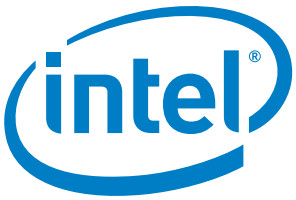

White Paper

Intel Digital Health Group

Personal Health Systems

Addressing the Challenges of Chronic Illness with Personal Health System Technology

Executive Summary

A number of trends, such as an aging population, an increasing number of people with chronic conditions, rising healthcare costs, and a desire to age in place, are creating a major impetus to delivering more care at home. These trends will increase strains on healthcare systems around the world, especially because many of those systems are geared to treat acute conditions on an episodic basis. Chronic care, on the other hand, calls for a preventative approach that treats illness on a long-term, continuous basis.

Personal health system technology is poised to play an important role in addressing many of the issues that will be facing healthcare in the coming years. It can aid clinicians and caregivers in monitoring patients with a single chronic condition or various comorbidities and ensure smooth communication of appropriate information on a timely basis among all the people involved in a patient's care.

Personal health systems work well for a number of chronic conditions, such as chronic heart failure or diabetes. They can do this by encouraging and supporting productive interactions between informed, activated patients and caregivers on the one hand and a team of prepared, proactive clinicians on the other.

Introduction: Where We Stand Now

Chronic conditions affect roughly 133 million Americans today and account for more than 70% of total U.S. expenditure on healthcare. By 2020, that number will rise to 157 million. In Europe, the situation is similar: chronic conditions account for more than 70% of the disease burden. Managing the health of people with chronic conditions is therefore a clear clinical, financial, and human imperative. In most cases, homecare for patients with chronic illness is preferable to institutional care because it provides autonomy and comfort to patients and keeps medical costs down. (Anderson 2004, HHS 2004; WHO 2006)

The great trend associated with the growing number of older people is that more care is being delivered at home, the result of push-pull forces at play. The push is that for some time now, hospitals have been reducing their average length of stay. Because hospital stays are expensive, health plan administrators look carefully at the marginal value of each additional day spent in the hospital, asking themselves what the costs of an additional day's stay in the hospital are, and, for each procedure, what the benefits are. At the same time, hospitals are also acting as sentinels, redirecting people with less serious medical conditions to sites where they can be treated on an out-patient basis. For people over 65 (80% of whom have at least one chronic condition), the cost of providing healthcare ranges from three to five times what it is for patients under 65. (CDC/Merck 2007) For all these reasons, cost is a driving consideration.

There is also a pull that is keeping people at home: more people prefer to have their care delivered at home. In one major survey, more than 90% of those 65 and older preferred to stay in their current residence. (Bayer 2000, Lawler 2001) Certainly, there can be a financial aspect to this, but in many cases people want to maintain a degree of independence that characterizes their life at home but not time spent in a hospital. Perhaps as important as any financial pressures here are the personal costs: many people feel anxious or otherwise ill-at-ease in a hospital. The upshot of all of this is that more and more people are staying at home while managing their illnesses. This is true both for post-acute recovery as well as for longer-term chronic illnesses.

The Perfect Storm

These financial and personal preference considerations suggest why home healthcare is important, but they don't capture the full impact of what could be described as a "perfect storm," a confluence of various events that are having a significant effect on healthcare. One component of this "perfect storm" is the Age Wave, the aging of the generation of baby boomers born in the twenty years after World War II. (Dychtwald 1989)

Though the effect of the Age Wave is more pronounced in some places than others (the United States suffered fewer casualties than many European countries, for example), people in general are living longer, and that means that more of them will have to live with chronic conditions. As Baby Boomers age (all of them are now over 40) many are already at retirement age and are requiring more healthcare. Not only are they requiring more healthcare, but, having lived through a period of great medical advances, they have great expectation for the healthcare they will receive.

The effects of this Age Wave will be enormous. Whether in Europe or the United States, the absolute number of people 65 and older is increasing, and as the Baby Boomers age, the portion of the population over 65 will also increase. (CDC/Merck 2007) As this group retires, there will be a decrease in the availability of experienced nurses, physicians, and other healthcare professionals to take care of them, since many of the experienced nurses, etc., are Baby Boomers themselves. One estimate, for example, projects the 6% shortage of nurses that existed in 2000 to rise to 20% by 2015. (HRSA 2002, Cooper 2004) In fact, many of those retiring will be adding to the population

with chronic conditions. Of course, chronic illnesses do not affect an older population exclusively, but they do affect this population disproportionately, and the longer people live, the greater the chance is that they will have a chronic illness.

Comparing Healthcare Systems: US, UK, and France

Comparing different healthcare systems can be a difficult task. For example, both the UK and France have single-payer systems, while the US, alone among developed western-style nations, relies on a number of discrete private sources to provide healthcare coverage; government coverage is for the old and the young only. Therefore, the UK and French systems are more like each other than either is to the American system, right? Not necessarily. While France has a single-payer system for basic healthcare, under which everyone has some basic healthcare coverage (*securite sociale* or *assurance personelle*), the French system relies to a great extent on private health insurance plans to supplement or compliment the government mandated coverage. In fact, many in France dismiss the UK system as "socialized medicine," by which they mean both a single-payer system and a system in which the terms of healthcare are set by the government. In part, because of the supplementary private coverage used there, France does not have the waiting lists characteristic of Canada and the UK. Advanced industrialized countries are generally similar in having very low infant and adult mortality rates, but they can differ in their rates of particular conditions, such as diabetes. All of them have aging populations that will require more and better management of chronic conditions, and personal health system technology is designed to meet the management challenges of the full spectrum of such conditions.

Another component of this "perfect storm" is the well-known fact that healthcare costs are high and are rising. In the United States, the situation is particularly pronounced, since, on a per-capita basis, Americans pay more for healthcare than anyone else—roughly twice as much as Canada, France, Germany, or the United Kingdom. (CRS 2007)

Healthcare costs are a concern everywhere, however, and health system administrators are looking for ways to lower, check, or slow down rising expenses. In addition to demographic and financial trends affecting healthcare, there are some long-standing features of the system that place considerable burdens on the delivery of chronic care services. The most important of these is that healthcare today is generally designed to treat people with acute problems or episodes; it is not designed to manage people with chronic conditions. This orientation can have serious consequences, because people with chronic conditions use a disproportionate share of healthcare resources.

Moving Care to the Home: A Mandate

As the number of people with chronic conditions increases and as more care moves to the home, home healthcare becomes a mandate, not just something that is nice or desirable to have. In other words, to appropriately respond to the healthcare needs of the Age Wave, we will have to provide care in the home—as a financial necessity, as well as a medical, staffing, and social necessity. We can expect this mandate to create its own call to action: getting the right information to the right people at the right time. The right information will take a variety of forms: traditional medical measures, such as blood pressure, glucose levels, weight, as well as more subjective measures, such as mood or affect; in addition, educational and motivational content can be offered to customize and integrate the care. The right group will include patients, first of all, along with physicians, nurses, case managers, and family members, who are able to coordinate their efforts because they are able to share that information at the appropriate time with the appropriate people.

The Potential of Technology: A Congestive Heart Failure Example

Hospitalization for heart failure is expected to cost $18 billion in 2007. In Congestive Heart Failure (CHF), the heart is unable to pump enough blood to the body's other organs. Classic signs and symptoms of heart failure are shortness of breath, fatigue, and fluid retention, which sometimes leads to congestion in the lungs and edema in the legs and ankles. CHF patients typically have limited mobility, since physical exertion is fatiguing, so they are therefore often homebound, making homecare solutions highly desirable. Personal health systems technologies may now offer the hope of doing the impossible — monitoring multiple patients on a day-by-day, even hour-by-hour basis. Using personal health systems will allow patients, clinicians, and care providers the ability to manage multiple comorbidities, maximizing the benefits of complex drug therapy while reducing the risks associated with polypharmacy. In addition, as the American Heart Association has concluded, "of the general measures that should be used in patients with heart failure, possibly the most effective yet least utilized is close attention and follow-up." Personal health systems represent a way of providing that attention and follow-up. (Hunt 2006)

Responding to this call will entail some changes in the way things are currently done. Anything that can help people take a more active role in the management of their own health will benefit all who are involved, especially because the patient is often the first to observe or suspect a change in his or her own health status. With patients becoming more engaged and active in their own health management, clinicians, physicians, and nurses can extend their reach and effectiveness. At the same time, healthcare workers will need to become better prepared to handle patients with chronic healthcare issues, and that includes being more proactive—anticipating the needs of chronic care patients, rather than just reacting to acute episodes as they occur.

The question is, how can this be done? To answer this, let us first look to how care for chronic conditions is being delivered now, in the midst of the "perfect storm," and then try to understand what a solution might look like.

How Care is Delivered Now

Consider how home healthcare for patients with chronic illnesses is being delivered today. Many modes of home care are currently used, such as using phone calls to check in on people, the use of extensive health status surveys, the application of electronic devices that provide remote patient monitoring, as well as on-site examinations and hands-on care by home health nurses. During such visits, the nurse might monitor the patient's vitals signs (such as blood pressure, heart rate, etc.), check on prescriptions, or inspect the safety of the home.

These methods accomplish important tasks, but they can involve a number of limitations. For example, telephone-based programs have an obvious appeal because of their relatively low cost, but some of the cost savings disappear when well-paid nurses spend much of their time just trying to connect with somebody instead of providing the care they're trained to deliver. Furthermore, in comparison with care management programs that are designed to accommodate more than one condition, phone-based programs are generally less successful. And while the use of visiting nurses to monitor patients in their homes may be less expensive than having them come into the office, it is still a time- and labor-intensive undertaking. (Fonarow 2004, Wagner 2004)

Another limitation of this approach is that it is not scalable: one nurse can visit and monitor only one patient at a time. With nursing shortages affecting many healthcare systems, this is not a financially or medically sustainable approach. It is also not a particularly interactive approach, because of time constraints it places on the nurse. If the nurse has a survey or a set of particular questions for the patient, for

example, she or he may feel time constraints to move on to the next appointment once they've acquired the information about the patient requested by the survey. There may often be little time for fruitful back-and-forth between nurse and patient.

Fortunately, there are alternative models that address many of the limitations of current systems.

Personal Health Systems and the Chronic Care Model: A Framework for Improved Care

The most well-developed and perhaps highly regarded framework for dealing with chronic care was formed nearly ten years ago by Dr. Ed Wagner, of Group Health Cooperative in Seattle, Washington. [See Figure 1] In Wagner's model, the best care for patients with chronic conditions, such as diabetes or coronary artery disease, takes place within a system in which community resources and health systems are properly coordinated. Under this plan, informed and engaged patients work closely and productively with prepared health teams that are able to anticipate and respond to their patients' needs in a timely way. This model was created in part as a response to those frequently found health management models that focused on costs over health outcomes, and on reviewing utilization rather than employing clinical sophistication. [See Table 1] (Wagner 1998, Wagner 2000)

The promise and the limitations of nurses' home health visits highlight the need for more flexible, expandable, scalable, interactive, and comprehensive solutions to the healthcare needs of people with chronic conditions. This is a place where a personal health system can make a significant contribution, helping patients and healthcare professionals weather the perfect storm of increased chronic illness, rising costs, and limited resources with its scalable, expandable, flexible and interactive features. By providing patients with the means to monitor their conditions, with interactive materials that can educate them on their conditions, and with a way to communicate with family members, physicians, nurses and others, personal health systems allow patients to take a more active role in the management of their own condition. The advanced communications tools connect the patient, clinicians and caregivers – through video conferencing, email, and alerts.

Most importantly, perhaps, adoption of personal health systems can support the Chronic Care Model advanced by Dr. Wagner. For one thing, it helps activate patients and caregivers by offering an in-home solution that can adapt to their particular circumstances. It can also provide educational content appropriate for the condition or conditions they're working with.

Traditional Health Management Model vs. Chronic Care Model	
Traditional Model	Chronic Care Model
More important to focus on reducing costs than on improving health.	Priority should go to improving health outcomes—this will drive down costs in the long run.
Patients causing the highest expenses should be given priority over others.	Priority should be given to preventive measures in the chronic care population, since costs for a given chronic care patient can vary from year to year.
Case managers who have a singular focus and are good at monitoring utilization, are best suited to manage chronic care patients.	Because of their training and clinical sophistication, PCPs are best suited to manage the care of patients with chronic conditions, especially patients with comorbidities, who represent a large portion of chronic patients.

Table 1.

While helping to activate patients, personal health systems also help prepare the clinical care team by providing them with real-time information about their patients. This includes the kind of information routinely communicated by remote patient monitoring devices, such as blood pressure, blood sugar, weight, and so on, as well as other pieces of information that can be particularly useful for clinicians looking to develop a more complete picture of their patients. This can include information about how a patient is feeling—sad, energized, lightheaded, confused—as well as information about what the patient has been doing, such as what they have eaten or whether they have exercised.

What allows a personal health system to do all this is that it has the right tools—individual objects that perform specific tasks—that are useful each time a particular individual task needs to be performed. What makes a personal health system a more flexible and sophisticated approach to managing chronic conditions is that it provides a systematic approach to managing chronic conditions that takes into account multiple aspects of patients' lives, including their medical status, social interactions, personal preferences, mobility, and so on. Because its tools activate patients and prepare clinicians, a personal health system can contribute to and support the truly productive interactions between patients and healthcare workers that lead to improved functional and clinical outcomes that are the goals of the Chronic Care Model.

Conclusion

Many trends are converging to encourage more healthcare being provided in the home. These trends include increasing healthcare costs, a growing population over 65 years old, more people with chronic conditions, a decrease in the supply of medical practitioners, and a growth in the number of people with comorbidities. Overall, patients with chronic conditions are significant consumers of healthcare resources.

Although these complex chronic conditions can't be cured, they are compatible with home-based self-care, which could be enhanced through an interactive personal health management system. Personal health systems can be used for this growing population to monitor patients' vital signs, educate members of the care team, and to communicate between the patient's home and the clinician's office. The benefits can include better responsiveness, increased prevention, and improved use of resources. Personal health systems also support the Chronic Care Model, which places an emphasis on outcomes over cost-reduction measures, on the expertise and experience of physicians over case managers, and on prevention over reactive episodic care.

Personal health systems could be a tireless and ever-patient provider of continuing education for patients and caregivers. In sum, an interactive personal health system could work around the clock to improve the overall quality of care for patients with serious chronic conditions.

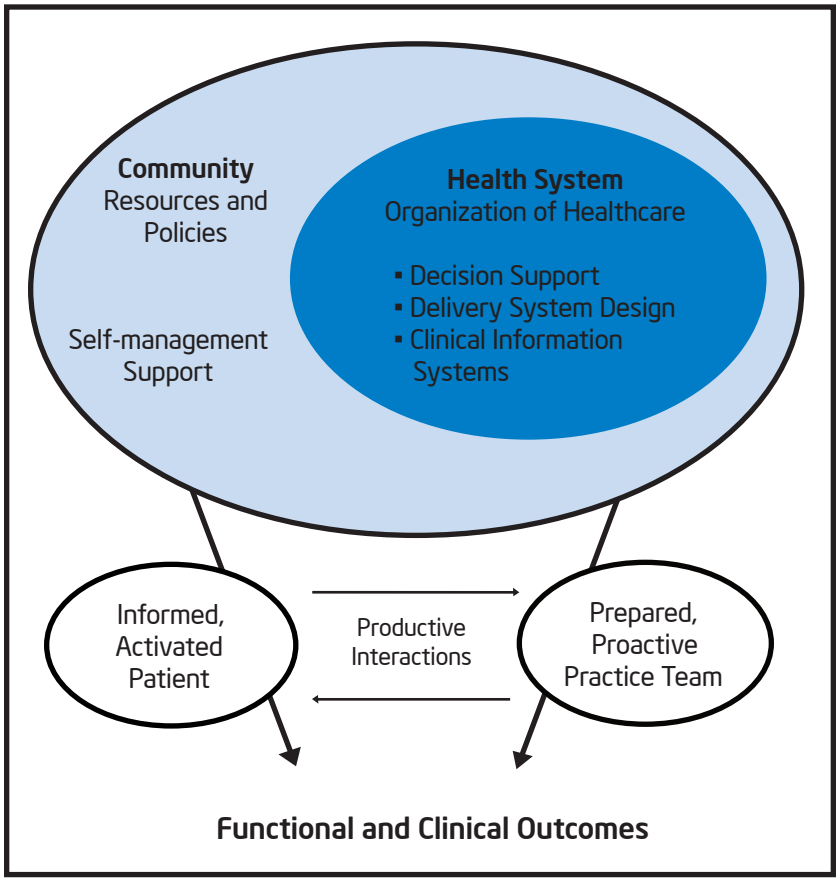

Figure 1. Wagner's Model for Improvement of Chronic Illness Care. Adapted from Wagner 1998.

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