Improving Population Care with an Integrated Electronic Panel Support Tool

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Abstract

This study measured the impact of an electronic Panel Support Tool (PST) on primary care teams' performance on preventive, monitoring, and therapeutic evidence-based recommendations. The PST, tightly integrated with a comprehensive electronic health record, is a dynamic report that identifies gaps in 32 evidence-based care recommendations for individual patients, groups of patients selected by a provider, or all patients on a primary care provider's panel. It combines point-of-care recommendations, disease registry capabilities, and continuous performance feedback for providers.

A serial cross-sectional study of the PST's impact on care performance was conducted, retrospectively using monthly summary data for 207 teams caring for 263,509 adult members in Kaiser Permanente's Northwest region. Baseline care performance was assessed 3 months before first PST use and at 4-month intervals over 20 months of follow-up. The main outcome measure was a monthly care performance percentage for each provider, calculated as the number of selected care recommendations that were completed for all patients divided by the number of clinical indications for care recommendations among them. Statistical analysis was performed using the *t* test and multiple regression. Average baseline care performance on the 13 measures was 72.9% (95% confidence interval [CI], 71.8%–74.0%). During the first 12 months of tool use, performance improved to a statistically significant degree every 4 months. After 20 months of follow-up, it increased to an average of 80.0% (95% CI, 79.3%–80.7%). (*Population Health Management* 2011;14:3–9)

Introduction

GAPS BETWEEN EVIDENCE-BASED RECOMMENDATIONS and health care are well documented. In the United States, patients receive roughly half of recommended preventive, acute, and chronic illness care.^{1–4} Information technology has the potential to substantially improve health care.⁵ To do so, it must: (1) help primary care providers follow practice guidelines, (2) provide disease registries for individual care planning and population care management, and (3) provide feedback to physicians and other health care professionals about performance.⁶

Clinical decision support systems can help health care providers follow practice guidelines by automatically comparing patient information against evidence-based recommendations. Approximately 90% of systems provide point-of-care reminders or alerts, which are variably effective at improving provider performance.^{7–9} Challenges to creating and maintaining effective clinical decision support systems include continually updating evidence-based recommendations and providing highly relevant content.^{10,11}

Disease registries track lists of patients with 1 or more shared diagnoses and manage relevant information about them. Used largely for populations with chronic conditions, disease registries enable outreach activities in which primary care teams or centralized case managers contact patients who need care. Disease registries improve process and outcome measures for chronic disease management but are used by less than half of all US physician organizations with more than 20 providers.^{12–14} Disease registries commonly supplement the patient record, constituting a parallel documentation system; their shortcomings include duplicate data input and, often, a significant time lag before current patient data is recorded in the registry.^{15,16} They typically address single conditions and omit preventive care needs.

The third function of information technology, performance feedback, can boost provider performance on evidence-based care recommendations.^{17,18} Short-term quality improvement initiatives often effectively combine performance audit, provider feedback, and continuing medical education strategies.¹⁹ Integrated ongoing provider feedback is less common.

This study reports on an examination of the use of an integrated information technology application—the Panel Support Tool (PST), also known as the Population Management Tool—that optimally provides all 3 functions necessary to improve health care: (1) robust and relevant point of care reminders, (2) patient registries with immediate data availability, and (3) continuous performance feedback. Our objective was to measure the tool's impact on performance on preventive, monitoring, and therapeutic care recommendations by primary care teams.

Methods

Setting and subjects

Kaiser Permanente is the largest not-for-profit integrated health delivery system in the United States, serving 8.6 million members in 8 regions spanning 9 states and the District of Columbia. Kaiser Permanente provides and coordinates the entire scope of care for members including preventive care, well baby and prenatal care, immunizations, emer-

gency care, hospital and medical services, and ancillary services including pharmacy, laboratory, and radiology.

The Kaiser Permanente Northwest region, with 363,000 adult members in March 2008, is located in Oregon and southwest Washington. We studied performance on recommended care guidelines by 207 internal medicine and family practice primary care teams. A physician or a nurse practitioner/physician assistant led each team, which also included medical assistants and other health care professionals such as registered nurses and health educators. Each team cared for a list, called a "panel," of patients who had chosen or been assigned to the lead provider; the 207 primary care panels included an average of 1273 adult members and collectively cared for 263,509 patients. Members under 18 years old are excluded. In addition, many physicians work part-time and carry a smaller panel than do full-time providers.

The Panel Support Tool

A proprietary Web-based application, the PST is tightly integrated with KP HealthConnect, a comprehensive

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The Panel Support Tool

Return to list | Copy MRN to Clipboard | Mark as Reviewed | No Follow-up | No remarks

Print detail for clinician | Print handout for patient

Name: DEMO1001874374 MRN: 1874374 Age: 53 Sex: M Date of birth: 10/13/56	Home: 123-4567 Work: 123-4567 Last PC Visit: 4/16/08 Next PC Visit: Last Reviewed:	PCP: DEMO DOC1 Last THA: <small>kp.org</small> INACTIVE																																																																			
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Most recent KP pharmacy dispense of each drug within certain drug classes in last 12 months. Bolded = dispensed in last 3 months

NOVOLIN 70/30 INJ 70/30 Date: 11/23/09
SIMVASTATIN TAB 20MG Date: 11/23/09 Daily Dose: 20.0
LISINAPRIL TAB 40MG Date: 3/10/09 Daily Dose: 80.0

FIG. 1. Panel Support Tool, patient-level view.

electronic health record; providers can toggle between them. KP HealthConnect includes comprehensive documentation of patient care in all settings and connectivity to lab, pharmacy, radiology, and other ancillary systems.

The adult primary care module of the PST was deployed between March and December of 2006 as part of a model of care called *total panel ownership*.²⁰ Harnessing the power of immediately available and complete patient information, the PST allows primary care providers to examine rapidly what is recommended for the specific care needs of individual patients, any group within their patient panel (eg, members diagnosed with diabetes), or their entire panel.

The PST is displayed as a dynamic report. The patient-level view (Fig. 1) highlights the most recent clinic, urgent care, and/or emergency department visits, vital signs, medications, and any differences or “gaps” between 32 evidence-based care recommendations and delivered care. The PST monitors recommendations pertaining to medication management and screening for comorbidities for 5 chronic conditions: asthma, type 2 diabetes, coronary artery disease, heart failure, and chronic kidney disease. The tool also monitors preventive care measures such as administering adult immunizations, and screening for breast, cervical, and colorectal cancer, hyperlipidemia, and osteoporosis. For each care recommendation, the PST precisely indicates any action needed.

Some recommendations monitored by the tool are derived from the Healthcare Effectiveness Data and Information Set (HEDIS). HEDIS is collated by the National Committee for Quality Assurance and is a series of standardized performance measures used by the majority of US managed care plans. Other recommendations reflect organizational priori-

ties based on peer-reviewed literature and/or internal research at Kaiser Permanente.

In the panel-level view (Fig. 2), the PST enables outreach by displaying key information on all panel members such as age, sex, diagnoses (indicated by a Y), and any gaps between recommended care and what patients have received. By default, members are listed in decreasing order of gap scores between recommended care and care received, so clinicians can immediately see which members are most in need of outreach, as well as how successfully they are performing recommended care for the entire panel. Color-coding indicates disease severity and care gaps.

Gaps in care are identified electronically using data from multiple sources and a methodology similar to that of HEDIS. Each night, the PST extracts data from KP HealthConnect and the data repository for all encounter, pharmacy, laboratory, and claims data and automatically updates all patient-level and panel views. When patients obtain needed screening or lab tests or fill prescriptions, the PST reflects the activity the following day.

Design

A serial cross-sectional study was conducted, retrospectively using monthly summary data for 207 teams. Baseline care performance was assessed 3 months prior to first use of the tool and in the month in which was began. Care performance was then assessed at 4-month intervals over 20 months of follow-up.

Outcome measures

The main outcome measure was a monthly care performance percentage for each provider team, calculated as the

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The Panel Support Tool

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Complete Panel View

PCP(s): DEMO DOC1
Total Patients : 831
Currently showing all records. If page is loading too slowly, please click here to return to 200 records per page.

Report	Handout	MRN	NAME	Age	Sex	Dx	Prev	Gap	DM	CVD	CHF	HTN	CKD	Asth	Remarks	Last Seen	F/U Rev'd	PCP
☐	☐	001686265	DEMO10016862	65	M			16	Y			Y	1-2			08/09		DOC1
☐	☐	001514306	DEMO10015143	58	M			15	Y			Y						DOC1
☐	☐	001934766	DEMO10019347	61	M			15	Y			Y						DOC1
☐	☐	010365834	DEMO10103658	64	M			14	Y	Y	Y	Y	1-2			08/09		DOC1
☐	☐	001690811	DEMO10016908	72	M			13		Y	Y	Y	1-2			08/09	10/19/09	DOC1
☐	☐	004245816	DEMO10042458	66	M			13		Y		Y				06/08		DOC1
☐	☐	010589676	DEMO10105896	69	M			13	Y	Y	Y	Y	1-2			04/09		DOC1
☐	☐	010481157	DEMO10104811	44	M			12	Y			Y				10/08	1/8/10	DOC1
☐	☐	001785764	DEMO10017857	47	M			11	Y									DOC1
☐	☐	001635540	DEMO10016355	56	F			9	Y			Y	3			08/09		DOC1
☐	☐	001874374	DEMO10018743	53	M			9	Y			Y	1-2			04/08		DOC1
☐	☐	001938524	DEMO10019385	42	M			8	Y			Y				07/09		DOC1

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FIG. 2. Panel Support Tool, panel-level view.

number of completed care recommendations for all panel patients divided by the number of clinical indications for care recommendations among them. Care performance percentage was calculated using 13 of the 32 PST care recommendations (Table 1); 19 care recommendations were excluded because of strong seasonal variation or changes in the definition of the measure over time.

A single patient can qualify for multiple care recommendations on the basis of age, sex, and/or diagnosed conditions, and a single constellation of age, sex, and diagnosed conditions may indicate a need for more than 1 recommended intervention. For instance, heart failure with systolic dysfunction between the ages of 18 and 85 indicates a need for

treatment with beta-blockers and for treatment with an angiotensin-converting enzyme inhibitor or angiotensin II receptor blocker; each indicator was counted separately.

The *t* test was used to assess the statistical significance of changes in monthly care performance summary data, comparing each 3-month measurement interval to the previous one. Multiple regression was also used to model the relationship between several independent variables and care performance. Independent variables included panel size and composition, baseline care performance, length of PST use, and an index of severity called the "care opportunity rate." The care opportunity rate for each provider team was calculated as the number of clinical indications for care measures among all panel patients divided by the number of panel patients. All data used in the analysis for this paper was aggregated to the level of provider teams; ethics approval was not required.

TABLE 1. CARE RECOMMENDATIONS MONITORED BY THE PANEL SUPPORT TOOL

Therapy recommendations

- Statins
 - Cardiovascular disease and diabetes mellitus populations* or based on 10-year coronary artery disease risk score
- Angiotensin-converting enzyme/Angiotensin receptor blocker
 - Indication: cardiovascular disease risk,* diabetes mellitus nephropathy,* heart failure*
- Beta-blockers
 - Indication: Post-myocardial infarction* or in heart failure*
- Glycemic control
 - Insulin if hemoglobin A1c ≥ 9 and on oral medications for ≥ 1 year
 - Metformin if body mass index ≥ 27 and hemoglobin A1c ≥ 8
- Blood pressure control
 - Medications when blood pressure $>140/90$ in uncomplicated hypertension
- Osteoporosis treatment
 - In women older than age 65 with T-score ≤ -2.5
 - Post fracture

Monitoring recommendations

- Diabetes
 - Hemoglobin A1c*
 - Renal screening*
 - Foot screening
 - Retinal screening
 - Low-density lipoprotein screening*
- High-risk populations
 - Low-density lipoprotein screening
- Medication monitoring
 - Annual laboratory tests
- Chronic kidney disease
 - Creatinine, urine protein, hemoglobin, electrolytes

Prevention recommendations

- High-risk populations
 - Flu shot during flu season
 - Pneumovax*
- General population
 - Mammogram*
 - Pap smear*
 - Colorectal screening
 - Cholesterol screening*
 - Tetanus shot*
 - Osteoporosis screening

*Included in analysis.

Results

Among the 207 teams, average panel size included 1273 adult patients; within each panel, on average, 45% of adult patients were male, 52% were between the ages of 35 and 64 years, and 19% were 65 years of age or older. The average baseline care opportunity rate was 1.76. In other words, there were 1.76 unmet clinical care recommendations per panel patient.

Average care performance before PST implementation was 72.9% both 3 months before implementation and in the month in which use began. After 12 months, it increased to 78.0% (95% confidence interval [CI], 77.3%–78.7%). After 20 months of follow-up, it further increased to an average of 80.0% (95% CI, 79.3%–80.7%). Table 2 displays improvements measured at 4-month intervals over the course of the observation period and their corresponding *P* values with Bonferroni correction.

In a mixed model with repeated measures analysis, baseline care performance had the highest β coefficient at 0.85 (95% CI, 0.78–0.91). As a result, expected care performance improvements corresponded closely to observed improvements ($R^2 = 0.76$). Also of interest were the linear and quadratic terms of length of use, which indicated a 5% increase in performance in the first year. Independent variables and their coefficients are detailed in Table 3.

TABLE 2. IMPROVEMENTS IN CARE PERFORMANCE PERCENTAGE WITH PANEL SUPPORT TOOL USE

Months since implementation	Performance (95% confidence interval)	Corrected <i>P</i> value*
–3	72.9% (71.8%–74.0%)	n/a
0	72.9% (72.2%–73.6%)	NS
4	74.6% (73.9%–75.3%)	<0.006
8	76.5% (75.8%–77.2%)	<0.006
12	78.0% (77.3%–78.7%)	<0.03
16	79.1% (78.4%–79.8%)	NS
20	80.0% (79.3%–80.7%)	NS

*Bonferroni correction.

NS, not significant.

TABLE 3. REGRESSION ANALYSIS WITH REPEATED MEASURES OF CARE

	β coefficient (95% confidence interval)	P value
Intercept	0.30 (0.25–0.35)	<0.0001
Average baseline care performance	0.69 (0.63–0.75)	<0.0001
Percent of panel members aged 18 to 34 ^a	–0.06 (–0.09––0.04)	<0.0001
Percent of male panel members	–0.05 (–0.07––0.03)	<0.0001
Panel size/1000 members	–0.01 (–0.02––0.01)	0.0004
Length of use in years	0.06 (0.05–0.17)	<0.0001
Length of use in years $\times$ length of use in years ^b	–0.01 (–0.01––0.01)	<0.0001
Average baseline care opportunity rate ^c /10 performance improvements	–0.04 (–0.07––0.02)	0.002

^aThere was no statistical significance to the percent of members aged 35 to 64 or the percent of members aged 65 and older.

^bWe used the quadratic term (length of use in years $\times$ length of use in years) in addition to the linear term (length of use in years) because the performance improvement slowed as length of use increased. In other words, the relationship between performance improvement and length of use is not a simple linear one.

^cCalculated as the number of clinical indications for care measures among all panel patients divided by the number of patients on the panel.

Discussion

In 20 months, 207 teams using the PST increased their performance on 13 care recommendations by 7.1%. The care recommendations spanned therapeutic and monitoring needs in patients with heart failure, coronary artery disease, and diabetes, as well as routine preventive care. Improvements were most rapid and statistically significant in the first 12 months of use but continued throughout 20 months of follow-up. In an organization with high baseline performance on care recommendations, the PST enabled further improvements.

Alternative explanations for our findings include the presence of other initiatives to increase performance on care recommendations. While adherence to evidence-based guidelines has long been a focus at Kaiser Permanente, there were no contemporaneous initiatives. Baseline performance remained unchanged when measured 3 months before and during the month of PST implementation. In addition, teams that used the tool more performed better than those that used the tool less. This is true for some measures despite baseline performance of some high-use teams being lower than baseline performance of some low-use teams.

Strengths of this study include the large number of providers and patients and the ability to capture evidence-based care in multiple domains. Limitations include the lack of a control group. System architecture and the implementation schedule precluded randomizing Kaiser Permanente Northwest clinicians or patients into intervention and control groups, and significant interregional operational differences prohibited using another Kaiser Permanente region as a control. In addition, while performance on evidence-based care recommendations improved, patient outcomes were not studied.

The PST differs substantially from previously reported information technology tools by simultaneously supporting “inreach” and “outreach.” Inreach occurs when all of a patient’s needs are met during clinical encounters. The tool supports inreach by highlighting all unmet needs, regardless of the reason for a scheduled visit. Outreach activities include contacting patients to arrange needed tests, medications, and visits. The tool enables outreach by stratifying patients from the greatest care gap to the least, allowing providers to identify who most needs care. The PST provides current

patient data and is tightly integrated with the patient’s complete electronic health record. Last, the tool provides continual performance feedback to physicians.

Few reports of similarly comprehensive systems were found in the literature. Published reports focus largely on just 1 of the functionalities offered by the PST. Numerous evaluations and reviews of disease-specific decision support systems have been reported.²¹ Paper or electronic evidence-based checklists have been designed to increase preventive care among adults of average risk.^{22,23} Only 1 other clinical decision support system was found that addressed both prevention and therapeutic goals across diagnoses, using structured questions for patients and physicians to elicit more information related to the patient’s chief complaint and linking the results to an electronic knowledge base.²⁴ However, its functionality was limited and it demonstrated no consistent pattern of clinician performance improvement.

A systematic review found that information systems that provide decision support automatically as part of clinician workflow are associated most strongly with successful outcomes.²⁵ In contrast, the current findings demonstrate that systems that rely on the initiative of primary care provider teams are also effective. One best practice for inreach depends on a medical assistant to review PST care recommendations that should be addressed in an upcoming visit, regardless of the reason for the visit. The medical assistant adds these recommendations as pending orders in the patient’s electronic health record; the primary care clinician reviews and signs the pending orders when seeing the patient.

Best practice outreach strategies include querying the system for care gaps for the entire panel every 2 to 4 weeks, sending standardized letters or secure e-mail messages around the time of members’ birthdays that identify all needed care, having medical assistants or nurses call patients to schedule screening tests, and having pharmacists review the patient’s record for needed care when refilling medications. Continuous performance tracking integrated into the PST is a feature for which we found no other examples in the literature.

Other studies and meta-analyses that assessed the potential of clinical decision support systems to improve screening rates demonstrated variable improvements on individual measures from 5.8% to 16.3%.^{26–28} However, while previous

studies have focused largely on the efficacy of clinical decision support systems,²⁹ the current study presents data on effectiveness within a large and diverse population.

It is important to note that PST implementation occurred in the context of strong support from clinical and operational leadership, a clear expectation from leadership that all primary care teams would use the tool and would also focus on specified quality goals during 2007, and postimplementation support that continued to adjust the tool to fit best within team workflows. These factors no doubt played a role in the tool's impact on performance.

The results point out the potential of "next generation" information technology to improve quality of care without creating additional burden for primary care providers. In the current model, medical assistants working to the full scope of practice use the PST to help busy primary care clinicians attend to inreach and outreach needs that might otherwise go unmet. Despite increasing demand for primary care services, 73% of clinicians and staff surveyed in 2008 agreed with the statement, "the PST has improved my work life."

However, health information technology alone is insufficient to improve care. Integrated health systems with incentive structures that promote quality and efficiency of care can motivate its effective use. In this study, additional quality was added to visits already scheduled through inreach activities, and outreach improved performance on care recommendations—without concern for revenue impacts. Nonintegrated systems could achieve similar results with population care registries, electronic supports similar to the PST, and aligned incentive structures.

We note that performance on care recommendations measures only the process of care. This study does not address health outcomes. While the relationship between care processes and outcomes has been documented for some care recommendations, a comprehensive discussion of this evidence is beyond the scope of this paper. Future research should confirm that improved performance on recommended care using the PST does indeed improve health outcomes.

PST functionalities continue to improve. Its integration within the electronic health record has increased since this study was conducted; physicians can now view the patient-level screen from within any clinical encounter in the electronic health record and, with a few clicks, care recommendations in the PST appear as orders in the electronic health record. An additional function under development is the inclusion of biomathematical modeling that will predict patient outcomes of adhering to care recommendations. We anticipate that modeling will provide additional motivation for patients to follow through on care recommendations. Future research should assess its impact.

Conclusion

A PST, integrating point-of-care decision supports, population care management functions, and performance feedback with a comprehensive electronic health record, is an effective tool to improve performance on evidence-based care guidelines.

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Author Disclosure Statement

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