

Medical Home Features of VHA Primary Care Clinics and Avoidable Hospitalizations

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BACKGROUND: As the Veterans Health Administration (VHA) reorganizes providers into the patient-centered medical home, questions remain whether this model of care can demonstrate improved patient outcomes and cost savings.

OBJECTIVE: We measured adoption of medical home features by VHA primary care clinics prior to widespread implementation of the patient-centered medical home and examined if they were associated with lower risk and costs of potentially avoidable hospitalizations.

DESIGN: Secondary patient data was linked to clinic administrative and survey data. Patient and clinic factors in the baseline year (FY2009) were used to predict patient outcomes in the follow-up year.

PARTICIPANTS: 2,853,030 patients from 814 VHA primary care clinics

MAIN MEASURES: Patient outcomes were measured by hospitalizations for an ambulatory care sensitive condition (ACSC) and their costs and identified through diagnosis and procedure codes from inpatient records. Clinic adoption of medical home features was obtained from the American College of Physicians Medical Home Builder®.

KEY RESULTS: The overall mean home builder score in the study clinics was 88 (SD=13) or 69 %. In adjusted analyses an increase of 10 points in the medical home adoption score in a clinic decreased the odds of an ACSC hospitalization for patients by 3 % ($P=0.032$). By component, higher access and scheduling ($P=0.004$) and care coordination and transitions ($P=0.020$) component scores were related to lower risk of an ACSC hospitalization, and higher population management was related to higher risk ($P=0.023$). Total medical home features was not related to ACSC hospitalization costs among patients with at least one ($P=0.074$).

CONCLUSION: Greater adoption of medical home features by VHA primary care clinics was found to be significantly associated with lower risk of avoidable hospitalizations with access and scheduling and care coordination/transitions in care as key factors.

KEY WORDS: medical home; avoidable hospitalizations; access; care coordination.

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INTRODUCTION

In recent years, there has been renewed focus on integrated health care models such as the patient-centered medical home and accountable care organizations to improve care and lower health care costs. In 2010 the Veterans Health Administration (VHA) began implementation of the patient-centered medical home, called Patient Aligned Care Team (PACT), in its primary care clinics. Under PACT, clinics are expected to assign patients to a dedicated primary care team, increase access, improve care coordination, provide more non-face-to-face care, and implement other measures to improve access and quality.

The emphasis on improving ambulatory care in PACT suggests the benefits will be realized by reducing unnecessary and expensive acute care. In early adopters of the medical home, there is evidence of reduced utilization of acute care. Medicare Advantage enrollees in medical homes for high-risk patients had 18 % lower hospitalizations and 36 % lower rehospitalizations.¹ Group Health Cooperative's medical home pilot found 29 % fewer emergency department visits and 6 % fewer hospitalizations among enrollees.²

Hospitalizations for an ambulatory care sensitive condition (ACSC) are believed to be preventable through high-quality ambulatory care.³ ACSC rates have been found strongly correlated with insurance status,⁴ self-rated access to care,⁵ and enrollment in HMOs compared to fee-for-service plans.^{6,7} Consequently, moving patients into medical homes is thought to decrease avoidable hospitalizations.

As VHA and other health care systems reorganize care through the medical home, evidence documenting significant impacts on outcomes is critical to its ongoing

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implementation. Baseline adoption of medical home features was assessed within all VHA primary care clinics to track progress of implementing PACT. In a national, cross-sectional study, we looked at whether patients in primary care clinics with more features of the medical home overall and its components had lower risk and costs of potentially avoidable hospitalizations. We also estimated the potential costs of averted hospitalizations for clinics associated with greater medical home adoption.

METHODS

Data Sources

We obtained patient-level data from 814 primary care clinics from VHA utilization and cost records in fiscal years (FY) 2009–2010. VHA FYs begin the October 1 prior and end September 30 of the indicated year. These data included patient characteristics, date of death, inpatient utilization, and costs of care. We linked patient data to clinic-level data from survey data and VHA administrative records. The study cohort was limited to patients who had at least two primary care visits in the baseline year (FY09), did not die during the study period, and had complete demographic information. There were a total of 2,853,030 patients in the study cohort. Our cohort of patients was older, more male, more likely to have service-connected disabilities or be below the means test, and sicker based on risk scores and chronic conditions compared with excluded patients. This study received approval from the Stanford University IRB (protocol #20124).

Measures

Our outcome measure, potentially avoidable hospitalizations for an ambulatory care sensitive condition (ACSC), was measured in the follow-up year, FY10. ACSC diagnoses were based on AHRQ's Prevention Quality Indicators and included the following diagnoses: asthma, angina without procedure, bacterial pneumonia, chronic obstructive pulmonary disorder, congestive heart failure, dehydration, diabetes short and long-term complications, uncontrolled diabetes, lower-extremity amputation for diabetes, hypertension, perforated appendix, and urinary tract infection.³ ACSC hospitalizations were identified through ICD-9 diagnosis and CPT procedure codes from inpatient records. Hospitalization costs were obtained from cost data that reported the total costs of each admission. The total number and costs of ACSC hospitalizations were measured for each patient during the 12-month follow-up period.

Our main independent variable, adoption of medical home features, came from a survey of all VHA primary care clinics fielded in November 2009 using the American

College of Physicians Medical Home Builder® (MHB), a self-administered, practice biopsy used to support practices towards recognition of NCQA 2008 PCMH standards. The MHB covers seven medical home components: 1) access and scheduling, 2) care coordination and transitions in care, 3) organization of practice, 4) patient-centered care and communication, 5) population management, 6) quality improvement and performance improvement, and 7) use of technology. A description of these components is in the [Appendix](#). The survey was self-administered by clinic director or other clinic leader, and responses were coded "yes" equal to 1 and "no" equal to 0 and summed by component and overall. The total score of medical home features could range from 0 to 127. The survey response rate was 100 %.

Other clinic data included clinic case-mix as measured by proportion of patients who had diagnostic cost group (DCG) scores above the mean (0.8). Clinic rurality was assessed by metropolitan/non-metropolitan codes from the Area Resource File (ARF).⁸ Clinic type was categorized as VA medical center (VAMC) based, leased community-based outpatient clinic (CBOC) (staffed by VHA providers with VHA governance), or contracted CBOC (staffed by contract providers without VHA governance).⁹

Patient-level measures included age, sex, race/ethnicity, marital status, service connection, means test, insurance, DCG risk score, ACS condition indicators, area income, area education, and distance to home clinic. We categorized patients with service-connected disabilities or those recently discharged as service-connected. Those with low incomes according to the VHA eligibility means test were labeled as means test eligible, and those with incomes above that level were labeled as above the means test. Patients were also categorized by service-connected percent into three groups. We categorized insurance status as no insurance, private insurance (major medical or private insurance), or Medicare and/or Medicaid coverage.

We obtained the diagnostic cost group (DCG) risk score for all patients from administrative records. Several indicators for ACS conditions (asthma, angina, chronic heart failure, bacterial pneumonia, chronic obstructive pulmonary disease, diabetes, hypertension, perforated appendix, urinary infection, lower extremity amputation) were also included.

U.S. Census data on area income and maximum years of educational attainment was linked to each patient's zip code. We also estimated patients' distance to their primary care clinic to account for propensity to use VHA care.

Statistical Analysis

In bivariate analyses we compared the rate of ACSC hospitalizations per 1,000 patients by clinic factors using one-way ANOVA and grouping clinics into low (< 81), medium (81–90), and high (> 90) medical home adoption based on the distribution of scores.

In multivariate analyses, we estimated the association of adoption of medical home features with risk for ACSC hospitalizations using a multi-level, random effects logistic model¹⁰ adjusting for baseline patient factors (age, race/ethnicity, VHA eligibility, insurance, distance to clinic, area income, area education, chronic condition diagnoses, and DCG risk score) and clinic factors (rurality, clinic type, and case mix) and random effects for the primary care clinic. Medical home features was included as a continuous measure of the total home builder score divided by 10. We also examined the home builder component scores as predictor variables in a separate regression. Because several component scores were correlated with each other, the component scores were grouped into low, medium, and high categories and associated dummy groups in a regression model that included all component measures to avoid multicollinearity.

We conducted multivariate analysis of the costs of ACSC hospitalizations among the subset of patients who had at least one admission ($N=49,203$) since few patients had any hospitalizations. The costs of ACSC hospitalizations was regressed on the total medical home measure adjusting for patient and clinic factors using generalized linear mixed models with a gamma log-link function¹¹ and random effects for the primary care clinic.

Role of the Funding Source

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RESULTS

Most of the primary care patients (90 %) in the cohort were 45 years and older (Table 1). The cohort was predominantly male (95 %), and a majority were white (67 %) and married (57 %). Many of the patients were eligible for VHA care because they had a service-connected disability (41 %) or were below the means test (31 %), and few received private health insurance. Patients traveled a mean distance of 18 miles to their home clinic. The mean area-level income of patients was \$40,592, and a majority of their area-level population had a high school degree or less as their highest degree. The most prevalent conditions were hypertension (66 %) and diabetes (31 %), and the mean DCG risk score was 0.8 (SD=0.7).

Among the 814 primary care clinics in our study, the overall mean home builder score was 88 (SD=13) or 69 %. By component, the mean scores were 58 % for patient-centered care and communication, 67 % for access and scheduling, 75 % for organization of practice, 67 % for care coordination

Table 1. Characteristics of VHA Primary Care Patients in the Baseline Year (FY2009)

Baseline patient characteristics	Percent of patients/mean(SD) <i>N</i> =2,853,030
Age group (in years)	
< 45	10 %
45–64	45 %
65+	45 %
Gender	
Male	95 %
Female	5 %
Race/ethnicity	
White	67 %
Black	15 %
Hispanic	5 %
Other	13 %
Marital status	
Married	57 %
Separated/divorced/widowed	29 %
Single	13 %
Eligibility category	
Service connected	41 %
Below means test	31 %
Above means test	26 %
Other	2 %
Service connectedness (in percent)	
0	60 %
1–50	22 %
51–100	18 %
Insurance type	
Not insured	41 %
Medicare/Medicaid	41 %
Private/Champus	17 %
Other	1 %
Distance to home clinic (in miles)	18.1 (18.9)
Mean area-level income	\$40,592 (\$14,235)
Mean percent of area population by educational attainment	
No high school diploma	21 % (11 %)
High school diploma	31 % (8 %)
Some college, but no degree	21 % (5 %)
College degree or higher	27 % (13 %)
Mean DCG risk score	0.8 (0.7)
Diagnosed chronic conditions	
Angina	3 %
Asthma	3 %
Bacterial pneumonia	< 1 %
Chronic heart failure	6 %
Chronic obstructive pulmonary disease	12 %
Diabetes-related	31 %
Hypertension	66 %
Lower extremity amputation	1 %
Perforated appendix	< 1 %
Urinary tract infection	3 %
Baseline clinic characteristics	Percent of clinics/mean (SD) <i>N</i> =814
Medical home adoption score	
Overall (0–127)	88 (13)
Access & scheduling (0–9)	6 (1)
Care coordination & transitions in care (0–18)	12 (4)
Organization of practice (0–16)	12 (2)
Patient-centered care & communication (0–19)	11 (4)
Population management (0–13)	10 (3)
Quality improvement & performance improvement (0–15)	13 (3)
Use of technology (0–37)	25 (3)
Facility type	
VAMC clinic	25 %
Leased community-based outpatient clinic	59 %
Contracted community-based outpatient clinic	15 %
Population case mix	
≤ 40 % high-risk patients	85 %
> 40 % high-risk patients	15 %
Rurality	
Metropolitan	69 %
Nonmetropolitan	31 %

and transitions in care, 68 % for use of technology, 77 % for population management, and 87 % for quality/performance improvement. Most of the study clinics (69 %) were located in metropolitan areas. While 25 % of clinics were medical center-based, 59 % were leased, and 15 % were contracted community-based outpatient clinics. Few clinics (15 %) had more than 40 % high-risk patients.

In unadjusted analyses total medical home features of clinics was associated with lower ACSC admission rates (Table 2). Patients in clinics with the highest medical home adoption had significantly lower ACSC rates (20 per 1,000) compared to patients in clinics with the lowest (25 per 1,000) ($P < 0.0001$) and medium adoption (26 per 1,000) ($P < 0.0001$) of medical home features. All of the separate medical home components were significantly associated with lower ACSC rates (all $P < 0.0001$). Patients visiting medical-center based, higher case-mix, and metropolitan clinics also had higher ACSC hospitalization rates (all $P < 0.0001$).

In adjusted analyses, total medical home features was significantly related to risk for ACSC admission after adjusting for patient demographic and health status characteristics and clinic factors (Table 3). Medical home features had an odds ratio of 0.97 ($P = 0.032$), so a ten-point increase in the home builder score reduced the odds of avoidable hospitalizations by 3 %. Patients in clinics that had sicker patients or were medical center-based also had higher risk of an ACSC. Several demographic characteristics also predicted higher odds of ACSC hospitalization: older age, male gender, being service connected or below the means test, having no insurance or Medicare/Medicaid, not being currently married, shorter distance to clinic, lower area income, and lower area education. Other patient-level factors that increased the risk of hospitalization included higher DCG risk score, and previous diagnosis of angina, asthma, chronic heart failure, pneumonia, COPD, diabetes, hypertension, urinary infection, and lower extremity amputation.

In adjusted analyses examining the separate component measures of medical homes, patients in clinics with the highest access and scheduling scores had a 17 % lower odds of having an ACSC admission ($P = 0.004$) compared to patients in the lowest group (Table 4). Patients in clinics with medium care coordination/transitions scores had lower risk of hospitalizations ($OR = 0.89$, $P = 0.020$) while patients in clinics with the highest population management scores actually had a 15 % higher odds of an ACSC hospitalization compared to those in clinics with the lowest scores ($OR = 1.15$; $P = 0.023$). The other components were not significantly associated with risk for ACSC admissions.

Among patients with at least one admission, there was no significant relationship between total medical home features and costs of ACSC hospitalizations ($P = 0.074$). While the adjusted mean cost of a hospitalization did not vary with total medical home features, we estimated the potential cost savings from reduced admissions under higher adoption. If

Table 2. Unadjusted Rates of ACSC Admissions among VHA Primary Care Patients in the Follow-up Year (FY2010) by Clinic Characteristics

Clinic characteristics	Number of ACSC admissions per 1,000 patients N=2,853,030	F-statistic from one-way ANOVA	P-value
Medical home adoption score			
Overall		290	< 0.0001
Low (< 81)	25.2		
Medium (81–90)	25.9		
High (91–127)	19.8		
Access & scheduling		136	< 0.0001
Low (<5)	26.4		
Medium (5–6)	23.9		
High (7–9)	20.6		
Care coordination & transitions in care		149	< 0.0001
Low (< 12)	26.4		
Medium (12–14)	20.5		
High (15–18)	20.1		
Organization of practice		313	< 0.0001
Low (< 10)	26.4		
Medium (10–13)	22.5		
High (14–16)	20.2		
Patient-centered care & communication		109	< 0.0001
Low (< 11)	24.3		
Medium (11–13)	22.5		
High (14–19)	19.9		
Population management		17	< 0.0001
Low (< 8)	24.0		
Medium (8–10)	22.9		
High (11–13)	22.2		
Quality improvement & performance improvement		44	< 0.0001
Low (< 12)	25.3		
Medium (12–13)	22.3		
High (14–15)	22.3		
Use of technology		28	< 0.0001
Low (< 25)	23.7		
Medium (25–29)	22.1		
High (30–37)	21.1		
Facility type		7,354	< 0.0001
VAMC clinic	30.4	2,930	< 0.0001
Leased community-based outpatient clinic	12.0		
Contracted community-based outpatient clinic	10.8		
Population case mix		2,853	< 0.0001
≤ 40 % high-risk patients	19.6		
> 40 % high-risk patients	35.3		
Rurality		68	< 0.0001
Metropolitan	23.2		
Nonmetropolitan	20.4		

clinics currently at the mean level of medical-home adoption were transformed into the maximum level of adoption, the probability of an ACSC admission could potentially be reduced from 1.51 % to 1.36 %. The predicted mean cost of an ACSC admission was \$15,820, so the reduction in costs in an average-sized clinic with 3,500 patients could be as large as \$83,000 annually.

DISCUSSION

As VHA primary care clinics are reorganized to improve the process and outcomes of care through the PACT program, the evidence for transforming care into medical

Table 3. Adjusted Odds Ratios of ACSC Admission in Follow-Up Year among VHA Primary Care Patients

Primary care clinic characteristics	OR* for any ACSC admission, N=2,853,030
Medical home adoption score	
Overall score/10	0.97†
Clinic type	
VAMC clinic	1.00
VHA-leased community-based outpatient clinic	0.51††
VHA-contracted community-based outpatient clinic	0.51††
Population case mix	
≤ 40 % high-risk patients	1.00
> 40 % high-risk patients	2.09††
Rurality	
Metropolitan area	1.00
Nonmetropolitan area	0.93

*OR from multilevel logistic regression with random effects for the primary care clinic. Patient-level factors in the model included age, race/ethnicity, VHA eligibility, insurance, distance to clinic, area income, area education, chronic condition diagnoses, and DCG risk score
†Significant at 5 %; ††Significant at 1 %

homes is essential to supporting its ongoing implementation and development. Overall, greater medical home features of VHA primary care clinics was found to be significantly associated with lower risk of avoidable hospitalizations after adjusting for patient and other clinic factors. Two components of medical homes appeared to be important elements: access and scheduling and care coordination/transitions in care were independently related to lower ACSC risk. Total medical home features was not related to costs of ACSC hospitalizations among those who had any hospitalizations suggesting that intensity of the hospitalization and rehospitalizations were not affected by total medical home features, but the potential for lower costs due to averted hospitalizations from greater medical home implementation may provide cost savings for clinics after accounting for the upfront investment in establishing medical homes.

Avoidable hospitalizations may be particularly sensitive to measures of access to ambulatory care.^{12,13} Another study of VHA primary care clinics found that elderly adults with diabetes experienced a 3 % higher odds of an ACSC hospitalization with a 10-day increase in appointment wait time.¹⁴ This suggests that same day appointments, extended hours, and other access and scheduling components play a key role in improving acute, preventable outcomes.

While we found that care coordination/transitions in care was significantly related to avoidable hospitalizations, prior research on care coordination programs has had mixed results. A study of care coordination programs in Medicare found that only one of fifteen programs experienced lower hospitalizations after the program although there were modest improvements in quality.¹⁵

A review of studies found that population management had a positive impact on care processes and outcomes,¹⁶ so reasons for the significant association of higher population

Table 4. Adjusted Odds Ratios of ACSC Admission by Medical Home Component in Follow-Up Year among VHA Primary Care Patients

Medical home component	OR* for any ACSC admission N=2,853,030
Access & scheduling	
Low (< 5)	1.00
Medium (5–6)	0.94
High (7–9)	0.83††
Care coordination & transitions in care	
Low (< 12)	1.00
Medium (12–14)	0.89†
High (15–18)	0.93
Organization of practice	
Low (< 10)	1.00
Medium (10–13)	1.01
High (14–16)	0.96
Patient-centered care & communication	
Low (< 11)	1.00
Medium (11–13)	0.94
High (14–19)	1.01
Population management	
Low (< 8)	1.00
Medium (8–10)	1.07
High (11–13)	1.15†
Quality improvement & performance improvement	
Low (< 12)	1.00
Medium (12–13)	1.01
High (14–15)	0.97
Use of technology	
Low (< 25)	1.00
Medium (25–29)	0.99
High (30–37)	0.93

*OR from multilevel logistic regression with random effects for the primary care clinic. Other clinic factors in the model included rurality, clinic type, and case mix, and patient level factors included age, race/ethnicity, VHA eligibility, insurance, distance to clinic, area income, area education, chronic condition diagnoses, and DCG risk score
†Significant at 5 %; ††Significant at 1 %

management score and risk for avoidable hospitalizations in our population is unclear. It may be that a greater degree of population management enabled higher-risk individuals to be identified and hospitalized. It is also possible that unmeasured disease severity of patients could be associated with clinics more likely to adopt population management features and their patients having more hospital stays.

While we did not find significant associations between potentially avoidable hospitalizations and patient-centered care, quality improvement, organization of practice, and use of technology components of the medical home, there may be other outcome and process measures that are impacted by these components, or it may be necessary to identify individual activities within the components that are significant. For example, studies on patient-centered care and acute care outcomes have had mixed results,^{17,18} so certain patient-centered care activities may have more impact than others.

The instrument used in this study, the ACP MHB, was able to capture clinic differences in structure and processes of primary care that predicted patient outcomes. As PACT becomes fully implemented, these results suggest the MHB may be a valid tool to recognize organizations' progress towards medical home adoption.

Limitations

The MHB was a self-reported instrument designed by ACP for organizations to assess progress towards building a medical home model. Responses to the survey were not formally validated. However, other analysis found that the MHB scores were strongly correlated with other measures of quality improvement orientation in VHA clinics.¹⁹

The study cohort only included patients who had at least two primary care visits in the past year, so our results may not be generalizable to less frequent users of primary care. Less frequent users of VHA primary care represent about 30 % of patients²⁰ and tend to be younger, healthier, and prefer non-VHA care.²¹ Our findings may not be generalizable outside of VHA system since the VHA is a highly integrated system with a national electronic medical records system, so medical home feature scores are likely higher and may have less variation between clinics than private systems.

Our findings were based on clinics' self assessment of medical home features just prior to the nationwide rollout of PACT implementation across all VHA clinics. Because of the cross-sectional design of this study, we were not able to determine a causal relationship between clinic medical home components and patients' risk for avoidable hospitalizations. It is possible that unmeasured clinic factors such as academic affiliation and primary care orientation may be related to both medical home features and sicker populations so that association of medical home adoption with reduced avoidable admissions is overstated.

CONCLUSION

As providers and payers continue to search for medical home models that prove the most beneficial to patients and health care organizations, several clinic factors may be critical to improving outcomes and reducing unnecessary care. Access and scheduling and care coordination/transitions in care had a significant relationship with avoidable hospitalizations, so emphasis on these areas may have the greatest impact on improving acute outcomes when designing and implementing medical home models. While these results suggest promising results for medical home implementation in the VHA and other settings, it is not clear what resources are needed to transform clinics from low levels of medical home adoption to greater adoption and whether these resources involve financial, technological, management, or other structural support that may be difficult for clinics to obtain. While some primary care clinics may not reach full medical home adoption and certification, it may be sufficient to implement key medical home components to impact certain patient outcomes. Further understanding of the specific aspects of these components that are most effective and cost effective is needed to make the medical home successful and sustainable.

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APPENDIX

Description of Medical Home Builder Components

- 1) Access and scheduling: Provides scheduling flexibility such as same day appointments and open access scheduling and non face-to-face services.
- 2) Care coordination and transitions in care: Offers individualized treatment plans, assessment of treatment and self-management goals, and has procedures for communication and coordination with other providers and facilities.
- 3) Organization of practice: Tracks procedures, test results, medications, and practices as a team.
- 4) Patient-centered care and communication: Provides support for patients' self-management and decision-making and staff training in communication.
- 5) Population management: Uses patient registries and clinical guidelines and identifies frequent diagnoses and unmet needs in patients.
- 6) Quality improvement and performance improvement: Uses performance measures, satisfaction surveys, and other measures of quality.
- 7) Use of technology: Uses practice management systems, electronic health records, and decision support systems.