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Is Patient Activation Associated With Future Health Outcomes and Healthcare Utilization Among Patients With Diabetes?

Carol Remmers, PhD; Judith Hibbard, PhD; David M. Mosen, PhD; Morton Wagenfield, PhD; Robert E. Hoye, PhD; Chester Jones, PhD

Abstract: We examined the relationship between the patient activation measure (PAM) and future diabetes-related health outcomes through retrospective analysis of secondary data using multivariate logistic regression. PAM scores from a 2004 survey on 1180 randomly sampled adults with diabetes and health information from a 2006 diabetes registry were the data sources used. The PAM was predictive for hemoglobin A_{1c} (HbA_{1c}) testing ($P < .008$), low-density lipoprotein cholesterol (LDL-C) testing ($P < .005$), HbA_{1c} control ($P < .01$), and all-cause discharges ($P < .03$), but not for lipid-lowering drug use, LDL-C control, or acute myocardial infarction discharges. These results suggest that PAM scores can be used to identify patients at risk for poorer health outcomes. [AQ2]
Key words: *diabetes*, *patient activation measure*, *quality of care*

CHRONIC ILLNESSES such as diabetes are a growing and costly problem. Diabetes is a major cause of morbidity, disability, and mortality, affecting about 20.8 million persons in the United States, including 6.2 million with undiagnosed diabetes, and is often occurring at younger and younger ages (Centers for Disease Control and Prevention, 2005). Chronic illnesses are not well managed [AQ3] (Bodenheimer et al., 2002), and diabetes specifically has found to be poorly controlled in the United States (Li et al., 2004). Our healthcare system is geared toward acute rather than chronic illnesses (Bodenheimer et al., 2002b) [AQ4] and is not well equipped to handle the long-term commitment required to treat chronic conditions. Individuals with chronic illnesses and their families play a central role in managing their health (Bodenheimer et al.), yet most clinicians are ill [AQ5] prepared to help their patients manage their illnesses (Clark, 2003).

Optimal treatment of chronic illness requires not only a healthcare system that recognizes the patient as central to his or her care, it also requires an activated patient who not only knows what to do, but also has the skills and motivation to do so. Assessing level of activation is important because many researchers (Lorig et al., 1999; Mosen et al., 2007; Von Korff et al., 1997) have found that engaged, informed, confident, and skilled patients are more likely to perform activities that will promote their own health.

The patient activation measure (PAM) assesses a person's beliefs, motivation, and actions for self-care. Patients with chronic

Author Affiliations: *Kaiser Permanente Utility for Care Data Analysis, Oakland, California (Dr Remmers); Department of Planning, Public Policy and Management, University of Oregon, Eugene, Oregon (Dr Hibbard); Kaiser Permanente Center for Health Research, Portland, Oregon (Dr Mosen); Department of Sociology, Western Michigan University, Kalamazoo, Michigan (Dr Wagenfield); College of Education and Human Development, University of Louisville, Louisville, Kentucky (Dr Hoye); College of Education and Health Professions, University of Arkansas, Fayetteville, Arkansas (Dr Jones).* [AQ1]

Corresponding Author: *Carol Remmers, PhD, Kaiser Permanente Utility for Care Data Analysis, 1 Kaiser Plaza, Oakland, CA 94612 (Carol.L.Remmers@kp.org).*

illnesses who have higher PAM scores, indicating a higher level of activation, enjoy better health outcomes than those with lower scores (Hibbard et al., 2004, 2007; Mosen et al., 2007). It is important to examine the effect of active involvement in one's health because supporting and teaching self-management and self-efficacy skills for patients with diabetes can improve health and lower costs of care (Bodenheimer et al., 2002a, 2002c). [AQ6]

Many chronic condition interventions are short-lived (Clark, 2003; Fisher et al., 2005), suggesting that chronic conditions require constant attention by the healthcare community as well as by the patient. A more activated patient is better positioned to continue following self-care strategies for the long term. In the Institute of Medicine's (2001) Summit on Crossing the Quality Chasm, measurement that focuses on the patients' experiences over time and is integrated in the care delivery system in a way that improves patient care is highlighted as the ideal. The PAM is well posed to help meet this ideal (Hibbard et al., 2004).

While others have identified external factors that influence adoption of care management practices (Li et al., 2004; Rundall et al., 2002), have evaluated patients' assessment of care management practices and subsequent effect on health outcomes (Glasgow et al., 2005; Schmittdiel et al., 2008), and have studied the relationship between PAM scores and current health outcomes (Mosen et al., 2007), there has been less focus on whether such factors can help predict future health outcomes and utilization. No previous study has examined the predictive value of the PAM. This article's primary objective is to examine the PAM's association with future process and health-related outcomes for adults with diabetes.

METHODS

Data sources

This study used secondary data sources to address the research question. The first source of data was a descriptive, cross-sectional survey fielded during the fall of 2004 of Kaiser Permanente Medical Care program members from 1 of 6 chronic condition populations: (1) asthma, (2) diabetes (DM), (3) heart failure, (4) coronary artery disease, (5) chronic pain, and (6) both diabetes and coronary artery disease. Out of a total of 8908 in the original sample, 6763 were contacted for a contact rate of 75.4%. Of the 6673 respondents contacted, 4108 completed the survey for a total response rate of 61.2%. The survey and study populations have been previously discussed in the peer-reviewed literature (Mosen et al., 2007). The Kaiser Permanente Northern California Institutional Review Board approved the fielding of the survey.

The second data source used in this study included a diabetes registry with administrative clinical data for 2006. Administrative data sources include information on outpatient utilization, laboratory testing, pharmacy utilization, and inpatient utilization. These data were the source for the predictor variables. The registry data included information on low-density lipoprotein cholesterol (LDL-C) [AQ7] testing and control, hemoglobin A_{1c} (HgA_{1c}) testing and control, lipid-lowering drug use, all cause discharges, and discharges due to acute myocardial infarction (AMI). Diabetes-specific utilization measures were included in the diabetes registry. Both the survey and the administrative data contain a medical record number that allowed appropriate linkage of member data in both data sources.

The final study population was obtained by merging the final survey population from all the cohorts with the 2006 diabetes cohort. Therefore, a patient could be included in the study population even if the original reason for being included in the survey sample was based on membership in another chronic disease. For example, a patient with asthma and diabetes may have been included in the survey sample based on inclusion in the asthma registry, but since that person also has diabetes, he is included in the final study population. The final sample included 1180 participants. The Walden University

Institutional Review Board approved this research study.

Survey elements

The cross-sectional survey included questions on health-related quality of life, satisfaction with care, use of chronic condition management related services, and demographic information along with the 22-item PAM instrument, the primary independent variable used in the present analysis. Most questions, including the PAM questions, were closed ended with ordinal responses.

The PAM was conceptualized and developed using literature reviews, expert opinion, and focus groups (Hibbard et al., 2004). It was scaled and tested using the Rasch methodology, which yielded a 22-item instrument measured on a theoretical 0–100 scale where 100 represents the highest activation level (Hibbard et al., 2004). The PAM has been extensively tested for criterion and construct validity and reliability and has strong psychometric properties (Hibbard et al., 2004). There are 4 levels of activation (Hibbard et al., 2007):

1. The individual is not prepared to play an active role in their own health.
2. The individual believes he or she plays an important role in managing his or her care, but lacks the confidence and/or knowledge to take action.
3. The individual is beginning to take action, but may still lack confidence.
4. The individual has adopted many self-management behaviors, but may not be able to maintain actions over time or during times of stress.

The study included 7 dependent variables: 3 process measures, 2 health-related outcome measures, and 2 healthcare utilization measures. The process measures included HgA_{1c} testing, LDL-c testing, and lipid-lowering drug use. For the testing measures, a patient was considered to be in compliance if at least one test was performed during 2006. A patient was considered to be on a lipid-lowering drug if at least 1 prescription for statins, niacins, fibric acids, and/or resins had been filled during 2006. The health-related outcome measures included HgA_{1c} and LDL-C good control. Good HgA_{1c} control was defined as any test result less than or equal to 8% during 2006. The definition for HbA_{1c} good control in the HEDIS measurement set (National Committee for Quality Assurance, 2005) is one HbA_{1c} test less than or equal to 7%. However, based on a recent study suggesting that a level of 7% may be too low for some individuals with diabetes and increased mortality rates (Action to Control Cardiovascular Risk in Diabetes Study Group, 2008), a more moderate level of 8% was chosen as a cutoff value. Good LDL-C control was defined as any test result less than 100 mg/dL during 2006. The 2 utilization measures included total inpatient discharges and discharges with a primary diagnosis of AMI (*ICD-9* code 410.xx) during 2006.

Statistical methods

All 7 dependent variables were analyzed as dichotomous measures: HgA_{1c} testing (1 or more tests vs no test), LDL-C testing (1 or more tests vs no test), lipid-lowering drug use (at least 1 prescription filled for statins, niacins, fibric acids, and/or resins vs no prescriptions filled), good HgA_{1c} control (at least 1 test result less than or equal to 8% vs no test result less than or equal to 8%), good LDL-C control (at least 1 test result less than 100 mg/dL vs no test result less than 100 mg/dL), inpatient utilization (at least 1 inpatient discharge vs no inpatient discharges), and AMI utilization (at least 1 inpatient discharge with a primary diagnosis of AMI vs no inpatient discharges with a primary diagnosis of AMI). The PAM was analyzed as a continuous variable scaled from 0 to 100. The covariate variables were coded as either categorical or binary. All analyses for this study were done using the SAS statistical software (SAS version 9.1 for Windows; SAS Institute Inc, Cary, North Carolina).

Univariate analyses were performed to obtain descriptive statistics of individual variables. Measures of association were tested using bivariate analyses. To test the association between the PAM scores and binary outcomes variables, binary logistic regression tests were performed. To test the association between the outcomes variables and covariates, chi-square estimates were gathered. For AMI discharges, where the numbers were small, the ANOVA method was used.

Finally, multivariate logistic regression analyses were conducted to assess the relationship between PAM scores and the process, outcomes, and utilization measures, adjusting for covariates shown to have a statistically significant relationship with the outcomes variables. Potential adjustor variables included age group, gender, race/ethnicity, educational level, number of insulin prescriptions, comorbidity, and regional location. Final predictor variables were included in the final model where the *P*-value was less than .10. For the final multivariate hypothesis testing, ordinal logistic regression techniques were performed. Nominal statistical significance was set at a *P* value of less than .05.

RESULTS

Sample characteristics

Descriptive statistics for both the analytic sample and nonrespondents, where available, can be found in Table 1. The average age for the analytic sample was 61.7 years. The sample was more likely to be male (58.6%) and well educated, with more than 60% having at least some college/technical training or better. The population was racially diverse. Less than half of the sample was white (47.3%), with African Americans, Asian Americans, nonwhite Hispanic Americans, and other or unknown races making up the remainder of the sample at 15.7%, 10.8%, 10.2%, and 16.0%, respectively. The mean PAM score for the population was 57.1. The lowest PAM score was 32.0, whereas the highest was 100. Most

Table 1. Demographic characteristics, respondents compared with nonrespondents

Sample characteristic	Analytic sample (*N* = 1180)	Nonrespondents (*N* = 844)	*P*
Mean age ± SD	61.7 ± 9.4	59.5 ± 10.1	<.0001
Male (%)	55.3	58.6	NS
Race/Ethnicity (%)		Unknown	
White	47.3		
African American	15.7		
Hispanic, nonwhite	10.2		
Asian American	10.8		
Other	16.0		
Educational attainment (%)		Unknown	
Less than high school	8.0		
High school graduate	19.3		
Some college/technical school	34.8		
College graduate or higher	26.0		
Unknown	11.9		
1+ Comorbidities (%) (no asthma)	39.7	35.2	.04
1+ Comorbidities (%)	41.6	36.8	.03
Coronary artery disease	26.9	23.2	.06
Asthma	2.0	2.0	NS
Depression	2.5	2.4	NS
Heart failure	21.7	18.3	.06
Insulin or oral hypoglycemics dispensings			.03
0	23.2	24.6	
1–5	29.8	34.7	
6–10	27.5	24.6	
10+	19.6	16.0	

Table 2. Predictor and response variables for respondents and nonrespondents

Sample characteristic	Analytic sample ($N = 1180$)	Nonrespondents ($N = 844$)	P
HgA_{1c} testing			
Mean number of tests ± SD	2.2 ± 1.5	2.1 ± 1.4	NS
Percentage at least 1 test during 2006	91.3	89.9	NS
LDL-c testing			
Mean number of tests ± SD	2.1 ± 1.6	2.0 ± 1.6	NS
Percentage at least 1 test during 2006	90.1	89.7	NS
Lipid-lowering drug use			
Percentage at least 1 Rx filled during 2006	80.2	75.4	<.01
HgA_{1c} control			
Mean result ± SD	7.3 ± 1.4	7.6 ± 1.7	<.0001
Percentage good control (≤8%)	70.6	63.9	<.01
LDL-c control			
Mean result ± SD	91.1 ± 29.6	94.4 ± 32.6	<.0001
Percentage good control (<100 mg/dL)	63.2	58.5	<.04
AMI-specific hospital discharges			
Percentage ≥1 discharges	1.4	1.5	NS
All-cause hospital discharges			
Percentage ≥1 discharges	21.4	17.6	<.04

respondents (44.4%) were in level 2, followed by 26.5% in level 3, 17.4% in level 4, and 11.5% in level 1.

Table 2 summarizes the individual predictor and response variables for respondents and nonrespondents. Members in the analytic sample and nonrespondents were as likely to have received HgA_{1c} and LDL-c testing (around 90%). Members in the analytic sample were more likely to have received prescriptions for lipid-lowering drugs and to have their HgA_{1c} and lipids in control. However, they were more likely to have had at least 1 inpatient discharge (21.4% versus 17.6%; $P < .04$).

Association of PAM with study outcome measures

In the bivariate analyses, significant associations were found between PAM score and HgA_{1c} testing, LDL-c testing, HgA_{1c} control, and all cause discharges, but not LDL-C control or AMI discharges. These positive relationships remained after controlling for significant covariates in the final multivariate model. Results are shown in Table 3.

DISCUSSION

The hypothesis for the study was that there would be a relationship between higher PAM scores and better rates for HbA_{1c} testing, LDL-c testing, lipid-lowering drug use, HbA_{1c} control, LDL-c control, AMI discharges, and all cause discharges. The results showed support for HbA_{1c} testing, LDL-c testing, HbA_{1c} control, and all cause discharges, but not for lipid-lowering drug use, LDL-c control, and AMI discharges. It is possible that no positive association was found for lipid-lowering drug use and LDL-c control because taking a drug to manage one's condition could take less effort and activation than other activities to manage one's condition. A lack of positive association between PAM scores and AMI discharges may have been due to the small numbers of AMI discharges in the study population.

Other studies have found that higher PAM scores are associated with better process, outcomes, and utilization measures (Hibbard et al., 2004; Mosen et al., 2007). Therefore, the construct of activation as measured in

Table 3. Logistic regression: Independent association of PAM with categorical outcome measures

Outcomes variable	Odds ratio (95% CI)	*P*
HgA_{1c} testing[a]	1.034 (1.009–1.060)	.008
LDL-c testing[b]	1.034 (1.010–1.058)	.005
Good A_{1c} control[c]	1.018 (1.004–1.033)	.01
Any inpatient discharge[d]	0.983 (0.967–0.998)	.03

[a]Model adjusted for age, comorbidity, diabetes-related prescription dispensings, and geographical location.
[b]Model adjusted for age, comorbidity, and diabetes-related prescription dispensings.
[c]Model adjusted for age, comorbidity, race/ethnicity, educational attainment, diabetes-related prescription dispensings, and geographical location.
[d]Model adjusted for age, gender, comorbidity, race/ethnicity, and diabetes-related prescription dispensings.

the PAM seems to have predictive power as well. Those who exhibit higher PAM scores are more likely to follow recommended testing procedures and medical advice and less likely to use healthcare services in the present as well as in the future.

This study was the first to find an independent association between patient activation and future health-related measures. Those with higher PAM scores were significantly more likely to experience better outcomes in the future. Those health systems and healthcare providers who choose to invest in supporting patient self-efficacy and activation for their patients with diabetes and then tailoring interventions based on score will likely be rewarded with better patient outcomes not just in the short term, as most previous research has suggested, but also at least 18 to 24 months in the future. Further research is necessary to determine how PAM scores can be increased and whether interventions and care plans based on PAM scores are more effective and less resource intensive than interventions and care plans that are not based on PAM scores (Hibbard et al., 2005). Further work is also needed to determine the usability of the PAM in a real-world, clinical care setting.

There were several limitations of the study. One such limitation was that all participants were in a fully integrated, staff-model HMO and may not be representative of the entire population of people with diabetes. The study population was better educated, had access to healthcare, and had higher incomes than the general population. Therefore, it is likely that this population was more activated than the general population if more educated, wealthier individuals tend to be more activated. While this may have limited the generalizability of the study results, the Kaiser Permanente population has been shown to be representative of the demographics within regions that it serves (Van Den Eeden et al., 2003), which may help minimize the generalizability problem. [AQ8]

Another limitation is the cross-sectional study design. Since we only know PAM scores for 1 point in time, it is impossible to ascertain causality. Do higher PAM scores cause better health outcomes or does success in engaging in better self-management increase PAM scores? Or, do people with better health have higher PAM scores? Similarly, we do not know how PAM scores varied between 2004 and 2006 and how any variation in scores may have affected the study outcomes.

There were some significant differences between respondents versus nonrespondents in this population. Respondents were older and more likely to have another chronic condition. However, these variables were included as covariates in the model, so any response bias is likely minimal. In addition, several of the predictor variables were significantly different between the 2 groups. These differences cannot be controlled for in the regression models, so it is unknown what the effect response bias may have had on the interpretation of the results.

The results of this study and associated limitations suggest areas of future research. Other populations should be studied to determine whether these study results can be replicated, including those without HMO coverage as well as individuals with other chronic conditions. In addition, more research is needed to examine how longitudinal differences in PAM scores affect outcomes and utilization metrics. Qualitative studies conducted to gain a better understanding of the individual's perspective of the concept of activation and how it relates to health outcomes would be an invaluable addition to the depth of knowledge on patient activation and health. Finally, a better understanding of how the effectiveness of interventions informed by PAM scores compares with those not informed by PAM scores is a crucial step in assessing PAM's utility in a real-world setting.

Clinicians do not always know which of their patients will comply with their recommendations and must assume that all patients need help and support in following their advice (Clark, 2003). However, the PAM could be used to identify patients who are likely to be less compliant and in need of more help to follow recommendations and self-care strategies. Tools that allow clinicians to target interventions can help save valuable time and resources for both the health system and the patient and can result in better health outcomes.

Beyond the importance of this work for the patient with diabetes and the healthcare system treating such patients, this study could prove to be a catalyst for changing the national health policy perspective to increase support for patient-centered care and patient activation. With current political discussions focused on healthcare coverage for the uninsured, it is critical to include patient-centered care and patient activation issues at the forefront of these discussions. Without their inclusion, we run the risk of continuing to have an omniscient healthcare system that views the patient as an illness first and person second.

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