

Health Affairs

At the Intersection of Health, Health Care and Policy

Cite this article as:

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Health Affairs, 35, no.3 (2016):489-494

doi: 10.1377/hlthaff.2015.1031

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DOI: 10.1377/hlthaff.2015.1031
HEALTH AFFAIRS 35,
NO. 3 (2016): 489–494
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ABSTRACT We explored whether supplementing a clinical risk score with a behavioral measure could improve targeting of the patients most in need of supports that reduce their risk of costly service utilization. Using data from a large health system that determines patient self-management capability using the Patient Activation Measure, we examined utilization of hospital and emergency department care by the 15 percent of patients with the highest clinical risk scores. After controlling for risk scores and placing patients within segments based on their level of activation in 2011, we found that the lower the activation level, the higher the utilization and cost of hospital services in each of the following three years. These findings demonstrate that adding a measure of patient self-management capability to a risk assessment can improve prediction of high care costs and inform actions to better meet patient needs.

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Under the Affordable Care Act, health care delivery systems are assuming more responsibility for health care costs and improved patient outcomes. A key challenge for these systems is improving their management of the financial risk of high-cost patients. Targeting high-risk patients for additional support is a mainstay of modern disease and case management and is widely used by delivery systems as they move toward payment models that involve shared financial risk. Targeting high-risk patients assumes that a small percentage of the population accounts for most of the health care costs and that closer management of those high-risk patients can reduce some of the costly utilization.

The dominant approach to identifying high-risk patients is typically based on an algorithm that relies on past claims data and clinical diagnostic codes. The method has limitations, as it relies primarily on past use to project future use.

Recently there has been recognition that other important factors could augment the predictive

value of clinical information. A recent review of risk models for thirty-day readmission found that including functional and social variables improved risk predictions.¹ The concept of “impactibility” developed by Geraint Lewis and colleagues² introduces the notion that risk-stratification approaches should not just identify people at high risk for a health event but should also identify people who are most likely to benefit from an intervention, or for whom there is a reasonable chance of reducing the risk.

The concept of impactibility, social and behavior factors, and factors that may be mutable in reducing risk could be very important predictors of risk and worthy of consideration in addition to the usual clinical factors. Current approaches fail to recognize that even though many high-risk patients have a heavy disease burden, they may also have well-developed self-management skills, while other high-risk patients may not. Patients with the same clinical risk level tend to be treated the same, regardless of their ability and willingness to manage their own conditions. Yet it is known that patient self-management

skills differ and that those differences are related to clinical outcomes, costs, and utilization.³

Considering patient activation (described below) along with traditionally determined clinical risk may provide a means of identifying not only groups of people who are at risk of particular health conditions, but also those who are most and least likely to act on symptoms, seek help, and manage their own health care needs. Furthermore, multiple studies show that well-designed interventions can increase patient activation, which makes it a high priority for inclusion in risk models that are designed to identify patients for whom there is a high probability of reducing risk.⁴⁻⁷

We explored whether knowing patients' activation level, or their likelihood of effective self-management, adds to the predictive value for patients already identified as at high risk. Specifically, would Patient Activation Measure levels (described in detail below) provide additional actionable information about which high-risk patients are most likely to have costly service utilization? We also examined the durability of activation level over time in predicting high-risk patients' service utilization and cost.

Patient activation refers to an individual's knowledge, skills, and confidence related to self-management. The construct is commonly measured using the Patient Activation Measure, which is a thirteen-item interval-level scale with strong psychometric properties that generates a score between 0 and 100.⁸ A Patient Activation Measure level may be assigned based on the score, from level 1 (least activated) to level 4 (most activated).

Studies show that Patient Activation Measure results are predictive of most health behaviors, clinical indicators, and hospital and emergency department (ED) use.^{3,9} Research also shows that less activated patients with chronic illness are more likely to experience care coordination problems, compared to more activated patients.¹⁰ Numerous studies also indicate that compared to more activated patients, less activated ones with chronic disease are less likely to effectively manage their conditions (for example, they are less likely to adhere to medication regimens), have healthy diets and get regular exercise, regularly monitor symptoms and clinical measurements, ask questions in the medical encounter, and report satisfactory care experiences.^{8,11-13} These findings suggest that less activated patients may benefit more from care coordination and care management services than patients who have equal disease burden but are more proactive about managing their health.

Study Data And Methods

This study was conducted in collaboration with Fairview Health Services, a Pioneer Accountable Care Organization (ACO) in Minnesota. Fairview has forty-four primary care clinics, fifty-five specialty clinics, and six hospitals and medical centers. Fairview began routinely collecting Patient Activation Measure results for its primary care patients in 2010.

The overall study population was made up of the 98,142 adult patients who completed the Patient Activation Measure in 2011; did not have an *International Classification of Diseases*, Ninth Revision (ICD-9), code for dementia; did not opt out of research; and continued to use Fairview's medical services through 2014. For most of our analyses, we focused on the 15 percent of patients ($n = 14,721$) with the highest risk for high health care costs, based upon Optum's retrospective risk score (hereafter, high-risk patients). This score is a commercially available risk measure that is based on demographic characteristics, episodes of care, diagnoses, and pharmacy use.¹⁴ The risk score and the underlying episode grouper are widely used by commercial payers.¹⁵

VARIABLES The independent variable in the analysis was degree of patient activation—that is, the extent to which the patient has the knowledge, skills, and confidence needed to manage his or her health and health care. Activation was measured using the Patient Activation Measure. In this study we used the four Patient Activation Measure levels. Level 1 indicates that a person does not yet understand the important role that patients play in determining their health, and level 4 indicates that a person is proactive about his or her health and engages in many positive health-related behaviors.

We used three dependent variables in the study. Two reflect costly service utilization: having had any ED visit and having had any hospitalization within the past year. Both of these variables include utilization only within Fairview hospitals. We adjusted for this limitation on the utilization data, and we describe the method we used for that adjustment below.

Our third dependent variable, cost of care, was the total annual medical charges from Fairview for ED visits and hospitalizations. Medical charges do not include the negotiated discounts that health insurance companies pay for medical services. However, they have the benefit of being consistent across insurance providers and are often used as a proxy for medical costs. In the analysis, we adjusted for utilization outside the Fairview system, which we did not capture in our cost measure.

ANALYTIC APPROACH We conducted descriptive analyses that compared the high-risk patients in

our sample (those at the top 15 percent of risk) to the lower-risk patients (those at the bottom 85 percent of risk) on measures of demographic characteristics (sex, age, and mean income of the patient's ZIP code of residence) and health (patient activation, risk score, chronic conditions, and costly utilization).

Then, focusing on the high-risk sample and using the patient's Patient Activation Measure level from 2011, we conducted analyses that examined the bivariate relationships between activation level and the two costly-utilization variables in each of the following three years: 2012, 2013, and 2014. We then developed multivariate logistic models that predicted having a costly-utilization visit in each year, controlling for demographic characteristics (age, sex, income tercile of the mean income of the patient's ZIP code) and 2011 prospective risk score.

To address the issue that hospital visits were only to Fairview hospitals, we used a clinic-level variable of the percentage of patient hospital costs from within Fairview. To do so, we used data from one insurer to compute the percentage of all hospital costs for patients from each primary care clinic that were from within Fairview as compared to the percentage for costs at clinics outside of Fairview. In addition to adjusting for outside utilization, the models also adjusted for the clustering of patients by primary care provider.

LIMITATIONS The study had several limitations. First, this research was conducted in a single delivery system in Minnesota, and only patients who had a Patient Activation Measure score in their electronic health record were included in the analysis. Only one measure of risk assessment was used: Although there are other measures of patient engagement, the study relied solely on the Patient Activation Measure.

Second, the dependent variables included only the utilization and cost within Fairview. While we controlled for use outside of the Fairview system, our measures were imperfect.

Finally, the study was observational. Thus, the study design did not allow us to determine whether or not risks would have been reduced more effectively by targeting patients differentially, based on both clinical risk and Patient Activation Measure scores.

Study Results

Compared with lower-risk patients, high-risk patients were twice as likely to be sixty years or older and were somewhat more likely to be lower income (Exhibit 1). High-risk patients were also almost twice as likely to be depressed and more than twice as likely to be at the lowest Patient

Activation Measure level. Furthermore, in 2011 high-risk patients were three times more likely to have had an ED visit and fourteen times more likely to have had a hospitalization.

We used the 2011 Patient Activation Measure level to predict utilization in each of the following three years. People at the lowest level were significantly more likely to have an ED visit and a hospitalization, compared to people at the highest level (Exhibit 2). The only exception was ED visits in 2013, where the relationship was in the same direction but not significant. Overall, the findings indicate that the Patient Activation Measure score predicted costly utilization three years later.

EXHIBIT 1

Sociodemographic and clinical characteristics of 98,142 adult patients of Fairview Health Services in 2011

Characteristic	High-risk patients (n = 14,721)	Other patients (n = 83,421)
Female	63.7%	57.6%****
Age (years)		
Less than 30	6.3%	14.1%****
30–44	15.4	28.0
45–59	27.0	32.6
60 or more	51.4	25.3
Income tercile		
Lowest	39.9%	33.5%****
Middle	31.2	33.6
Highest	29.0	32.9
2011 Optum retrospective risk score (mean)	5.0	1.2****
2011 PAM score (mean)	63.4	68.2****
2011 PAM level		
1 (lowest)	12.3%	5.6%****
2	15.6	11.7
3	43.0	44.8
4 (highest)	29.2	38.0
Any emergency department visit		
2011	33.8%	11.1%****
2012	25.2	10.1****
2013	22.1	9.7****
2014	21.4	9.3****
Any hospitalization		
2011	31.3%	2.0%****
2012	15.0	3.7****
2013	13.5	3.4****
2014	12.3	3.2****
Had in 2011:		
Diabetes	27.3%	9.0%****
Hyperlipidemia	36.9	28.9****
Hypertension	63.0	32.5****
Chronic obstructive pulmonary disease	12.1	2.3****
Coronary artery disease	22.2	4.0****
Congestive heart failure	15.8	1.1****
Depression	40.8	21.4****

SOURCE Authors' analysis of electronic health record data for 2011–14 from Fairview Health Services. **NOTES** High-risk patients are those in the top 15 percent of clinical risk. Risk score groupings are based on Optum's retrospective risk score. Percentages may not sum to 100 because of rounding. PAM is Patient Activation Measure. ****p < 0.001

EXHIBIT 2

Percentages of high-risk patients who had an emergency department visit or hospitalization in 2012–14, by 2011 Patient Activation Measure (PAM) level

	PAM level in 2011			
	1 (lowest) (n = 1,806)	2 (n = 2,301)	3 (n = 6,322)	4 (highest) (n = 4,292)
ANY EMERGENCY DEPARTMENT VISIT				
2012	30.3%	25.4%	24.3%	24.0%****
2013	24.5	22.3	21.8	21.6
2014	24.8	20.9	20.5	21.6***
ANY HOSPITALIZATION				
2012	20.8	16.9	14.3	12.5****
2013	16.2	14.5	13.2	12.3****
2014	16.8	12.8	11.9	10.6****

SOURCE Authors' analysis of data for 2012–14 from the high-risk patient panel data shown in Exhibit 1. **NOTES** High-risk patients are those in the top 15 percent of clinical risk. Risk score groupings are based on Optum's retrospective risk score. *** $p < 0.01$ **** $p < 0.001$

Compared to people at Patient Activation Measure level 1, those at level 3 or 4 were significantly less likely to have had an ED visit in 2011 (odds ratios: 0.85 and 0.82, respectively; data not shown). This was also true for 2012 (Exhibit 3). In addition, people at level 2 were significantly less likely to have an ED visit in 2012 and in 2014, compared to those at level 1 (this relationship was not significant in 2013).

There were also significant relationships between the activation levels and having any ED visits in 2013 and 2014. Furthermore, the relationships between having had any hospitalizations and Patient Activation Measure levels were similar in 2012 and 2014. Thus, even after demographic characteristics and patients' clinical risk

scores were controlled for, Patient Activation Measure level was still a predictor of hospital and ED use for up to three years after patient activation was measured.

Exhibit 4 shows the relationship between Patient Activation Measure level and the costs of hospital and ED care first with ordinary least squares regression coefficients (using a log transformation of the dependent cost-of-care variables), and then the coefficients were translated into predicted costs using the Duan smear adjustment. In 2012 hospitalization costs were 38 percent lower for people at Patient Activation Measure level 4, compared to those at level 1 (\$12,467 versus \$7,714). In 2014 the difference between the two groups was still 29 percent. In 2012 ED costs were 37 percent lower for patients at level 4, compared to those at level 1. In 2014 the differential for ED costs was 28 percent. The regression coefficients for patient activation in 2013 were in the expected direction but were not statistically significant. In 2012 and 2014 all of the regression coefficients for Patient Activation Measure levels 2, 3, and 4 were significantly higher than for level 1.

Discussion

As ACOs assume greater accountability for health outcomes and increased financial responsibility for their enrolled populations, they are looking for effective strategies to reduce financial risk. Our findings show that among high-risk patients, Patient Activation Measure level is associated with costly utilization and adds specific and actionable information to the information provided by the risk score: The level is predictive of ED visits and hospitalizations three years after it was measured. Combining the costs associated with hospitalizations and ED visits, the differential between the patients at the lowest level of activation and the highest level was \$5,168 in 2012 and \$3,129 in 2014.

For high-risk patients with multiple chronic illnesses, their ability to monitor conditions, follow treatment regimens, and manage their own symptoms is likely to determine whether they will need costly care. To improve the ability to modify risk, future models will need to be increasingly nuanced and to take into consideration patients' behavioral tendencies as well as their social and clinical profiles. With better segmentation models, health care delivery systems—particularly ACOs—can become more efficient in their use of resources in managing high-risk patients, by concentrating their efforts on patients whose future risk is modifiable. That is, instead of focusing on providing additional support to all high-risk patients, the systems will

EXHIBIT 3

Relationship between 2011 Patient Activation Measure (PAM) level and emergency department visits and hospitalizations among high-risk patients, 2012–14

	PAM level in 2011			
	1 (lowest)	2	3	4 (highest)
ANY EMERGENCY DEPARTMENT VISIT				
2012	Ref	0.81***	0.77****	0.72****
2013	Ref	0.91	0.88**	0.83**
2014	Ref	0.81***	0.78****	0.79***
ANY HOSPITALIZATION				
2012	Ref	0.84**	0.76****	0.71****
2013	Ref	0.94	0.91	0.91
2014	Ref	0.77***	0.77***	0.74****

SOURCE Authors' analysis of data for 2012–14 from the high-risk patient panel data shown in Exhibit 1. **NOTES** The exhibit shows odds ratios from logistic regression models. High-risk patients are those in the top 15 percent of clinical risk. Risk score groupings are based on Optum's retrospective risk score. All models controlled for patient age, sex, income tercile, baseline risk score, and clustering by primary care provider. Models were adjusted to account for utilization outside of the Fairview Health Services network. ** $p < 0.05$ *** $p < 0.01$ **** $p < 0.001$

EXHIBIT 4

Relationship between 2011 Patient Activation Measure (PAM) level and predicted costs for emergency department visits and hospitalizations among high-risk patients, 2012–14

PAM level in 2011	Linear regression coefficient			Translation of regression coefficients into predicted average cost per patient (\$)		
	2012	2013	2014	2012	2013	2014
EMERGENCY DEPARTMENT VISIT						
1 (lowest)	Ref	Ref	Ref	1,125.7	862.3	959.2
2	−0.33***	−0.12	−0.27***	809.3	764.8	739.6
3	−0.41***	−0.17**	−0.33***	747.1	727.5	689.6
4 (highest)	−0.46***	−0.24**	−0.32***	710.6	685.1	696.5
HOSPITALIZATION						
1 (lowest)	Ref	Ref	Ref	12,467.1	9,386.3	9,706.7
2	−0.31**	−0.11	−0.31**	9,144.0	8,408.6	7,119.4
3	−0.42***	−0.13	−0.30***	8,191.5	8,242.1	7,190.9
4 (highest)	−0.48***	−0.13	−0.34***	7,714.4	8,242.1	6,840.2

SOURCE Authors' analysis of data for 2012–14 from the high-risk patient panel data as shown in Exhibit 1. **NOTES** The models were one-part ordinary least squares regression models with log transformation of the dependent cost-of-care variables. All models controlled for patient age, sex, income tercile, baseline risk score, and clustering by primary care provider. Models were adjusted to account for utilization outside of the Fairview Health Services network. Predicted costs were computed using the regression coefficient and the Duan smear adjustment. ** $p < 0.05$ *** $p < 0.01$ **** $p < 0.001$

be able to focus their efforts on those patients who are likely to respond to them.

Fairview Health Services, a Pioneer ACO, uses the Patient Activation Measure to allocate its resources more efficiently to support patients. For example, Fairview's care coordinators and health coaches, who manage high-risk patients, use the Patient Activation Measure level to decide how intensely to follow and manage specific patients. Nurses supporting patients during care transitions use a similar approach, in which the Patient Activation Measure score determines the frequency and focus of their posthospital support efforts.

Peace Health—a not-for-profit health system serving Oregon, Washington, and Alaska—is another example of a system that has adopted this type of segmentation model, one that includes both a behavioral assessment (such as the Patient Activation Measure) and clinical assessments.¹⁶ Peace Health uses more active outreach and more supports to manage patients with low Patient Activation Measure scores and high disease burden, compared to its management of patients who have the same disease burden but are more activated. Peace Health reasons that more activated patients are more proactive about managing their health and can be supported with web-based and community-based resources, while less activated patients are more passive about their health and may require more support

from health professionals.

In this study we supplemented a commercial risk assessment product (Optum's retrospective risk score) with a measure of patient activation, and we found robust relationships between activation level and costly utilization over time among a high-risk patient population. Although we believe that the findings are likely universal, other settings that use other measures of engagement and other risk assessments may have different results.

Moreover, merely identifying and segmenting the highest-risk patients to target patient-level interventions may not improve outcomes unless those interventions are effective. Controlled trials will be needed to determine the actual impact and cost-effectiveness of the behaviorally informed patient segmentation approach we have presented here.

Conclusion

The findings from this study suggest that adding a behavioral assessment to current risk models may improve the ability to target people most in need of additional support. Delivery systems will need to continue to develop their capability to manage risk. The findings reported here provide insights into possible future directions for improving segmentation approaches. ■

The authors gratefully acknowledge funding for this study from the

Commonwealth Fund (Grant No. 20140714). Judith Hibbard is a

consultant to and an equity stakeholder in Insignia Health.

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