Population Health Management with Computerized Patient Records

CIGNA Healthcare of Arizona is using a computerized patient record system (EpicCare) for all medical care delivery at two primary care clinics. Use of this technology to improve quality of care for healthy populations and targeted groups of at-risk persons has led to population health management. This paper discusses strategies used in these endeavors.

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Computerized patient record systems are finally coming of age as organized medicine seeks the ultimate tool to enhance quality, service, and productivity while decreasing costs. Patients, nurses, and physicians are growing accustomed to the presence of a computer workstation in the patient examination room, although the interface between physician and computer is still evolving. One of the greatest strengths of a computerized patient record is the ability to manage and enhance the quality of care in large populations. Population health management represents a shift in the focal point of medical care delivery (1–5). Instead of focusing on the management of many individual patient visits, the physician population manager seeks to reduce risks and improve the overall health of defined populations. Many of the anticipated population-based, quality-of-care benefits of computerized patient record systems are tantalizing but are not yet proven. Population health management requires a long-term economic view that does not lend itself easily to traditional financial analysis. CIGNA Healthcare's Chandler, Arizona, clinic has used a computerized patient record system called EpicCare (Madison, Wisconsin) since 1993. We discuss our evolving practice of population health management through the use of computerized patient records.

Implementation of our computerized patient record system has been described elsewhere (6, 7) and is reviewed only briefly here. The CIGNA Chandler primary care clinic and a second nearby clinic (brought on-line in June 1997) are part of an 18-site staff-model HMO in the metropolitan Phoenix area. Approximately 65 support staff and 17 providers in pediatrics and family practice now use the computerized patient record system. EpicCare operates in a client–server environment. It is a Windows-based, graphical user interface system designed to completely replace a paper chart, allowing the physician to electronically conduct every aspect of medical practice. Pentium-133 PC workstations are located in every patient examination room, at nurses' stations, in the front office hub, and on each provider's desk. Our patients (8), nurses, and physicians have been receptive to the new automated environment and have expressed high satisfaction with the system. Ordering, prescribing, and documentation of visits or telephone conversations are done on-line; our staff members also use the system to analyze and manage all incoming laboratory and radiology results.

The Role of Computerized Patient Records in Population Health Management

The three general areas most demonstrative of the role of computerized patient records in population health management are the provision of automatic health maintenance reminders, the monitoring of disease-specific outcomes, and the use of on-line clinical guidelines.

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Health Maintenance Plan Reminders

Computerized patient records offer excellent automatic reminders and alerts for routine and disease-specific populations. We are using several standard health maintenance plans (HMPs) with on-line reminders: These cover the usual childhood and adult immunizations, Papanicolaou smears, and mammography. We can also identify at-risk populations and assign these groups to customized HMPs for disease-specific reminders. Examples include assigning special HMPs en masse to diabetic patients or populations at high risk for colon or breast cancer. We can also readily search the entire patient database to identify groups that qualify for HMPs but are overdue for various procedures (whether routine or high-risk). These patients can be contacted and brought into the clinic for appropriate treatments.

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A physician can also individually assign a patient to a specific high-risk HMP (e.g., diabetes), or the system managers can easily apply a specific high-risk HMP to broad groups of identified patients. For example, our diabetic patients' HMP includes annual eye and foot examinations, proteinuria screening, and glycosylated hemoglobin testing. For patients at higher risk for breast or colon cancer, the high-risk HMPs include more frequent mammography or sigmoidoscopy. Some of these HMPs are satisfied by electronically ordering a procedure (e.g., glycosylated hemoglobin testing), whereas others are manually marked as having been done (e.g., diabetic foot examination). In addition, certain populations can be automatically excluded from specific reminders. We exclude women who have had hysterectomy from Papanicolaou smear reminders (unless the patient has a history of pelvic cancer).

These computerized patient record reminders consistently and correctly flag patients who are overdue for various preventive procedures. Once the requisite procedure is ordered and completed (e.g., a Papanicolaou smear result is received through our laboratory interface), the HMP flag is "satisfied" until the preset interval has again expired (12 months for a Papanicolaou smear, 10 years for adult tetanus–diphtheria immunization).

The only limitation of the system seems to be the controversial nature of the health maintenance guidelines themselves. For example, there is discord in the medical community about the frequency of screening mammography in women 40 to 50 years of age. The U.S. Preventive Services Task Force neither recommends nor discourages screening for women at average risk in this age range (9); in contrast, other groups, such as the American Cancer Society and the American College of Obstetricians and Gynecologists, call for screening at 1- to 2-year intervals for these patients. Both groups cite excellent scientific justification for their recommendations. Yet even in the face of this uncertainty, the medical organization must choose specific and unambiguous "rules" for the reminders in a computerized patient record system. To reconcile this issue, our quality management committee and department chairpersons are meeting to decide on acceptable standards throughout the organization. It should also be noted that EpicCare's guidelines can be changed over time. If "standard" recommendations change in the future, changing the HMPs for any topic is straightforward.

We believe that EpicCare's health maintenance module will eventually enable us to reach important population-health management goals in our health plan. Once we roll out the computerized patient record to the rest of our health plan and implement our re-engineered workflows to take full advantage of the technology, we expect to see high rates of health maintenance completion (both in healthy and disease-specific populations), limited only by the degree of patient compliance.

Monitoring Disease-Specific Outcomes

The second important area in population-health management is identifying and tracking key indicators or outcomes in disease-specific populations. EpicCare allows us to easily identify patients with important common diseases, such as diabetes, hypertension, asthma, and congestive heart failure, that are amenable to proactive intervention.

We screen for hypertension and diabetes control outcomes. At quarterly intervals, we identify all patients with uncontrolled hypertension who are overdue for follow-up. We use the following logical criteria to identify this population:

> Last recorded systolic blood pressure > 180 mm Hg *or* diastolic blood pressure >105 mm Hg
>
> *and*
>
> Date of last recorded blood pressure > 60 days ago.

We print out a list of patients meeting those definitions; we then review the electronic chart and pull the paper chart to see if a more recent and more acceptable blood pressure has been recorded anywhere in the paper-based arm of the health plan. (Because our health

plan is undergoing the transition between electronic and paper records, neither record can reflect the entire pattern of care throughout the health plan: Both types must be reviewed to derive "complete" information on any one patient. Thus, it is currently impractical to consider our computerized patient record–based centers as entirely "paperless.") Nurses call patients who require follow-up and invite them to come in for a nurse visit. At this visit, the patients are triaged according to the blood pressure reading.

For diabetic patients, the identified criteria are the following:

Last glycosylated hemoglobin level > 10%

and

Date of last glycosylated hemoglobin level > 90 days ago.

Once again, a list is generated, and both the electronic and paper charts are reviewed before anyone is called. These patients are then contacted and generally brought in for a nurse visit, at which time a diabetic review takes place, dietary and other counseling is provided, a repeated glycosylated hemoglobin test is ordered, and an appointment is made with the physician.

In the past 2 years, we have flagged and reviewed the electronic and paper charts of several hundred patients with uncontrolled hypertension and diabetes as defined above. The nurses have found the patients to be generally receptive to our outreach efforts. We have been limited only by patient compliance and occasionally by difficulty contacting patients who have moved or changed medical coverage.

Our most recent survey for diabetic patients was done in September 1997. The computerized patient record system identified 20 patients with uncontrolled diabetes (a number similar to that used for other quarterly surveys we have done). Only 3 of these patients had existing follow-up appointments at our clinic at the time the nurses called them; 2 others had appointments elsewhere. Nurses could reach 15 of the 20 patients; 4 patients had left the plan, and 1 could not be reached. Of the 15 patients we contacted, 10 received laboratory orders for glycosylated hemoglobin testing and were given appointments for follow-up in our office; of these 10 patients, 6 had improved glycosylated hemoglobin levels on retesting, 1 had an unchanged level, and 3 did not keep the appointment despite our contact. Five patients had diabetes follow-up outside our clinic at other offices; information on their repeated glycosylated hemoglobin levels was unavailable.

Although this is a very small sample without a control group, it represents real-world experience with computerized patient record–guided outreach and allows us to draw some qualitative conclusions. We can identify all patients with the targeted condition but cannot document follow-up on all of them. Twenty percent of diabetic patients had moved out of the area or had switched medical coverage. Of the patients successfully contacted, 20% are noncompliant with follow-up directions despite our efforts, but 80% are compliant. Most available repeated glycosylated hemoglobin results (85%) showed improvement. Although we have no control group, we believe that these efforts, continued over time, will result in improved care and outcomes for most of our targeted patients.

Similar disease-based analyses could identify asthmatic patients whose current medication list does not contain an inhaled steroid, patients who have had myocardial infarction and are not taking β-blockers or aspirin, or patients with congestive heart failure whose current medication list does not contain an angiotensin-converting enzyme inhibitor. We have not yet instituted these concepts globally at our centers but will do so in the future. We can also use EpicCare to search for specific at-risk populations for one-time intervention.

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An example of this was the 1995 identification of all female patients of child-bearing age who were taking angiotensin-converting enzyme inhibitors. In 1995, these drugs were found to be teratogenic; by using the computerized patient record system, we were able to review the at-risk patients and contact them about this adverse effect.

By using these computer-directed outreach efforts to contact disease-specific populations and by continuing our already-existing quality improvement programs, we expect to have a tangible positive effect on the quality of care delivered to the target population. Although we do not yet have outcomes data from these actions, we have identified and intervened in hundreds of at-risk patients at our clinic alone. We expect that better control of hypertension, diabetes, asthma, and congestive heart failure in our health plan will lead to better quality of care, better outcomes, reduced complications, greater patient satisfaction, and lower costs.

On-Line Clinical Guidelines

The third critical quality tool available with a computerized patient record system is on-line clinical guidelines or algorithms. These guidelines (called Pathways in EpicCare) are not automatic as in the case of HMPs; rather, they are available with a single mouse click as on-line reference material for physicians. They range from the simple to the complex. Examples in use at our center include the treatment of *Helicobacter pylori* infection, treatment protocols for patients with abnormal Papanicolaou smears, treatment protocols for community-acquired pneumonia, and the workup and treatment of patients with a positive tuberculin skin test result. Some of our guidelines are merely administrative or informational (e.g., proper referral sequence for patients with chronic pain). We can easily customize or edit existing standard guidelines or create our own de novo with addition of our own formulary or other information generic to our organization.

> The most significant step is to train and empower nurses to immediately order or directly carry out the overdue procedure at the time of the visit, without requiring permission of the physician.

Similar on-line guidelines called Alternative Medications also help to control costs. The system prompts providers to choose a more cost-effective medication before certain drugs are actually prescribed at the educable moment—that is, as the provider is electronically signing the prescription (e.g., one H_2-antagonist is as effective as but far less expensive than the others, and the system will prompt the provider to choose an alternative). This feature is effective in changing prescribing habits. Although we have no formal data on whether the guidelines improve treatment patterns, anecdotal evidence from one of our practices clearly shows the value of having immediately available reference material on-line at the point of service so that better treatment decisions can be made without delay. This may improve and standardize physicians' care patterns and improve quality while helping to control costs.

Program Success

Comparison of our computer-based and paper-based centers has not yet shown a significant increase in our rates of Papanicolaou smears and mammography in the EpicCare clinics. Physicians, regardless of whether they use computerized patient record systems, still practice in an episode-focused fashion wherein timely completion of visits is highly valued by managers. Our analysis suggests that our physicians often felt too rushed to directly address the on-line flashing alerts for overdue procedures because most episodic patient visits have a different agenda. Physicians acknowledge the reminders but often defer the issue and recommend an "annual physical" to patients for whom procedures are overdue (at these annual physical examinations, the physicians do consistently address the health maintenance issues). Not all patients follow this advice, and this results in further delays in completion of the target procedures. Thus, the traditional episodic focus of care delivery is often a barrier to achieving population management goals, notwithstanding the presence of a sophisticated computerized patient record system.

As a result, we are attempting to further leverage our computerized patient record system toward population management. After reviewing our workflows and policies, we have taken steps to eliminate these barriers. The most significant of these steps is to train and empower nurses to immediately order or directly carry out the overdue procedure at the time of the visit, without requiring permission of the physician. Our nurses are now empowered to administer appropriate immunizations and order mammography for anyone who is overdue; the physician then performs a breast examination during the visit if time permits. (If time does not permit, the breast examination can be done at a later time. The patient's immediate agenda still may outweigh the population focus.) The implementation of these new workflows is still in its early stage, and we are not yet entirely consistent in our application of them. However, we anticipate that this strategy will considerably improve compliance.

In addition, a new version of the software allows us to set EpicCare to visually warn the provider that overdue health maintenance procedures have not been ordered before the visit is closed. Thus, the HMP reminders will essentially force the medical staff to deal with the relevant issues, despite their continued focus on the episodic agenda. We realize that it is impractical for physicians to have agendas different from those of their often demanding patients; we must eventually achieve the difficult task of re-educating patients to focus their attention toward these larger goals. Barriers include burden of illness, social issues and secondary gain, and time management. Nonetheless, these population-based steps will ensure our goal of improved screening of general and high-risk populations for critical health maintenance procedures.

Summary

The use of computerized patient records is rapidly expanding in the United States, although many difficult barriers, often financial, limit use of these sophisticated tools. Perhaps the most compelling role for the computerized patient record is in population health management. This will lead to higher quality of care, improved medical outcomes, and long-term cost reductions across a healthier population. To achieve these goals, medical organizations will not only have to install computerized patient record systems but will need to re-engineer various key clinical processes to leverage these powerful tools. To balance the demands of episodic visit care and population health management goals, medical organizations may need to restructure medical delivery systems from physician-centered workflows toward team-centered workflows. Ultimately, with access to computerized guidelines and outcomes data on their own panel of patients, health maintenance plans and physicians (together with their teams of mid-level, nurse, and administrative partners) will become effective visit managers and population managers.

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