exposed to clinic-embedded case managers, and 3) completed a survey of satisfaction with care.

Measurements: Survey assessment of case manager performance and overall satisfaction with care and claims-based assessment of case manager performance and subsequent hospitalizations or emergency department visits. Survey measures were dichotomized into very good versus less than very good.

Results: A total of 1755 patients (44%) completed the survey and 1415 met study criteria. Survey respondents who reported very good ratings of case manager performance across all items had a higher probability of reporting very good overall satisfaction with care (92.2% vs. 62.5%; P < 0.001) and had a lower incidence of subsequent emergency department visits (incidence rate ratio, 0.79 [95% CI, 0.64 to 0.98]; P = 0.029) but not hospitalizations (incidence rate ratio, 0.92 [CI, 0.75 to 1.11]; P = 0.37) up to 2 years after the survey compared with survey respondents who reported less-than-very good case manager performance on 1 or more questions on the survey.

Limitations: Satisfaction data demonstrated substantial ceiling effects. Survey nonresponse may have introduced bias in the results.

Conclusion: Patients’ favorable perceptions of case managers are associated with higher overall satisfaction with care and may lower risk for future acute care use.

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As the health system’s end users, patients offer valuable feedback that can be used to improve the quality of care. Although they may not have the expertise to evaluate technical aspects of care, patients are uniquely positioned to evaluate patient–provider interactions (1–3). The quality of these interactions affects patients’ perceptions of care and their future health-related behaviors (4–7). Patients who report higher-quality interactions with their physicians are more likely to be satisfied with care, loyal to their physician, and adherent to the prescribed treatment plan (8–10). Given these associations, patient feedback may be of particular value in settings where interpersonal relationships form the cornerstone of care, such as in the delivery of primary care in the patient-centered medical home (PCMH) (11–14).

The adoption of team-based care has increased the role of nonphysician providers—such as nurses, medical assistants, and pharmacists—in caring for patients in primary care practices. In particular, nurse case managers have emerged in many PCMH programs as key coordinators for the care of clinically complex patients and have shown early promise in reducing costs (13, 15). However, little research has addressed patients’ perceptions of these nonphysician providers operating in a team-based setting.

In this study, we examined associations between patients’ perceptions of their case managers’ performance and two outcomes: overall satisfaction with care and future acute health care use. We hypothesized that patients who rated their case managers more positively would report greater overall satisfaction with care and be at lower risk for future emergency department (ED) visits or hospitalizations.

Methods

Overview

We conducted a retrospective cohort study of patients within an integrated health care system that launched a case manager system as part of a program. The health care system administered surveys in successive waves from 2009 through 2011 to assess patient-reported experiences with care. Survey responses were linked to insurance claims data to measure subsequent health care utilization. The institu-
Supplement | Patient Ratings of Case Managers in a Medical Home

Study Site
Geisinger Health System is a nonprofit, integrated health system that serves more than 2.6 million people in central and northeastern Pennsylvania. Within the Geisinger Health System is the Geisinger Health Plan (GHP), a regional managed care organization that has approximately 290,000 members. From 2006 to 2011, Geisinger Health System began deploying its version of the medical home, the Proven Health Navigator, in 38 of its Geisinger-owned primary care clinics.

With the rollout of the Proven Health Navigator, nurse case managers were embedded in primary care clinics to provide personalized, well-coordinated care for higher-risk patients (15). The case managers were registered nurses who had been certified in case management through a nationally recognized training program. Each site was provided 1 to 4 case managers, depending on clinic volume, for a total of 85 case managers across all sites. Case manager caseload was approximately 115 to 120 patients.

Geisinger Health System identified patients for case management program by 4 mechanisms: 1) discharge from an acute care setting or skilled-nursing facility, 2) referral by a nurse or physician, 3) presence of multiple medical conditions, and 4) high or recent increase in risk score. Risk scores were calculated by using the Centers for Medicare & Medicaid Services Hierarchical Condition Category (HCC) risk adjustment model (16, 17) and MEDai (Medical Artificial Intelligence, Inc.) risk adjustment scores (18). Patients were assigned to a case manager at their primary care clinic on the basis of case manager availability.

Participants
Starting in 2009, GHP sent the GHP Medical Home Survey via postal mail to all GHP members who had been under Proven Health Navigator case management for at least 3 months at the time of the survey and who had not previously been sent the survey. From 2009 to 2011, the survey was repeated at approximately 6-month intervals for a total of 4 waves. Participants in the current study included GHP members who completed the GHP Medical Home Survey from 2009 to 2011 and were older than 18 years of age. The Figure shows a flow diagram of patients in the study.

Data Collection
Survey Data
Geisinger Health Plan developed the GHP Medical Home Survey (19), a patient satisfaction survey based on the Consumer Assessment of Providers and Systems Clinician and Group Survey (CG-CAHPS) (16). Geisinger Health Plan added domains to the survey, including one on case manager performance, which consisted of 4 questions. This study used the 4 questions from the case manage-
mance. Overall satisfaction was the dependent measure in our primary analysis of patient satisfaction. It was assessed by using a single survey question: “How satisfied are you overall with the quality of care at your Primary Care site?” The survey collected information on other patient-reported measures of care quality (for example, access to care), but these responses were highly correlated with the case manager ratings and could not be included in our models.

On the basis of an a priori conceptual model, we averaged a survey respondent’s scores across the 4 case manager performance questions to compute a single score for patient perceptions of case manager performance. Factor analysis of the survey demonstrated that all 4 case manager performance questions loaded onto a single factor, supporting the composite case manager performance score. Missing items were dropped from the score calculations, and the ratings were computed according to the average of the remaining items. Sensitivity analyses, described in the following section, were conducted by imputing missing items. Individuals who answered none of the questions within the case manager performance domain or the overall satisfaction question were categorized as nonrespondents and excluded from all analyses.

As is typical for satisfaction data, there were large ceiling effects in the survey data (22). To adjust for the distribution of the data, we categorized domains of case manager performance and overall satisfaction into dichotomous variables: those that provided the rating of “very good” (the highest rating) across all items in the domain and those that provided at least one rating of less than “very good” on 1 item in the domain. This is similar to the “top box” approach used for CG-CAHPS (1, 16, 23). In sensitivity analyses, we examined models that included the measures as continuous variables and found that the results were qualitatively similar.

From the claims data, we examined 2 outcomes of acute care utilization: ED visits and hospitalizations. In this data set, ED visits that led to hospitalizations were counted only as hospitalizations and not ED visits. The primary utilization outcomes of interest were the incidence of ED visits and hospitalizations in 2 years. We used survey date as the index time for both outcomes to ensure that patients had been exposed to the case manager for at least 3 months at the time of the analyses. Individuals who did not have an HCC risk score at the time of the survey were excluded from the analyses (n = 22 [1.2%]).

Statistical Analysis

For the satisfaction analysis, we conducted a logistic regression to provide a direct measure of the magnitude of the association between patient rating of case manager performance and overall satisfaction. We used the binary measures of overall satisfaction and case manager performance and adjusted for age, sex, HCC risk score, and survey wave. To facilitate interpretation, we converted the results of the logistic regression to the probability scale and calculated absolute differences in probabilities (24). We calculated SEs by using the delta method (25). For the utilization analysis, we counted the total number of ED visits and hospitalizations separately at 2 years after the survey. We fit a zero-inflated negative binomial regression model to estimate incidence rate ratios with observation time as an offset to account for variability of follow-up time in the data set. We used zero-inflated negative binomial regression rather than Poisson regression because of overdispersion of the data and because a majority of participants (50% to 60%) had no ED visits or hospitalizations. We examined the models by using the Akaike information criterion, which confirmed the use of the zero-inflated negative binomial model as the preferred model. For all models, we adjusted for age, sex, HCC risk score, and survey wave. Because the data did not identify primary care providers or case managers, we could not adjust for clustering at the provider or case manager level; however, we stratified the analyses by clinic site. In a sensitivity analysis we imputed missing items from the case manager performance score using the nearest-neighbor hot-deck imputation method based on age, sex, and HCC risk score (26). Fewer than 4% of the items within the case manager domain were missing.

All analyses were performed by using Stata software, version 13.0 (StataCorp). All hypothesis tests were 2-sided, with an α value of 0.05.

Role of the Funding Source

The Department of Veterans Affairs and the Robert Wood Johnson Foundation funded the study. The funders had no role in the design, conduct, or analysis of the study or the decision to submit the manuscript for publication.

RESULTS

The GHP sent the GHP Medical Home Survey to 3951 members in 4 waves from 2009 to 2012. A total of 1755 (44%) members returned the survey; of these, 1415 (81%) had sufficient data to be included in the analysis. The median duration of claims data follow-up after survey administration for the 4 survey waves was 23 months (interquartile range, 1 to 36 months). Average follow-up duration did not differ substantially by overall satisfaction rating (21.8 months for a very good rating vs. 20.7 months for a rating of less than very good; P = 0.072) or case manager performance rating (21.5 for a very good rating vs. 21.8 months for a rating of less than very good; P = 0.65). Table 1 describes patient characteristics and utilization rates of survey respondents and nonrespondents. Compared with nonrespondents, survey respondents were older (76.7 vs. 74.0 years; P < 0.001), were more likely to be male (47.7% vs. 44.7%; P = 0.087), and had higher HCC risk scores (2.0 vs. 1.8; P < 0.001).

Table 2 describes survey questions and distribution of survey responses. Sixty-eight percent of respondents reported very good ratings of case manager performance.
Table 1. Characteristics of Participants and Nonparticipants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants (n = 1415)</th>
<th>Nonparticipants (n = 2196)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age (SD), y</td>
<td>76.7 (9.1)</td>
<td>74.0 (11.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Men, %</td>
<td>47.7</td>
<td>44.7</td>
<td>0.087</td>
</tr>
<tr>
<td>Mean HCC risk score (SD)</td>
<td>2.0 (1.3)</td>
<td>1.8 (1.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chronic disease burden, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>28.0</td>
<td>26.4</td>
<td>0.54</td>
</tr>
<tr>
<td>Diabetes</td>
<td>38.2</td>
<td>34.3</td>
<td>0.182</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>22.9</td>
<td>17.1</td>
<td>0.015</td>
</tr>
<tr>
<td>COPD</td>
<td>18.1</td>
<td>20.2</td>
<td>0.37</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>49.3</td>
<td>42.8</td>
<td>0.031</td>
</tr>
<tr>
<td>Hypertension</td>
<td>74.3</td>
<td>69.6</td>
<td>0.084</td>
</tr>
<tr>
<td>Cancer</td>
<td>19.2</td>
<td>17.1</td>
<td>0.36</td>
</tr>
<tr>
<td>Depression</td>
<td>13.2</td>
<td>13.6</td>
<td>0.85</td>
</tr>
<tr>
<td>Utilization measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean emergency department visits per year (SD), n</td>
<td>0.5 (0.9)</td>
<td>0.6 (0.9)</td>
<td>0.018</td>
</tr>
<tr>
<td>Mean hospitalizations per year (SD), n</td>
<td>0.6 (0.7)</td>
<td>0.6 (0.9)</td>
<td>0.136</td>
</tr>
</tbody>
</table>

COPD = chronic obstructive pulmonary disease; HCC = Centers for Medicare & Medicaid Services Hierarchical Condition Category risk adjustment model.

Table 2. Distribution of Survey Responses for Case Manager and Overall Satisfaction Ratings

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>Survey Responses, n (%)</th>
<th>Very Poor</th>
<th>Poor</th>
<th>Good</th>
<th>Very Good</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case manager domain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of communication with your case manager—How easy is it to contact your nurse?</td>
<td>5 (0.4)</td>
<td>11 (0.8)</td>
<td>351 (24.8)</td>
<td>1009 (71.3)</td>
<td>39 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Your case manager’s timeliness in responding to your concerns or decisions about your care</td>
<td>2 (0.1)</td>
<td>6 (0.4)</td>
<td>291 (20.6)</td>
<td>1068 (75.5)</td>
<td>48 (3.4)</td>
<td></td>
</tr>
<tr>
<td>Your case manager’s explanation of your medical condition, treatment options, and the medicines you take</td>
<td>3 (0.2)</td>
<td>7 (0.5)</td>
<td>263 (18.6)</td>
<td>1087 (76.8)</td>
<td>55 (3.9)</td>
<td></td>
</tr>
<tr>
<td>Your case manager’s effectiveness in working with you and your health care team (primary care provider or specialist, office nurses, etc.)—for example: setting up referrals and providing feedback from your doctor</td>
<td>5 (0.4)</td>
<td>10 (0.7)</td>
<td>244 (17.2)</td>
<td>1109 (78.4)</td>
<td>47 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Satisfaction domain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How satisfied are you overall with the quality of care at your primary care site?</td>
<td>0 (0)</td>
<td>15 (1.1)</td>
<td>231 (16.3)</td>
<td>1169 (82.6)</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

NA = not applicable.
* The 9 survey respondents who did not answer the overall satisfaction item were excluded from analysis.

Overall Satisfaction

In unadjusted analyses, patients who reported very good ratings of case manager performance across all items had a higher probability of reporting very good overall satisfaction with care than those who reported less-than-very good case manager performance on 1 or more questions (92.3% vs. 62.3%; absolute difference, 30.0 percentage points [95% CI, 25.2 to 34.8 percentage points]; P < 0.001). Similarly, in adjusted analyses, patients who reported very good ratings of case manager performance across all items had a higher probability of reporting very good overall satisfaction with care than did those who reported less-than-very good case manager performance on 1 or more questions (92.2% vs. 62.5%; absolute difference, 29.7 percentage points [CI, 24.6 to 34.8 percentage points]; P < 0.001) (Table 3). We conducted sensitivity analyses using imputed values for missing items from the case manager domain, which did not qualitatively change the results.

Utilization

Survey respondents and nonrespondents did not differ significantly in terms of their annual rates of hospitalizations (0.60 vs. 0.65 hospitalization per year; P = 0.136). However, survey respondents had lower rates of ED visits per year than did nonrespondents (0.55 vs. 0.62 visit per year; P = 0.018). When we examined only the subset of patients who responded to the survey, baseline rates of hospitalization did not differ between those who reported very good case manager performance on all questions and those who reported less-than-very good case manager performance (0.60 vs. 0.61 hospitalization per year; P = 0.77). Similarly, baseline rates of ED visits did not differ between these groups (0.64 vs. 0.61 visit per year; P = 0.59).
In an adjusted analysis that controlled for age, sex, HCC risk score, and survey wave, participants who reported very good case manager performance on all questions did not differ significantly from those who reported less-than-very good case manager performance on incidence rate of hospitalizations (incidence rate ratio, 0.92 [CI, 0.75 to 1.11]; \( P = 0.37 \)) at 2 years after the survey. Participants who reported very good case manager performance on all questions had a lower incidence rate of ED visits than those who reported less-than-very good case manager performance (incidence rate ratio, 0.79 [CI, 0.64, 0.98]; \( P = 0.029 \)) at 2 years after the survey (Table 4). In sensitivity analyses, we imputed values for missing items from the case manager domain, and the imputation did not qualitatively change our results.

**DISCUSSION**

In this study of patient perceptions of case manager performance in a PCMH program, a higher rating of case manager performance was associated with higher overall satisfaction with care and a lower risk for subsequent ED visits, but not hospitalizations. Specifically, compared with patients who reported a less-than-very good rating of their case manager’s performance, patients who reported very good performance had a 21% reduced risk for subsequent ED visits during a 2-year period after the survey.

The association of case manager performance rating with overall satisfaction is consistent with evidence demonstrating that provider behavior, including physician and nurse communication, is strongly correlated with patients’ ratings of care (27–30). This finding has important implications for PCMHs that feature team-based care with nurse case managers because it indicates that case managers may influence patients’ experiences in an ambulatory setting. Ambulatory practices may consider devoting resources to improving the communication and quality of care delivered by their case managers to improve the patient experience.

The second finding of the study was the association between case manager performance rating and subsequent ED use. Three possible mechanisms explain this finding. The first mechanism relates to attributes of a case manager. A higher-quality case manager may be better equipped to preemptively diagnose and address problems, thereby reducing downstream acute care needs. A second mechanism may be explained by the relationship of the case manager and patient. A patient with greater trust in and a stronger bond with his or her case manager may be more likely to consult the case manager when problems emerge and adhere to the treatment plan and less likely to go to the ED. The third mechanism may be explained by certain patient attributes, such as patient activation, which may be inde-

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**Table 3. Factors Associated With Probability of Very Good Overall Satisfaction With Care**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted Model*</th>
<th></th>
<th>Adjusted Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good CM rating (vs. less-than-very good)‡</td>
<td>30.0 (25.2 to 34.8)</td>
<td>&lt;0.001</td>
<td>29.7 (24.6 to 34.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (per year)</td>
<td>-0.04 (−0.3 to 0.2)</td>
<td>0.70</td>
<td>-0.10 (−0.3 to 0.09)</td>
<td>0.32</td>
</tr>
<tr>
<td>Male (vs. female)</td>
<td>0.05 (−3.9 to 4.0)</td>
<td>0.98</td>
<td>-1.3 (−4.7 to 2.1)</td>
<td>0.46</td>
</tr>
<tr>
<td>HCC risk score (per unit increase)</td>
<td>1.9 (0.3 to 3.5)</td>
<td>0.018</td>
<td>1.7 (0.2 to 3.3)</td>
<td>0.031</td>
</tr>
<tr>
<td>Survey wave (per wave)</td>
<td>-3.5 (−5.3 to −1.6)</td>
<td>&lt;0.001</td>
<td>-3.1 (−5.0 to −1.2)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

CM = case manager; HCC = Centers for Medicare & Medicaid Services Hierarchical Condition Category risk adjustment model.
* Based on individual bivariate models.
† Calculated based on a conversion of the logistic regression results to the probability scale.
‡ Survey respondent ratings of CM performance.

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**Table 4. Factors Associated With Rate of Emergency Department Visits and Hospitalizations**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Emergency Department Visits</th>
<th></th>
<th>Hospitalizations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incidence Rate Ratio (95% CI)</td>
<td>( P ) Value</td>
<td>Incidence Rate Ratio (95% CI)</td>
<td>( P ) Value</td>
</tr>
<tr>
<td>Very good CM rating (vs. less-than-very good)‡</td>
<td>0.79 (0.64–0.98)</td>
<td>0.029</td>
<td>0.92 (0.75–1.11)</td>
<td>0.37</td>
</tr>
<tr>
<td>Age (per year)</td>
<td>0.99 (0.98–1.00)</td>
<td>0.071</td>
<td>0.99 (0.98–1.00)</td>
<td>0.158</td>
</tr>
<tr>
<td>Male (vs. female)</td>
<td>0.92 (0.78–1.09)</td>
<td>0.34</td>
<td>1.09 (0.91–1.31)</td>
<td>0.35</td>
</tr>
<tr>
<td>HCC risk score (per unit increase)</td>
<td>1.06 (0.98–1.15)</td>
<td>0.132</td>
<td>1.22 (1.12–1.33)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Survey wave (per wave)</td>
<td>1.09 (1.01–1.17)</td>
<td>0.024</td>
<td>0.94 (0.87–1.04)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

CM = case manager; HCC = Centers for Medicare & Medicaid Services Hierarchical Condition Category risk adjustment model.
* Survey respondent ratings of CM performance.
ependently associated with higher ratings of care as well as reduced acute care use (31, 32). In addition to activation, other patient-level factors may independently affect care ratings and health care utilization, including mental health and substance abuse disorders, health literacy, and the degree of social support in the home. These 3 mechanisms represent important areas for future investigation.

A final and unexpected finding in our study was the variability in overall satisfaction over time, with wave 2 having the highest rating. Except for patient perceptions of access to care, the introduction of the PCMH has not measurably changed patient ratings of care (33). The discrepancy of our finding may be due to a change in patient selection for the case manager intervention over time rather than reflecting a true decline in satisfaction with care. Initial phases of the Proven Health Navigator at Geisinger targeted case manager services to the highest-risk patients and expanded these services to more patients over time. Although sicker patients typically report lower ratings of care (34, 35), it may be that sicker patients in a PCMH benefit most from a case manager intervention and are therefore more likely to report higher ratings of their case manager’s performance.

This study had 3 main limitations. First, our analyses included only patients who responded to a patient satisfaction survey. Respondents to the survey were older and had more comorbid conditions than nonrespondents. These factors may have led respondents to be more receptive to case management, which in turn may have reduced future acute care utilization and led to higher case manager performance ratings. Although adjusting for observed factors that differed between respondents and nonrespondents, including age, sex, and risk score, did not significantly alter our results, we had limited clinical and demographic information on patients, and our results are still subject to nonresponse bias.

A second limitation to the study was the ceiling effects of the patient-reported satisfaction data. This is a common issue with patient-reported experience data (36). For this reason, we focused on the comparison between patients providing the highest level of satisfaction (very good) on all questions versus those providing ratings of less than very good on 1 or more questions within a domain assessing overall satisfaction or provider performance.

A final limitation is lack of data collected on the duration and nature of case management relationship and how these variables interact with our findings. Although our study did not investigate the mechanism by which case management perceptions are associated with subsequent care use, the frequency, method, or quality of communications between case manager and patient may play a role (37). Productive questions for future research include how results might vary by dose of case management and method of communication.

Although the PCMH with embedded case management can reduce acute care utilization among clinically complex patients, how to customize care for these high-risk patients and optimize the case manager intervention across a medical home remains an open question (13, 15). The findings from this study indicate that patient responses on a satisfaction survey have predictive information about future acute care use. This information could be used to tailor the PCMH to the needs of individual patients. For example, among patients enrolled in case management, a less-than-perfect rating of case manager performance could serve as a red flag to identify patients who might benefit from additional case management activity or supplementary interventions.

In summary, our findings suggest that patient ratings of their case manager are positively associated with satisfaction with care and may predict patients’ future acute care utilization.

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