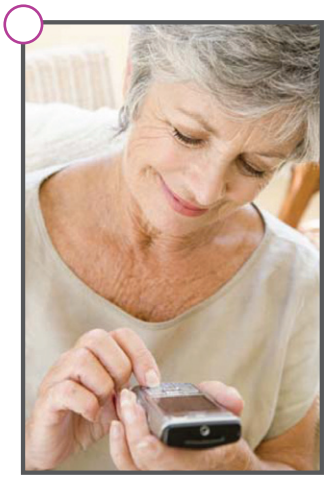


Center for Technology and Aging

Technologies to Help Older Adults Maintain Independence:

Advancing Technology Adoption

July 2009
Briefing Paper

Table of Contents

Introduction 3

Executive Summary 4

Background 7

Technology Focus Areas 10
- Medication Optimization 12
- Remote Patient Monitoring 16
- Assistive Technologies 19
- Remote Training and Supervision 21
- Disease Management 23
- Cognitive Fitness and Assessment Technologies 26
- Social Networking 28
- Next Steps 31

References 32

Introduction

Americans are living longer. And despite the health challenges of longevity, a majority of older adults hope to remain in their homes as long as possible.[1] Fortunately, many technologies have the potential to help older adults maintain their independence and health. Technology is an enabler in creating systems of health and long-term care that are more integrated and reliable, and that address the needs of older adults in a more efficient and effective way. If these technologies could also mitigate the workforce shortages and financial burdens that are inherent to long-term care today, both older adults and society at large will benefit.

Supported by a grant from The SCAN Foundation, the Center for Technology and Aging was established to advance the diffusion of technologies that help older adults lead healthier lives and maintain independence. The Center will identify promising technologies and adoption strategies, and provide grant funding to test these strategies. In collaboration with grantees and key stakeholders, the Center will identify and disseminate best practices and lessons learned from grantmaking initiatives. The Center will promote further adoption of successful technologies and serve as a state and national resource for those involved in this arena.

The SCAN Foundation is dedicated to finding innovative solutions to the health and long-term care needs of older adults in California and throughout the nation. The Foundation's vision is a society where older adults receive medical treatment and human services that are integrated in the setting most appropriate to their needs and have the greatest likelihood of creating a healthy, independent life. Technology is an enabler in creating systems of health and long-term care that are more integrated and reliable, and that address the needs of older adults in a more efficient and effective way.

This paper is intended to inform potential grant applicants and other key stakeholders, including older adults, health and social service practitioners, technology vendors, payers, policy makers/regulators, and The SCAN Foundation about technologies that are ready to be quickly taken to scale. Drawing from the array of existing telemonitoring, telehealth, assistive, and communication technologies that are used in the management of chronic disease, we identify specific technology domains that have proven benefits and have significant potential for diffusion. We further identify those technologies that offer the greatest opportunity to accelerate the pace of diffusion; have the support of a long-term, sustainable business model; and have the greatest likelihood of alignment with public and private policies designed to improve outcomes and reduce spending. As the Administration starts on the path toward health reform, the need to improve the delivery of care for older adults in home and community settings will be unavoidable. The broad diffusion of transformative technologies offers a significant means to advance the effort of improving quality and reducing cost of care.

Executive Summary

Technologies that extend the ability to provide care for persons with chronic illness have been increasingly successful in improving the well-being and independence of older adults, the segment of our population that has the greatest demand for health and long-term care services. These technologies offer a means of reducing the burden of chronic care for patients, families, and the health care system as a whole, while improving older adults' safety, health/well-being, and social interaction. However, for these technologies to realize their potential to improve the efficiency of health care delivery, reduce the costs of health care, improve health care outcomes, and most importantly, maximize the independence and quality of life of older adults, these technologies must be rapidly expanded to scale in home and community-based care settings.

The mission of the Center for Technology and Aging is to identify and promote successful strategies that accelerate the adoption and diffusion of technologies that improve the ability of older adults to remain in the community. This paper discusses technologies that have the greatest likelihood of successful diffusion and will offer a significant opportunity to reduce the burden of chronic care for older adults, their families, and the health care system. It further identifies the Center's current list of candidate technologies that will be targeted for near-term diffusion grants that promote broader adoption of technology. It addresses the current state of these technologies as well as the opportunities for and barriers to widespread adoption.

Technology Focus Areas

Technologies that assist in the care of chronic conditions and improve the independence of older adults can cover a very wide spectrum, including communication, assistive, telemonitoring, telehealth and other technology-enabled services. Based on an extensive literature review, expert interviews and data drawn from expert panels, seven technology domains were identified as high priority candidates for rapid diffusion. This process included an assessment of the experience of early adopters and the viability of each technology. After review of the seven areas of technology, two priority areas for the Center for Technology and Aging grantmaking have been identified: **medication optimization** and **remote patient monitoring**.

These two technology areas are well balanced in terms of offering high value to stakeholders and surmountable barriers to adoption and diffusion. In addition to alignment with the mission of the Center, each of these two technology areas offers evidence that there are clear benefits to as well as a high degree of acceptability for older adults. Both technologies offer immediate relevancy given the health reform debate and specific opportunities to inform national and/or state policymakers. These technologies also complement the interests and capabilities of potential grantees and should be able to support sustainable diffusion strategies. Finally, and of highest priority, each of these technology areas can lead to significant cost savings for the health and long-term care system.

Executive Summary

These two technology domains are defined as follows:

1) Medication Optimization refers to a wide variety of technologies designed to help manage medication information, dispensing, adherence, and tracking. Technologies range from the more complex, fully integrated devices that use information and communication technologies to inform and remind stakeholders at multiple decision and action points throughout the patient care process to the simpler, standalone devices with more limited functionality.

2) Remote Patient Monitoring (RPM) includes a wide variety of technologies designed to manage and monitor a range of health conditions. Point-of-care (e.g., home) monitoring devices, such as weight scales, glucometers, and blood pressure monitors, may stand alone to collect and report health data, or they may become part of a fully integrated health data collection, analysis, and reporting system that communicates to multiple nodes of the health system and provides alerts when health conditions decline.

The next three technology domains will continue to be reviewed closely for opportunities to test models of diffusion, but are not ready for immediate grantmaking.

3) Assistive Technologies include a wide range of devices and equipment that help individuals perform a task or prevent injury. Assistive technologies promote independence as they compensate for sensory, physical, and cognitive impairments, and promote safety for vulnerable individuals as they detect and report health hazards. Non-computer-based assistive technologies include items such as wheelchairs, grab bars, Braille, and a more accessible home environment. Examples of computer-based technologies include voice recognition software, and monitoring and alert systems that detect and report environmental hazards or personal crises.

4) Remote Training and Supervision (RTS) technologies can be used to train and supervise health and long-term care workers, and offer the potential for continuing education and quality assurance. Remote training means the student does not have to be physically located where the teaching is taking place – teaching and learning can be asynchronous or synchronous in time. Access to training is gained through technologies such as the Internet, interactive videoconferencing, and satellite. Examples of remote training include a distance learning course, a simulation exercise, and a video-guided practicum. RTS technologies are also useful in the ongoing supervision of workers, particularly low-skill workers, and for on-demand consultation with more experienced supervisors or instructors. In many cases, these or similar approaches may also be used to train and support informal caregivers, i.e., family members.

5) Disease Management (DM) is a patient-centric, coordinated care process for patients with specific health conditions, particularly chronic conditions and conditions that have a significant self-care component. DM programs include data mining processes to identify high risk patients within a population, use of evidence-based medical practice guidelines to support and treat individual patients, and a coordinated, data-informed system of patient outreach, feedback, and response.

Executive Summary

The final two areas, as newly emerging technologies, offer limited opportunity for rapid diffusion, but will continue to be tracked over time.

6) Cognitive Fitness and Assessment technologies include thinking games and cognitive challenge regimens. Like physical fitness, the premise of cognitive fitness is that cognitive health can be maintained or improved if individuals exercise their brain. The emphasis with older adults is to prevent or delay Alzheimer's and related dementias. Many cognitive fitness technologies are computer or Internet based, and include an assessment and tracking component.

7) Social Networking technologies enable the creation of social networks and focus on building communities of interest that help older adults communicate, organize, and share with other older adults and with their care providers. These are already gaining traction among older adults, and could be important both for the functions just described and for peer counseling and education that would complement the Remote Training and Supervision technologies described previously.

Next Steps

Prior to the initial round of grantmaking the priority technology areas will undergo further review with stakeholders who are engaged in the provision of aging technology services as well as with individuals with expertise in program diffusion. Technical experts in each respective technology area, including policymakers, regulators and funders, will be consulted to identify opportunities and barriers to diffusion. Finally, a field review will be conducted with health and social service organizations who are currently using the targeted technologies and who are potential large-scale adopters.

As health care delivery and long-term care evolve, evidence will continue to emerge regarding the viability of new technologies and their contribution to the health and well-being of older adults. This paper forms the framework for reviewing existing technologies as well as assessing emerging technologies in terms of their likely potential for rapid diffusion. Not only do beneficial technologies offer significant potential for assisting older adults in maintaining their independence, they provide a very promising method for helping address some of the challenges currently facing the US health care system. For if the rate and scale of technology adoption can be increased, even modestly, it offers considerable potential for reducing the ever escalating personal and societal costs of chronic illness among older adults.

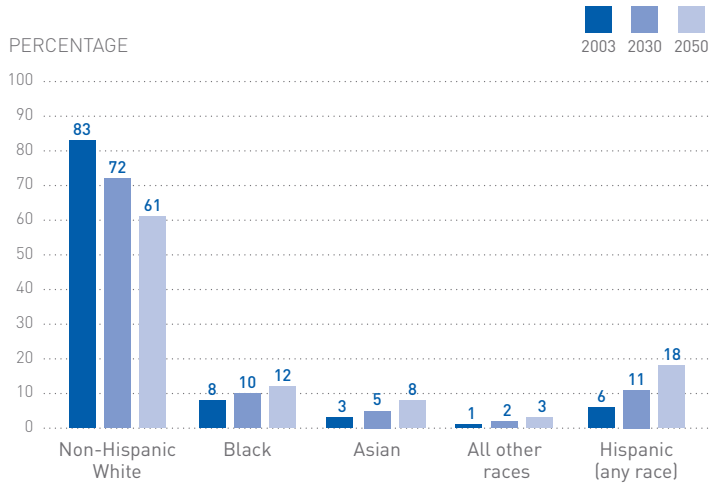
Background

The United States has experienced considerable gains in life expectancy in the past century thanks to a combination of medical and social innovations. However, our ever-growing, chronically ill, and aging population increases the public health challenges of curbing health and long-term care costs and minimizing the burden of disease and disability. Some of the demographic, epidemiological, workforce, and economic factors that underlie this challenge will now be described.

Demographics

In 2005, the average human life expectancy in the United States was 77.8 years, with life expectancy for women five years longer than for men.[2] The US Census Bureau estimates that life expectancy will increase by approximately six years by 2050. The population of Americans aged 65 and older will double during the next 25 years and account for roughly 20% of the total population. America's older adult population is also becoming more racially and ethnically diverse.[3]

The US Population Aged 65 Years Or Older Is Growing More Diverse

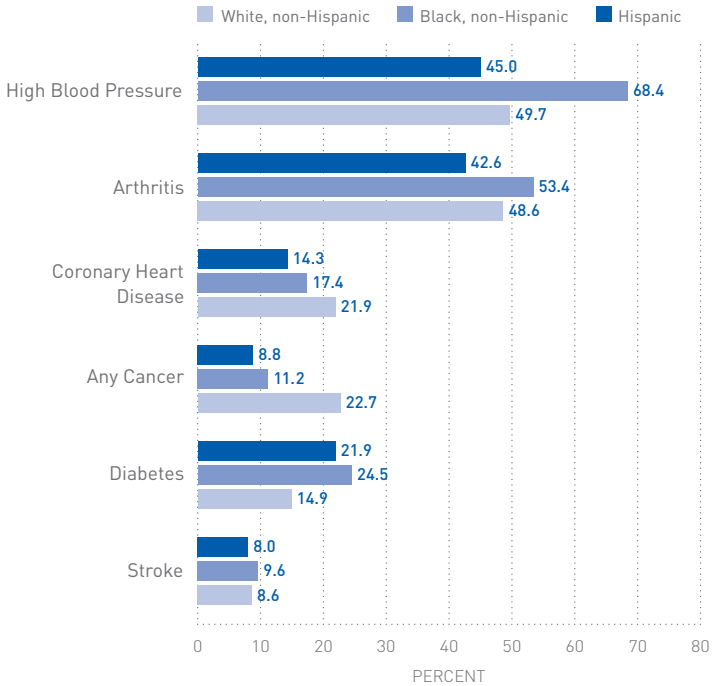


Source: http://www.cdc.gov/aging/pdf/saha_2007.pdf

Epidemiology

The US Centers for Disease Control and Prevention estimates that approximately 80% of older Americans have at least one chronic condition and 50% have at least two. A relatively few risk factors — smoking, poor diet, and physical inactivity — underlie the development of the majority of the nation's chronic disease burden (heart disease, cancer, stroke, and diabetes). The growing burden of chronic health issues among older adults correlates strongly with the likelihood of functional decline as the population ages. This burden is not shared evenly among the nation's population segments, as there is significant variation among racial, ethnic, and geographic subpopulations.[2]

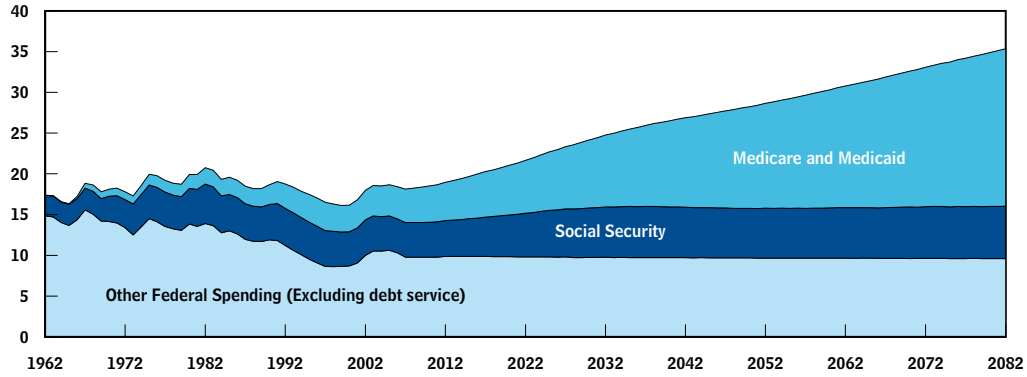
Prevalence Of Chronic Conditions Among Adults Aged 65 Years Or Older Varied By Race/Ethnicity In 2002-2003



Source: http://www.cdc.gov/aging/pdf/saha_2007.pdf

Background

Projected Federal Spending Under One Fiscal Scenario (Percentage Of Gross Domestic Product)



Source: Congressional Budget Office.

Note: The figure, from the December 2007 *Long-Term Budget Outlook*, portrays CBO's "alternative fiscal scenario," which deviates from the agency's baseline projections to incorporate some changes in policy that are widely expected to occur and that policymakers have regularly made in the past.

Source http://www.cbo.gov/ftpdocs/99xx/doc9925/12-18-HealthOptions.pdf

Economics

US health care spending as a percentage of gross domestic product (GDP) is almost twice the average of spending in other developed countries. The US Congressional Budget Office (CBO) estimates that the US share of GDP on health care spending is likely to rise from 16% of GDP in 2007 to 25% in 2025.[4] According to the CBO, the rise in cost will result from rising costs per beneficiary (which will continue to grow more quickly than per capita GDP) rather than rising numbers of beneficiaries.

The US Centers for Disease Control and Prevention reports that the cost of providing health care for an older American is three to five times greater than the cost for someone younger than 65.

Two-thirds of US health care spending is attributable to chronic illness treatment. This compares to 95% of health care expenditures among older Americans.[2] Per person personal health care spending for the 65 and older population was $14,797 in 2004, 5.6 times higher than spending per child ($2,650) and 3.3 times spending per working-age person ($4,511).[5]

By 2030, the nation's health care spending is projected to increase by 25% due to epidemiologic and demographic shifts. The health system is in urgent need of new tools that bring about systemic change and help slow down the rate of cost increases and the rate of spending growth.

Background

Workforce

In the next decade, home- and community-based long-term care providers will face a shortage of direct care workers (nurse aides, home health aides, home care aides, personal aides, and paraprofessional caregivers). The number of women aged 25 to 54 (the traditional source for direct care workers) will increase by only 1%, while overall demand for direct-care workers is projected to increase by 34%.[6]

Compounding the problem of workforce shortages, high-stress, low pay, and poor benefits make it difficult to attract and retain large numbers of these workers once employed.

Conclusion

Many technologies have the potential to simultaneously help older adults remain in their homes as long as possible and mitigate the workforce shortages and financial burdens that are inherent to long-term care. The drivers identified above are all compelling reasons to consider technology solutions that will improve the health and long-term care system for older adults.

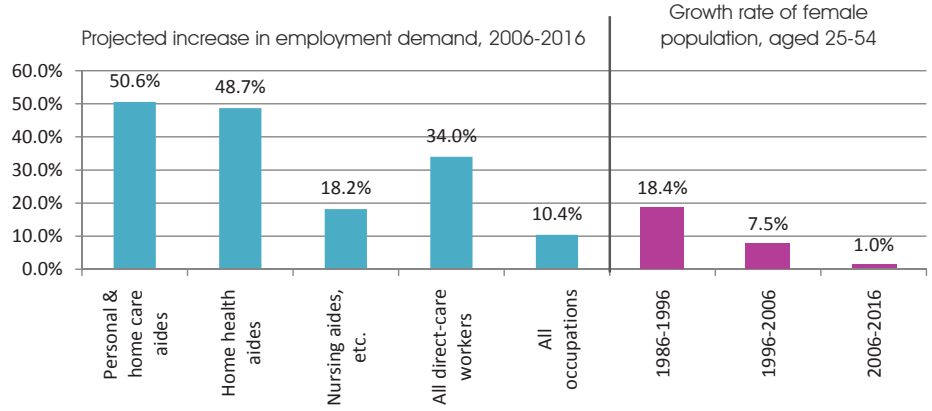
Health and Home-Care Jobs Among the Top 30 Fastest-Growing Occupations in the United States, 2006 to 2016

Occupation	Employment by Year (in Thousands) 2006	2016	Percent Increase (%)
Personal- and home-care aides	767	1,156	50.6
Home health aides	787	1,171	48.7
Medical assistants	417	565	35.4
Physical therapist assistants	60	80	32.4
Pharmacy technicians	285	376	32.0
Dental hygienists	167	217	30.1
Mental health counselors	100	130	30.0
Mental health and substance abuse social workers	122	159	29.9
Dental assistants	280	362	29.2
Physical therapists	173	220	27.1
Physician assistants	66	83	27.0

SOURCE: BLS, 2007a.

Source: Retooling for an Aging America: Building the Health Care Workforce, IOM

Demand for Direct-Care Workers Is at an All-Time High but Growth in Core Female Labor Supply is Now Stagnant



Technology Focus Areas

Seven technology focus areas will be described in the following pages. As can be seen, these offer numerous opportunities for the Center's grantmaking program. However, the initial round of diffusion grants will be focused in two areas: **medication optimization** (MedOp) technologies, and **remote patient monitoring** (RPM) technologies. While the Center will continue to build its knowledge and experience base in all focus areas, a focus on two initial priority areas will support a more cohesive evaluation of results, and a more effective means to share the lessons learned.

The Center's initial prioritization of MedOp and RPM technologies was based on a comparative assessment using the following criteria.[7]

1) Population Applicability: The degree to which the technology is beneficial to a significant population of older adults who are at-risk for moving to a higher level of care, or the technology is instrumental in enabling people with high-burden disabilities and chronic illnesses to better self-manage their health conditions and prevent injuries and complications.

2) Health Outcomes: The degree to which credible outcome studies demonstrate that use of the technology significantly improves or maintains patient health.

3) Economic Outcomes: The degree to which credible health economic studies demonstrate that technology use reduces or has the potential to reduce the overall costs of care.

4) Workforce Relief: The degree to which use of the technology mitigates home care and health care workforce shortages.

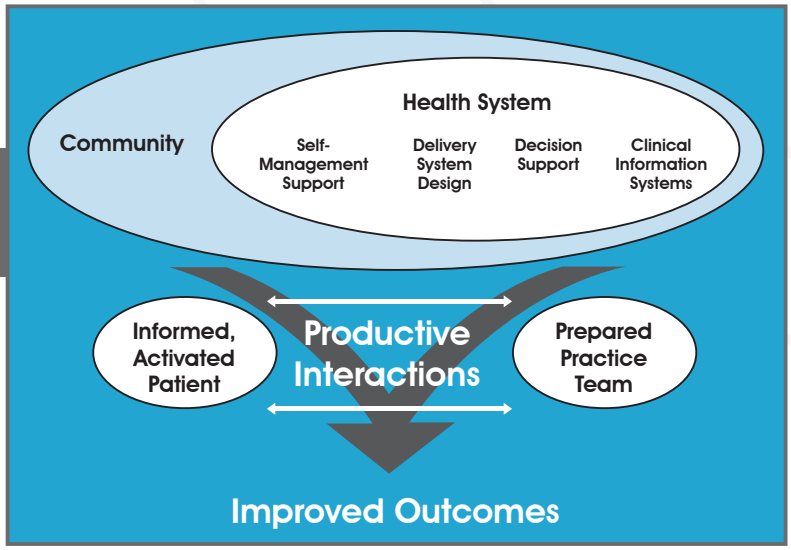
5) Technology Viability: The degree to which the technology is ready for adoption and diffusion—either in theory or practice. In practice, a credible organization (e.g., the VA) may demonstrate and endorse the technology's viability. In theory, technologies will diffuse more rapidly within a social system if they have certain characteristics.[8] Viable technologies are often designed so they are:

- *Compatible* with legacy knowledge, attitudes and practices (KAP). This assumes that the technology design or user interface requires or elicits a reaction from stakeholders. A compatible technology will resonate with legacy KAP and be adopted and diffused more quickly. Adoption and diffusion of an incompatible technology will stall because it is at odds with entrenched KAPs, e.g., adoption of the technology requires a change in an organization's business model or a change in stakeholder roles and self-perceptions.
- *Trialable*, meaning the technology can be used on a limited basis. In other words, the technology is amenable to "test driving." A technology that is not trialable will require a commitment from stakeholders before they may be comfortable with that commitment.
- *Observable/Communicable*, meaning the benefits of using the technology can be easily seen, understood, and communicated. Benefits are difficult to see if technologies are bundled along with other complex technologies, or when the benefits have to be taken on "faith." Note that high-visibility role models, such as the VA, are important in demonstrating technology benefits.
- *Usable*, meaning the technology can be easily installed, used, and maintained by stakeholders and end-users.

Technology Focus Areas

Technology Enables the Chronic Care Model

Wagner EH. Chronic disease management: What will it take to improve care for chronic illness? Effective Clinical Practice. 1998;1(1):2-4.]



6) Stakeholder Readiness: The degree to which the people and systems are ready to adopt and diffuse the technology in a reasonable time frame (i.e., introduction and expanded use of technology within one year). Note that technologies can be designed to meet the needs of stakeholders ("technology viability") or stakeholders can change or transform to accommodate the technology.

7) Policy Relevance: The degree to which use of the technology aligns with current/emerging policies, or further diffusion of the technology could inspire positive change to health and long-term care system policies.

Focus Technologies in Context

The Institute of Medicine has called for fundamental reform in the way that care is delivered to older adults. Current models of care often fail to deliver adequate and efficient care to older adults. A transformation in care processes is needed, according to the IOM, in order to better address the needs of the growing population of older adults in a workforce- and cost-constrained health and long-term care environment. The IOM believes that innovative models of care, and the use of transformative technologies to implement such care models, are urgently needed.[9]

Developed by Edward Wagner in collaboration with the Robert Wood Johnson Foundation, the Chronic Care Model (CCM) is particularly useful as a guide to the care of older adults with multiple chronic illnesses. The CCM conceptualizes an integrated, coordinated, and productive system of care at the community, organization, practice, and patient level. This care involves self-management, delivery system redesign, and clinical information systems.

Technology is widely recognized as an enabler of the CCM model. As depicted above, each of the Center's technology focus areas supports one or more care processes within the CCM.

Technologies described in the following pages better enable self-management support, delivery system redesign, and decision support. Clinical information systems collect data and track numerous steps in the process.

Technology Focus Areas

Medication Optimization

Overview

Medication optimization refers to a wide variety of technologies designed to help manage medication information, dispensing, adherence and tracking. Medication optimization technologies are particularly applicable for the elderly, caregivers, and people with chronic illness or complicated medication regimens.[10]

Technologies described in this section tend to help individual patients take their medications according to clinician instruction. Although not mentioned here, medication optimization technologies could also include technologies that help physicians, pharmacists, and other professionals better carry out their responsibility to provide the right medications, in the right dose, to the right patient.

Technology	Medication Optimization
Applications	Chronic disease and medication management
Comparison Technology	Patient and caregiver reminders
Vendors	Many; some examples include Pillbox Pager, EMMA™, Med-e-Monitor™, Health Hero® Network
Drivers	Better medication adherence has been shown to reduce hospitalizations and improve health outcomes
Barriers	Cost and/or complexity for some technologies
Cost	Varies widely; $4-$1000+
Reimbursement	Mostly consumer-driven

Technology Focus Areas

Medication Optimization

Applications

Medication optimization technologies range from very simple to highly sophisticated. A technology can potentially provide one or more functions to an individual patient under a "medication administration continuum," including:[11]

1) Fill: provides patient with information and/or instructions about the drug

2) Remind: reminds patients to take medications – audibly, visually, or both

3) Dispense: automatically dispenses medications (e.g., in the home), usually at certain times/intervals

4) Ingest: detects whether or not a patient has ingested his/her medications

5) Metabolize: detects whether or not a patient has metabolized his/her medication

6) Report: logs date and time when medication is taken and reports to clinician/caregiver

7) Adjust: adjusts medication automatically if needed

Ingest, Metabolize, and Adjust can be considered "advanced functions" because these capabilities are still largely in development.

Medication Administration Continuum

Drug information: standalone or add-on app.	Reminder devices	Dispenser devices	Ingestion Sensors	Drug Metabolism Checks	Logging Clinician Feedback	Automatic Medication Adjustment
Usually an add-on to a reminder or dispenser technology but can be standalone. Gives information about the drug, instructions, side effects, drug interactions, etc.	Device or application reminding patients – audibly, visually, or both - to take medication at timed intervals.	A device that separates medication by day. May automatically dispense by day. Some models feature a locking mechanism to prevent double dosing.	A device that detects whether or not a patient has ingested their medication.	A device that detects whether or not a patient has metabolized his/her medication.	Usually an add-on to a reminder/ dispensing device. Logs date and time every time a medication is taken or not taken. Log of medication adherence is sent to a clinician or caregiver who is monitoring care.	Clinician uses information about the patient's medication adherence to adjust their medication automatically.

Note: Technologies in BLUE are already available. Technologies in GREY are in development. Technology continuum focused mainly on patient errors.

Technology Focus Areas

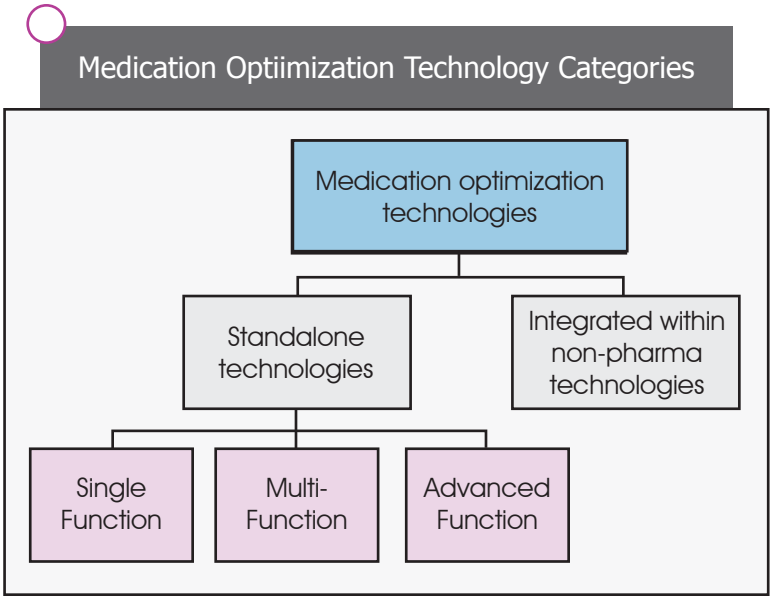
Medication Optimization

Medication optimization technologies have been expanding in both variety and sophistication. Medication error data highlight the growing importance of these technologies. Deaths from medication errors at home increased sevenfold (adjusted for population) from 1983 to 2004, while 50% of the 1.8 billion prescription medications dispensed annually in the U.S. are taken incorrectly.[12] In addition, medication errors can have significant financial implications. Medication non-adherence results in approximately $177 billion annually in direct and indirect costs to the U.S. economy, while $47 billion each year is spent for drug-related hospitalizations.[13]

Given these issues facing medication administration, a wide variety of technologies have emerged to help improve medication adherence. **Standalone technologies** tend to be less complicated and include some single-function technologies as well as some multi-function technologies. These technologies are the simplest and easiest to use; however, they lack the functionality for more comprehensive health management. Examples of a standalone technology include a medication reminder, a medication dispenser, or a device that combines filling, reminding, and dispensing. Many standalone technologies are currently available on the market, with a wide price range depending on the level of sophistication. Additional standalone technologies are currently being developed, including those with advanced functions.

Standalone Technology: Talking Pill Bottle

On the other hand, **integrated technologies** are a more recent development. These technologies are more complex and integrate medication management with other health management capabilities such as general health monitoring, sensors, or health information storage. While these integrated technologies allow for more comprehensive health management, they can be more expensive and complicated than their standalone counterparts, making them inappropriate for simpler situations. These integrated technologies often use a service-based pricing model (compared to a one-time fee for standalone technologies). Some integrated solutions are currently available on the market, while others are currently in development.



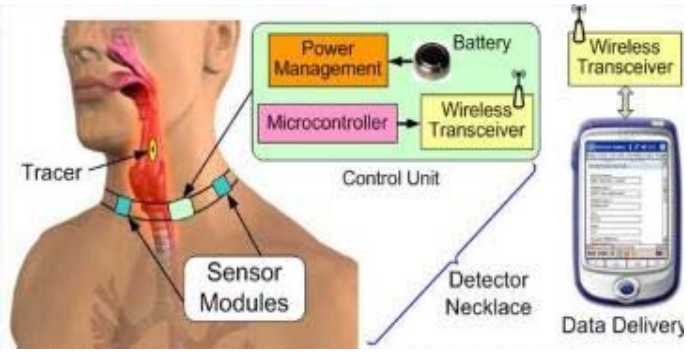
Technology Focus Areas

Medication Optimization

The Future

Many medication optimization products are available and continue to be developed. Both standalone and integrated technologies will continue in their adoption and development. It will be up to consumers and providers to select the solution(s) that are most appropriate.

Currently, advanced function technologies are mostly in development and not yet available on the market. These correspond to technologies that perform the Ingest, Metabolize, or Adjust functions on the continuum. A few examples include MagneTrace (pictured) and Xhale's SMARTTM. Being able to fully develop these advanced technologies and incorporate them with existing technologies would result in getting closer to the "ideal medication administration technology," which would allow for closed-loop optimal dosing and automatic adjustment of medication. This ideal technology, though still many years off, would continue to improve the patient's medication behavior, as well as automatically adjust medication doses.



Advanced Technology: Diagram of Magne Trace

Integrated Technology: Health Hero® Network's Health Buddy®

Integrated service-oriented technologies will also continue in their development and adoption, allowing consumers more choices in managing their health. Currently, several of these technologies are widely used, including the Health Hero® Network's Health Buddy® (pictured) by the Veterans Health Administration. Funding decisions may also impact the adoption of these technologies, as these technologies tend to be more expensive. These integrated technologies especially hold promise for patients with multiple health problems, elderly people living alone, and patients who are looking for more independent ways to manage their health.[14]

Over the longer-term, as more people continue to use medication administration technologies appropriate for managing their conditions, the ultimate goal is an improvement in patient outcomes. This will translate into decreased hospitalizations, decreased costs, increased quality of life, and a more independent lifestyle for patients. These technologies also can help clinicians and caregivers by allowing for remote monitoring and better health management on the part of the patient. The extent of these gains will depend on the development, adoption, and usage for this class of technologies.

Technology Focus Areas

Remote Patient Monitoring

Overview

Remote Patient Monitoring (RPM) refers to a wide variety of technologies designed to manage and monitor a range of health conditions. Point-of-care (e.g., home) monitoring devices, such as weight scales, glucometers, and blood pressure monitors, may standalone to collect and report health data, or they may become part of a fully integrated health data collection, analysis, and reporting system that communicates to multiple nodes of the health system, and provides alerts when health conditions decline. These technologies are particularly useful for the elderly, chronically ill, and people who have trouble accessing traditional sites of care.

Several types of health care organizations are now fielding RPM-enabled programs for chronic disease management. Broadly deployed within the Veterans Health Administration and in many small trials elsewhere like Kaiser Permanente and Group Health of Puget Sound, RPM has been shown to support patient self-management, shift responsibilities to non-clinical providers, reduce the use of emergency department and hospital services, and improve patient and provider satisfaction.

Early adopters of RPM technologies identify six components of chronic care management that are facilitated by these technologies: (1) early intervention—to detect deterioration and intervene before unscheduled and preventable services are needed; (2) integration of care—exchange of data and communication across multiple co-morbidities, multiple providers, and complex disease states; (3) coaching—motivational interviewing and other techniques to encourage patient behavioral change and self-care; (4) increased trust—patients' satisfaction and feelings of "connectedness" with providers; (5) workforce changes—shifts to lower-cost and more plentiful health care workers, including medical assistants, community health workers, and social workers; and (6) increased productivity—decreased home visit travel time and automated documentation.[15]

Technology	Remote Patient Monitoring
Applications	Chronic disease management
Comparison Technology	In-person visits
Vendors	Many; some examples include Bosch, Philips, Cisco, Intel and other companies
Drivers	Improved patient outcomes and efficiency, lower costs, better access to care, and others
Barriers	Reimbursement and funding inconsistent; technology requirements also a barrier in some cases, lack of interoperability between devices, data security concerns
Cost	$100 - $1000 technology cost
Reimbursement	Varies widely

Technology Focus Areas

Remote Patient Monitoring

Applications

RPM technologies provide essential support for the coordination of care, behavior change (of providers as well as patients), and evidence-based decision support for patients. There are features of remote patient monitoring that can be used by patients, providers, and caregivers. An ideal remote patient monitoring solution takes into account the needs of all three. The evidence base for RPM is building, and demonstrates decreases in emergency department (ED) visits and hospital admissions for pulmonary and cardiac disease. In four New England hospitals, in-home monitoring and coaching after hospitalization for congestive heart failure (CHF) reduced rehospitalizations for heart failure by 72 percent, and all cardiac-related hospitalizations by 63 percent.[15]

Patients	Providers and Caregivers
• Collect patient info – Remote collection of patient information, whether physiological or emotional, using a device. May include video or phone interaction. May collect specific vital signs manually or automatically. • Send alerts – Sends alerts to patients on changes in health status, medication reminders, upcoming appointments, or motivational statements. Sends alerts to caregivers and providers on changes in health status and/or warning signs. • Educate – Built-in patient education programs allow patients access to information on their specific condition(s), medications, symptoms, etc.	• Diagnose early – Use remote information to diagnose patient early. • Intervene early – Inform providers of changes in health status and intervene early to prevent hospitalizations. • Improve care coordination.

RPM Process in Integrated Health Care Systems

Patient interacts with telehealth device	Patient interacts with telehealth device	Patient interacts with telehealth device
Data collected includes: • Vital signs (blood pressure, glucose meters, pulse oximeters, weight, etc.) • Physical and emotional well-being assessment	Data transmitted over: • Video over low-bandwidth POTS • Video over IP • LAN/WAN	Results include: • Enhanced communication between caregivers, providers, and patients leads to improvements in care coordination and caregiver support • Reduce unnecessary visits • Improve medication compliance

Note: POTS is "plain old telephone service." IP is "internet protocol." LAN/WAN is "local area network/wide area network."

Technology Focus Areas

Remote Patient Monitoring

The Veterans Health Administration (VHA) has evaluated, piloted, reevaluated, and deployed RPM technologies in a continuing process of learning and improvement. Reports in the literature of VHA studies cite improvements in a wide range of metrics. In addition to the expected decreases in ED, hospital, and nursing home use, use of preventive services and medication adherence increased, as did patients' understanding of their condition, confidence in self-management, communications with physicians and nurses, feeling of connectedness to the care team, sense of security, and health-related quality-of-life scores. Although most studies did not include direct cost measures, remote monitoring for end-of-life care decreased the total combined costs of hospital and ED use over six months for 100 veterans from $151,771 to $25,119.11.[16]

The Future

Remote patient monitoring is currently growing rapidly, bringing convenience and simplifying care for patients and healthcare professionals. In the future, not only is remote patient monitoring expected to expand in terms of adoption, but also in terms of the variety of applications and offerings. An increase in the use of general broadband technology and the "wiredness" of homes, hospitals, and other care settings will facilitate the growth of RPM.

Home care agencies may well prove to be the most effective entities in the adoption of RPM. Unlike provider-based plans and home health agencies, the business model for hospital-based delivery systems has historically been poorly aligned with chronic care innovations and the RPM technologies that support them. After some early experimentation with RPM technologies, many health plans have relied upon disease management (DM) contractors to identify opportunities to use RPM in chronic care management.

RPM technologies represent an opportunity to grapple with the coverage issues that arise when a category of technology is continuously and rapidly evolving. Whether it is by DM companies, health plans or homecare providers and senior living communities, coverage and reimbursement policies remain a barrier to RPM deployment. We have a great deal to learn about the most effective means of compensating providers for their use.

The prevalence of this technology will increase and the skills of providers will be tested not only by the quality of the patient-provider interaction, but by technological proficiency and access. In turn, medical facilities will encounter new challenges in preparing and training adequate personnel. The cost structures of medical facilities will change as capital investments in medicine will have to increase to respond to growing demand. Given its enormous potential, remote patient monitoring will continue its rapid growth, playing a large role in the future of medicine and treatment.

Technology Focus Areas

Assistive Technologies

Overview

Assistive Technologies include a wide range of devices and equipment that are used to increase, maintain, or improve functional capabilities of individuals with disabilities.[17] An AARP study showed that 34% of adults over 65 have an impairment that limits one or more basic physical activities.[18] These impairments impact Activities of Daily Living (ADLs) as individuals age. Assistive technologies promote independence as they compensate for sensory, physical, and cognitive impairments, and promote safety for vulnerable individuals as they mitigate, detect and report health hazards.

Examples range from active technologies that directly interact with the user to support ADLs such as wheelchairs and large-button cellphones, to more passive systems such as computer controlled "smart homes" that provide support for persons with substantial cognitive impairment through the use of motion sensors and other passive data. Additionally, active and passive systems such as Personal Emergency Response Systems and acceleration sensors have been developed to assist individuals who would otherwise be unable to contact emergency services in the event of a fall or loss of mobility.

The market for assistive devices is large. More than 19,000 products are available and the market for wheelchairs alone was $1.33 billion in 2007.[19] Despite the size of the market there is limited evidence that assistive devices improve outcomes, reduce workforce demands, and reduce overall healthcare expenditures.[20,21]

Technology	Assistive Technologies
Comparison Technology	N/A
Vendors	ADT, ScanSoft, IBM, Honda, AbleNet
Drivers	Demographics, Cost reduction, Drive for aging at home, Payer policy
Barriers	Limited outcomes data, Receptivity of aging population, Privacy
Cost	$10-$40,000 (e.g. smart wheelchair)
Reimbursement	Government and Private Payers

Applications

Assistive Technologies provide for independence and safety for aging adults in a variety of settings including: home, work, transportation, recreation, and health care environments. There are a number of systems of classifications for assistive technologies including standards developed by the WHO, and the International Standards Organization (ISO), and the National Institute on Disability and Rehabilitation Research (NIDRR).[22] The example applications that follow are a subset of the system developed by rehabtool.com, a resource to assist consumers in selecting products.

Technology Focus Areas

Assistive Technologies

Activity/Application of Technology	Example technology
Communication	Large button cellular phone
Computer Access	Voice recognitions software
Environmental	Smart HVAC systems
Sensory	Cochlear implants
Mobility and Transportation	Smart Wheelchair
Seating and Positioning	Posture optimization devices
Vision and Reading	Visible light audio information transfer systems

The Future

As the population continues to age the number of people who will benefit from assistive technologies in a variety of settings (home, work, recreation, transportation) will continue to increase. More and more assistive technologies will integrate with other smart systems in the home to provide information remotely to both professional and family caregivers. These systems will take advantage of the wealth of data that can be obtained passively from technologies that a frail elder may interact with directly. For example, a grab-bar with a pressure sensor could communicate important information about the activity level of an elder. Additionally, breakthrough technologies for mobility such as Honda's exoskeleton to assist with walking or smart wheelchair technologies that integrate GPS with route planning systems will support independence for aging individuals with increasing levels of disability. Although changing demographics will be a powerful driver for the development and adoption of assistive technologies, there are a number of barriers that may inhibit the diffusion rate including receptivity of seniors, and reimbursement by payers.

As assistive technologies integrate with other remote devices and home monitoring equipment they will present an opportunity to gather important information about the level of activity of a frail elder. It will be critical to design technologies that are unobtrusive and/or passive as studies show that elders are very receptive to technologies that will support independence in their home even those that will limit their privacy.[23]

Payer reimbursement will also be a challenge to the diffusion of technologies. Future, networked technologies will increase in complexity and cost. The market for assistive technologies is large, estimated at $15-20 billion with Medicare accounting for over $2 billion in 2002.[24] These data indicate that a substantial portion of spending is out of pocket. Even though there will be considerable growth in the market driven by the elderly population, substantial reductions in health care costs are only likely to be achieved through changes in Medicare reimbursement policy.

Technology Focus Areas

Remote Training and Supervision

Overview

Remote Training and Supervision (RTS) technologies are systems that support the training and supervision of health care workers who are not physically collocated with their educator. The training can occur synchronously in real-time, or asynchronously in the manner of an online education course. Training is facilitated using web-based internet protocol (IP) technologies ranging from basic e-learning courses, to collaborative web conferencing platforms, to immersive virtual environments. Additionally, training can be accomplished using existing video-conferencing technologies that utilize analog communication systems. Particularly in the case of less skilled health workers, the use of remote systems for ongoing supervision of the workers, and for on-demand consultation with more experienced supervisors or instructors, offers the potential for continuing education and quality assurance. In many cases, these technologies can also be used to train and support family caregivers to augment the existing workforce. This is particularly important to support "aging at home" initiatives. The US health system will face a multitude of challenges over the coming years as it attempts to cope with a rapidly aging population. Workforce shortages will be one of the key obstacles to success in the coming decades. By 2025, it is estimated that there will be a shortage of 500,000 RN's alone.[25] RTS offers a possible solution to mitigating the effects of these shortages by increasing the training capacity of existing institutions and educators, and also by augmenting paraprofessional and family caregivers with access to professional consultation and support.

Technology	Remote Training and Supervision technologies for caregivers
Applications	Training, support, and specialty consultation for professional and family caregivers
Comparison Technology	On-site training and consultation
Vendors	MedSmart, InTouch, aquire Training Solutions
Drivers	Workforce Shortages, Aging at home, Demographics
Barriers	Outcomes data, Funding for initiatives, Availability of trained educators, limitations of virtual interaction
Cost	$100-$2000
Reimbursement	N/A

Applications

RTS technologies are being applied as training tools for paraprofessionals and family caregivers to support continuing education, address a shortage of educators, and provide a low cost alternative to on-site training initiatives. Also, RTS systems are augmenting paraprofessionals and family caregivers with consultation and support from more skilled or specialized professionals.

Technology Focus Areas

Remote Training and Supervision

Role	Training Application	Support Application
Professional Caregivers	E-learning, Video-classroom training, Remote Simulation	Telemedicine specialty consultation, Online Decision support tools
Paraprofessional Caregivers	E-learning, Video-classroom training	Telemedicine consultation, Tele-nursing support
Family Caregivers	E-learning	Telemedicine consultation, Tele-pharmacy consultation

The Future

As the population continues to age and workforce shortages become more acute, the need for innovations in remote training and supervision will grow. These needs will drive the development and deployment of RTS solutions, and it is likely that RTS solutions will begin not only to supplement education and support but in some cases to substitute for on-site education and consultation. Technology developments in medical simulation will likely diffuse to remote training. For example, virtual environments being used to train professionals are often web-based and could easily be made accessible from a home or long-term care setting. Additionally, developments in Remote Patient Monitoring (RPM) technologies will increase the volume of clinical information that may be made available to consulting or supervising clinicians. Integrating the RTS and RPM systems can enhance the ability of less skilled caregivers to support frail elders who would otherwise need to be cared for in settings that provide a higher level of care.

Barriers to adoption and development include limited outcomes data, access to funding for initiatives, a shortage of trained educators and limitations inherent in remote education and support. Many of these challenges may be overcome in the future through the use of simulation and remote training for clinicians and healthcare professionals. Substantial work in medical simulation is being done in university, military, and health systems settings. This work is generating positive outcomes data regarding remote and virtual training and is supporting the development of curriculums and expertise in the discipline.

Technology Focus Areas

Disease Management

Overview

Disease Management (DM) is a patient-centric, coordinated care process for patients with specific health conditions, particularly chronic conditions and conditions that have a significant self-care component. DM programs include data mining processes to identify high-risk patients within a population; use of evidence-based medical practice guidelines to support and treat individual patients; and a coordinated, data-informed system of patient outreach, feedback, and response.

Applications

DM is a proactive care coordination process that is commonly used to control or reverse the effects of chronic health conditions. In the past decade, the emphasis of DM has shifted from a strictly disease-centric approach, where separate DM programs were tailored to single chronic illnesses, to one that is more patient-centric, where programs are tailored more to individual patient needs and better accommodate patients with multiple health challenges. DM programs have also expanded beyond the "big five" chronic illnesses.[a] For example, current DM programs are designed to improve patient management and decision making for "supply-sensitive" health conditions;[b] and, they have expanded from an emphasis on secondary prevention to an emphasis on primary prevention.

Technology	Disease Management
Applications	Chronic illnesses, disabilities, supply-sensitive care
Comparison Technology	In-person visits
Vendors	Healthways, Health Dialog, LifeMasters, McKesson Health Solutions and many more
Drivers	Improved patient outcomes and efficiency; competitive advantage (for health plans)
Barriers	Demonstrating positive economic outcomes
Cost	$70 to $200 PMPM for Medicare eligible patients
Reimbursement	Health plan: absorbed into overhead costs; Large employer: paid for directly; Patient: usually no OOP fees

Note: PMPM is "per member, per month."
OOP is "out of pocket."

Outcomes from a successful DM program include decreased utilization of ED and hospital services, health status improvements, decreases in health care costs, and increased utilization of evidence-based medical practices. Improvements in a patient's self-management skills, satisfaction with care, and perceived quality of life are also benefits of DM.

[a] The "big five" chronic illnesses include asthma, diabetes, chronic obstructive pulmonary disease, cardiovascular diseases, and congestive heart failure.

[b] "Supply sensitive" condition means the amount and type of treatment will be influenced by the type and location of the supplier, which is typically the physician. For example, surgery will be recommended for back pain if the patient seeks the opinion of a back surgeon. An internist, chiropractor, or acupuncturist will each have a different approach.

Technology Focus Areas

Disease Management

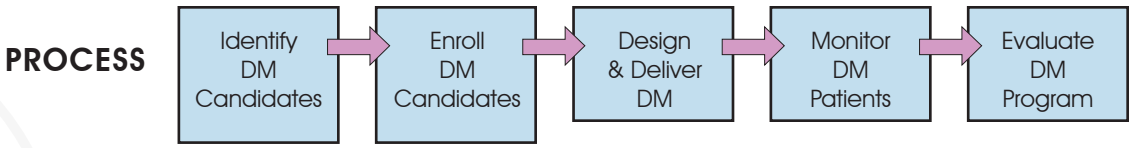
Nearly all managed care organizations (MCO) offer DM services to employer-based health plan members. DM is offered on a more limited basis to Medicaid recipients. States once considered DM as "the new tool for cost containment" for Medicaid recipients.[26] But studies are showing that cost savings of DM (vs. usual care) have been limited to specific patient populations, e.g., patients with congestive heart failure (CHF).[27] Medicare is concluding a large-scale study of DM that began in 2005. Although study results continue to be discussed and debated, results do not seem to support the expectation that DM would become the new, hoped-for cost containment tool.

Health care stakeholders can build DM services and programs organically, or they can subcontract to dedicated DM vendors. The DM industry is large and growing. According to the Disease Management Purchasing Consortium, industry revenues grew from $78 million in 1997 to an estimated $1.2 billion in 2005.[28]

DM programs are typically high touch and high tech. One-on-one health coaching is an important component of most DM programs. Health coaches (typically nurses) often work from large call centers to reach out to patients via phone or email.

Technologies support many phases of the disease management process. An example of technology use can be seen in the first step below. Data must be collected and analyzed to identify patients that will benefit from a disease management program. Since electronic medical records are still largely absent in much of the health care system, DM vendors have become masters at patching together disparate data, such as health claims, pharmacy, laboratory, and hospitalization data. But often these data are too little, too late as, for example, health claims are submitted weeks after a health event. Electronic health records clearly enable identification of at-risk patients. In non-EHR health systems, self-completed, online health risk assessments can be a useful supplement.

The Disease Management Process and Supporting Technologies



Example Technologies

- Data collection and analysis software and hardware
- Predictive modeling algorithms
- Interactive health risk assessments, patient health records
- Communications technologies (phone, internet based)
- Remote monitoring technologies
- Decision support for patients and clinicians
- Medication optimization technologies
- Patient registries, electronic health records
- Variety of health interventions (behavioral, biomedical, etc.)

Technology Focus Areas

Disease Management

The Future

Outcomes from disease management programs have recently been scrutinized through the use of large, randomized trials. Study results have been disappointing in many cases. However, niche applications of DM still seem promising, e.g., the use of DM in managing individuals with congestive heart failure. The Center will continue to track DM outcomes studies and determine the best applications of DM.

The Center also believes that DM outcomes studies will continue to offer many useful lessons learned. DM outcomes have been scrutinized with study methods that are generally more rigorous than that of the other six technology focus areas. This raises the question: if other technologies were tested with large-scale, randomized trials would they yield the same positive cost and health outcomes results that have been seen in less rigorously controlled studies (e.g., observational studies where patients choose to use, or not use, a particular technology)? Moreover, some believe that DM is not yielding the expected cost and health outcomes improvements in randomized trials because of simple but important barriers, such as high study dropout rates. In the future, the Center will track approaches used to overcome these barriers—because such approaches may be relevant to adoption and diffusion of other remote management technologies.

Technology Focus Areas

Cognitive Fitness and Assessment Technologies

Overview

Cognitive fitness and assessment technologies include thinking games and cognitive challenge regimens. Like physical fitness, the premise of cognitive fitness is that cognitive health can be maintained or improved if individuals exercise their brain. The emphasis with older adults is predominantly focused on the prevention or delay of Alzheimer's disease and related dementias. Many cognitive fitness technologies are computer- or internet-based, multi-media platforms, and include assessment and tracking components.

Participation in cognitive stimulation can lessen decline in memory, mental speed and decision-making. One study found adults over 65 who frequently participated in cognitive stimulation activities had 35% less cognitive decline than those with infrequent cognitive activity.[29] Use of computer-based cognitive fitness and assessment technologies have rapidly expanded over the last five years with advancements in computing and communication technologies.

Sales of cognitive fitness and assessment products in the US grew between 2005 to 2008 from an estimated $100 million to $265 million.[30] Most of the growth came from consumers, followed by healthcare providers. Residential facilities are also experiencing a large uptake in computerized cognitive fitness and assessment technologies. Over 700 residential facilities, mostly independent assisted living facilities and continuing care retirement communities (CCRCs), have installed these technologies.

Applications

Cognitive fitness and assessment technologies give health professionals, caregivers and acute care hospitals a better understanding of whether the patient can be self-sufficient and self manage their care at home. Clinicians and acute care hospitals use assessment tools to understand where deficits are occurring in the patient and incorporate these results in the decision-making process and discharge planning. Health insurers and delivery systems are beginning to explore the potential of cognitive fitness and assessment technologies. OptumHealth made an $18 million agreement with Brain Resource to develop computerized assessments for clinicians to evaluate social cognitive functions in 40-minute tests. Older adults can also use these technologies for preservation of cognitive abilities. Many products offer cognitive fitness games for regular long-term use. Common areas of focus for games include long-term and short-term memory, language, executive function, computation, visuospatial orientation and critical thinking.

Technology	Cognitive Fitness and Assessment Technologies
Applications	Health and Wellness, Fitness, Disease Management, Rehabilitation
Comparison Technology	Paper based assessments
Vendors	Nintendo, Dakim, Brain Resources, Archimage, Second Life, HopeLab
Drivers	Demographics, increased number of dementia and Alzheimer's disease cases
Barriers	Emerging evidence base of direct health outcomes and benefits
Cost	$20 - $5,000
Reimbursement	N/A

Technology Focus Areas

Cognitive Fitness and Assessment Technologies

Cognitive Fitness and Assessment Technology Example	Description
InSight (Posit Science)	Reduced effects of age-related mental decline through exercising areas of memory, language, concentration, executive function, and assessing visual attention performance with cognitive speed and skills. InSight software can be installed on a PC.
Dakim BrainFitness www.dakim.com	Touch screen device with internet connection providing over 125 cognitive assessment and fitness games for regular long-term use. Games focus on improving 6 cognitive domains including long- and short-term memory, language, computation, visuospatial orientation and critical thinking. Games integrate historical and generational-specific references.

The regular use of computerized cognitive assessments can establish a clear baseline of cognitive function. Subsequent assessments can track changes in cognition related to aging and onset of various clinical conditions. In May 2008, the military implemented the Automated Neuropsychological Assessment Metrics, a computer-based cognitive test examining reaction time, memory, attention, concentration and other cognitive functions.[32] This test is given to troops before they are deployed providing a baseline cognitive assessment. When examining a post-deployment injury, clinicians can compare cognitive test results with the baseline test to provide greater accuracy in diagnosis and treatment.

Combination computer-based cognitive and physical fitness and assessment technologies have also been developed to help prevent physical and cognitive decline simultaneously. The use of gaming consoles like Wii and Xbox not only support strength training and balance games, but also can assist with physical rehabilitation for stroke and traumatic brain disorders.

The Future

Despite the strong consumer interest in cognitive fitness and assessment technologies, the evidence base to validate and support the broad use of these technologies to deliver measurable health benefits is limited (but emerging). Lack of uniformity across cognitive assessment measures is another challenge. In 2006, the National Institutes of Health (NIH) launched a 5-year initiative called the NIH Toolbox, which seeks to assemble brief, comprehensive assessment tools with a particular emphasis on measuring outcomes in longitudinal epidemiologic studies.[31] The high cost of clinical research testing represents a considerable barrier to market development. Development of better training tools to improve cognitive functions and to reduce cognitive decline will grow with validation studies.

Dakim Brain Fitness System

Technology Focus Areas

Social Networking Technologies

Overview

Web-based social networking allows communities of older adults to connect, share knowledge with, and provide support to other older adults and their care providers. These web-based social networks utilize a variety of means to facilitate communication among patients including discussion groups, chat, messaging, email, video, and file-sharing.

In 2007, 56 percent of American adults used the Internet to look for health information.[33] Their activities ranged anywhere from seeking opinions on medications and treatments and getting emotional support, to researching conditions or treatments, learning self-management skills, and receiving education to manage a condition. The benefits of providing support and exchanging knowledge, especially for patients with chronic conditions, are well studied. Web-based online social networking emerged as a way to connect peers, independent of geography. Before web-based social networking services existed, in-person peer groups like the Chronic Disease Self-Management Program[c] have recognized the effect of sharing experiences, exchanging knowledge, and providing support to improve health outcomes for patients with various chronic conditions. The combination of patient-centered knowledge exchange and caregiver support makes social networking a powerful platform in changing the way that healthcare is delivered.

Applications

Social networking services connect older adults with other older adults as well as to clinicians, caregivers, researchers, health plans and suppliers. Older adults can use web-based social networking services to connect with friends and family as well as to exchange their knowledge and experiences of managing their conditions with other patients.

Caregivers and clinicians can use social networks to manage and coordinate care for an older adult. Clinicians are also able to educate and promote preventive health, to collectively understand their patients' needs and to remotely assist the patient, caregiver and family members.

Technology	Web-based Social Networking Services for Patients and Family Caregivers
Applications	Health education & promotion, social support and information exchange, enable self-management
Comparison Technology	In-person patient education and support groups
Vendors	Patientslikeme, DiabetesMine, Jive Kinnexxus, Facebook, Tyze
Drivers	Increased connectivity between patients and clinicians, lower costs in the acute setting
Barriers	Conflicts of interest between stakeholders and users, patient privacy concerns, healthcare's organizational culture
Cost	$0 - $100
Reimbursement	N/A

[c] The Chronic Disease Self-Management Program was developed by Kate Lorig and colleagues.

Technology Focus Areas

Social Networking Technologies

Use of Social Networking by Older Adults		
Application:	**Example:**	**Description:**
Connect with Friends and Family	**Facebook** www.facebook.com	Website where users can join networks organized by city, workplace, school, and region to connect and interact with other people. Users can add friends, send messages, update their personal profiles, and use an increasing number of applications.
Connect with Friends and Family	**Jive** http://jive.benarent.co.uk/	Three bundled products designed to connect older adults to friends and family online in "plug and play" capacity. The 3 products include a router, mouse free communication device, and friend passes, which store friends and family contact information.
Chronic Disease	**PatientsLikeMe** www.patientslikeme.com/	Website where members share treatment and symptom information in order to track and to learn from real-world outcomes. PatientsLikeMe currently has communities for amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS), Parkinson's disease, fibromyalgia, HIV, and mood disorders, as well as the rare conditions progressive supranuclear palsy, multiple system atrophy, and Devic's disease (neuromyelitis optica).

Use of Social Networking by Caregivers and Clinicians		
Application:	**Example:**	**Description:**
Care Coordination	**Tyze** www.tyze.com	A platform that hosts personal support networks for older adults, persons with disabilities and their caregivers. Tyze offers scheduling, task planning and messaging as well as storytelling around the person at the center of the network.
Care Coordination	**Kinnexxus** www.kinnexxus.com	Web-based platform provides a senior support network connecting older adults to each other, caregivers and professional care providers. Features include: scheduling, task planning and messaging as well as integrating with remote monitoring devices.

Technology Focus Areas

Social Networking Technologies

The Future

Social networking is rapidly evolving, with new players still joining and transforming the field. Though the future remains uncertain due to recession-induced funding decreases, the potential for transforming healthcare outside of the traditional model remains.

Despite these drivers, there are three main barriers preventing rapid development and dissemination of social networking for health. The first barrier involves conflicts of interest between stakeholders and users. It is oftentimes unclear how a patient's information will be used by health plans and suppliers. The second barrier involves patient privacy concerns. Social networking for health relies on the open sharing of patient information. Within a hospital, a patient's privacy is protected by HIPAA. Outside of the hospital, privacy issues become a concern. It is uncertain how our judicial system will deal with violations of privacy as well as how they will provide for protection of this information. The third barrier relates to the organizational culture of traditional healthcare, where health care providers control the information and messages that are directed to patients. Since content on social networking is mostly patient-generated, traditional healthcare is concerned how this will affect their message.

Social networks are just beginning to incorporate applications such as search and personal health records (PHRs). Websites that integrate search with social networking allow older adults and caregivers to search for health information and see both their Web search results as well as a list of patients that may be suffering from similar conditions. Additionally, websites that integrate PHRs with social networking give the patients the ability to view their medical information data as well as to share it with whom they wish. Furthermore, the overlay of intelligent algorithms onto both applications gives patients the ability to see customized information about their health that they could then use to proactively manage their health in a personalized and tailored fashion. Not only can intelligent algorithms help patient's improve their own health, the integration of intelligent algorithms has the potential to learn from the collective wisdom of patients by seeking patterns, understanding behaviors, and ultimately using that wisdom to improve care. As patients demand different ways to manage their health outside of the traditional healthcare model, these powerful new additions will play a large role in advancing online social networking services for health.

Traditional healthcare stands to benefit greatly from the addition of social networking services to their model. Over the long term, social networking can benefit health care providers in a number of ways including "integrating patient care and enabling community, enhancing patients' compliance with therapies, building goodwill in communities, providing useful health information to people who opt-in to receive it, and averting costs that would be incurred in acute settings."[34] Social networking services have the potential to form a more collaborative model of healthcare delivering more effective and efficient care.

Tyze

Next Steps

The Center will continue to review the seven technology areas with the help of experts and stakeholders in a number of areas. To identify potential opportunities, the Center will tap the experience and expertise of individuals involved in aging technologies, aging services, and program diffusion. Such individuals will include technical experts, policymakers, regulators and funders. The Center will also conduct field reviews with health and social service organizations, which are current and potential users of aging technologies.

As health care delivery evolves over the coming years, evidence will continue to emerge regarding the viability of new technologies and their contribution to the health and well-being of older adults. Not only do beneficial technologies offer significant potential for assisting older adults in maintaining their independence, they also provide a very promising method for helping address some of the challenges currently facing the U.S. health care system. For if the rate and scale of technology adoption can be increased, even modestly, it offers considerable potential for reducing the ever escalating personal and societal costs of chronic illness among older adults.

References

Introduction

1. Barrett L. Healthy@Home. Washington, DC: AARP Foundation; March 2008.

Background

2. National Center for Health Statistics. Health, United States, 2008: Centers for Disease Control and Prevention, Department of Health and Human Services; 2009.
3. Centers for Disease Control and Prevention and The Merck Company Foundation. The State of Aging and Health in America 2007. Whitehouse Station, NJ 2007.
4. The Congress of the United States Congressional Budget Office. Budget Options, Volume 1. Health Care. Pub. No. 3185 2008.
5. Hartman M, Catlin A, Lassman D, Cylus J, Heffler S. U.S. Health Spending By Age, Selected Years Through 2004. Health Affairs Web Exclusive. November 6, 2007;27(1):w1-12.
6. PHI National. Paraprofessional Healthcare Institute (PHI) National Chart Gallery. Available at: http://www.flickr.com/photos/phinational/3121346085/in/set-72157611365445819/. Accessed June 12, 2009.

Technology Focus Areas

7. New England Healthcare Institute, Massachusetts Technology Collaborative, Health Technology Center. FAST Update: 2008-2009 Candidate Technologies. Cambridge, MA January 1, 2008. Note: the Center for Technology and Aging utilized some of the FAST criteria for evaluating medical innovation as a basis for developing the Center's own criteria.
8. Rogers E. Diffusion of Innovations, 5th Edition. New York, NY: Free Press; 2003.
9. Committee on the Future Health Care Workforce for Older Americans, Institute of Medicine. Retooling for an Aging America: Building the Health Care Workforce. Washington, DC: National Academies Press; 2008.

Medication Optimization

10. Sabaté E, World Health Organization. Adherence to Long-Term Therapies: Evidence for action. Geneva, Switzerland 2003.
11. Rich M, Beckham V, Wittenberg C, Leven C, Freedland K, Carney R. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. New England Journal of Medicine. Nov 2 1995;333(18):1190-1195.
12. Phillips D. Fatal Medication Errors At Home Rise Sharply. Wall Street Journal - Eastern Edition, 2008: D2.
13. National Council on Patient Information and Education. Enhancing Prescription Medicine Adherence: A National Action Plan. Bethesda, MD August 2007.
14. Schmittdiel JA, Uratsu CS, Karter AJ, et al. Why don't diabetes patients achieve recommended risk factor targets? Poor adherence versus lack of treatment intensification. J Gen Intern Med. May 2008;23(5):588-594.

Remote Patient Monitoring

15. Coye M, Haselkorn A, DeMello S. Remote Patient Management: Technology-Enabled Innovation And Evolving Business Models For Chronic Disease Care. Health Affairs. 2009;28(1):126-135.
16. Darkins A, Ryan P, Kobb R, et al. Care Coordination/Home Telehealth: The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veteran Patients with Chronic Conditions. Telemedicine Journal & E-Health. 2008;14(10):1118-1126.

References

Assistive Technologies

17. The Assistive Technology Act of 1998. Public Law 105-394, 29 USC 2201.

18. Barrett, L. Healthy@Home. Washington, DC: AARP Foundation; March 2008.

19. Cooper RA, Cooper R, Boninger ML. Trends and issues in wheelchair technologies. Assist Technol. Summer 2008;20(2):61-72.

20. Fuhrer MJ. Assessing the efficacy, effectiveness, and cost-effectiveness of assistive technology interventions for enhancing mobility. Disabil Rehabil Assist Technol. May 2007;2(3):149-158.

21. Agree E, Freedman V, Cornman J, Wolf D, Marcotte J. Reconsidering Substitution in Long-Term Care: When Does Assistive Technology Take the Place of Personal Care? Journals of Gerontology Series B: Psychological Sciences & Social Sciences. 2005;60B(5):S272-S280.

22. The Interagency Committee on Disability Research, US Department of Education. Compendium of Assistive Technology Research. A Guide to Currently Funded Research Projects. Washington, DC, 2004.

23. Assistive Technology Act of 1998. Public Law 105-394, 29 USC 2201.

24. Freiman M, AARP Public Policy Institute. In Brief: Public Funding and Support of Assistive Technologies for Persons with Disabilities. Available at: http://www.aarp.org/research/longtermcare/programfunding/inb115_assist.html. Accessed June 7, 2009.

Remote Training and Supervision

25. Barrett, L. Healthy@Home. Washington, DC: AARP Foundation; March 2008.

Disease Management

26. National Governors Association Center for Best Practices. Disease Management: The New Tool for Cost Containment and Quality Care. National Governors Association Issue Brief. February, 2003.

27. Holmes AM, Ackermann RD, Zillich AJ, Katz BP, Downs SM, Inui TS. The net fiscal impact of a chronic disease management program: Indiana Medicaid. Health Aff (Millwood). May-Jun 2008;27(3):855-864.

28. Matheson D, Wilkins A, Psacharopoulos D, Boston Consulting Group. Realizing the promise of disease management. Payer trends and opportunities in the United States. Boston, MA. February 2006.

Cognitive Fitness and Assessment

29. Wilson RS, Bennett DA, Bienias JL, Mendes de Leon CF, Morris MC, Evans DA. Cognitive activity and cognitive decline in a biracial community population. Neurology. Sep 23 2003;61(6):812-816.

30. SharpBrains. The State of the Brain Fitness Software Market 2009. May 2009.

31. The National Institutes of Health. The NIH Toolbox for Assessment of Neurological and Behavioral Function. Available at: http://www.nihtoolbox.org/default.aspx. Accessed June 6, 2009.

32. United States Army Medical Department. Automated Neuropsychological Assessment Metrics (ANAM). Available at: http://www.armymedicine.army.mil/prr/anam.html. Accessed June 6, 2009.

Social Networking

33. Robert Wood Johnson Foundation. More Americans Seeking Health Information, Especially on the Internet. Education level remains key in likelihood of seeking health information. (Press Release). Available at: http://www.rwjf.org/pr/product.jsp?id=33852. Accessed June 6, 2009.

34. Sarasohn-Kahn J, THINK-Health and the California HealthCare Foundation. The Wisdom of Patients: Health Care Meets Online Social Media. Available at: http://www.chcf.org/topics/chronicdisease/index.cfm?itemID=133631. Accessed June 6, 2009.

About the Authors

This report was developed collaboratively between the Center for Technology and Aging and HealthTech. Authors included Jean Armas, Andrew Broderick, Molly Coye, Steve DeMello, Barbara Harvath, David Lindeman, Aaron Mintz, Neeraja Penumetcha, Lynn Redington, Valerie Steinmetz, and Thomas Tinstman.

About the Center for Technology and Aging

The Center for Technology and Aging is devoted to helping California and the nation more rapidly adopt and diffuse technologies that improve home- and community-based care for older adults. The Center is addressing the challenge of adoption, diffusion and sustainability of creative technologies that support the health and independence of older adults. Through research, grants, public policy involvement, and development of practical implementation tools, the Center serves as a resource for all those seeking to improve the quality and cost-effectiveness of long-term care services. The Center for Technology and Aging at the Public Health Institute is funded by The SCAN Foundation.

About The SCAN Foundation

The SCAN Foundation, an independent charitable foundation located in Long Beach, California, is focused on finding innovative solutions to the healthcare needs of California seniors. It is one of the nation's largest foundations dedicated to the needs of the elderly. The organization's vision is a society where seniors receive medical treatment and human services that are integrated in the setting most appropriate to their needs and with the greatest likelihood of a healthy, independent life.

About the Public Health Institute

The Public Health Institute (PHI), an independent nonprofit organization based in Oakland, California, is dedicated to promoting health, well-being and quality of life for people throughout California, across the nation and around the world. PHI's primary methods for achieving these goals include: sharing evidence developed through quality research and evaluation; providing training and technical assistance; and promoting successful prevention strategies to policymakers, communities, and individuals.

Request for Proposal

The initial RFP cycle for proposals addressing diffusion of a specific area of technology that helps maintain the independence of older adults will be released in the fall of 2009.

If you would like to be added to the Center for Technology and Aging RFP notification email list, please submit an email request to: Valerie Steinmetz, Senior Researcher at vsteinmetz@techandaging.org

Supported by a grant from The SCAN Foundation, based in Long Beach, California. The SCAN Foundation is an independent nonprofit foundation dedicated to advancing the development of a sustainable continuum of quality care for seniors that integrates medical treatment and human services in the settings most appropriate to their needs and with the greatest likelihood of a healthy, independent life. The SCAN Foundation supports programs that stimulate public engagement, develop realistic public policy and financing options, and disseminate promising care models and technologies.

Center for
Technology and Aging

An Initiative of The SCAN Foundation
and Public Health Institute

555 12th Street, 10th Floor
Oakland, CA 94607
www.techandaging.org