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Emerging Information Management Technologies and the Future of Disease Management

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ABSTRACT

Disease management (DM) has become a widely accepted way to support care delivery in the chronically ill patient population. Patients enrolled in these programs have been shown to have better health, fewer complications and comorbidities, and lower health care costs. The development of advanced information management technologies is further enhancing the role DM plays in optimizing outcomes and cost-effectiveness in clinical care. These emerging information management technologies (EIMT) include advances in software, hardware, and networking, all of which share common impact attributes in their ability to improve cost-effectiveness of care, quality of care, and access to care. Specific examples include interactive websites with the ability to engage patients in the self-care management process, the embedding of biometric devices (digital scales, modem-enabled glucose meters in the home, blood pressure monitoring, etc.), workflow and care coordination programs that add intelligence via guideline-directed alerts and reminders to the delivery process, registries that include a summary of personal health data that can be used as a reference point for improved clinical decisions, and the systematic collection of aggregated, de-identified clinical, administrative, and cost data into comprehensive data sets to which predictive modeling analytic tools can be applied. By way of case example, we also present data from a controlled clinical trial utilizing EIMT in the form of home-based weight measurement using a digital scale and linkage to a care coordination center for the management of severe congestive heart failure. Outcome results on 85,515 patient-months of an aggregate commercial and Medicare continuously enrolled population demonstrated an average reduction of care utilization (hospitalization) of 57% and a reduction in related delivery cost (per member per year payments) of 55%. We conclude that EIMT have already begun to offer significant and quantifiable benefits to DM and are likely to become heavily embedded in care management strategies in the future. (Disease Management 2003;6:219–231)

INTRODUCTION

DISEASE MANAGEMENT (DM), defined as a set of systematic, well-coordinated, and evidence-based communication programs, has become a widely accepted way to support care delivery in the chronically ill patient population. Recognized standards of care exist for these conditions, and patients who follow those standards have been shown to have better health, fewer complications and comorbidities, and lower health care costs.[1,2]

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The development of advanced information management technologies is further enhancing the important role DM plays in optimizing outcomes and cost-effectiveness in clinical care.[3] As discussed in the case study presented in this paper, one particular DM program that incorporates new information technology is achieving a 50%–60% reduction in health care costs, suggesting that technology-supported DM warrants further attention as a means to controlling escalating health care costs.

Emerging information management technologies (EIMTs) now available to facilitate DM include both "one-way" and interactive disease-specific web sites on the Internet, home-based biometric measurement devices that collect and communicate objective clinical information, and the use of context-sensitive alerts, guidelines, and reminders delivered to the point of care via electronic linkages that connect health plans, consumers, and their care givers. The effective utilization of these new tools has paved the way for efficient, cost-effective care delivery strategies, which include accurate and regular monitoring of key clinical indicators such as weight, glucose levels, and blood pressure, as well as the deployment of targeted guidance and information. These approaches are similar in that they are aimed at delivering patient education and communication support, ultimately achieving behavior modification in areas such as medication compliance, dietary discretion, and adherence to other aspects of a sound medical regimen.

While technological innovations provide new strategies with which to overcome limitations of traditional DM protocols, much of what determines the success and ultimate impact of technology-leveraged DM is not dependent on the technology alone but rests, in large part, in the hands of nurse care managers and their successful daily interaction with patients. Studies conducted on technology-based DM interventions combined with skilled nurse interaction have demonstrated enhanced health outcomes and decreased resource utilization in select patient populations. While these studies underscore the value of innovative methods for chronic care management, additional studies need to be conducted to assess the clinical, social, and economic impact of technology-leveraged programs and determine their suitability as a standard of care for the treatment of certain chronic conditions.

TRADITIONAL DM STRATEGIES

Expanding role of DM in the care continuum

Nearly a half of all Americans, almost 100 million people in the United States, report having one or more chronic conditions. As the population ages, this number will increase dramatically. By 2020, nearly 134 million Americans are projected to have a chronic health condition, and 39 million of those will be limited in their daily activities (Fig. 1).

The costs to the health care system for caring for the chronically ill are staggering. On average, people with chronic conditions cost 3.5 times as much to serve as others, accounting for 80% of all bed days and 69% of hospital admissions, 96% of home care visits, 66% of physician visits, 83% of prescription drugs, and 55% of emergency room visits.[4,5]

Recognizing that chronic illness accounts for three-quarters of the country's direct health expenditures, DM emerged as a way to effectively manage—in a coordinated fashion—consistency of care for ill and at-risk populations. Originated in part by pharmaceutical companies to encourage medication compliance, today a wide variety of DM programs are initiated by health clinics, managed care organizations, and health care providers.

DM programs now target a wide range of clinical conditions such as asthma, diabetes, coronary artery disease, congestive heart failure (CHF), and renal disease. In 2000 health plans spent about $360 million on DM, and this is expected to rise to over $510 million in 2002.[6] General enthusiasm for these programs among payers and purchasers of care has grown in response to marked frustration with the seemingly inexorable increase in health care expenditures over the last few years.[7] In addition, the customization of care support programs to match individual circumstances is consistent with increased "consumerism" in regards to health care, and an attempt by health plans to create and support member satisfaction.[8]

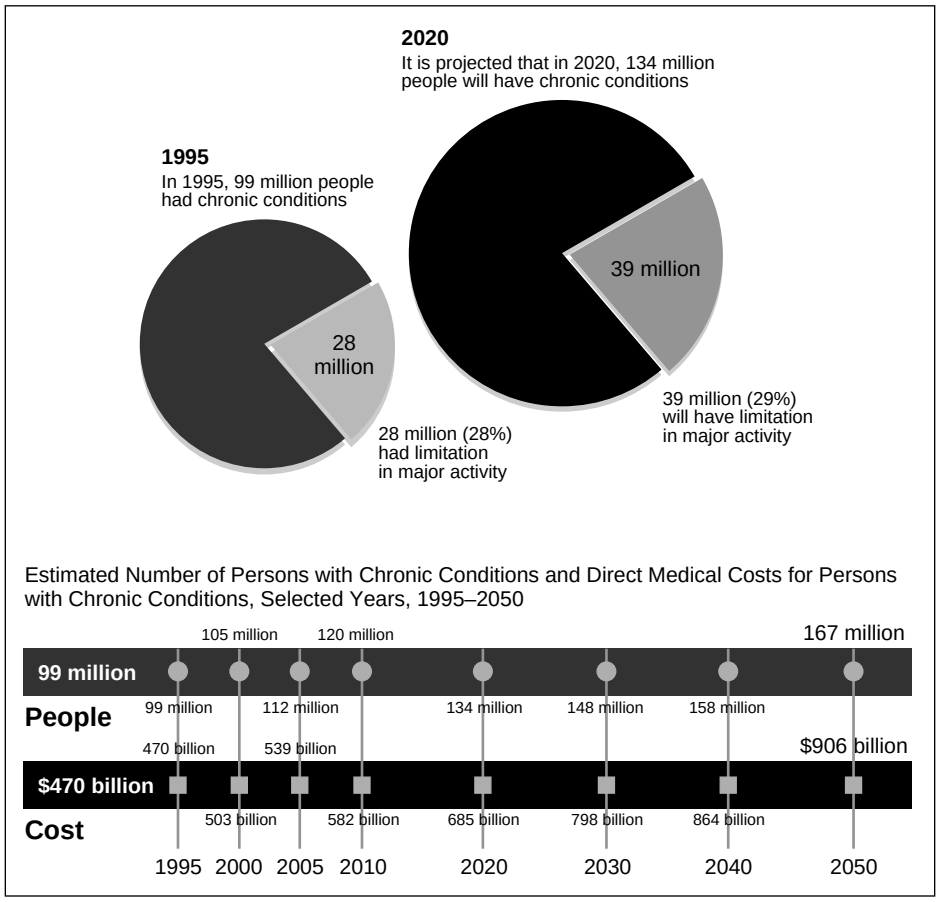

FIG. 1. Chronic disease impact. Reproduced with permission from Hoffman and Rice.[5]

Universal components of DM programs

Although widely varied at the detail level, almost all effective DM programs can be viewed as being composed of several linked modules, each of which contributes to the ultimate success of the program. These modules, which include candidate identification and stratification, enrollee recruitment, the intervention itself, and finally evaluation, form a process loop so that lessons learned are continually used to improve the quality of the programs delivered (Fig. 2).

At each of these stages, timely access by program coordinators to critical information is fundamental. Unless the candidate is identified at the appropriate time in the course of his or her illness and the clinical severity of the illness assessed, it is difficult to effectively match the DM intervention to the needs of the patient. Once identified, the patient still needs to be enrolled, again requiring knowledge as to how best to find and communicate with the potential enrollee. The intervention itself is typically a complex set of communication and support interventions that unfold over the time the candidate is enrolled in the program. In the best of programs, each intervention is customized and launched based on particular evidence-based guidelines that are relevant to the clinical and psychosocial parameters of each individual. This ability to provide customization efficiently and on a large scale, so that it has the look and feel of personalized care, is a program characteristic achievable with EIMT and often referred to as "mass customization."[6] Finally, continuous evaluation of the program in regards to its cost-effectiveness, enrollee satisfaction, and overall clinical impact needs to be a feature of the program design and not added as an afterthought. This requirement is best manifested as a capability inherent in the informational infrastructure of the program suf-

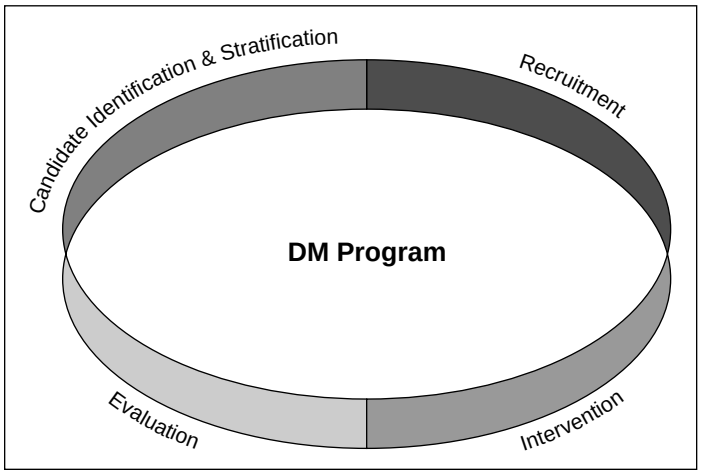

FIG. 2. Key components of DM programs.

ficient to collect key information, analyze it, and provide feedback to participants, program managers, and purchasers of the program.

Limitations in traditional DM

DM strategies include addressing the care needs of the chronically ill, optimizing prevention, and providing consistent and reliable education, evaluation, and intervention. While many traditional programs succeed in supporting long-term patient care, almost all are challenged by inherent limitations that lessen their impact on outcomes.

Standardized versus customized care. Most traditional DM programs are standardized, thus allowing large populations to be managed with one set methodology. However, many patients have illness parameters and experiences that lie outside the "norm." These patients may not always be well served through a standardized approach. The challenge many disease managers face is developing a care process that is standardized for efficiency yet customized for effectiveness, the same dilemma that physicians face in caring for their patients. For example, a new type II diabetic may not require the same program as an insulin-dependent diabetic. Consequently, access to baseline information regarding disease parameters on a patient-specific basis is a major factor in creating targeted and optimally effective programs.

Capturing the "golden moment." Another challenge faced is the lag time between patient identification and DM program initiation. The "golden moment" where patients are most likely to respond to behavior modification intervention is often lost if the DM program implementation is delayed. For example, initializing a smoking cessation program at the start of pregnancy captures the window of opportunity to impart important behavior changes when it is most likely to be effective.

Communication "silos" prevent integrated care. DM often encompasses prevention, acute care management, chronic care management, rehabilitation, and follow-up care. Most traditional DM programs, however, can only address one or two of these domains at a time. Gaps in communication between the "silos of care" often create barriers to effective long-term management. Key to successful integrated care is an approach that coordinates care and support being delivered at the appropriate time, by creating linkages between all participants in the care delivery process.

Frequent monitoring by nurses can be burdensome. Traditional DM is based on an educational model that encourages behavioral change and includes some kind of outreach to a population. Historically, nurse-initiated monitoring of key indicators such as blood sugar, blood pressure, and weight has proven too

costly and difficult to implement effectively. A DM program could, in concept, initiate telephone communication with a diabetic patient every day to encourage compliance to medication and diet on a periodic basis, but could drain program resources relative to the benefit achieved. Additionally, the lag time between gathering a patient's clinical information and acting on it makes daily monitoring ineffective. Therefore, most traditional DM programs focus on relatively simple education and outbound communication and lack the monitoring capabilities and objective clinical information required to fully customize the intervention to specific patient requirements.

With the increasing prevalence of technology-supported DM programs targeted at specific chronic disease populations, it is likely that we will now be able to better address the traditional limitations linked to limitations in information access and distribution. Consequently it is reasonable to expect that newer DM programs will overcome some of these limitations and better address the challenges of achieving clinical effectiveness and cost-effectiveness.

EIMT AND DM

Categories of information management in DM

It is useful to divide the types of information management requirements associated with DM into the categories of information gathering, information integration and analysis, and information deployment.

Information gathering. Timely access to relevant clinical, administrative, and logistical information is fundamental to effective program deployment. These information flows can be supplied automatically from already collected data such as health care claims and electronic medical records, assuming appropriate privacy and confidentiality precautions are taken. In addition, patients can supply subjective information in a cost-effective way by using a variety of methods, including direct data entry onto an interactive website, telephonically via interactive voice response methods, or by simply informing an interviewer telephonically who can directly enter data electronically into a system. All these approaches have benefits and limitations. Successful program design will fit the best information acquisition strategies to the particular types of information required.

Information integration and analysis: converting information into knowledge. Once information is acquired it needs to be analyzed to identify opportunities for effective intervention. If databases containing important information are not centralized into a single repository, a mechanism must be designed and implemented to allow data from disparate sources to be accessed and reviewed. Business rules, whether clinical, administrative, or logistical, can then be applied to the aggregated data, revealing opportunities for enhanced care management.

Deploying information and knowledge effectively. Simple awareness of an opportunity to intervene to improve patient care is typically only the starting point of improved management. The information management system must also support the program's requirements for notification, assessment of the impact of intervention, and the consequent distribution of these reports to appropriate parties. Multiple EIMTs support this requirement. Most notable is the convergence of the communication network. It is easy to imagine that, in the not too distant future, a robust nexus of electronic devices (handheld personal digital assistants, PCs, cell phones, etc.) and linkage technologies (landlines, wireless, LANs, WANs, etc.) will be instrumental in addressing the information and knowledge deployment requirement.

EIMT defined

This paper uses the term "Emerging Information Management Technologies" to refer not only to the Internet but also to a wide variety of information input and distribution technologies including biometric sensors, "query" devices that can be used to interview patients, and wireless handheld devices. In general, these new technologies have in common their ability to manage the collection and distribution of information.

Table 1 summarizes the leading categories of EIMTs and some of the companies offering services in each category. The list is intended to be illustrative, not exhaustive.

EIMT and DM: overcoming limitations

New technology-leveraged DM models are already providing potentially powerful solutions to many of the limitations of traditional DM programs identified under Limitations in traditional DM. In fact, the ability to deliver some of the capabilities identified below have become major drivers of program effectiveness.

Personalized outreach. EIMTs provide various communications channels for programs including phone, Internet, cable TV, and print. Software further supports customized program outreach and care, delivering highly personalized information in a timely and convenient way.

Instant program deployment. Patients can be profiled at the outset, and programs can begin immediately to leverage the "golden moment" principle. Rapid integration of new information, including patient preferences, also adds to the programs' customization and appeal.

Table 1. Emerging Technologies and What They Support

Emergent technologies	*What they can do*	*Representative companies*	*Web addresses*
Static web sites	Disseminate disease-specific information to a broad patient audience	WebMD Disease-specific associations (e.g., American Diabetes Association, American Cancer Society)	www.webmd.com www.diabetes.org www.cancer.org
Interactive web sites	Create a community information platform to share and disseminate information between providers and patients and to push educational information to targeted populations for specific disease categories	Care Wise, Inc. Caresteps E-Diets	www.carewiseinc.com www.caresteps.com www.ediets.com
Biometric devices	Home-based measurement devices used to monitor and collect daily readings and symptom information (e.g., digital scales, glucometers, and airflow meters). Once collected this information is uploaded via telephone or the Internet to a DM provider such that caregivers can access patient data through a standard browser and desktop PC	Alere Medical, Inc. Health Hero Network iMetrikus LifeLink Monitoring	www.alere.com www.healthhero.com www.imetrikus.com www.lifelink.com
Handheld devices—such as personal digital assistants (PDAs)	Allow patients to track daily progress such as weight and medications taken. Patient records information and uploads the data to a care manager via telephone or a PC	Personal Health Technologies	www.phtcorp.com
Connectivity-facilitated workflow management	Deployment of clinical and administrative workflow support through web-based connectivity among health plans, physician offices, and hospitals. Allows the customized delivery of alerts, guidelines, reminders, and other targeted information in real time at the point of care	NaviMedix	www.navimedix.com

Seamless coordination across the care continuum. The web allows multiple databases to be sourced simultaneously, including drug claims, clinical events, and lab data, allowing seamless communication throughout the acute and chronic care process. Caregivers and nurse case managers can act in a coordinated fashion to best meet the needs of the patient.

Rigorous daily monitoring. New technological devices provide a way to remotely monitor biometric information, moving the traditional DM concept from behavior modification only, to include daily monitoring of key parameters. Incorporation of timely clinical information increases the ability of the program to recognize opportunities for intervention and react quickly.

HOME-BASED BIOMETRIC DEVICES AS AN EXAMPLE OF EIMT

A full review of the entire spectrum of emerging information management currently being applied to DM is beyond the scope of this paper. One of the more promising advancements in DM is the utilization of remote biometric measuring and monitoring devices in the home. Because these devices facilitate timely information exchange and concomitant behavior modification, we have chosen to focus on them by way of example of the improvement that can potentially be achieved through broader information management technology utilization in DM.

Breakthroughs in microprocessor technology have allowed the design of small, portable, and inexpensive sensors that measure a wide range of objective clinical indicators from the convenience of a patient's home. Today, everything from blood pressure to glucose levels and weight can be monitored via sensitive devices that also have built-in response capabilities to send information directly to data stores for clinical evaluation. The gathering and distribution of this clinical information in a reliable, low-cost way open up new opportunities to support the behavior modification process.

Examples of EIMT and DM in the home

U.S.-based Alere® Medical, Inc. (Reno, NV) is a care management and technology company that has patented the AlereNet™ system to remotely monitor and care for patients with CHF. The AlereNet system provides an at-home technology that enables the collection and exchange of biometric and symptomatic information between patients and caregivers. Patients initiate the monitoring process each morning by simply standing on the DayLink® monitor located in their home. A phone line to the Alere Network automatically transmits the information to a central call station monitored by cardiac-trained nurses who analyze trends that may reveal a change in the patient's health status. If indicated, the patient's doctor is notified, and the need for clinical intervention is assessed before a serious and costly intervention, such as an emergency room visit or hospitalization, is required. Additionally, AlereNet helps patients adhere to their physician-prescribed health regimen including medications and weight management, and patients take comfort in being "connected" on a daily basis.

Similar to the way Alere has melded personal care management, the web, and device technology, other innovators in CHF, asthma, diabetes, and weight management have useful offerings. Among them is iMetrikus (San Diego, CA), a personal communications company that monitors asthma, diabetes, and cardiovascular disease. For asthma, their AirWatch Monitor™ tests airflow and also acts as a modem to transmit patient data to iMetrikus.com, a website where data are automatically organized and available to patients and their care givers. Similarly, for diabetes, a patient's blood glucose information is measured and uplinked into a collaboratively available data repository. One aspect of this approach is that patients rely on their own judgment to evaluate the data and then alert their doctor if a negative pattern emerges. Alternatively, patients could rely on their doctors to perform timely review of information.

Another company, Health Hero® (Mountainview, CA), provides a communications infrastructure that connects health care professionals and patients. Their Health Buddy®

appliance has an easy-to-use, very readable screen that asks patients questions about their condition. Information is automatically downloaded, risk-stratified, and available to health care managers via the HealthHero iCare Desktop™ monitor. With this approach, all of the patient information is self-reported; thus the data are subjective and may be less accurate than true biometric sensors. This system requires patients to be linked to care managers who must assist with monitoring as Health Hero does not provide in-house care managers to help assess the information and coordinate follow-on activity.

Combining "high tech" and "high touch"

The trend we see emerging is the proliferation of technology-leveraged DM programs. Of critical note, however, is that while the Internet and biometric devices prove useful and efficient for collecting and sharing information, it is not the technology alone that drives a program's success. All the technology in the world cannot replace the human element in the care management mix. The opportunity for early intervention is only possible if a trained clinician is available to evaluate accumulated data, including biometric, symptomatic, and historical information. In the Alere model, for instance, if monitoring reveals an increase in weight, a cardiac-trained nurse places a call to the patient to troubleshoot and assess whether weight changes were related to CHF, or perhaps overindulgence. Effective DM identifies situations that exacerbate the condition and captures them before they escalate into an emergency situation. Home-based biometric monitoring is simply a tool for monitoring pathophysiologic parameters more effectively and is an important component of the crisis prevention mix. It is not a replacement for human intervention and communication, but rather a means to better support it.

EIMT as support for sustainable patient-empowering behavior change

A growing body of scientific literature and studies is showing that by actively participating in their own care process, patients achieve valuable and sustained improvement in their emotional lives, physical well-being, and their daily functioning.[9] The use of EIMT is making it possible for patients to build new practices and routines (eg, monitoring daily symptoms) around their illness, in a sense changing their perception of control in managing it.[10]

For example, by routinely monitoring a symptom and speaking with a caregiver, patients feel connected, cared for, and attended to. When the patient forgets to monitor his or her symptom, the caregiver is there to provide immediate feedback, check in, find out what is happening, and encourage the patient to resume his or her medical regimen. As a result of these new routines, patients feel empowered and a greater sense of mastery over their health. Sustainable behavior change, as the literature shows, requires not only an awareness of and desire for a new behavior, but more importantly, the introduction of new practices for changing the behavior combined with a belief that change is possible.[11] Effective DM that utilizes EIMT can clearly support this aspect of collaborative care management, by linking the patient to the care manager. Moreover, it is interesting to speculate that perhaps the change in daily routine introduced by the use of EIMT-based monitoring actually changes the patient's relationship to his or her illness, resulting in increased motivation for improved self-management.

THE ALERE AND PACIFICARE CASE STUDY ON CHF MANAGEMENT

Alere Medical, Inc. develops and deploys home-based biometric sensing devices and associated communication platforms and strategies to support DM in heart disease. Alere's corporate goal is to keep the most severely ill patients with CHF out of the hospital (R. Geraty, personal communication). As outlined above, they achieve this by combining a "high tech" state-of-the-art application of EIMT with the "high touch" of a nurse-managed outbound call center. In order to provide a useful case example, we will present a brief review of CHF and its management, outline the Alere approach to the use of home-based biometric monitoring and automated patient engage-

ment as an example of EIMT, and present outcomes from the Alere program deployment in two distinct patient populations.

Introduction to CHF and its management

CHF is a disorder affecting a significant number of people, and represents a large and rapidly growing area of expense for health insurers, including Medicare.[12]

Fortunately, it is now clear that the introduction of organized support programs that reinforce careful attention to medication and diet can generate improvements in symptoms and other disease parameters. Recent trials have also demonstrated a concomitant improvement in the quality of life for patients as well as a significant reduction in the use of resources required for their care. These programs typically involve the traditional approach to DM that combine the development of evidence-based guidelines with an outbound communication strategy, typically involving telephone-based nurse interaction with the patient.[13,14]

The Alere approach, as described below, builds on this basic platform, but adds certain elements of EIMT in the form of home-based biometric monitoring and interactive communication. A brief description of the AlereNet system and its "real-life" deployment follows, as does a summary of outcomes obtained in a typical patient population under active management.

The Alere/PacifiCare approach

For CHF, there is no question that early detection of symptoms provides the ability to uncover and respond to clinical situations that might otherwise lead to urgent care events (eg, emergency department visits, hospitalizations). For example, an increase in body weight in CHF might indicate fluid accumulation in the lungs, even before the patient has a symptom such as shortness of breath. PacifiCare Health Systems has been working with Alere since December 2000, and has demonstrated that prompt intervention during this pathophysiological "window of opportunity" can have significant payoffs.

PacifiCare is a large, western-U.S. managed care firm whose Secure Horizons membership constitutes the largest Medicare+Choice (Medicare HMO) plan in the country. PacifiCare began rapid implementation of a full DM portfolio coincident with taking back risk from previously capitated hospitals and provider groups. After identifying that end-stage renal disease, CHF, coronary artery disease, and chronic obstructive pulmonary disease were accounting for 90% of the costs of the top 5% most expensive senior members (which group comprised 58% of total costs for the senior population at risk), PacifiCare expedited its due diligence and contracted for these four DM programs within 6 months. For CHF, this decision was aided by a comparative study of four on-

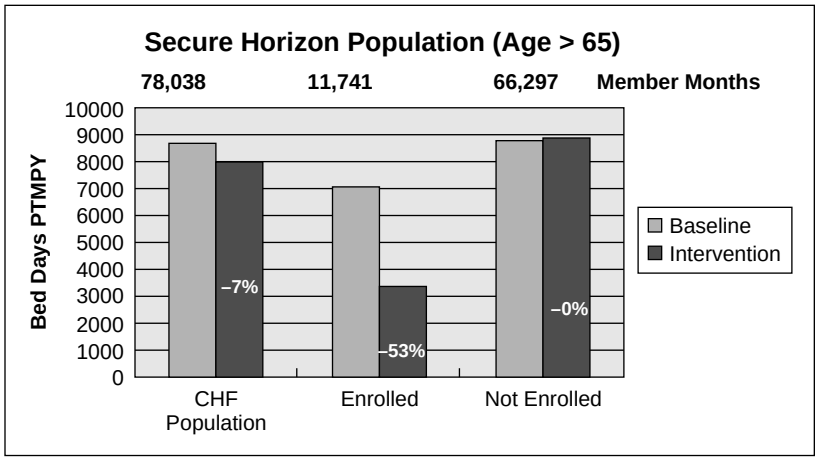

FIG. 3. Secure Horizon population CHF-related bed days PTMPY, per thousand members per year.

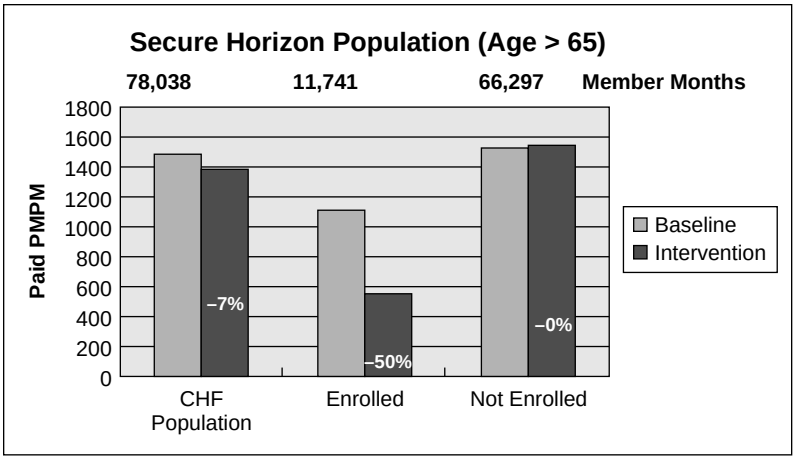

FIG. 4. Secure Horizon population CHF-related payments PMPM, per patient per month.

going approaches to CHF DM then being undertaken in four different PacifiCare markets: two using external vendors, one using internal case management, and one taking a hybrid approach with internal and external partners. Alere was the top performer in this comparison, offering convincing "proof of principle" for their unique approach to CHF DM via their proprietary Daylink monitors.

In December 2000, PacifiCare implemented Alere's DM program in two distinct patient populations: the Secure Horizon population (>65 years) and the commercial population (<65 years). Prior to implementation, baseline metrics were calculated for the entire "at-risk" pool of selected cardiac patients in each population. The "CHF disease" population was defined as members with ICD-9 or CPT codes indicative of CHF. The Secure Horizon CHF population (Figs. 3 and 4) included 78,038 member months, and the commercial CHF population 7,477 member months (Figs. 5 and 6). For a 12-month period beginning December 1999 through November 2000, two baseline metrics were established through retrospective analysis: one for direct resource utilization [hospital days per thousand members per year (PTMPY)] and one for costs [paid per member per month (PMPM)].

The initial intervention period covered 12 months beginning December 2000 through November 2001. In addition to patients enrolled in the program, a control group of CHF patients not actively enrolled was also monitored for

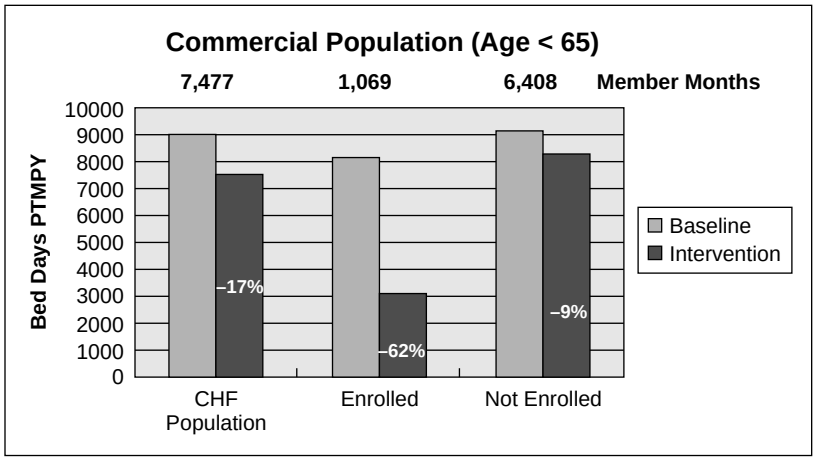

FIG. 5. Commercial population CHF-related bed days PTMPY, per thousand members per year.

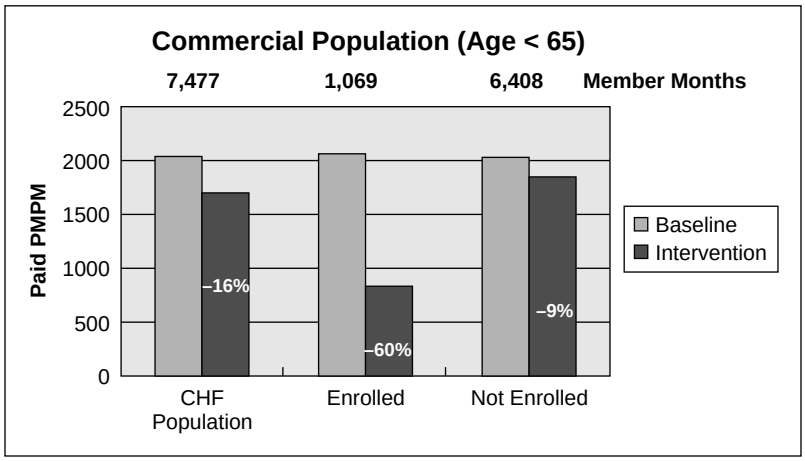

FIG. 6. Commercial population CHF-related costs PMPM, per member per month.

comparative purposes. In addition to the use of a Daylink monitor in the enrolled members' homes to allow for daily weight and symptom assessment, Alere cardiac-trained nurses also assessed patients' understanding of their condition and treatment, self-care skills, diet, and medication compliance. This established a relationship with these members to facilitate future education and monitoring. When unexpected weight changes or symptom scores indicate potential clinical deterioration, members' physicians are immediately notified by fax or phone, and the member is called and urged to seek appropriate same-day or emergent care.

Outcomes

In the Secure Horizon population, CHF-related bed days PTMPY were reduced 53% compared with 0% for the not-enrolled population and 7% for the entire CHF population (Fig. 3). A reduction was also measured in paid PMPM costs, which decreased 50% compared with 0% for the not-enrolled population and 7% overall (Fig. 4).

A similar degree of utilization and cost reductions was found in the commercial population as shown below. Days PTMPY were reduced 62% compared with 9% for the not-enrolled population and 17% for the entire CHF population (Fig. 5). Paid PMPM costs decreased 60% compared with 9% for the not-enrolled population and 16% overall (Fig. 6).

In summary, the initial 12 months of outcome data are dramatic, showing a range of 53% and 62% reduction in days for the Secure Horizon and commercial patients enrolled in the respective programs, and a 50% and 60% respective reduction in costs. These findings are particularly notable considering that a non–intervened-upon control group, similar in all other respects to the intervention group, provides a baseline adjustment to assess regression to the mean. Member testimonials regarding the positive impact of the Alere program on symptom levels, functional status, and enhanced member/caregiver security have been abundant.

PacifiCare is also working to determine when to refer members out of disease-centric DM programs into broader-based active case management, as well as planning to bring sophisticated predictive modeling into the candidate identification process to identify eligible members even prior to their initial hospitalization.

CONCLUSION

As the worldwide population ages and breakthroughs in acute medical management lead to longer patient lives and higher incidence of chronic disease, the importance of having effective DM programs is clear. Medical management is increasingly coming to

mean chronic DM, and facing this new challenge, emerging technologies will continue to have a sustainable and enduring role. Despite the fact that percentage of gross domestic product related to health care in many European and other countries is less than that in the United States, growth of chronic disease prevalence has received the attention of policy makers worldwide, and as a consequence, meaningful interventions to control resource expenditure on managing these diseases will be of importance globally.

We continue to see evidence that improved coordination of the management strategies associated with chronic diseases treatment makes sense and can be effective.[15] As the potential positive social, financial, and personal well-being impact of these approaches emerges, the spotlight will remain on DM as a critical aspect of the future of health care. New technologies will help to address some key public health challenges faced in population-coordinated care. The key benefit of combining EIMT and DM is that information can be collected and distributed cost-effectively and in time to address clinical needs.[16] However, objective analyses are limited, and the challenge remains to differentiate and test the incremental value of technological offerings and justify the continued investment in them.

The driving factor behind technology-leveraged disease management is the ability to transform the way information is gathered and exchanged, relationships are built and maintained, and action is coordinated. The ideal technology-leveraged DM program combines both front-end information sharing, where patients interact to gain or exchange information, with a back-end aspect that acts as an automatic communications facilitator and transmits information into the hands of someone who can evaluate it in time to make a difference. Additionally, there need to be features of interactivity, such as telephone follow-up or two-way electronic messaging, to solve problems along the way.

When will EIMT-leveraged DM become commonly accepted? One clear and growing trend is the number of health care professionals who are becoming more facile and familiar with these technologies as they are being utilized in a variety of ways. For many of these professionals it is now a usual and routine part of their day to be online both completing medical as well as executing personal tasks. These information-mediated activities may be as diverse as accessing medical information relating to new therapeutic modalities, booking airline tickets, and checking on stock portfolios. Many are even using handheld devices daily as practice management tools, and while the Internet has not penetrated the medical office the way it has banking or travel, physicians, allied health personnel, and their support staffs are slowly but surely moving in the direction of technological integration, including medical records and insurance transactions.[17]

DM is still in its infancy, with growth anticipated. It is our view that the application of EIMT to DM will continue to grow, positively impacting the health and quality of life of patients with many diseases, while helping insurers and care providers manage their most challenging, expensive, and fastest-growing population, the chronically ill.

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