Executive Summary

The U.S. health care system is facing a convergence of serious trends that are threatening the viability of the nation’s entire economy. The current consumption rate of health care services is approximately 17 percent of the Gross Domestic Product (GDP) and is expected to increase to 20 percent by 2013. 76 million aging Baby Boomers are heading toward retirement and with them will come increased demand for health care services related to advancing age and chronic disease along with a continuing shortage of skilled health care labor. This emerging perfect storm will require fundamental transformation of the current system with innovative solutions to meet the discrepancies between supply and demand. Because chronic disease constitutes roughly 75 percent of all health care spending, any approach to care delivery must integrate the realistic challenges faced by chronically ill individuals. The current health care system is driven by a reimbursement model structured for acute care needs. This model features fragmented and episodic care with lack of transitional support and little time on the part of providers to help patients manage the complexities of a lifelong chronic condition. Studies show that approximately 50% of patients with chronic disease do not obtain optimal clinical benefit because of poor compliance with medication and recommended treatment. There is strong evidence correlating the lack of compliance with poor clinical outcomes, increased risk of hospitalizations, lower quality of life and higher overall health care costs.

Educating patients related to health care treatment and interventions is not a new issue, but the challenge for patients is that regular and consistent adherence with recommended care is difficult. The co-morbidities and treatments associated with chronic illness are time consuming and complex, yet there is insufficient time and resources within the overburdened healthcare system to provide effective instruction and oversight. Case Management has always placed a high value on informing patients and caregivers about their options and assuring that patient educational needs are considered. In fact, disease management owes its emergence as a health care standard to the concept of educating patients about their condition resources within the overburdened healthcare system to provide effective instruction and oversight. Case Management has always placed a high value on informing patients and caregivers about their options and assuring that patient educational needs are considered. In fact, disease management owes its emergence as a health care. Financial savings assumptions associated with disease management are based on the expectation that patients will take active role in their own care. However, Care Management and Disease Management initiatives have shown only modest improvements in quality indicators and patient satisfaction, with few programs showing statistically detectable improvements in self-care. Moreover, these programs have not met cost savings objectives.

Outcomes analysis from the Medicare Coordinated Care Demonstration (MCCD) showed that one of the primary causes of avoidable utilization is poor adherence to drug, diet and self-care advice resulting from ineffective communication between patients and providers. The analysis reviewed 15 care management and disease management programs. It concluded that most successful care management programs include a strong patient education component combined with a proactive approach to preventing medical problems through integrated relationships between patients and case managers (Mathematica 2007). The emerging theme to come the out of the MCCD is that any approach to managing chronic illness requires more that just providing patient education. It requires intervention strategies to change behavior, emphasize self management skills and improve communication with health care providers. This type of approach requires a bi-directional relationship where patients assume a greater role in identifying concerns and communicating with their healthcare providers along with providers delivering the recommended interventions. Care Management initiatives must offer not just disease knowledge, but
a strong element of coaching with the goal of empowering the patient by increasing his or her self-efficacy in overcoming the many barriers to achieving success.

*Self management is defined as the individual’s ability to manage the symptoms, treatment, physical and social consequences and lifestyle changes inherent in living with a chronic condition.* Interactive monitoring technology provides for the examination of data recording as a result of the actual task itself which in turn leads to actionable solutions specific to the patient’s needs. It is logical to conclude that a monitoring parameter such as blood pressure or weight recorded on a regular basis by the patient or caregiver outside the structured professional environment provides a more realistic picture of disease control. Self-monitoring of data such as capillary blood glucose, blood pressure, respiratory peak flow and daily weight allows patients to make adjustments in response to dietary and activity variations, medications or symptoms suggestive of a deteriorating condition. Remote monitoring of physiologic parameters combined with “just in time” coaching provided by care management nurses helps patients assimilate the critical skills they need to take control of their illnesses and make sustained behavioral changes to their everyday lives.

*Strong care management capabilities are emerging as a strategic core competency to survive in the current health care environment.* Programs aimed at effective control of disease must integrate a complete set of effective interventions that achieve an optimal treatment plan, overcome cost barriers and address behavior factors unique to each patient. Home telemonitoring offers a cost effective tool to provide “skill based” self-management education combined with performance assessment and reminders that help facilitate the change to a health “coaching approach that is needed to achieve desired outcomes.

### 1. The Need for New Approaches to Care

*New approaches to the delivery of care are required to address the issues associated with chronic illnesses.* Two emerging models of care, Patient Centered Care and the Chronic Care Model, are helping to make the transformational change in how people think about health, illness and the system of care delivery. Patient-centered care is one of six interrelated factors constituting high-quality care identified by the Institute of Medicine in its major report on the U.S. healthcare system called “Crossing the Quality Chasm: A New Health System for the 21st Century”. This influential report solidified the patient-centered care approach not only as a way of creating a more appealing patient experience, but also as a fundamental practice for the provision of high-quality care. It entails the coordination and integration of care, as well as the use of appropriate information, communication, and education. Medical decisions should be made with the patient or patient’s family present and should be based on the best available evidence. Today, patient-centered care has been widely embraced by many of the industry's most influential care providers, policy-makers, regulatory agencies, research bodies, and funders.

*The Chronic Care Model is a framework for re-engineering chronic care delivery systems.* It was developed by Dr. Edward Wagner and colleagues at the MacColl Institute for Healthcare Innovation. The Chronic Care Model strongly emphasizes the need for effective self-management interventions. It highlights the concerns that patients with chronic illness often experience: they often don’t receive enough appropriate information about their condition and are not supported in caring for themselves after they leave the office or hospital setting. According to Dr Wagner, physicians don’t have time to educate patients enough to keep them healthy, moreover the typical physician’s office is designed to respond to acute events rather than to anticipate and prevent them. The Chronic Care Model promotes a delivery system developed to foster “productive interactions” between informed patients who take an active part in their care and providers with the right resources and expertise. The primary outcome of the chronic care model is an activated patient assuming a central role in managing his/her illness. This, combined with a proactive, team-based clinical approach, leads to sustained improvements in functional and clinical outcomes. The concept of patient activation level is a reflection of an individual’s beliefs, confidence and knowledge about his/her ability to manage health. Patient’s recording of daily activities associated with self management helps to create a meaningful insight between daily life and the effects on illness.
Self efficacy, as defined by the Social Cognitive Theory, influences actions that individuals choose to perform and is a predictor of behavioral change. Individuals chose an action only if they believe that they are capable of doing it and it will benefit them. Therefore, the transition from a traditional medical model to a social model will require new approaches that lead to assimilation of lifelong skills such as realistic goal setting, self monitoring with internal reminder systems, problem solving and recognition of personal risk situations.

II. Linking Cause and Effect: The Role of Interactive Technology In Promoting Productive Interactions

Key elements of any effective care management program include instructing patients on how to recognize symptoms and side effects, monitoring to prompt adherence, and regular reviews of clinical data to check on outcomes and spot adherence failures. Monitoring data also offers valuable evidence of disease and symptom control that is used as a guide for contact frequency and coaching content. Studies done on a variety of chronic conditions show that combining education of patients with reminders or prompts to perform specific tasks was associated with improved disease control and demonstrated health benefits in terms of reduced hospitalization days, reduced clinic visits, enhanced quality of life and satisfaction with technology. Interactive technology helps to make the tangible cause and effect connections essential to long term management success. This generates the “aha” moment for the patient that comes with connecting the hot dog consumed while watching the baseball game, to the 2 lb weight gain seen the next morning; or that relationship between the piece of birthday cake and the subsequent blood glucose reading of 350.

Technology alone will not create the behavioral change required for effective self care. However, it offers a tool to support efficient means of patient engagement by breaking down complex human actions into easily understood related components. The key to telemonitoring success is the combination of the interface between the human and the technology. Monitoring data generated by the patient’s actions demonstrates personal impact to the patient regardless of whether the data is related to daily weights or taking medications. The interactive experience helps to enhance motivation through appropriate positive and negative feedback loops. Daily use with minimal time and effort helps to reinforce both the habit and the problem solving skills required for long term change. In addition, the confidence associated with better understanding helps patients to communicate more clearly with health care providers. The monitoring data and the patient’s own experiences associated with the data can serve as a valuable tool during office visits to promote communications and evaluate treatment effectiveness.

Patient Acceptance and Satisfaction

Consumer friendly, home-based technology such as cell phones and personal computers enables patients to feel familiar with health related monitoring devices. As the potential for universal internet access approaches reality
and familiarity with technology grows, consumer ability to access to health information and portals for health monitoring related services is accelerating the capacity of technology to support health management efforts. Recent studies on desirable attributes of health care delivery show that consumers want real-time communication with health care providers, more personalized health care information, guidance on how to manage their symptoms and prevent complications, and technology that they trust and are comfortable in using. However, it is essential that the technology also be matched to needs and capabilities of the patient or caregiver that is responsible for the self-management efforts. Remote technology for physician use will have dramatically different features than interactive technology designed to be integrated into the daily lifestyle habits of the general public.

Deloitte 2008 Consumer Survey Results

- 72% of consumers report being very interested in using a self-monitoring device at home
- 67% are interested if a home monitoring device would help them in adjusting their medications
- 75% report being interested if a monitoring device could eliminate trips to the physician office to be tested
- 69% report they would use a device if their doctor recommended it
- 69% report interest if it would relay results electronically via the internet or cell phone
- 62% report being interested if it would offer a continuous stream of information to their clinician by wireless connection

SOURCE: 2008 Survey of Health Care Consumers; Deloitte Center for Health Care Solutions

Key findings from a Deloitte online survey of 3,000 adults shows that interest in using self-monitoring devices in the home is high across all groups. The highest levels of interest are Medicare enrollees, seniors, baby boomers and females. The perceived consumer benefits of home monitoring technologies relate to convenience in handling medications and test results, avoiding trips to the doctor’s office, help with getting more involved in their own care while at the same time providing a continuous stream of information to their physicians.

III. The Benefits of Interactive Home Telemonitoring

*Interactive monitoring technology offers benefits for patients, providers and payers.* For patients, it means fewer office and emergency room visits, reduced risk of hospitalizations, less patient travel time and expense and increased access to clinicians for guidance. For providers, it means more informed decision-making and a vehicle to support efficiencies in office practice. For payers and risk-bearing entities, interactive telemonitoring technology promotes the optimal use of staffing resources related to outreach, engagement and delivery of patient interventions by increasing the capacity of nurses to meet the demands for complex care management.

**Improved Effectiveness of Interventions**

*Strategies to reduce unnecessary utilization require the ability to provide timely interventions in order to deliver the intended quality and cost outcomes.* For high-risk patients, this requires monitoring that is conducted regularly and often, and the distribution of meaningful and actionable data to physicians, care managers, and caregivers. However, if the monitoring and assessment are too labor-intensive, the costs of obtaining the information can offset some or all of the anticipated savings. In addition, regardless of how well a nurse or other healthcare professional conducts monitoring; an activated patient is critical to the control of administrative costs associated with patient assessment and monitoring. Outreach contact made on the basis of objective clinical data when the patient can benefit most from the interaction is the most efficient way to utilize costly clinical resources. Any patient with a
condition requiring frequent monitoring or trending of health status information to help facilitate optimal clinical management and promotion of effective self-management skills could be an appropriate candidate for home based interactive telemonitoring technology. Other variables to consider are related to patient or caregiver capacity to achieve an interactive relationship and/or capacity to perform the essential tasks that are being monitored.

**Interactive technology tools help to offset the need for higher nurse-patient ratios by enabling a scalable process for effective timing of nurse-patient interactions.** In a federally funded study of the administrative impact of telemonitoring, the average caseload of home care nurses increased by five to ten patients during the initial launch of a telemedicine technology demonstration. Researchers reported “strong evidence that nursing productivity increased with the advent of telehealth tools.”

**Increases in clinician productivity associated with the use of telemonitoring technology contributed to the cost savings achieved in several reported telemonitoring studies.** Increasing the capacity of clinical resources offers an important benefit in an era of significant nursing shortages and shrinking administrative budgets. Interactive technology also provides a needed boost to the program enrollment and patient outreach activities associated with care management programs through in-home patient engagement activities surrounding the equipment setup. Real-time alerts and reminders associated with interactive telemonitoring enable workflow efficiencies and tailored recommendations to achieve reductions in avoidable intensive health care utilization.

**Alerting the care manager about data outside of established parameters provides an early indication that a patient may be starting to decompensate.** It enables the care management staff to initiate communication with the patient’s provider regarding a change to the plan or care. This type of productive interaction and coordination among clinical staff to resolve an emerging problem before it reaches crisis level provides an opportunity to model the problem-solving and proactive skills the patient must assimilate for effective self management. Moreover, the timely and objective indicators provided by the monitoring data avoids the resource intensive “hit or miss” information gathering approach of telephonic outreach. The cyclical repetition of actionable communications supports ongoing learning about the reality of the patient’s health for both the patient and the physician managing the care.

**The financial challenge for organizations providing care management services, regardless of the clinical condition being targeted, is to balance the cost of administering the interventions with the intensity of services required to reduce demand and yield some degree of measurable savings.** One underlying reason is the lack of a standard approach to patient outreach and coordination of care. According to the Mathematica analysis of the Medicare Coordinated Care Demonstration, the care management and disease management programs participating in the demonstration varied greatly in the mode and intensity of contacts, ratio of staff to patients, method of monitoring activity, patient education tactics and approaches to improving communications between and among physicians and patients. Of the 15 programs studied, 12 contacted the patients anywhere from one to three times per month with only two of the programs having more frequent contact. In general, all but one program provided patient education, yet these efforts did not lead to measurable improvements in self-reported knowledge, adherence or health related behaviors. The study concluded that the presence or absence of any one individual program “feature” or characteristic did not show a greater likelihood of program success but achievement of intended results was more related to how effectively the program interventions were performed. The use of interactive telemonitoring technology as a tool to enhance the structure and process of patient interventions can help to achieve the appropriate balance between efficiency and results.

**Benefits that span the population continuum**

Interactive technology tools offer a cost effective way to collect and disseminate the objective data associated with the population management continuum. The greater availability of intravenous infusion, point-of-care blood testing, pulse oximetry, feeding pumps, ventilators, and mobile diagnostic technology enables providers to diagnose and
treat patients for conditions that were previously too complex or acute to address at home. From the lifestyle coaching of healthy patients to home-based monitoring for functional or cognitive impairment, real-time data collection and timely interventions, medication adherence helps patients to change from passive recipients of provider instructions and interventions to more active and knowledgeable participants in the decision making and management of their own health.

**IV. Interactive Telemonitoring Applications for Care Management**

**Medication Adherence**

*Medication adherence is a complex issue involving an array of contributing barriers.* These include polypharmacy, multiple providers prescribing medications, drug interactions and side effects, patient willingness and ability to adhere, lack of understanding, and cost. A recent report by the World Health Organization (WHO) revealed that 50% of patients with chronic disease do not take their medication as prescribed. The end result is that medication adherence problems lead to poor health outcomes for patients and have a significant negative economic impact on healthcare resources. A recent report from the New England Health Institute found that medication non-adherence costs the US healthcare system approximately $290 billion or 13% of all spending. Payers are burdened by the costs associated with over-medication, under-medication, and adverse interactions, all of which lead to hospitalizations. Providers and industry leaders see lower efficacy rates. Most importantly, patients do not benefit from the desirable clinical outcomes of effective medication management but instead experience greater risks of morbidity and mortality.

Although care management and disease management programs frequently measure whether patients receive a prescription, according to the DMAA, it is the measurement of medication adherence that offers a more valuable metric. Prescription medication will not promote better outcomes unless the patient takes the medication as prescribed. Frequent monitoring and feedback may be the most effective strategy for improving medication adherence. Technology-enabled medication adherence programs that include prompts and data tracking of adherence failures offer an innovative approach to addressing the medication adherence issue in a scalable format. In a study of elderly patients with hypertension, those who had their blood pressure checked regularly were more likely to adhere to medication than those who did not. Because their blood pressure was monitored regularly, these patients were more aware of their personal patterns and could see the effectiveness of the medications they were taking. Of the 65 million Americans with hypertension, almost 70% do not have adequate blood pressure control. Studies show
that many patients do not even understand why they have been given a prescription or why it is important to take the medication. Social and behavioral based studies on adherence report that, patients must make the connection between prescribed interventions and the perception of tangible benefits to their personal health.

Any intervention program designed to improve both adherence and persistence must be patient centric and integrate all stakeholders in order to address the behavioral, functional, financial and clinical barriers associated with medication adherence. Some experts believe that a large portion of non-adherence could be corrected if doctors had a comprehensive and accurate reconciliation of medications patients are actually taking as compared to evidence-based recommendations of what they should be taking. Once gaps in recommended therapy are identified, a treatment regime tailored to a patient’s individual needs and preferences can be developed. Another important intervention is the reconciliation of all medications after a sentinel event such as hospitalization to assure a smooth transition to baseline health status. A multi-disciplinary approach that includes the physician, the pharmacist, care management staff, the patient or caregiver and the benefit perspective of the payer help to develop an integrated approach to the complexities of medication adherence. Interactive technology tools can provide timely and complete data on relevant medication adherence patterns and enable the coaching required to facilitate communication and sustained adherence. Any indication of non-adherence, whether simply forgetting to take the medication or early indications of adverse reaction, provides an opportunity to proactively address the barriers and develop patient-specific interventions. In addition, medication adherence data and the associated non-adherence causes can be communicated back to the rest of the care team to assure continuity and coordination.

Post-Hospitalization and Readmission Management

There are significant opportunities for improvement in 30-day hospital readmission rates. According to the 2008 Commonwealth Fund Study, approximately 18% of patients are readmitted within 30 days of their hospital discharge, with a range of 14% at the 10th percentile to 21% at the 90th percentile. CMS estimates that 13% of these readmissions are “potentially avoidable,” with the major areas of concern centered on poor communication with patients at discharge, especially around medications and inadequate post-hospital discharge monitoring. Studies show that patients who receive counseling immediately preceding and/or following a discharge from the hospital are more apt to adhere to therapy. One study found that, among elderly patients with more than three medications, adherence improved by 43 percent (as defined by self-reporting of “never missing a dose”) among patients who received pharmacist counseling before and after hospital discharge when compared to patients who did not receive the counseling intervention.

Reducing avoidable re-admissions is emerging as a target for reimbursement penalties and pay for performance initiatives because of the clear quality improvement and savings opportunities. Interactive monitoring technology combined with timely interventional strategies around post hospital medication compliance, adjustment to treatment changes and promotion of appropriate follow-up visits can together achieve transition to baseline status and reduce the risk of preventable re-admissions. Daily monitoring of vital signs, health status and symptoms can identify early signs of deterioration or complication and facilitate clinical intervention before the threshold for facility readmission is reached. Post hospitalization programs to address re-admission may require episodic monitoring for 30-60 days period or require a more longitudinal monitoring approach for over six months depending on factors such as access to follow-up care, the clinical status at discharge, the risk for potentially avoidable complications, the capacity and support for self-management. Finally, the impact of a hospitalization offers an opportunity to capture the attention of the patient who has previously refused to participate in self-management activities. The reality of hospitalization can increase a patient’s readiness to change, and initiation of behavioral coaching during this vulnerable period of recovery can lead to the assimilation of proactive and sustained behavioral change.

Management of Long Term Care and Dual Eligible Population

Compared to the commercial population, chronically ill Medicare patients experience more complex, multiple chronic conditions and take a longer time to recover from acute episodes. Heart disease, diabetes, COPD,
arthritisk, stroke, and cancer are among the most common diagnoses that drive the use of health care services in this population. Older adults currently account for 60% of overall health care spending in the U.S. as co-morbidities, functional and cognitive deficits and multiple medication requirements complicate patients’ ability to manage their own care. Furthermore, 92% of these older adults live alone in their own apartments, homes, or assisted living facilities and approximately 50% of those are 75 and older. The frail and chronically ill populations require complementary intervention strategies that revolve around the patient, and engage family caregivers and local community resources with the goal of maintaining functional capacity with clinical stability. Family caregiver support is often needed as the illness burden increases with advancing frailty, and patient-centric approaches become essential to achieving both financial and clinical goals. This population exemplifies the delicate balance between realistic treatment outcomes, functional capacity and measurable impact on quality of life.

The spiraling personal and governmental costs associated with caring for this vulnerable population clearly demonstrate an urgent need for innovative technology-based tools to enable older adults to live independently while maximizing the use of limited resources. The largest portion of US healthcare dollars is spent during the last years of life, when living with eventually fatal chronic illness generates the most intense treatment and costs. Growth in life expectancy continues to exceed expectations. Previously fatal illnesses are no longer fatal. Flexibility, continuity of care and comprehensive solutions are required to address the combination of functional, cognitive and clinical impairments affecting this population. In one recent study on “aging in place,” nearly 90% of seniors who were not living in a nursing home or assisted living facility said that remaining active and independent in their own home was very important to them. More than half of this group identified potential health problems as the biggest threat to living independently. A majority of seniors would prefer to receive care at home rather than in a hospital, and their personal experiences with consequences of hospitalizations make them receptive to new ways to manage their condition. Avoiding hospitalization and institutionalization saves more than money for this population: it avoids the considerable risk of suffering iatrogenic complications and resistant bacterial infections including loss of functional capacity and independence. The use of functional and health status monitoring tools greatly increases the capacity to provide an individualized intervention approach for seniors in their homes while avoiding the financial and social costs of institutional care. Teaching complex, chronically ill patient and their families how to recognize an emerging exacerbation will also require interventions that mobilize care directly to the patient’s home and help mitigate care access barriers. Safety, activity, physiologic and socialization monitoring data can be analyzed to detect early and subtle indicators of deterioration or improvement in health conditions in a variety of environments. Solutions for this population must be adjusted to meet family and patient preferences as well as individual financial and clinical risks. Remote monitoring data can help the individual patient improve self management capacity and can provide an objective evaluation related of the capacity for independence, an especially important consideration for family members. For example, medication adherence and fall monitoring can yield qualitative information enabling families to accurately grasp the patient’s capability for daily functioning, as well as provide quantitative information on adherence with prescribed medication dosage.

Increasing evidence demonstrates that self-management support reduces hospitalizations, emergency department use, and overall managed care costs. A recent study by the Department of Veterans Affairs looked at the health outcomes of more than 17,000 VA patients enrolled in a home telehealth program. The study found a 25% reduction in the average number of days hospitalized and a 19% reduction in hospitalization costs for patients using home telemonitoring. The study showed that telemonitoring data on blood pressure and blood glucose, as well as other patient information in the electronic system, allowed the health care team members to anticipate and prevent avoidable problems. According to the VA officials, the results are not specific to the technology, and instead describe how the technology helped identify and coordinate timely delivery of the patient-centric plan of care required by the patient. The telemonitoring technology helped the patients understand and manage their chronic
conditions while facilitating their partnerships with their medical teams. This was shown to delay the need for institutional care and maintain patient independence for an extended time.  

Disease Specific Applications

**CHF**

*Congestive Heart Failure (CHF) is the most common discharge diagnosis for Medicare beneficiaries.* Readmissions after hospitalization for CHF are common, with almost 50% of beneficiaries being readmitted within six months. Heart failure patients should weigh themselves daily as a means for early detection of fluid accumulation. Changes in blood pressure and heart rate can also provide early indications of exacerbations or adverse effects. Telemonitoring provides a powerful tool to signal early indications of the potential need for therapy refinement and available data from existing studies show that heart failure telemonitoring offers substantial cost saving opportunities.

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<tr>
<th>Principal Author</th>
<th>% Savings of Telemetry Monitoring</th>
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<tbody>
<tr>
<td>Benatar</td>
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<td>Dimmick</td>
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<td>Lehmann</td>
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<td>Scalvini</td>
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A study of 426 patients found that remote monitoring substantially reduced the mean duration of hospital admissions and the number of home or office visits when compared to monthly follow-up phone calls from nurses. — An electronic device recorded and reported blood pressure, pulse, heart rhythm and weight and transmitted measurements via telephone lines to a Web site. The average duration of each hospital stay for the remote monitoring patients was 10.9 days versus 14.8 days for patients who only received telephone calls from nurses. Office visits were reduced 10% and home visits were reduced 65% for the remote monitoring group versus the nurse telephone call group. In another study, a randomized trial of 280 patients from 16 U.S. heart failure centers found that a home monitoring device that captured and transmitted the daily weight of heart failure patients reduced the six-month mortality rate 56.2%, as compared with a group of patients who did not use home monitoring. The study concluded that, “Despite aggressive medical management in both arms of the study, this non-drug, daily monitoring technology intervention provided an additional mortality benefit beyond guideline-recommended care for patients with advanced heart failure.” According to the authors, daily monitoring and evaluation of symptoms by trained nurses via remote monitoring when warning signals appeared allowed for rapid assessment, immediate notification and action by physicians when necessary.
Diabetes

Several studies have shown that interactive technology improves patient knowledge, self-management and the quality of the ambulatory care for people with diabetes. In one study, diabetes patients who received bi-weekly automated assessment calls and self-care training by a nurse had 21% better adherence (as measured by self report of missed doses) than those patients who received usual care. Diabetes telemonitoring programs show better physiologic control as measured by daily home capillary blood glucose (CBG) monitoring and office measurement of HbA1c levels. Studies show that, systems which notify either the patient or the clinician, or both, concerning blood glucose values outside a mutually identified target range can stimulate important corrective action. This includes actions taken by clinicians to modify the treatment regimen to prevent acute complications, and subsequent actions by patients to make diet or lifestyle changes. Interactive telemonitoring technology provides interactive learning opportunities about the association between blood glucose levels and the patterns of response to diet, exercise and medication. Monitoring and timely interaction facilitate the development of realistic baseline management plans, and build the patient experience required for effective adaptation to unanticipated disruptions and planned variations in the routine of daily living. As a result, patients learn to make good decisions in real time rather than waiting for clinician advice at the next office appointment.

Asthma/COPD

Self-management interventions have been proven as useful tools in treating people with chronic respiratory disease. When patients with severe respiratory illness on long-term oxygen therapy were remotely-monitored, hospital admissions decreased by 50%, acute home exacerbations decreased 55%, and hospitalization costs were reduced by 17 percent, even after the costs of monitoring technology were included in the analysis. Monitoring of this kind can enable more sophisticated home care, detect deterioration prior to symptom development and minimize the need for complicated and cumbersome patient transportation to hospital/office appointments.

V. VRI’s Pioneering Approach to Interactive Technology for Managed Care

VRI interactive technology tools are designed to augment existing care management initiatives with cost effective tools to support improved clinical and financial outcomes. They offer a portfolio of easy to use in remote monitoring equipment and services to enable providers, health plans and patients or caregivers to monitor daily vital signs and physiologic parameters associated with a wide range of chronic conditions including diabetes, congestive heart failure, hypertension, COPD and asthma. Their home monitoring capabilities are the result of 20 years of experience with in-home monitoring of clients with chronic illness, disability and advanced age. The VRI care center monitors for falls, medication adherence, basic physiologic parameters and self-management compliance 24 hours a day, 7 days a week and 365 days a year.

VRI programs have been designed to support MCOs and offer a range of benefits for the payer. There are few responsibilities for the payer, as VRI provides, deploys, stores, and maintains all hardware and software, and utilization-based costs are billed as a claim expense using CPT and HCPCS rather than as overhead expense for the payer. VRI supports care management outreach and enrollment by providing in-home telemonitoring set-up by a VRI-trained professional installer. During the installation visit, the technician installs the electronic connection using existing phone lines or wireless technology, demonstrates how to use the equipment and then observes the patient during the first use of the device and initial transmission of the data upload. This assures a positive initial experience with VRI technology and helps to gain the trust and confidence of the patient, and helps engage the patient in active self-management. VRI provides an open technology platform that is “device-agnostic,” supports customization with virtually any telemonitoring device from any source, and facilitates seamless integration with existing systems and programs. VRI internet portals support convenient and timely user access to monitoring data, and support reminder contacts in response to the data, actions responding to patient specific exception data, and graphs and charts showing progress and trends.
White Paper Presented by VRI Telemonitoring: Interactive Technology for Care Management Outcomes

The VRI portfolio of patient-centered technology tools are easily embedded within the day-to-day flow of the patient’s life. Electronic data capture, timely review and virtual interactions enable immediate and preventative management adjustments between office visits. When a signal is received from the monitoring equipment in the patients’ home is an “exception” reading based upon pre-determined specified metrics or criteria, VRI’s call center determines whether the signal reflects a situation that needs to be addressed by care management, or whether there was simply a technical or connectivity issue. Having VRI be responsible for the initial follow-up on every exception avoids the need for care managers to have to deal with calls regarding technical/connectivity issues, and allows care managers to focus 100% on bona fide patient management issues. If no reading is received at a designated time, a VRI Care Representative contacts the patient, reminds the patient to perform the monitoring activity, and confirms that there is no indication for urgent medical attention. If the reading does in fact meet exception criteria, the VRI Care Representative contacts the patient first to ensure that there is not a critical emergency. VRI Care Representatives follow our clients’ notification triage protocols to inform them of exceptions and enable their Care Management staff to initiate the appropriate follow-up actions. The monitoring, reminder and exception notification approach is based upon recommendations and evidence from studies of effective self management and adherence programs. This turn-key approach allows for client-specific algorithms to drive patient monitoring protocols reflective of program goals and the needs of the population.

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<thead>
<tr>
<th>Clinical Application</th>
<th>VRI Monitoring Service</th>
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<tbody>
<tr>
<td>Hypertension, CHF, COPD</td>
<td>Blood Pressure Cuff</td>
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<td>COPD, CHF, Heart and Lung conditions</td>
<td>Pulse Oximeter / Oxygen Saturation</td>
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<td>Obesity, CHF, Fluid and Weight Management</td>
<td>Automatic Scale/Weight Management</td>
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<tr>
<td>Diabetes, Conditions requiring Blood Glucose Monitoring,</td>
<td>Glucometer</td>
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<tr>
<td>COPD, Asthma, restrictive lung conditions</td>
<td>Peak Flow / Exhalation</td>
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<td>Medication adherence and compliance</td>
<td>MedReady Pill Dispensers</td>
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<td>Status checks for wellness, falls and inactivity</td>
<td>Medical Alert System</td>
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VRI Medication Adherence

Over the last 13 years, VRI has emerged as a leader in home-based medication adherence. The VRI Med Ready Management System is proven, simple to use, effective, and low cost. With tens of thousands of units in the field, VRI has proven that it can increase compliance from an average of 50% to over 90% in patients with a variety of chronic conditions regardless of socioeconomic status. Most of the data assessing the value of telemonitoring in attaining medication adherence has been gathered from various Medicaid patients located throughout the United States. VRI currently works with more than 40 Medicaid payers and vendors.

The primary feature of the VRI medication adherence device is its ease of use. With 28 slots for medication, it can supply approximately a month of medication with one dose per day, two weeks with two doses per day and a 1.5 weeks with three doses per day. At the dosage time, the unit rotates giving the patient access to the appropriate medication. If the patient does not take the medication within 30 minutes, the unit electronically notifies the VRI Care Center. A Care Center representative receives the signal and calls the patient to remind the patient to take the pills. If the patient does not respond, the VRI Care representatives will follow the contact notification chain specified in the patient-specific protocol. If the Care Center representative fails to contact the caregiver or
designated contact to verify that the medication was taken, a medication non-adherence note is placed in VRI’s Online Medication Management system and client-specific follow-up actions are instituted.

**VRI Medication Adherence**

**VRI Telemonitoring Support for Diabetes**

VRI provides monitoring & time sensitive interactions to increase blood glucose compliance and reduce avoidable hospitalizations & ER visits. It also facilitates appropriate and timely PCP access and communication to assure treatment plan adjustments are made. VRI provided two services; the daily blood glucose monitoring and reminders from the VRI Care Representatives and weekly video-enabled nurse practitioner diabetes counseling. Program enrollment totaled 516 patients with 70% of patients (361) demonstrating a reduction in blood glucose levels and 26% (132) demonstrating an increase in average Blood Glucose levels. The program showed a 48% reduction in inpatient costs after 6 months post-enrollment compared with baseline costs 6 months pre-enrollment.

![Average BG](image)

**VRI Telemonitoring Support for CHF**

Study results from a CHF program using VRI technology showed reductions in utilization and improved patient program retention compared to a similar group of patients receiving IVR technology. A study was done on 417 CHF patients in a Medicare Special Needs Plan program. The patients were divided into two populations. The first required 217 patients to call a toll-free number and enter their daily body weights through the telephone over an Integrated Voice Response system (IVR). The second group of 200 patients used the VRI technology which required patients to simply step on a VRI scale that automatically sent weight readings to VRI Care Representatives. Through the use of the wireless internet-enabled scale, combined with the remote monitoring, a patient’s weight was immediately communicated to a CHF data analysis engine. Within seconds of stepping on a scale, information
was logged and analyzed, and alerts were generated and communicated to staff in an appropriate manner. Intervention calls were made by nurses when reported weights fell outside medical guidelines (same for both study populations).

**CHF Results Using VRI Technology**

The IVR group had a 65% retention rate, in contrast with the telemonitoring group, which showed a 95% retention rate. The VRI monitoring technology did not require any change in the patient’s routine daily behavior, deemed a key factor is contributing to the high retention rate. The IVR group had a baseline (pre-comparison) admission rate of 620 per 1000 and the VRI technology group had a baseline admission rate of 630 per 1000. Three months after enrollment, the VRI technology group displayed a 57% decline in hospital admissions (a 27% hospital admission rate); while the IVR group had a 46% decline in hospital admissions (a 33% hospital admission rate). Upon further analysis, when calculating the numbers of patients intended to manage (IM) with the assumption that all those not retained on an intervention program would have exhibited consistent patterns with usual care on an ongoing basis, the differences between the IM IVR and telemonitoring patients groups are even greater: IM IVR patients showed a 31% decline in admissions (a 43% rate of hospital admissions); while the telemonitoring patients still retained a 57% decline in admissions and 27% rate of hospital admissions.

> “In our country, patients are the most under-utilized resource, and they have the most at stake. They want to be involved and they can be involved. Their participation will lead to better medical outcomes at lower costs with dramatically higher patient/customer satisfaction. We should remember that the real goal of improved health information systems is not better hospitals or better physician practices, but better quality of health care and healthier consumers.”

**Summary**

Interactive telemonitoring tools offer a cost effective and innovative approach to improve the outcomes of care management efforts. However, outcomes improvements will not result from the simple addition of technology alone. It is the integration of interactive telemonitoring technology into the structure of the care management program that facilitates the proactive communications that promote measurable improvements in self management skills.
Interactive technologies provide the opportunity for timely, effective and personalized interactions and enable pre-emptive treatment adjustments that break the cycle of emergency care and hospital re-admissions resulting from non-compliance. The flexible and easy to implement business model offered by the VRI portfolio of interactive monitoring tools offers an excellent example of this effective approach.

Interactive technology is expected to be an integral part of the current overall effort to improve general health and fitness, lower chronic illness costs and support the growing frail elderly population. Regular and frequent monitoring of key parameters offers timely opportunities to improve communication and information sharing between patients and members of the healthcare team as well as help reduce the need for inefficient office visits. With overall trends toward greater patient involvement in all aspects of healthcare, technologies that encourage patient engagement are likely to show greater success compared to those that treat patients as passive participants. The time has arrived to pursue a systematic approach to the integration of technologies that can help realize the promise of a coordinated approach to care and the measure of success will be seen in the impact those integrated strategies have on the achievement of sustained behavioral change. The convergence of interactive monitoring technologies and self-management coaching that ultimately prevails will depend on effective communication and collaboration between all the players involved in the effective delivery of care, including but not limited to the most important player--the patient.
White Paper Presented by VRI Telemonitoring: Interactive Technology for Care Management Outcomes

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