

# Primary Care Provider Turnover and Quality in Managed Care Organizations

Mary E. Plomondon, PhD, MSPH; David J. Magid, MD, MPH; John F. Steiner, MD, MPH;  
Samantha MaWhinney, ScD; Blair D. Gifford, PhD; Sarah C. Shih, MPH; Gary K. Grunwald, PhD;  
and John S. Rumsfeld, MD, PhD

**C**ontinuity of care is known as an important element of quality of care.<sup>1</sup> It has been associated with higher patient ratings of their healthcare.<sup>2-4</sup> Patients who have a continuous relationship with their provider have more trust in their provider, believe that their provider shows respect and listens well, and give higher ratings for coordination of care.<sup>4-9</sup> Continuity of care has also been associated with higher rates of compliance with preventive care measures, such as higher rates of childhood immunizations.<sup>2,3,5,10-15</sup> Although associations with continuity of care have been studied, little is known about associations with a specific aspect of continuity of care, namely, primary care provider turnover.

From literature, primary care provider turnover is the rate at which primary care providers leave a health plan organization. Known to be costly, healthcare turnover, including physicians, nurses, allied health personnel, and staff, is estimated at 3.4% to 5.8% of a health plan's annual budget.<sup>16</sup> The largest cost was due to loss and replacement nurses. Because of the high cost of recruitment and orientation, health plans with higher provider turnover have higher operating costs.<sup>17-19</sup> It is unknown whether primary care provider turnover is associated with quality of care. The few studies on the associations between primary care provider (physician provider and nonphysician provider) and patient satisfaction and preventive care measures have reported mixed results.<sup>14,20-24</sup>

Based on the continuity of care literature, we propose that lower provider turnover rates might improve both communication and coordination of patient care.<sup>20</sup> Further, low provider turnover rate might be associated with an increase in a physician's knowledge of a patient's needs, patients' trust in their physician, and improved provider teamwork,<sup>5,9,25</sup> and therefore, should improve the coordination of patient care.<sup>26,27</sup> This in turn would be expected to promote high quality of care, specifically higher patient satisfaction with care and improved effectiveness of care.

The goal of this study was to improve the understanding of associations between primary care provider (both physicians and nonphysician providers) turnover and quality-of-care indicators, including measures of member satisfaction and preventive care. We hypothesized that organizations with higher provider turnover would be associated with lower member satisfaction and lower rates of preventive care measures in the organizations. If found, interventions could

**Objectives:** To examine the association between primary care provider turnover in managed care organizations and measures of member satisfaction and preventive care.

**Study Design:** Retrospective cohort study of a national sample of 615 managed care organizations that reported HEDIS® data to the National Committee for Quality Assurance from 1999 through 2001.

**Methods:** Multivariable hierarchical regression modeling was used to evaluate the association between health plan primary care provider turnover rate and member satisfaction and preventive care measures, including childhood immunization, well-child visits, cholesterol, diabetes management, and breast and cervical cancer screening, adjusting for patient and organizational characteristics, time, and repeated measures.

**Results:** The median primary care provider turnover rate was 7.1% (range, 0%-53.3%). After adjustment for plan characteristics, health plans with higher primary care provider turnover rates had significantly lower measures of member satisfaction, including overall rating of healthcare ( $P < .01$ ). A 10% higher primary care provider turnover rate was associated with 0.9% fewer members rating high overall satisfaction with healthcare. Health plans with higher provider turnover rates also had lower rates of preventive care, including childhood immunization ( $P = .045$ ), well-child visits ( $P = .002$ ), cholesterol screening after cardiac event ( $P = .042$ ), and cervical cancer screening ( $P = .024$ ). For example, a 10% higher primary care provider turnover was associated with a 2.7% lower rate of child-members receiving well-child visits in the first 15 months of life.

**Conclusions:** Primary care provider turnover is associated with several measures of care quality, including aspects of member satisfaction and preventive care. Future studies should evaluate whether interventions to reduce primary care provider turnover can improve quality of care and patient outcomes.

(*Am J Manag Care.* 2007;13:465-472)

**In this issue**  
Take-away Points / p471  
[www.ajmc.com](http://www.ajmc.com)  
Full text and PDF

**For author information and disclosures,**  
see end of text.

potentially be implemented at the organizational level of care to lower primary care provider turnover and thereby improve quality of care.

## METHODS

### Data

Data for this study were from the National Committee for Quality Assurance (NCQA). NCQA is an independent, not-for-profit organization created to examine and report on the quality of care the public receives at managed care organizations.<sup>28</sup> Managed care organizations voluntarily report aggregate, health plan level data to NCQA. This retrospective cohort study included all commercial managed care organizations that reported data to NCQA on variables measured during the calendar years 1998-2000.

### Study Measures

The outcome variables were aggregated health-plan level measures of member satisfaction and preventive care. Data on member satisfaction were obtained from NCQA, which used the Consumer Assessment of Health Performance Survey (CAHPS 2.0H<sup>®</sup>).<sup>29</sup> CAHPS is a survey of member experiences administered to a random sample of health plan members at the end of each measurement year. The CAHPS measures used in this study comprised 3 domains: satisfaction with provider (overall rating of personal provider, reporting frequency of provider showing respect, reporting of frequency of provider listening carefully, and reporting of frequency of provider explaining well), satisfaction with timeliness of care (how often patient obtained a routine appointment when desired, how often patient obtained an injury/illness appointment when desired, and frequency of clinic wait time longer than 15 minutes), and overall satisfaction (overall rating of healthcare and overall rating of health plan). For this analysis, satisfaction scores were measured on a continuous scale as a percentage of members who answered favorably (ratings of 8, 9, or 10 on a scale of 0 to 10; frequencies of "always" or "usually" vs "sometimes," "rarely," or "never").

On average, 1276 satisfaction surveys were sent out for each plan. The average response rate was 48% and ranged from 15% to 86%. Because the survey response rates varied by outcome and by organization, the analyses were weighted by sample size.

Data on preventive care were obtained from NCQA's Health Plan Employer Data Information Set (HEDIS).<sup>29</sup> HEDIS measures are collected by the health plan on specific illnesses and preventive care as a percent of eligible members. The HEDIS data chosen as outcomes in this study comprised

4 domains: well-child visits (percentages of childhood immunizations by age 2 and well-child visits within the first 15 months of life); cardiovascular secondary disease prevention measures (percentages of  $\beta$ -blocker treatment at discharge from hospital after a heart attack, and cholesterol screening performed within 60-365 days after discharge from hospital for acute myocardial infarction, coronary artery bypass graft, or percutaneous transluminal coronary angioplasty); cancer screening measures (percentages of 1 cervical cancer screening among women 21-64 years of age in the past 3 years and 1 breast cancer screening among women 52-69 years of age in the past 2 years); and diabetes management measures (glycosylate hemoglobin control, eye examination, lipid control, nephropathy). Although other outcome variables were available, we chose these 4 domains because they cover a range of health issues (cardiovascular, cancer, diabetes) and populations (pediatric and adult).

To assure accurate rates from all organizations, NCQA required a 100% sample from organizations with fewer than 411 eligible members. Otherwise, a minimum sample of 411 was required, with some organizations reporting rates from much larger samples. In cases in which the organization was not able to report preventive care outcomes (ie, fewer than 30 members were eligible for the rate), the outcome was left as missing. In cases in which the organization had at least 30 eligible members for the rate, but chose not to report the results, the values were imputed to the lowest 10th percentile, consistent with NCQA methodology.

The independent variable of primary interest was the primary care provider turnover rate. Primary care providers included primary care physicians, nurse practitioners, and physician assistants. The turnover rate was defined as the percentage of primary care providers affiliated with the health plan as of December 31 of the year preceding the measurement year who were not affiliated with the health plan as of December 31 of the measurement year.<sup>28</sup> The primary analysis used a combined turnover rate that was weighted by the number of each type of provider (physician/nonphysician) in the organization. A secondary analysis defined turnover using only primary care physician turnover rather than the combined physician and nonphysician turnover rate. Because the turnover rates were based on only one point in time (December 31), it is unknown at what time point during the year the providers left the organization. To help avoid the possibility of measuring the preventive care outcomes prior to turnover, we matched 1 year's turnover with next year's preventive care outcomes. Therefore, the provider turnover rate measured on December 31, 1999, was matched to preventive care outcomes measured in 2000. Consequently, the analysis

## Primary Care Provider Turnover and Quality in Managed Care Organizations

of preventive care outcomes required a minimum of 2 years of data for cohort follow-up, excluding 259 organizations that reported only 1 year of data. The final study cohort for the preventive care outcome analysis consisted of 356 managed care organizations; 132 organizations with 2 years of data, and 224 organizations with 3 years. The member satisfaction outcomes, however, were measured after the end of the measurement year and therefore, could be matched with the same year's provider turnover rate. The study cohort for the member satisfaction outcomes contained all available data from 615 organizations.

The measures used for risk adjustment are listed in **Table 1**. These variables, from NCQA, included health plan characteristics such as size, market penetration, and proportion of male members within the organization. Age and sex were defined by NCQA membership characteristics, whereas race and education were self-reported from the CAHPS survey. Market penetration came from InterStudy of managed care penetration and was defined as the proportion of population enrolled in health maintenance organizations (HMOs).<sup>30</sup> Many of the health plan characteristics, such as type of managed care organization and tax status, have been associated with quality of care outcomes and with provider satisfaction.<sup>31,32</sup> Member characteristics, such as age and sex, have been identified as important covariates.<sup>33</sup> Less than 10% of the risk adjustment variables were missing. For variables that were missing, imputations were done using the Transcan function in S-plus version 6.2 (Insightful, Seattle, Wash). Transcan uses only the risk variables to model each risk variable as an outcome. The missing values are then imputed to be within the range of the nonimputed values, producing unbiased estimates of variances and covariances.<sup>34</sup>

### Statistical Analysis

The goal of these analyses was to assess associations between primary care provider turnover rate and both member satisfaction and preventive care outcomes, adjusting for covariates. The data were repeated measure; that is, organizations report multiple times throughout the study period. Repeated measures are more closely correlated than independent measurements; therefore, the statistical analysis needed to account for this correlation.<sup>35</sup> Furthermore, not all organizations reported data for all years, so the analysis had to account for unbalanced data. Mixed-model methodology was chosen for the analyses because it is able to model continuous, normally distributed outcomes with unbalanced data and adjust for repeated measures at the managed care level.

First, univariate mixed models were developed for each satisfaction and preventive care outcome. Next, multivariable

models were developed that accounted for year and possible confounders (Table 1) for each satisfaction and preventive care outcome. Although several outcomes were studied, no adjustment for multiple comparisons was performed because each of the hypotheses was developed a priori based on clinical experience. The primary analysis was performed on the imputed data set. As a sensitivity analysis, the models were also analyzed on the nonimputed dataset. The results were similar and are therefore not presented in this report. SAS software version 9.0 (SAS Institute Inc., Cary, NC) was used for all data analyses.

## RESULTS

The distribution of primary care provider turnover is shown in the **Figure**. Primary care provider turnover rate was not normally distributed. The median was 7.1% (range, 0%-53.3%). The denominators used to create these rates ranged from 61 to 11 303 providers. Although not outside the range of plausibility, the 53.3% was an outlier, with the next highest value of 36.7%. Elimination of the outlier did not change the results.

The average health plan size was 185 005 members. Most plans were for profit (78%) and most often point-of-service (POS)/HMO combined plans (58%). The plans had been in business for 14 years on average with market penetration averaging 29%. Overall, plan membership averaged 48% male and 74% Caucasian. Associations between covariates and provider turnover are shown in Table 1. Organizations with higher turnover rates were more often in the East North Central and South Central regions. Organizations with higher turnover were more often HMOs than POS or combination plans, had fewer members with greater than high school education, and had more non-Caucasian members.

### Provider Turnover and Member Satisfaction

In multivariable analyses, primary care provider turnover was significantly associated with most of the member satisfaction measures (**Table 2**). Higher primary care provider turnover was significantly associated with a lower rating of personal doctor ( $P = .002$ ), lower ratings of provider's communication skills (listening, explanations, show of respect;  $P < .001$  for each), lower rating of getting appointment for injury/illness ( $P < .001$ ), lower rating of wait time in clinic ( $P = .019$ ), and lower overall rating of health plan ( $P < .001$ ) and health-care ( $P = .001$ ). A 10% higher primary care provider turnover rate was associated with 0.9% less members rating their overall satisfaction with their healthcare greater than 7 out of 10 (ie, highly satisfied) after controlling for plan characteristics

■ MANAGERIAL ■

■ **Table 1.** Plan-level Characteristics

Variable	Plans With Turnover ≤7.48 (n = 468)	Plans With Turnover >7.48 (n = 468)	P*
<b>Years in business, median (25th-75th percentile)</b>	14.8 (7.3-18)	14.0 (11-17)	.8214
<b>No. of members, mean ± SD</b>	209 253 ± 337 228	160 758 ± 272 833	.2092
<b>Market penetration, mean ± SD, %</b>	29.2 ± 10.7	27.8 ± 10.9	.5988
<b>Census region, %</b>			.0018
Middle Atlantic	20.9	3.9	
East North Central	14.1	16.9	
Mountain	4.3	9.6	
New England	10.9	2.1	
Pacific	6.0	11.1	
South Atlantic	16.9	18.2	
South Central	13.5	22.2	
West North Central	5.1	6.4	
Multiple regions	8.3	9.7	
<b>Hybrid collection method, %<sup>†</sup></b>			
Childhood immunization	96.4	94.9	.3290
Well-child visits (0-15 mo)	57.3	55.8	.4609
Cholesterol management	77.8	80.3	.1428
β-Blocker	79.3	78.2	.8398
Cervical cancer screening	84.4	86.1	.6503
Breast cancer screening	70.5	71.4	.6598
<b>Tax status, %</b>			.2479
Not-for-profit	25.0	18.2	
For profit	75.0	81.8	
<b>Type of plan, %</b>			.0418
HMO	27.1	41.7	
POS	8.5	7.5	
POS/HMO plans	64.3	50.9	
<b>Male members, mean ± SD, %</b>	48.3 ± 1.7	48.3 ± 1.7	.4189
<b>Members by age, mean ± SD, %</b>			
≤19	31.6 ± 2.5	32.0 ± 2.4	.3718
20-44	42.4 ± 3.6	41.8 ± 3.4	.0122
45-64	24.3 ± 3.4	24.5 ± 3.4	.0824
≥65	1.7 ± 1.6	1.7 ± 1.3	.6154
<b>Members with more than a high school education, mean ± SD, %</b>	60.3 ± 8.4	58.8 ± 9.8	.0281
<b>Non-Caucasian members, mean ± SD, %</b>	23.4 ± 12.8	29.6 ± 15.4	<.0001

\*P value based on univariate mixed model with adjustment for repeated measures.

<sup>†</sup>Hybrid data collection = combination of administrative data and chart review collection methodologies. HMO indicates health maintenance organization; POS, point of service; SD, standard deviation.

## Primary Care Provider Turnover and Quality in Managed Care Organizations

(Table 2). Although, primary care provider turnover was not significantly associated with getting appointment for routine care ( $P = .08$ ), it was directionally similar. Multivariable analysis using primary care physician-only turnover yielded similar results.

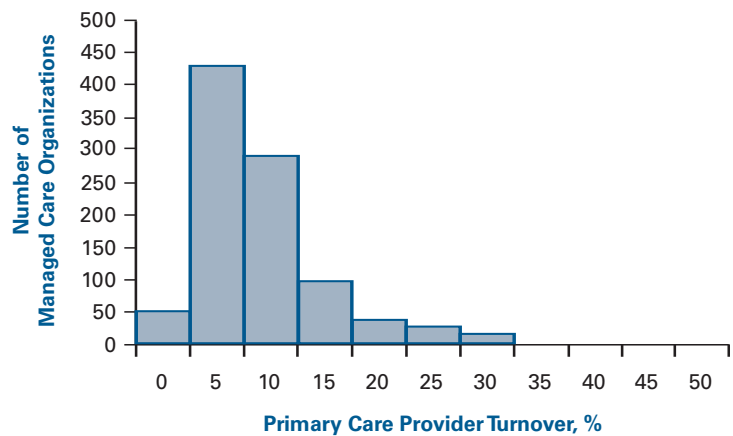
### Provider Turnover and Preventive Care

In multivariable analyses, higher primary care provider turnover was significantly associated with lower rates of childhood immunization ( $P = .045$ ), lower rates of well-child visits in the first 15 months of life ( $P = .002$ ), lower rates of cholesterol screening ( $P = .042$ ), and lower rates of cervical cancer screening ( $P = .024$ ) (Table 2). A 10% higher provider turnover was associated with a 2.7% lower rate of child members receiving well-child visits in the first 15 months of life, a 1.5% lower rate of childhood immunizations, a 1.7% lower rate of cholesterol screening after a heart attack, and a 1.2% lower rate of cervical cancer screening after adjusting for plan characteristics. Primary care provider turnover was not significantly associated with rates of  $\beta$ -blocker treatment or rates of breast cancer screening. Similarly, primary care provider turnover was not significantly associated with any of the diabetes management measures. Multivariable analysis using primary care physician-only turnover and preventive care outcome had similar results.

## DISCUSSION

The goal of this study was to assess the association between primary care provider turnover and multiple quality-of-care indicators in a large national sample of managed care organizations. We found that higher provider turnover rates were associated with lower member satisfaction ratings of their personal doctor and their provider's ability to listen, to explain, and to show respect for their patients. Higher provider turnover rates were associated with lower satisfaction with getting appointments when desired, wait time in clinic, and overall ratings of healthcare and health plan. Furthermore, organizations with higher provider turnover rates reported lower childhood immunization and lower well-child visit rates, lower cholesterol screening rates, and lower cervical cancer screening rates. In contrast, no associations were found between provider turnover and rates of  $\beta$ -blocker usage, rates of breast cancer screening, or rates of diabetes management. These results remained whether provider turnover rate was defined by physician-only providers or a combination of physician and nonphysician providers.

■ **Figure.** Distribution of Primary Care Provider Turnover Rates



Our results align with the continuity of care literature, suggesting that providers who remain in an organization are able to build and maintain a relationship with their patients and, consequently, have more satisfied patients. Patients who have a more continuous relationship with their provider rate higher trust in their provider, believe their provider shows respect and listens well, and rate coordination of care and overall quality of care higher.<sup>4-8,36</sup> Further, our study found an association between high provider turnover and poor satisfaction ratings of clinic wait time. Perhaps this finding is reflective of the more immediate turmoil in the aftermath of a provider leaving an organization. This study expands existing continuity of care literature by demonstrating an association between the specific aspect of continuity of care, provider turnover, and multiple measurements of member satisfaction.

Previous studies have found similar associations between continuity of care and well-child measures, including immunization rates and well-child visits.<sup>11-13,37</sup> However, the published findings on associations between continuity of care and cardiovascular secondary disease prevention measures and cancer screening measures are not as consistent.<sup>14,38-41</sup> Particularly in the cancer screening literature, results have been mixed as to whether the association was with the site of care or the provider of care.<sup>14,38-41</sup> Furthermore, much of the cardiac and cancer literature focused on collaboration between specialists and primary care providers, suggesting that less reliance on a primary care provider is necessary.<sup>14</sup> Our findings of associations between primary care provider turnover and cholesterol screening and cervical cancer screening rates suggest that a primary care provider, rather than a specialist, monitor these specific preventive care measures. Given the width of the 95% confidence intervals, the findings of no association between primary care provider

■ **Table 2.** Multivariable Associations

Outcome	Change in Rate (SE) Associated With 10% Higher Provider Turnover	P*
<b>Satisfaction</b>		
High rating of personal doctor	-0.7 (-0.9, -0.5)	.002
High rating of getting appointment as soon as wanted for routine care	-0.4 (-0.6, -0.2)	.08
High rating of getting appointment as soon as wanted for illness/injury	-0.8 (-1.0, -0.6)	<.001
Wait time in clinic	-0.6 (-0.09, -0.03)	.019
High rating of provider's listening skills	-0.6 (-0.7, -0.5)	<.001
High rating of provider's explanation	-0.5 (-0.6, -0.4)	<.001
High rating of provider's showing respect	-0.5 (-0.4, -0.6)	<.001
High rating of all healthcare	-0.9 (-1.1, -0.7)	<.001
High rating of health plan	-1.0 (-1.3, -0.7)	.001
<b>Preventive care</b>		
Childhood immunization rate	-1.5 (-2.2, -0.8)	.045
Rate of well-child visits in the first 15 months	-2.7 (-3.5, -1.9)	.002
Rate of cholesterol screening management	-1.7 (-2.5, -0.9)	.042
Diabetes management		
HbA1c control	-2 (-1.3, 0.9)	.888
Eye examinations	0.3 (-0.6, 1.2)	.722
Lipid control	0.2 (-0.6, 1.0)	.750
Nephropathy	0.1 (-1.0, 1.2)	.905
Rate of $\beta$ -blocker treatment	-0.5 (-1.3, 0.3)	.543
Rate of breast cancer screening	-0.2 (-0.6, 0.2)	.672
Rate of cervical cancer screening	-1.2 (-1.7, -0.7)	.024
*Adjusted for variables listed in Table 1. HbA1c indicates glycosylated hemoglobin; SE, standard error.		

turnover and  $\beta$ -blockers administered after a myocardial infarction, breast cancer screening rate, or diabetes management are inconclusive. However, no association would indicate the use of disease management programs (such as, postcard/computerized reminders and/or collaborative care between a primary care provider and a specialist, such as, a cardiologist).<sup>42</sup>

Although limited by the study design, our findings may be viewed from a health plan perspective. For instance, because associations have been found between member satisfaction and patient retention in a managed care delivery system,<sup>43</sup> it may be hypothesized that higher primary care provider turnover rates, associated with lower member satisfaction, might therefore lead to worse patient retention. Similarly, studies have found associations between increased preventive care usage and decreased morbidity and mortality related to

those measures.<sup>44-47</sup> Although the magnitudes of associations among the preventive care measures found in our study are modest when viewed separately, collectively they could potentially have a large impact on preventive care usage within a managed care organization. Overall, the associations found in this study suggest the importance of monitoring primary care provider turnover as a potential measure of quality.

Primary care provider turnover rates are potentially modifiable. Previous literature has reported that giving physicians authority to care for their patients, including the ability to hospitalize, order tests/procedures, and obtain referrals for patients, is associated with a reduction in primary care provider turnover.<sup>18,19,48-53</sup> Further, the nursing literature has reported that nurses who perceived their work as more "patient-centered" were more satisfied.<sup>15</sup> Another potentially modifiable variable is compensation rate. Surveys have

found that physicians want to have individual control over their compensation rather than having their compensation dependent on the behavior of other physicians in the organization.<sup>21</sup> Both compensation arrangements and restrictions on how providers practice are factors that health plans can address to potentially decrease turnover and thereby increase quality. Finally, the cost of physician turnover is extremely high, estimated at 3.4% to 5.8% of a health plan's annual operating budget, or \$17 million to \$29 million for an organization with a \$500 million base.<sup>16,17</sup> Nursing turnover cost is estimated at more than \$10 000 per registered nurse turnover.<sup>54</sup> Thus, reducing provider turnover may lead to significant cost savings to health plans in addition to improving quality of care.

We would like to acknowledge several potential limitations. First, this study was based on aggregate managed care organization data. There is no way for us to know if the members who lost their primary care provider were the same members who had lower satisfaction and/or lower effectiveness of care rates. However, as with other studies that have used aggregate data, this study has resulted in several valuable hypotheses to pursue further using individual data. Second, the analysis was primarily limited to the organizational characteristics, process, and outcome data that NCQA collect. However, from InterStudy,<sup>30</sup> we were able to add the percent market penetration. Even so, there may be other factors not available to us that may influence these relationships and should be evaluated in future studies. Third, for the preventive care outcomes, organizations that did not submit 2 years of data were eliminated, adding to potential bias. However, this was required to avoid the potential confounding by reverse causality (ie, quality of care decreases leading to more provider turnover), a separate avenue of investigation, but was not our focus or a priori hypothesis to investigate. Finally, not all managed care organizations voluntarily submit their data to NCQA, potentially limiting the generalizability of our findings. However, the organizations that do report to NCQA provide care to more than 68 million people and represent approximately 70% of all managed care enrollees in the United States.

In conclusion, primary care provider turnover is associated with quality of care in managed care organizations. Associations were found between primary care provider turnover and both member satisfaction and preventive care measures. Measures implemented at the organizational level to decrease primary care provider turnover may potentially improve member satisfaction and preventive care, with the goal of improving patient retention and overall quality of care.

### Take-away Points

Analysis of a national sample of managed care organizations found associations between higher primary care provider turnover and lower ratings of member satisfaction and lower ratings of preventive care measures.

- Managed care organizations should view primary care provider turnover as an associate of quality-of-care indicators.
- Measures implemented at the organizational level to decrease primary care provider turnover may potentially increase quality measures, specifically patient satisfaction, timeliness of care, and effectiveness of care, with the goal of improving patient retention and overall quality of care.

**Author Affiliations:** From the Eastern Colorado Health Care System, Department of Veterans Affairs Medical Center, Denver, Colo (MEP, GKG, JSR); University of Colorado at Denver and Health Sciences Center, Denver, Colo (DJM, JFS, SM, BDG, GKG, JSR); Colorado Health Outcomes Program, Denver, Colo (JFS); Colorado Permanente Medical Group, Denver, Colo (DJM); and National Committee for Quality Assurance (NCQA), Washington, DC (SCS).

**Author Disclosure:** The authors (MEP, DJM, JFS, SM, BDG, SCS, GKG, JSR) report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter discussed in this manuscript.

**Authorship Information:** Concept and design (MEP, DJM, JFS, SM, BDG, SCS, JSR); acquisition of data (MEP, DJM, SCS); analysis and interpretation of data (MEP, DJM, JFS, SM, SCS, GKG, JSR); drafting of the manuscript (MEP, DJM, JFS, SM); critical revision of the manuscript for important intellectual content (MEP, DJM, JFS, SM, BDG, SCS, GKG, JSR); statistical analysis (MEP, SM, GKG); administrative, technical, or logistic support (MEP); supervision (JFS, SM, BDG, JSR).

**Address correspondence to:** Meg Plomondon, PhD, Care Coordination Research Program, Eastern Colorado Health Care System (Denver VAMC), Cardiology 111B, 1055 Clermont St, Denver, CO 80220. E-mail: meg.plomondon@va.gov.

## REFERENCES

1. Starfield B. *Primary Care: Concept, Evaluation, and Policy*. New York: Oxford University Press; 1992.
2. Christakis DA, Wright JA, Zimmerman FJ, Bassett AL, Connell FA. Continuity of care is associated with well-coordinated care. *Ambul Pediatr*. 2003;3:82-86.
3. Christakis DA, Wright JA, Zimmerman FJ, Bassett AL, Connell FA. Continuity of care is associated with high-quality care by parental report. *Pediatrics*. 2002;109:e54.
4. Weyrauch KF. Does continuity of care increase HMO patients' satisfaction with physician performance? *J Am Board Fam Pract*. 1996;9:31-36.
5. Mainous AG 3rd, Baker R, Love MM, Gray DP, Gill JM. Continuity of care and trust in one's physician: evidence from primary care in the United States and the United Kingdom. *Fam Med*. 2001;33:22-27.
6. Forrest CB, Shi L, von Schrader S, Ng J. Managed care, primary care, and the patient-practitioner relationship. *J Gen Intern Med*. 2002;17:270-277.
7. Kao AC, Green DC, Davis NA, Koplan JP, Cleary PD. Patients' trust in their physicians: effects of choice, continuity, and payment method. *J Gen Intern Med*. 1998;13:681-686.
8. Saultz JW, Albedaiwi W. Interpersonal continuity of care and patient satisfaction: a critical review. *Ann Fam Med*. 2004;2:445-451.
9. Safran DG, Taira DA, Rogers WH, Kosinski M, Ware JE, Tarlov AR. Linking primary care performance to outcomes of care. *J Fam Pract*. 1998;47:213-220.
10. Saultz JW, Lochner J. Interpersonal continuity of care and care outcomes: a critical review. *Ann Fam Med*. 2005;3:159-166.
11. Christakis DA, Mell L, Wright JA, Davis R, Connell FA. The association between greater continuity of care and timely measles-

- mumps-rubella vaccination. *Am J Public Health*. 2000;90:962-965.
12. **Gill JM, Saldarriaga A, Mainous AG 3rd, Unger D.** Does continuity between prenatal and well-child care improve childhood immunizations? *Fam Med*. 2002;34:274-280.
  13. **Irigoyen M, Findley SE, Chen S, et al.** Early continuity of care and immunization coverage. *Ambul Pediatr*. 2004;4:199-203.
  14. **Flocke SA, Stange KC, Zyzanski SJ.** The association of attributes of primary care with the delivery of clinical preventive services. *Med Care*. 1998;36(8 suppl):AS21-AS30.
  15. **Rathert C, May DR.** Health care work environments, employee satisfaction, and patient safety: care provider perspectives. *Health Care Manage Rev*. 2007;31:2-11.
  16. **Waldman JD, Kelly F, Arora S, Smith HL.** The shocking cost of turnover in health care. *Health Care Manage Rev*. 2004;29:2-7.
  17. **Buchbinder SB, Wilson M, Melick CF, Powe NR.** Primary care physician job satisfaction and turnover. *Am J Manag Care*. 2001;7:701-713.
  18. **Buchbinder SB, Wilson M, Melick CF, Powe NR.** Estimates of costs of primary care physician turnover. *Am J Manag Care*. 1999;5:1431-1438.
  19. **Gray AM, Phillips VL, Normand C.** The costs of nursing turnover: evidence from the British National Health Service. *Health Policy*. 1996;38:117-128.
  20. **Kalisch BJ, Curley M, Stefanov S.** An intervention to enhance nursing staff teamwork and engagement. *J Nurs Adm*. 2007;37:77-84.
  21. **Misra-Hebert AD, Kay R, Stoller JK.** A review of physician turnover rates, causes, and consequences. *Am J Med Qual*. 2004;19:56-66.
  22. **Nutting PA, Goodwin MA, Flocke SA, Zyzanski SJ, Stange KC.** Continuity of primary care: to whom does it matter and when? *Ann Fam Med*. 2003;1:149-155.
  23. **Ruhe M, Gotler RS, Goodwin MA, Stange KC.** Physician and staff turnover in community primary care practice. *J Ambul Care Manage*. 2004;27:242-248.
  24. **Pereira AG, Kleinman KP, Pearson SD.** Leaving the practice: effects of primary care physician departure on patient care. *Arch Intern Med*. 2003;163:2733-2736.
  25. **Campbell SM, Hann M, Hacker J, et al.** Identifying predictors of high quality care in English general practice: observational study. *BMJ*. 2001;323:784-787.
  26. **Wolff JL, Starfield B, Anderson G.** Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Arch Intern Med*. 2002;162:2269-2276.
  27. **Safran DG, Karp M, Coltin K, et al.** Measuring patients' experiences with individual primary care physicians. Results of a statewide demonstration project. *J Gen Intern Med*. 2006;21:13-21.
  28. **National Committee for Quality Assurance (NCQA).** *State of Health Care Quality, 2000*. Washington, DC: NCQA; 2000.
  29. **National Committee for Quality Assurance (NCQA).** *NCOA Quality Compass*. Available at: <http://web.ncqa.org/tabid/177/Default.aspx>
  30. **InterStudy.** *The InterStudy Competitive Edge: HMO Industry Report 7.1*. St. Paul, Minn: InterStudy Publications; 1997.
  31. **Gillies RR, Chenok KE, Shortell SM, Pawlson G, Wimbush JJ.** The impact of health plan delivery system organization on clinical quality and patient satisfaction. *Health Serv Res*. 2006;41:1181-1199.
  32. **Sirovich BE, Gottlieb DJ, Welch HG, Fisher ES.** Regional variations in health care intensity and physician perceptions of quality of care. *Ann Intern Med*. 2006;144:641-649.
  33. **Weisman CS, Henderson JT, Schifrin E, Romans M, Clancy CM.** Gender and patient satisfaction in managed care plans: analysis of the 1999 HEDIS/CAHPS 2.0H Adult Survey. *Womens Health Issues*. 2001;11:401-415.
  34. **Harrell FE Jr.** An improved nonlinear imputation/transformation method. Presented at: Meeting of the International Biometric Society, Eastern North American Region (ENAR); April 12, 1994; Cleveland, Ohio. Available at: <http://biostat.mc.vanderbilt.edu/twiki/pub/Main/FHHandouts/transcan.pdf>. Accessed June 26, 2007.
  35. **Diggle PJ.** An approach to the analysis of repeated measurements. *Biometrics*. 1988;44:959-971.
  36. **Fuss MA, Bryan YE, Hitchings KS, et al.** Measuring critical care redesign: impact on satisfaction and quality. *Nurs Adm Q*. 1998;23:1-14.
  37. **O'Malley AS, Forrest CB.** Continuity of care and delivery of ambulatory services to children in community health clinics. *J Community Health*. 1996;21:159-173.
  38. **Xu KT.** Usual source of care in preventive service use: a regular doctor versus a regular site. *Health Serv Res*. 2002;37:1509-1529.
  39. **Mandelblatt JS, Gold K, O'Malley AS, et al.** Breast and cervix cancer screening among multiethnic women: role of age, health, and source of care. *Prev Med*. 1999;28:418-425.
  40. **Selvin E, Brett KM.** Breast and cervical cancer screening: socio-demographic predictors among White, Black, and Hispanic women. *Am J Public Health*. 2003;93:618-623.
  41. **O'Malley AS, Mandelblatt J, Gold K, Cagney KA, Kerner J.** Continuity of care and the use of breast and cervical cancer screening services in a multiethnic community. *Arch Intern Med*. 1997;157:1462-1470.
  42. **Lafata JE, Baker AM, Divine GW, McCarthy BD, Xi H.** The use of computerized birthday greeting reminders in the management of diabetes. *J Gen Intern Med*. 2002;17:521-530.
  43. **Wood SD.** Strategies for improving health plan member retention. *Healthc Financ Manage*. 1999;suppl:1-5.
  44. **Ferdinand KC.** The importance of aggressive lipid management in patients at risk: evidence from recent clinical trials. *Clin Cardiol*. 2004;27(6 suppl 3):III12-III15.
  45. **Fracheboud J, Otto SJ, Van Dijck JA, Broeders MJ, Verbeek AL, De Koning HJ; for the National Evaluation Team for Breast cancer screening (NETB).** Decreased rates of advanced breast cancer due to mammography screening in The Netherlands. *Br J Cancer*. 2004;91:861-867.
  46. **Coburn NG, Chung MA, Fulton J, Cady B.** Decreased breast cancer tumor size, stage, and mortality in Rhode Island: an example of a well-screened population. *Cancer Control*. 2004;11:222-230.
  47. **Morabia A, Zhang FF.** History of medical screening: from concepts to action. *Postgrad Med J*. 2004;80:463-469.
  48. **Hadley J, Mitchell JM, Sulmasy DP, Bloche MG.** Perceived financial incentives, HMO market penetration, and physicians' practice styles and satisfaction. *Health Serv Res*. 1999;34:307-321.
  49. **Williams ES, Linzer M, Pathman DE, McMurray JE, Konrad TR.** What do physicians want in their ideal job? *J Med Pract Manage*. 2003;18:179-183.
  50. **Landon BE, Reschovsky J, Blumenthal D.** Changes in career satisfaction among primary care and specialist physicians, 1997-2001. *JAMA*. 2003;289:442-449.
  51. **Hadley J, Mitchell JM.** The growth of managed care and changes in physicians' incomes, autonomy, and satisfaction, 1991-1997. *Int J Health Care Finance Econ*. 2002;2:37-50.
  52. **Zuger A.** Dissatisfaction with medical practice. *N Engl J Med*. 2004;350:69-75.
  53. **Kerstein J, Pauly MV, Hillman A.** Primary care physician turnover in HMOs. *Health Serv Res*. 1994;29:17-37.
  54. **Jones CB.** Staff nurse turnover costs: part II, measurements and results. *J Nurs Adm*. 1990;20:27-32. ■