A Multifaceted Model for Implementing Clinical Practice Guidelines Across the Continuum of Care

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Much effort goes into producing high-quality evidence-based clinical practice guidelines; however, the effort is of little value if the guidelines are not incorporated into clinical practice. Research has identified in general which guideline implementation strategies work and which do not [1,2]. Approaches involving organizational change (eg, standing orders, reminders) have been shown to be more effective than interventions such as mailed guidelines, patient and provider education, and feedback [3–6]. Another key finding is that combined strategies are more effective than a single strategy [7]. Further, computerized information and decision support systems based on guidelines are demonstrating great effectiveness in primary care and hospital settings [8–11]. The use of multicomponent interventions that include information technology support are now being reported in larger, generally primary care settings and are demonstrating effectiveness in improving provider adherence to guidelines for chronic disease management [12–16].

The primary care setting is not the only point of service at which clinical guidelines can be applied. Health care is delivered through a complex system of providers and settings, including primary care and specialty office visits, laboratory, pharmacy, emergency care, inpatient care, and self-care at home. Each setting represents an opportunity to implement guidelines. This article describes a multifaceted model for implementing clinical practice guidelines for diabetes across the continuum of care. Implemented within a large, integrated health care system, the model applies strategies that have been demonstrated to be effective, catching the patient at various points of service. Selected clinical and utilization data associated with model implementation also are reported.

Setting

Kaiser Permanente Southern California (KPSC) is a large integrated health care delivery system comprising the multispecialty Southern California Permanente Medical Group (SCPMG), 11 Kaiser Foundation Hospitals, and the Kaiser Foundation Health Plan. More than 3000 SCPMG physicians provide care exclusively for more than 3.1 million Kaiser Foundation Health Plan members in 12 medical centers and in more than 100 medical offices. The not-for-profit Kaiser system owns and operates outpatient and inpatient pharmacies, clinical laboratories, home health services, emergency departments, and urgent care centers and contracts for skilled nursing, rehabilitation, and tertiary care services. Quality improvement of diabetes care is one of KPSC’s highest clinical priorities.

A regional diabetes care management team, made up of representatives from the medical group, analysis, information technology, health education, and pharmacy, is responsible for coordinating the implementation of the diabetes guidelines. In addition, each medical center has its own diabetes care management implementation team. The interventions described in this paper are the result of the work of the regional and local teams of stakeholders, key among them the physician and staff leaders who become champions for implementation across the health care system.

Evidence-Based Diabetes Care

SCPMG has its own guidelines development unit and has developed evidence-based guidelines for diabetes care [17] based on its own critical review of the literature. The guidelines share some similarities with other published guidelines [18–22] and include guidelines for

- Physical examination (retinal exam, foot exam, blood pressure)
- Laboratory testing (hemoglobin A\(_c\), lipids, microalbuminuria)
- Medication management (blood sugar control, lipid management, renal function, hypertension management)
- Immunization (influenza and pneumococcal vaccination)
- Routine care and prevention (cancer screening, smoking cessation)
- Self-care (diet, exercise)

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**Systems Support**

A Web-based diabetes registry and tracking system was implemented in 1998 that links computer-stored data from the pharmacy information system, laboratory management system, Kaiser Foundation Hospital records, Kaiser Foundation Health Plan membership records, and SCPMG outpatient encounter system. The system is refreshed daily and subject to the accuracy, timeliness, and completeness of each of the Kaiser Permanente feeder systems. All members with diabetes are systematically identified using specific criteria and entered into the registry and tracking system, which tracks the performance of key clinical and utilization indicators for each patient. Using clinical information contained in the system, members are stratified according to risk for hospitalization into low, medium, high, very high, and renal failure levels; there are specific guidelines for each risk level. The diabetes registry and tracking system is accessible to clinicians within the program and supports computer-generated fax reminders, outreach letters, physician-specific panel reports, and other guideline implementation strategies, as described in the next section.

**Multicomponent Intervention**

As previously mentioned, the primary care visit is not the only point of service at which various clinical guidelines can be applied. A patient with diabetes may intersect the health care system at many points (Figure 1). Each setting represents an influence point, an opportunity to apply or reinforce a clinical guideline by targeting the clinician, patient, or family. The following is a description of some of the organizational change and decision support strategies that our organization has introduced to imbed diabetes practice guidelines into our processes of care. The strategies are organized by category; we recognize that some interventions may fall into multiple categories.

**Reminders/Prompts**

- Care management summary sheet. The night before a scheduled office visit, the system automatically “faxes” a 1-page summary of the patient’s medical care to the clinician at the location where care will be delivered. The summary sheet contains information on labs, pharmacy, risk category, and emergency and hospital visits and provides patient-specific, guideline-based recommendations for care (eg, ordering needed laboratory tests, prescribing or adjusting medications, administering immunizations).

- Outreach letters. The system automatically triggers an outreach letter to the patient if the patient is missing any screening or laboratory tests recommended by the clinical practice guideline. The letter serves as the lab slip for testing at any KPSC laboratory. A flu shot reminder is mailed annually in the fall to all members with diabetes.

- Automated telephone reminders. Clinicians or care managers can trigger an automated telephone outreach system that “calls” the patient and asks the patient to call a number to receive a private prerecorded message. The message contains test results and/or reminder advice to get follow-up care or testing as recommended by the guideline.

- Physician-specific panel reports. Summary and detailed feedback reports are sent to every primary care physician and diabetologist at least twice per year and are available online at any time.

**Standing Orders**

- Outpatient laboratory testing. The system regularly uploads standing orders to the outpatient laboratory computer for any missing lab tests. A diabetic patient who visits the laboratory for any reason is assured of also getting any standing lab order at the same time.

- Influenza vaccinations are offered to diabetic patients in all medical offices according to a standing order by SCPMG physicians.

- Emergency room standing orders and protocols for diabetes management and admission are available for physicians.

- Blood sugar level is a vital sign for diabetic inpatients; there is a standing order for testing.

- Discharge orders for diabetic patients are provided.

**Protocols/Procedures**

- Diabetes laboratory panel. The clinician can request a single test that orders HbA1c, lipids, and microalbuminuria testing rather than filling out 3 or more forms.

- Pharmacist counseling. When patients pick up their outpatient prescriptions, clinical pharmacists counsel them regarding new medications, including information about indications, safe administration, side effects, advice on compliance, and referral to clinician for more information and follow-up.

- Care/case management treatment protocols are built around clinical practice guidelines, under the direction and oversight of SCPMG physicians, as part of diabetes disease management.
Inpatient management of glycemic control in all diabetic patients. Elevated blood sugars trigger protocols for medication management by the clinical pharmacist and/or on-call physician or hospitalist.

Linking interventions. For example, a patient presenting for a retinal screening examination in optometry or primary care is referred to the laboratory for any required testing.

Patient-Initiated Self-Care Decision Support
Clinical practice guideline recommendations have been incorporated into information and materials for members with diabetes:

- *Healthphone* is a 1-800 information service for Kaiser Permanente members that offers a menu of health information recordings, including several on diabetes care.
- *Kaiser Permanente Healthwise Handbook* [23] is a handbook on general self-care that is provided to all health system members for at-home reference. Diabetes care guidelines are reflected in the text.
- *KPOnline* is a members-only Web site containing health information. It includes the *Healthwise Handbook* materials, chat rooms for patients with chronic disease, a health encyclopedia, and a query function for patients to ask questions; questions are answered via e-mail within 48 hours.

Results of Guideline Implementation Effort
General population trends and performance results for
Data source: KPSC Diabetes Population Registry, an administrative database linked with computer-stored data from pharmacy information system, laboratory management system, Kaiser Foundation Hospital records database, KFHP membership database, and SCMPG outpatient encounter system [24].

Patient selection criteria: diabetes is defined as (1) an ICD-9 hospital discharge diagnosis of 250.xx, (2) HbA$_1c$ $\geq$ 6.7%, or (3) a prescription of insulin or oral hypoglycemic medication. Exclusions: as of 1996, age $>$ 18 yr and only 1 Rx for oral hypoglycemic medication; as of 1994, gestational diabetes; as of 2000, age $>$ 18 yr and only 1 hospitalization with ICD-9 code 250.xx.

Denominators for measures are the number of members with diabetes (age $>$ 18 yr) enrolled on 1 January of each calendar year.

Numerator 
Lipid testing: number of members age $>$ 18 yr with diabetes who had dyslipidemia screening/testing performed at least once in the calendar year.
Microalbuminuria testing: number of members age $>$ 18 yr with diabetes who had at least 1 test for proteinuria (microalbumin-spot, 24-hour urine, or albumin/creatinine ratio) in the calendar year.
HbA$_1c$ testing: number of members age $>$ 18 yr with diabetes who had HbA$_1c$ or fructosamine test performed in the calendar year.
LDL $<$ 100: number of members age $>$ 18 yr with diabetes with an available LDL cholesterol who have LDL $<$ 100 mg/dL.
Lipid medication use: number of members age $>$ 18 yr with diabetes known to have LDL $\geq$ 130 who filled at least 1 prescription for lipid-lowering medication.
HbA$_1c$ $<$ 8.0: number of members age $>$ 18 yr with diabetes tested by glycosylated test who have HbA$_1c$ $<$ 8.0%.

common diabetes care measures from 1994 to 2000 are reported. Our measurement and reporting methods derive from our diabetes population registry and are described in the Table; the methods are described in more detail in a previous article [24]. Due to the large size of the population, a 1% difference between years is significant at the $P < 0.001$ level. These results cannot be compared to HEDIS results because of differences in case identification and continuous enrollment criteria. For example, our HEDIS HbA$_1c$ testing rate for 1999 and 2000 was 78.3% and 78.8% for the commercial population and 84.2% and 84.9% for Medicare recipients, respectively. Many of our interventions outside of primary care were only recently implemented, and our results do not report on their impact or effect.

Figure 2 shows the prevalence of diabetes mellitus within KPSC from 1994 to 2000. Prevalence increased from 3.7% to 5.2% over this time, with 155,999 members identified with diabetes in 2000.

Figure 3 shows the timeline for the various interventions that were used to implement clinical practice guidelines from 1994 to 2001 and trends for selected diabetes clinical indicators. Microalbuminuria testing increased from 10% to 55% during the period. Early improvement (after the introduction and dissemination of the clinical guidelines in 1994) was modest. Fifty percent of the improvement occurred after 1998 with the introduction of the diabetes lab panel, patient outreach letters, and computer-generated faxed reminders at office visits. Lipid testing followed a similar pattern, improving from 44% to 65% during the period. HbA$_1c$ testing showed a more moderate improvement but started at a higher baseline (Figure 3B). Each of these measures exhibited an S-pattern of improvement associated with interventions, reaching a plateau level by 2000. Treatment and control measures (Figure 3C) exhibited a more linear rate of improvement from 1994 to 2000 and did not achieve the comparatively high levels of performance seen for diabetes screening measures by year end 2000.

With regard to utilization, there was a downward trend in hospital discharges and total hospital days per 1000 members with diabetes from 1995 to 2000 (Figure 4). Of interest, the winter of 1997–1998 saw a major influenza epidemic in southern California, which likely was partly responsible for the relative plateau in rates for those years. By comparison, overall hospital utilization for KPSC increased slightly from 1998 to 2000.

Discussion

In this article, we have described the multifaceted approach taken by a large, integrated health care delivery system to systematically implement clinical practice guidelines for diabetes. Rapid rates of improvement for common diabetes care measures were seen during the implementation period.

It appears that the diabetes clinical practice guidelines had little impact when they were first introduced in 1993–1994. Clinical indicators slowly began to improve after total medical group performance feedback was introduced in 1994. The effects of passive interventions and group-level feedback can be variable, according to previous reports [1–6,24]. The greatest improvement in process measures was seen after 1998 with the introduction of the clinical information system and the organizational change and decision support tools it supported (eg, diabetes lab panel, computer-generated fax reminders, physician panel reports, outreach letters).

Improvement in the rates of lipid control and use of lipid medications were not as great as for diabetes screening rates. There may be several reasons for this. It is easier to order a test than to titrate medication and manage long-term risks beyond glucose control. In addition, the impact of guideline
Figure 2. Members identified with diabetes in Kaiser Permanente Southern California, 1994 to 2000.

Figure 3. (A) Timeline of the introduction of various guideline implementation strategies from 1994 to 2001, (B) associated trends in testing rates for lipids, microalbuminuria (MAU), and HbA1c, and (C) trends in diabetes treatment and control measures.
implementation that might be observed in a continuously enrolled cohort of actively managed patients might be obscured in our setting due to the continual entry of new, uncontrolled diabetics into the population. Further, the tools used to implement some treatment and control guidelines may be less effective than those used to implement screening guidelines, or insufficient time may have elapsed to see the impact of these tools. We continue to pursue superior performance in metabolic treatment and control through additional guideline implementation strategies.

Improvements were noted in hospitalization rates, which are a useful proxy for morbidity. We believe that the downward trend in hospital discharges, along with total hospital days, indicate tangible success in the outpatient care setting and reflects the combined results of the diverse interventions in diabetes care implemented by KPSC.

Program Innovations and Success Factors
Health care delivery today involves a complex system of multiple providers, facilities, and support departments through which the physician and patient navigate. KPSC is applying various implementation methods across the continuum of care. Implementing interventions at different patient contact points helps to reinforce the use of guidelines. There is built-in redundancy in the model, which helps to ensure that the model will at some point “catch” the patient or clinician to guide practice according to current clinical guidelines.

The sustainability and reproducibility of interventional support is vital in a large, complex health care organization. We do not want to implement changes that result only in short-term improvements or that contribute to variation across clinical settings. Our centralized clinical information system, which includes a real-time patient registry, tracking functions, and decision support functionality, is a key factor in our ability to coordinate the implementation of guidelines in a consistent manner. The system enables the rapid and widespread introduction of changes to guidelines and tools, which is necessary as new clinical evidence is realized over time. For example, when revised guidelines were adopted, reminder messages on the care management summary sheet were changed as soon as the programming was completed. More decentralized systems, computerized or manual, often take weeks, months, or years to change.

While we have introduced innovative organizational changes, we have not abandoned traditional implementation methods, such as dissemination of guidelines, education, and provider feedback. While these techniques used alone may not change behavior and practice, they are necessary to assure that physicians have knowledge about the evidence base that supports the guidelines implementation effort. They are also important for gaining organizational “buy-in.” Physicians and staff can undermine or override prompts, reminders, and outreach if they do not understand or support the system. In our medical group setting, a high degree of physician leadership and participation in the design and development of the practice support tools is achieved.

Similar Approaches Reported in the Literature
Our results support past research indicating that multiple organizational change and reminder interventions are an effective approach to guideline implementation [3–7]. Other health care systems have reported various applications of multicomponent interventions to support guidelines implementation [12–16]. These efforts included typical strategies of guideline dissemination and education (CME), online clinical practice guidelines, panel feedback report methods, and accessible diabetes registry information. While most reported significant improvement in their settings, few have implemented organizational change and decision support reminders or prompts at the time of care.

Other groups have implemented similar interventions. McCullough [14] and Friedman [13] describe a summary sheet and prompting/reminder screen like our care management summary sheet that can be available at the point of service. Sperl-Hillen [16] refers to a clinic that has an automated medical record system and a prompting system for diabetes tests that has consistently shown superior results. Nyman [15] describes a clustered lab order tool similar to...
our diabetes lab panel. Several authors are describing disease or care management approaches (practice redesign) that incorporate written protocols for care/case managers or the health care team. Sperl-Hillen describes the Staged Diabetes Management approach, a system of care that makes use of guidelines and decision paths for providers and patients as well as a nurse self-management educator in the clinics. These reports do not describe the type and scope of automated outreach and non–primary care support interventions that we describe here.

Limitations

There are limitations to interpreting our results. This is not a randomized or controlled trial. The data sources and data specifications changed slightly over time, but we feel the general trends and pattern of improvement over time can be deduced. Results through 2000 illustrate the impact of interventions prior to that date, which were mostly in primary care settings. The impact of strategies implemented from 2000 to 2002 in other parts of the care continuum cannot be interpreted at this early date and await later reports.

Not all health care organizations have a clinical information system such as ours or the resources to develop one. Although such a system is efficient, it may not be necessary in all settings. As described, some of our tools, such as standing orders for influenza vaccine and management of care in the emergency room or at hospital discharge, are still manual systems that use written templates and documents to standardize care. To implement these systems, physicians and staff across the care continuum must work together as a team, following specific procedures and practices and developing a feedback system to reinforce the ongoing practice.

Future Directions

KPSC has expanded the model to support clinical practice guideline implementation for other conditions across the continuum, such as asthma, coronary artery disease, and heart failure. Additional technology and the expanded role of the patient in self-care hold promise for the future. KPSC is just beginning a multiyear program to implement a large-scale electronic health record, as has been done in Kaiser Permanente in Oregon and Colorado. This electronic record will include automated decision support, reminders and flags, decision menus, documentation templates, and connectivity throughout the integrated delivery system. Furthermore, we are anticipating an expanded internet relationship with patients, which may include reminders and prompts to patients (e-mail, Web) and patient access to customized Web sites and information.

Conclusion

We have described how a large, integrated health care delivery system is using a coordinated, multifaceted, organizational change approach to systematically implement clinical practice guidelines for diabetes. This approach has been associated with progressive and, in some cases, rapid rates of improvement in testing, treatment, and utilization measures. We believe our model supports the conclusion of the Institute of Medicine, which stated that “carefully designed, evidence-based care processes, supported by automated clinical information and decision support systems, offer the greatest promise for achieving the best outcomes from care for (patients with) chronic conditions [25].”

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