HOME AND COMMUNITY
TELEHEALTH FOR MINNESOTA:
Background, Challenges, Potential

Metro Area Eldercare Development Partnership
Metropolitan Area Agency on Aging
North St. Paul, MN
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**PURPOSE:** This report has been prepared by the Lifetime Home Project (Minneapolis, MN) for the Metro Area Eldercare Development Partnership of the Metropolitan Area Agency on Aging (N. St. Paul, MN). The Partnership’s 2011-2013 work program contains a strategy area focused on using technology to expand the capacity of the community long-term care system, and this report responds in part to that strategy by:

- Assessing which technologies are both care and cost beneficial, including through a review of research literature, and
- Investigating other states' public policy around the use of these technologies, comparing their status with Minnesota’s, and identifying where Minnesota could make changes that would have an impact on technology use.
EXECUTIVE SUMMARY

CHAPTER 1: SETTING THE STAGE

We live in an incredibly electronic world where an ever-growing number of disruptive technologies continue to emerge and interact. They bring with them extraordinary opportunities as well as profound changes in many areas of everyday life. The electronic healthcare revolution is a prime example of how technology can alter practices followed for decades and shift historic delivery capacities and boundaries.

Telemedicine is part of this revolution - the original delivery focus on remote treatment and consultation by credentialed providers in clinical/hospital settings. Telehealth is the term that has come to encompass telemedicine affairs along with general wellness/fitness technologies and assistance with both post-acute and chronic care needs at home and in the community. Original equipment connections relying on telephones have expanded to wired and wireless options, typically using Internet linkages. Advances in radio-frequency identification technologies have contributed to an expanding array of sensor-based products, including those worn, surgically implanted and/or ingested biosensors.

Services provided remotely at home can be grouped into two broad categories. The first involves equipment that monitors various body vital signs and medication adherence/management; evolving delivery may also encompass mental health and rehabilitation assistance. The second category involves remote activity/safety monitoring, including emergency response and fall and/or wander management capabilities. Smart home security and automation technologies have been marketed for decades, and some activity/safety monitoring now similarly imbeds sensors into a home's structure and fixtures.

As the array of remote care products for use within the home has expanded, a parallel revolution involving wireless smart devices has taken place. Smartphones and computer tablets are now adapted to become diagnostic tools. Peripherals devices are designed for use with them in data gathering, and program "apps" (applications) perform a huge array of functions. Smart device-mediated healthcare assists not just individuals, but can be used in public health-related research, tracking and notifications. And while seniors in the past may not have used or been comfortable with basic electronic technologies, examples from recent surveys show general acceptance/adoptions.

Electronics are relocating the "point of care" for some health and wellness services from their historic clinical/hospital base to delivery at home, in the neighborhood and potentially far beyond. Healthcare organizational boundaries are shifting as a result - a major example is the home care/home healthcare industry, whose members have been the prime historic providers of in-home medical services and support. Some functions previously performed at home can also now be done when mobile using smart devices and peripheral equipment. Additionally, doctors who in the past may have made home
care/healthcare referrals are now making house calls and becoming in-home delivery care team members. "Hospital at home" care models are also being tested.

A "quantified self" movement is expanding as electronic products routinely enable people to self-monitor health status on a long-term basis. These products are becoming an economic growth engine, fostered by expanding numbers of healthcare technology incubators and evolving alliances among manufacturers, care providers and telecommunications carriers.

CHAPTER 2: TRENDS AFFECTING HOME TELEHEALTH ADOPTION

The need for home/community telehealth is influenced by broad trends advancing in the country. One of the most evident is efforts to respond to our healthcare and cost crises. Home telehealth is an integral component in the design and implementation of the federal Affordable Care Act, from priorities on avoiding rehospitalization, to testing better methods for hospital-to-community transitions and use of home-based primary care teams.

Another pervasive trend surrounds boomer demographics and the desire of a large percentage of its members to age in place. By their simple numbers, boomers represent potential demand for greatly expanded healthcare/support at home. They will continue facing rapid exits from acute-care treatment, and many also have or will acquire age-related chronic conditions needing long-term management. This potential increase in demand for home-/community-based assistance will occur at the same time that care workforce shortages are projected to increase. Geographic disparities will add to challenges for those not living in major urban centers, particular in availability of specialized medical services.

CHAPTER 3: MAJOR COMPONENTS AFFECTING DIRECT DELIVERY

Previously highlighted macro-trends affect home/community telehealth adoption on both an individual and collective basis. Practitioners' abilities to incorporate telehealth into service delivery are further affected by a number of prominent operational factors including:

- Healthcare decision-making instability, particularly surrounding the Affordable Care Act's implementation;
- Historic medical credentialing requiring that physicians and other practitioners have licenses from all states in which they routinely deliver telehealth services;
- Expansion of broadband capacity around the country and in Minnesota, its regulation by the Federal Communications Commission and impact from some of its recent actions;
• Data gathering/management capacities, including electronic health records implementation;

• Impacts the federal Food and Drug Administration's device regulation have on new products coming to market and changes in existing hardware/software systems, and most recently, on developments in the expanding mobile health field;

• Concerns about device interoperability and the role the trade association, Continua, has played in creating a "level playing field" among manufacturers;

• Financing issues - including equipment acquisition/maintenance, operations (e.g., staff training and data management), connectivity, and the emerging "telehealth as a service" model where companies contract to effectively become outsourced telehealth departments;

• The impact introduction of these technologies has on staffing patterns, responsibilities, practices, and strategies for successfully promoting the technologies' uses in an organization's culture;

• Recent federal legislation aimed at increasing telehealth access for persons insured through a range of federal services, at fostering the technology's use in less-populated locations, and enhancing the FDA's mobile health capacity.

Findings from a 2012 national survey on home care, home healthcare and geriatric care management agencies' telehealth usage is a proxy for the extent of adoption in those fields. Results showed respondent familiarity with the technologies, but moderate adoption rates for very basic equipment like personal emergency response systems and medication dispensers (slightly over 50%). Use of various types of vital signs peripherals was far lower (14% or less, depending on devices involved).

CHAPTER 4: EFFICACY AND COST-BENEFIT

Outcomes from a substantial number of research projects over many years have answered the question of telemedicine's and telehealth's efficacy. However, issues regarding whether mobile health products are sufficiently exacting in remotely performing certain procedures are presently being researched and assessed.

The issue of the technologies' cost-benefit capabilities has also been extensively covered over time, although interpreting results depends in part on whose costs and whose benefits are of concern. The typical approach has been to assess direct acquisition/operational costs and reimbursement opportunities using a business return on investment approach. However, organizations may also factor a number of subjective measures into the benefits side of the equations - e.g., impact on reputation, image, "goodwill," patient/support network satisfaction. Additional broader and more indirect qualitative measures beyond a single organization's costs-benefits should but
typically aren't accounted for in these calculations - e.g., adverse social outcomes technology use may reduce/eliminate, community economic benefits.

An array of abstracts or full reports for approximately 20 formal U.S. research studies (2009 to the present) were reviewed, and findings supporting the technologies' efficacy and/or cost-benefit summarized. Additional significant study or program result highlights include:

- The British "Whole System Demonstrator Program" involved 6,200 patients and 240 general practices across three program sites;

- A wide range of initiatives overseen by the Veterans Health Administration, one of the earliest and most expansive telehealth adopters/users in the U.S;

- A major study involving cardiac care conducted by the Center for Connected Health, a national cutting-edge promoter of telehealth affiliated with Partners Health Care (Boston, MA);

- A residential study involving the long-term care provider, New Courtland Life (Philadelphia, PA) and Healthsense (Mendota, MN), a manufacturer of remote sensor activity/safety monitoring and related products;

- A study by the Health Partners Research Foundation (St. Paul, MN) of blood pressure management involving telepharmacy;

- A rural telehealth initiative conducted in North Dakota, South Dakota and Montana by St. Aleius Medical Center (Bismarck, ND) and the federally funded Great Plains Telehealth Resource and Assistance Center (Minneapolis, MN).

CHAPTER 5 - MINNESOTA TELEHEALTH RESOURCES, CHALLENGES

Minnesota statutes involving telemedicine (including one permitting use of remote monitoring technology as an alternative to overnight supervision in adult foster care settings) are highlighted. Pertinent Department of Human Services Medicaid regulations covering telehealth services are also profiled.

The key role Minnesota home care, home healthcare and geriatric care management agencies will perform in this evolving field is discussed, as are the findings from state and trade association contacts that data unfortunately aren't available from them reflecting agencies' electronic technology usage rates or operating challenges.

Three resources contributing to telehealth delivery in Minnesota are also highlighted - broadband capacity and usage monitoring by the nonprofit, Connect Minnesota; long-term efforts by a group of organizations to establish telemedicine networks around the state (reflected most recently in the "Greater Minnesota Broadband Telehealth
Initiative”), and resources available through the Great Plains Telehealth Resource and Assistance Center (Minneapolis, MN), one of 12 regional technical services supported by the federal Department of Health and Human Services.

CHAPTER 6: TELEHEALTH AMONG THE STATES

Telehealth is a continually changing field, including evolving affairs within each state. Only anecdotal data on state policies and practices have been available for many years, and a number of research and/or trade associations in response have undertaken major data gathering/analysis projects. Many of these studies have been point-in-time reviews, but the Center for Connected Health Policy, funded by the federal Department of Health and Human Services, launched a website in 2013 to maintain timely data on states' telehealth regulations and operations.

Data from the website were also used to prepare a report on states' telehealth affairs. Summary findings include that: at least 44 states have some form of telehealth reimbursement, at least 10 (including Minnesota) reimburse for remote patient monitoring, all states appear to permit telepharmacy, at least nine have regulations involving some form of special licensure, and at least 16 have laws addressing private payer reimbursements.

Summary characteristics were profiled for states identified as permitting remote monitoring: Alaska, Colorado, Kansas, Minnesota, New York, Pennsylvania, South Carolina, South Dakota, Utah and Washington. Although not identified by this report, another study's findings showed that Alabama and Wisconsin support remote monitoring, and basic features for their programs are also highlighted. While the various reports focus on technologies used for seniors, Medicaid Waivers support remote activity/safety monitoring for younger persons with disabilities in states including Indiana, Ohio and Minnesota.

The state of New York appears to use a coordinated and comprehensive approach in its Medicaid deliver which integrates remote vital signs monitoring, patient education, medication management and equipment management. The state has also implemented a "Health Home" program for those with complex medical, behavioral and/or long-term needs, using a tiered reimbursement system based on levels of connectivity and class of telehealth devices.

Pennsylvania is another state that appears to use a coordinated management approach including remote vital signs monitoring, activity sensor monitoring, personal emergency response devices and medication dispensing/management. A sliding-scale "Options" program extends client eligibility beyond Medicaid income eligibility - no cost for those at 125% of federal poverty level, 100% for those at 300%. Area Agencies on Aging manage reimbursements for installation and monthly fees.
CHAPTER 7: OBSERVATIONS AND RECOMMENDATIONS

A key report objective has been to provide a working knowledge of the overall home/community telehealth field and highlight its status in Minnesota. A number of "next steps" within our state's affairs have emerged along the way, and include:

- **Promoting in-home telehealth.** Home care, home healthcare and geriatric care management occupy a central position in delivering telehealth to persons with widely varying medical conditions and acuity. However, the extent of adoption/use by these Minnesota's providers is unknown. A first step should be to survey agencies to obtain benchmark data about their interests, capabilities and barriers faced. A related step would be to survey "early adopter" long-term care providers in the state for experiences and recommendations they would be willing to share.

- **Learning from the Veterans Health Administration.** VHA was one of the earliest telemedicine/telehealth adopters in the country, resulting in an extensive, growing body of experience. The Minneapolis VA Medical Center has been involved in these efforts for many years, and organizations interested in promoting telehealth in Minnesota should consult with pertinent staff there for expertise they can provide and to identify areas where potential partnering could occur.

- **Home telehealth in state policy.** Virtually all states have authorized using various telehealth technologies with their Medicaid programs, but not necessarily in a systematic, planful manner aimed at achieving the greatest cost savings balanced against promoting personal independence. Minnesota should evaluate if its current service delivery infrastructure is achieving optimal outcomes.

- **Home telehealth resource center.** Telehealth has the potential to promote independence and achieve public and private cost savings. Consumers and care professionals need practical data on products, their capabilities and performance to make good decisions and investments. However, information supporting efficient Minnesota decision making isn't readily available.

A strategic response could be to organize a virtual telehealth technical assistance center with the collaborative support of key public and private stakeholders. This center could monitor the status of major existing and new products. It could track legislative and regulatory actions, gather and disseminate performance-type data, and offer how-to workshops for those products family and informal care providers can set up and manage. It could offer periodic round-up presentations on industry trends and offerings.
CHAPTER 1 -
SETTING THE STAGE

We live in an incredibly electronic world where an ever-growing number of disruptive technologies continue emerging and interacting. They bring with them extraordinary opportunities that at the same time are profoundly changing historic, everyday conventions. This electronic world has become a complex environment where the old often overlaps and coexists uneasily with the new. "Mash-up," a term from the computer field for combining existing data or formats to yield new outputs, has become a figure of speech for the many striking developments becoming commonplace.

New medical treatment and support approaches are being fostered, and serious cost pressures coupled with consumer preferences further promote their adoption. In the process, historic healthcare boundaries - who works in various fields, what’s performed in them and where - all are shifting. The healthcare delivery paradigm is being reconfigured, taking with it past stability and familiarity.

This report will assess developments in one facet of the electronic healthcare (r)evolution - telehealth and related forms of support at home and in the community. It will highlight trends influencing and shaping it, identify broad forces promoting and curtailing it, review research literature on its efficacy and cost effectiveness, look at basic Minnesota elements and comparative practices in other states, and consider ways to further advance the technologies' use for the benefits they can provide.

The focus is on technologies and supports for seniors, spanning both a long age and capability arc. At one end are boomers who have turned 65 or will do so in a few years, and those a few years ahead of them in their late 60s through 70s. Many in this young seniors' cohort have been exposed to and used a wide array of electronic/digital equipment in their work and personal affairs. At the other end of the arc are persons in their mid- to later 80s and beyond, many with modest exposure to electronic devices in general and slight-to-moderate experience with healthcare-related uses in particular. The report will attempt to address concerns across this span.

TERMS AND DEFINITIONS

As often happens in a highly technical and rapidly evolving field, it’s a challenge to keep up with terms and phrases characterizing health/wellness functions now being performed remotely. Even though somewhat academic, it may be helpful at the outset to highlight this language for the frame of reference it provides.

Generations of prefixes have been attached to conventional treatment-, care- and health-related words, and they highlight the shifts occurring over time in the communications technologies involved. Tele is the original prefix which referenced how the earliest connections were by telephones and landlines. These connections evolved over the years to involve other types of physical lines - fiber optics and cable - and then wireless radio
frequency broadcasting and satellites. Even though the amount of transmission via POTS - "plain old telephone service" - has been eclipsed by the range of other connections, the prefix is still used as an abbreviation for methods of telecommunications encompassing all the approaches.

**Telemedicine** is the earliest term used to identify the field where medical personnel and/or researchers exchange data for diagnosis, therapy, treatment, surgery, consultation, instruction and study/analysis. (1) These exchanges may just involve data collection/transmission or increasingly involve data collection and video. A key transmission characteristic is that they are either done in real time or use "store-and-forward" capacity enabling later review.

The general telemedicine discipline rapidly expanded into an extremely wide range of specializations, many now with extensive best practices and recommended protocols. Some involve clinical services/treatment, some involve in-home/in-community supports. Common examples include: telepharmacy, teledermatology, telehospice, teleradiology, telementalhealth, teleoncology, and telerehabilitation.

As various forms of broadband communications advanced, use of the technologies expanded beyond medical personnel and practices performed in hospitals and clinics. It now includes a wide range of medical communications, health and wellness activities occurring at home and in the community. **Telehealth** and **digital health** have come into widespread use as umbrella terms encompassing telemedicine and these broader activities.

In roughly the past half-decade, the prefix e- began being used instead of tele-. It reflects that various methods of transmission as well as equipment operations are all electronic. More recently, the prefix m- has come into use denoting the mobile nature of connections where data captured and/or transmission is done wirelessly with specialized equipment.

A critical, core aspect of the e-care revolution is its use of sensor technologies. Basic sensors are extremely small electronic chips in which wireless radio antennas with a unique frequency are imbedded - radio-frequency identification or RFID. They remain silent until activated when a wireless message broadcast by a scanning unit (typically hand-held) activates them to send an "on" location signal. Depending on how they're manufactured, they operate at distances that can vary from a few feet to much wider areas.

The essential use for basic sensors is to locate and/or identify objects and actions. The changes brought on by their marriage with pervasive wireless transmission capabilities are significant for the types of items that can be monitored - e.g., surgical tools, taxi fleets, theme park visitors, buried cables and pipelines, library materials. One wide-ranging impact is the prediction that RFID “tags” will soon replace the Universal Product Code/UPC inventory control tool - unlike codes, RFID chips can also store data tracking characteristics such as site of manufacturing and subsequent locations in a supply chain, shipping history, ambient temperatures, etc.
When basic sensors are enhanced with additional monitoring/reporting functions, they create a further, extraordinary range of capabilities. One key example is when additional capacities are imbedded that enable sensors to monitor/report on a wide range of conditions in a particular environment - light, sound, heat/cold, movement, fluid flow, vibration, pressure. As will be profiled shortly, sensor systems using these capabilities have been developed to monitor health, activities and safety at home.

Biosensing - the term for when body-based data is obtained for diagnosis, treatment and/or monitoring purpose – is another emerging area with profound implications. Ranging from the outside inward, passive monitoring products and equipment are now marketed that are:

- **Worn** - devices imbedded in articles of clothing, wristbands or armbands, shoes, inserts or shoelaces (e.g., for gait analysis or location monitoring), vibrating "memory" bracelets
- **Direct-contact household articles** - e.g., sheets and pillowcases that monitor for temperature, moisture, cardiac functions
- **Skin patch applications** that can monitor temperature; heart functions over an extended period; "smart" bandages that can monitor for infection, healing rate
- **Surgically implanted** - e.g., glucose monitors that eliminate finger-prick blood testing; sensor-enabled heart pacemakers that monitor beat regularity and passively transmit periodic reports as well as irregularity alerts to medical personnel
- **Ingested** - e.g., “digital pills” taken with other medications to monitor usage – “Proteus” is the first ingestible sensor approved by the U.S. Food and Drug Administration, and may represent the start of "digital medicine.” (2)

The technology firm ABI Research reports that approximately 30 million wearable m-health products were shipped in 2012, and the device market is anticipated to grow at a compound annual rate of 40% between 2011 and 2017. (3)

**HOME TELEHEALTH**

For many, advancing age brings with it health complications. Electronic monitoring technologies that manage these needs at home go by a number of names, including telehomecare, home telecare, remote home health monitoring, remote monitoring and in-home patient monitoring. They are typically provided as an extension of the services home healthcare agencies have historically delivered, managed by personnel with medical credentials and/or training.

Post-acute and chronic healthcare issues may be monitored as well as general health status, with education for self-care and behavior modification also provided. This class
of activities encompasses two broad functions. The first is monitoring and managing acute and/or chronic health conditions, and it’s comprised of two types of activities. Remote vital signs monitoring involves transmitting patient data by itself or in conjunction with video.

Remote vital signs monitoring is an extremely important advance in managing chronic conditions. Its frequent or continuous tracking can establish precise trend patterns as well as catch subtle, sometimes infrequent changes that periodic visits to a healthcare provider wouldn’t yield. Current vital signs monitoring products used at home are typically designed as a suite with a small central console unit that tracks a variety of body systems/functions, depending on a person's particular needs. The console may also have functions built in to query, inform and/or educate. Peripheral equipment typically used includes:

- Cardiac rhythm monitors
- Spirometers for pulmonary function
- Glucometers (glucose monitors) for blood sugar level
- Scales for general weight monitoring as well as for gain from fluid buildup due to congestive heart failure
- Blood pressure monitors
- Pulse oximeters for blood oxygenation

Specialized devices - e.g., for blood coagulation or mental health medications - may also be incorporated. As previously indicated, vital signs monitoring systems have been designed for tracking chronic and sometimes serious medical conditions, where assessment/follow up by healthcare professionals is needed. However, there is a broader, expanding market where these types of peripherals are used by persons with chronic, but not severe, conditions to either self-monitor or monitor and periodically provide data to physicians and other healthcare providers. Consumer electronics retailers like Best Buy as well as Walgreens, RiteAid, CVS and other major pharmacy chains are now marketing them.

Telehealth has opened up opportunities to deliver supports that weren't previously available at home or can be expanded in scope. For example, physical therapy and rehabilitation are being provided using techniques from the video gaming field. It enables individual or group work involving exercise instructions, prompts and performance tracking once a hand's-on treatment regimen is in place. Some of these systems are designed around the capabilities of Microsoft's "Kinect for Windows" - its 3-D motion-capture sensor capability can be integrated into game-like interactive therapy sessions and also potentially track movements for remote reporting. (4)
Similarly, there is great promise in electronically assisting persons with a very wide range of mental health needs - from medication management to direct individual and group counseling. Seniors' mental health needs and their impact on physical health are being increasingly recognized, and it's very likely that this services will be integrated into or closely coordinated with delivery of home physical care services in the future.

The ability to extend the reach of mental health services is extremely important in a state like Minnesota, where there are historic practitioner shortages as well as imbalances in geographic distribution. A 2010 state report on telemental health in rural Minnesota highlights these challenges. It estimated that of the 446 psychiatrists licensed and practicing in Minnesota, 65% practice in the metro Twin Cities area, 14% in Olmsted County, fewer than 90 (12%) practice in rural areas and 50 rural counties have none practicing. Those in rural locations are predominantly connected with community mental health centers or hospitals. The number of psychologists in the state is reported as above national averages, but they are similarly concentrated in the metro area and 13 counties have none.

The other major category of home acute and/or chronic health monitoring involves medication adherence and management. It provides not only convenience, but responds to a serious healthcare cost problem - according to NEHI (previously known as New England Healthcare Institute), as many as 50% of patients in the U.S. don't take medications prescribed for them, at a projected $290 billion cost.

The issue of seniors' adherence is particularly acute. Forgetfulness - stray incidents or due to a cognitive condition - often occurs. Patients may discontinue before a regimen is completed when symptoms subside. They also may have difficulty with side effects when a single medication is taken or expected/unexpected effects when multiple medications are required. Necessary prescriptions may not be refilled for reasons including problems or delays in ordering and/or securing and concerns about out-of-pocket or co-payment expenses.

It's projected that, not including over-the-counter and/or herbal products, seniors take more than one-third of all medications annually prescribed in the U.S. Those who are ambulatory fill between nine and 13 prescriptions a year (new and refills), and the average senior takes more than five prescriptions. Electronic monitoring technologies along with various low-tech strategies can address many of these concerns. Reminders can be given via a range of options - text, voice, visual and/or auditory signals. Some electronic medication devices automatically track the need for refills and may directly alert the pharmacist - an example is the "Glow Caps" container system marketed by AT&T.

Telepharmacy is also becoming an effective adherence and care management resource, as highlighted in a recent Minnesota Public Radio news story. It reported on how Fairview Partners, the senior care branch of the Fairview Health System, is using webcams to connect pharmacists and relatively housebound rural seniors. The news
story highlighted a 78-year old woman who lived for 50 years in Jordan where her husband and she dairy farmed.

The woman at the time of the report was two years post-heart attack, has diabetes and major stomach upset problems from taking 18 medicines daily. She is periodically linked via telehealth webcam to a Partners' pharmacist specially certified in geriatric pharmacy. The pharmacist periodically reviews each medication, checks for adverse drug interactions and side effects, and adjusts doses. The Fairview Partners' operations director reported that the system calculates per-patient savings at $1,500 in transportation and emergency room costs avoided through use of telepharmacy.

**ACTIVITY/SAFETY MONITORING**

The second major class of home telehealth encompasses monitoring for well-being and safety, and is comprised of two major components. The first is remote activity/safety sensor monitoring or remote sensor monitoring. The original market for these systems was long-term care settings, particularly assisted living, and vendors are now extending them for use in both single-family and multifamily housing.

These systems employ small radio frequency sensor devices that are positioned throughout a housing unit to track a wide range of basic activities:

- Movement through the outside door(s)
- Opening/closing the refrigerator or kitchen storage
- Turning the stove and oven on/off
- Moving around in various rooms
- Getting in/out of chairs and the bed
- Water flow for flushing the toilet
- Humidity changes when a shower or bath is taken

The wireless sensor devices are configured to passively track activities in relation to a person's standard activity patterns established over time. Normal conditions register as ongoing trend data in a "dashboard" configured with the patterns. Exceptions trigger an alert where the need for follow up is screened, or one or more designed parties are notified to visit the site.

Companies selling/installing these products may perform the necessary remote monitoring services, or home healthcare provider staffs may take on the responsibility. Depending on the system and a person's situation, remote assessment may also be performed by family, friends, neighbors or others in a person's support circle. Vendors as
disparate as municipal governments and organizations delivering local phone, sewer/water and/or gas utilities or home security services are also delivering services in the field as well.

A related group of products in this category is the wide array of personal emergency response system (PERS), fall detection and wander alert devices on the market. The earliest PERS were pendants worn around the neck where wearers pressed an alert button for help with a serious fall, medical crisis or other major problem. The alert was wirelessly transmitted to a monitoring unit connected to the home's land line telephone that sent it to a call center. Staff there talked with the user by a speakerphone in the monitoring unit, and dispatched assistance as required.

Original PERS was limited in two ways - it had to be activated by the wearer (who might not be capable, depending on the emergency) and the transmission range was limited to within the home or very close to the monitoring unit. A number of tech advances have greatly modified capabilities, though:

- Internet connections and wireless communications enable sending alerts not only from in/near a home, but also from the neighborhood and sometimes far beyond; these connections can also enable two-way communication via a pendant, wristwatch or belt clip worn.

- Global positioning system/GPS as well as radio telemetry and similar technologies now provide capability to determine a person's location within large areas.

- Very small devices called accelerometers track rapid shifts in body position, and can automatically activate an alert when a fall or similar sudden change occurs.

These technologies have expanded old-style PERS capabilities to not only include passive fall detection but help with location-finding concerns as well - not only a caregiver wanting to find a user, but users checking on where they're located when walking or driving. While some products still concentrate on one type of monitoring, there's been a "function creep" with some devices now incorporating two or all three capabilities.

These products' utility may be expanding even further in the near future. The report, "Next Generation Response Systems: From Fear to Function," profiles how the character of PERS devices is evolving. (10) The report highlights how these products have been thought of as medical devices but haven't been integrated into care management. It predicts how they could be used to monitor behavior patterns to discern potential decline and/or the needs of specific disabling conditions. Capabilities could also extend to gait tracking, responding to post-acute care discharge needs, monitoring seizures, better assessing when true emergencies have taken place and in providing concierge-type assistance.
Sensor devices/systems for general home management have also being available in the do-it-yourself consumer/home improvement markets for many years. These smart home products are attached to or incorporated into the structure to provide remote home security, automate various functions (e.g., control lights, heat, etc.) and for entertainment purposes. A well-known example is the Insteon line of sensor products from the Smarthome firm (11).

It had been predicted for many years that care-related devices capable of coordinating with these other home monitoring components would eventually come to market, and that point has now been reached with the "Iris" product line the home improvement company Lowes carries. (12) “Sensor kits in a box” for security, automation and energy management came out in 2012, and the company in 2013 added a caregiver kit to the array.

Iris care components track movement and activity with visual confirmation via motion and contact sensors. Alerts for falls or emergency situations are done via the Iris "Senior Pendant." Pre-set monitoring patterns based on normal activities assess if/when a daily routine isn't performed. Any follow up is done not by medical or vendor personnel, but formal and informal caregivers.

The remote sensor systems targeted for care settings as well as the emerging consumer market flexibly place small components in various locations throughout a living unit or home - on doors and cabinets, on walls, under rugs and mattresses, etc. Part of the evolving smart-home care technology market also involves sensors permanently installed in a home's structure or installing sensor-enabled appliances and fixtures. Examples include:

- Stair landings equipped to light when stepped on or stairs equipped to register motion when passed
- Sensors positioned in floor joists to monitor gait as well as falls
- Medicine cabinets equipped with monitors triggering voice response with use/overuse
- Devices extending into vital signs monitoring area, e.g., toilets that can monitor blood sugar level

CAREGIVER AND COMMUNICATIONS RESOURCES

Although not precisely telehealth devices, various digital programs and services provide caregivers with a range of supports and help foster communications among many parties. Resources may help with tasks such as recordkeeping, scheduling appointments, managing medications, hiring in-home staff, tracking care records and sharing information among caregivers. Communications resources include phones adapted for
persons with reduced hearing, easy-to-use cellphone models, devices that convert speech to text and flexible videoconferencing arrangements.

THE SMART DEVICE REVOLUTION

Home care/healthcare agencies and related organizations (e.g., hospital outpatient departments) are expanding functions they've historically performed through use of home telehealth monitoring equipment. At the same time, though, there's been an incredible surge in mobile electronics products which are profoundly altering healthcare delivery practices.

Capitalizing on availability of advanced wired and wireless communications, the equipment foundation is based on tablet devices such as the Apple iPad, personal digital assistants such as the BlackBerry and most frequently, smartphones such as Apple's iPhone or Samsung's Galaxy. All these products seem to have an ever-expanding array of features.

Basic cellphones and more advanced smartphone adoption in the U.S. is estimated at close to 90% of the population, with 78% of adults between 50-64 years and 82% of those between 65 and 74 having a cellphone. (13) A growing number of units on the market also respond to a range of seniors' functional needs - streamlined features, easy-to-understand and easy-to-finger controls, hearing aid compatibility.

Programs written for smart devices - applications or "apps" - are greatly extending health data collection/management capabilities as well. Apps seem to be available for any and every purpose - "...there's an app for that..." - as reflected in trends studied by the tracking/data analytics firm, Mobilewalla. It reported that smartphone apps for the four major operating platforms - Apple, Android, BlackBerry and Windows - surpassed one million at the end of 2011, and that approximately 2,000 come to market daily. (14) Within that massive market, it was estimated in early 2012 that approximately 40,000 health apps were currently available across various operating platforms. (15)

Smart device-mediated healthcare encompasses a rapidly expanding range of activities and participants. The most basic involves care providers sending simple notifications/prompts and alerts, whether by voice or text. A second segment involves individuals using smart device health apps for tracking and education purposes - health and fitness tracking has become a huge market, as has tracking family and/or caregiver health records, histories, medications and scheduling.

An example of scope here was reported by a 2012 research study that evaluated Android-based diabetes management apps where users self-tracked blood glucose and diabetes medications and calculated insulin doses. (16) It identified over 80 apps where 42 were eligible for the study - 18 were free of charge and the other 43 had an average purchase price of slightly less than $3.00.
A third segment involves where health-related businesses have developed apps as a convenience for their customers. A good example is the Walgreen app that can find stores, refill prescriptions with a barcode scan, set personal medication reminders, look up prescription information and make appointments at in-store clinics. The company has further expanded its electronic capacity by developing an "application program interface" enabling outside software developers to incorporate the company's prescription scanning/refill technology into apps the developers are creating.

In a fourth smart device segment, patients use miniature peripheral medical equipment designed to attach to a smart device for gathering various types of vital signs at home or when mobile - monitoring blood pressure, blood sugar, respiratory function, various cardiac functions. A fifth segment highlighted at the beginning of the chapter involves smart devices that become biosensing data gathering/transmission tools for wearable, imbedded and/or ingested sensor healthcare products.

A sixth segment involves smart devices actually becoming diagnostic tools. They are being adapted to become microscopes, perform eye examinations (e.g., retina or cataract assessment), perform ear examinations, match test strips for diabetes urinalysis and function as a mobile electrocardiogram.

A seventh segment of smart device-mediated healthcare extends beyond individuals into the broader realm of public health. It focuses on issues either affecting a very large geographic area or where a large population base needs to be assessed or monitored. The term crowdsourced health is being used to depict these capabilities, as highlighted by the following examples:

- An epidemiologist spent many years trying to track events triggering asthma attacks. His eventual solution was to mount a GPS sensor on an asthma inhaler to monitor time and location where medication is taken, and send the data to a smartphone for further transmission. This device, "Asthmapolis," was recently used in a 500-person study in Louisville, KY to explore potential causes for the area's higher-than-normal asthma rates. The term geomedicine designates activities that evaluate health based on location.

- Epidemiology studies can involve one-time or periodic participant data gathering. Smart devices, coupled with social media like Facebook and Twitter, can greatly extend data-gathering capacity, frequency and the number of participants that can be involved.

- Monitoring the spread of virulent strains of influenza and other life-threatening diseases has become a priority public health concern worldwide. Smart devices, again coupled with social media, can rapidly gather extensive trend data about the location, extent and severity of outbreaks.
Doctors are starting to prescribe apps and the peripherals that go with them as a cost-effective and proactive way for patients to manage chronic conditions - specialized devices or treatment/maintenance regimens don't have to be purchased if care needs can be integrated into products many people already own. A trend that may expand over time is doctors prescribing and insurance companies covering costs for peripheral devices, since apps often are free or low-cost.

Figure 1 at the end of this chapter provides examples of the various types of telehealth products being used at home and when mobile.

SENIORS AND ELECTRONIC TECHNOLOGIES

It was argued in years past that seniors weren't capable of or interested in taking advantage of many electronic technologies, including those supporting their care. This may have been the case for those their 80s or older at the time. Some seniors now in this age range, though, have had basic exposure to different types of everyday electronic technologies - garage door openers; TV remotes; microwaves, stoves and other appliances with electronic features; autos incorporating digital connections; digital picture frames; digital TVs.

It was also said many years ago that seniors wouldn't accept technology for their care, but many anecdotal reports indicate remote monitoring is accepted as long as direct video isn’t used. In many cases, seniors understand that as they become more vulnerable, these technologies may represent the difference between living relatively independently and having to relocate to a care setting. Anecdotal findings also indicate that seeing friends and relatives use vital signs and sensor monitoring products may influence seniors to view the products as a standard-of-care benchmark.

The following study results highlight the extent of seniors’ communications and healthcare technology adoption:

- The Pew "Internet and the American Life Project" reported in spring 2012 surveying (20) that:
  - For the first time, cellphone use among those 65/+ has exceeded 50% (52%)
  - 86% of Internet users age 65/+ use e-mail, with 48% doing so on a typical day
  - 34% of the 65/+ cohort report using Facebook, 18% on a typical day
  - 69% of adults 65/+ report owning a cellphone (up from 57 % in 2010)
  - Among those ages 76/+, reported cellphone ownership is 56% (up from 47% in 2010)
• Deloitte Center for Health Solutions reported results of a 2012 survey (21) in which 35% of seniors and 44% of boomers indicated receptivity to using self-monitoring technology and electronically forwarding results to their doctors.

• Clarity, a hearing aid/adapted phone manufacturer, and the EAR Foundation have partnered over the years on studies aimed at better understanding seniors' health and lifestyles, and increasing public awareness of seniors’ hearing and other disability issues. In 2012, the partnership supported a survey of over 800 seniors and baby boomers exploring attitudes toward and use of technologies enabling independent living. (22) Findings included that:

  • 65% of seniors surveyed were open to using new technologies, with more than half indicating willingness to have sensor technologies at home for monitoring their health and safety.

  • 49% of boomers were interested in new technologies that would help monitor their parents' safety, and 50% were open to sensors being used to monitor their parents' health and safety.

THE "POINT OF CARE" REVOLUTION

As is evident in the overview presented so far, many aspects of healthcare delivery are profoundly changing. Methods for collecting data have gone from direct/in person to landline phones, to computers, to cellphones and smart devices, to body sensing. Transmission into and out of a home has gone from landlines to fiber optics and cable to wireless via the major telecommunications carriers and satellites.

An equipment size continuum has developed in many product categories. First-generation home vital signs units were sometimes the same size or scaled-down tabletop versions of their hospital and/or clinic counterparts. Miniaturized versions designed for smartphones now fit in the palm of the hand or an even smaller space. Portable and property-imbedded alternatives are available.

There’s also a residential setting/function continuum. Products and assistance are often perceived as essentially for single-family homes, and significant use does take place there because houses make up a very large portion of the residential stock nationally and in Minnesota. However, both vital signs and sensor monitoring occur in individuals’ owned and rented units in multifamily properties, and kiosk-style monitoring units on the market can collect vital signs and other health/wellness data systematically for a group of users.

All of these changes contribute to the irrevocable shift that's occurring in the point of care. Up until the 1960s -1970s, care was predominantly provided at an institutional site - a hospital, clinic, doctor's office - and supplemented with provider house calls. Care began shifting in roughly the late 1970s -1980 from an institutional base to newer types of sites, e.g., free-standing "urgicare" and "minute clinics" in retail settings such as
Target, CVS and Walgreens. Sites have continued shifting since then to current-day examples such as Walmart now offering major self-service screening resources. (23)

Electronic and smart device-based mobile healthcare is further expanding this scope from home to the neighborhood or another part of town, or other parts of the U.S. or the world. An official for the Kaiser Permanente health organization was asked at a recent World Health Care Congress for his perspective on home healthcare technology’s integration into care delivery. (24) He observed that:

"With emerging clinical device technologies and mobile capabilities, the line is blurring between home care and care anywhere, and making them affordable for nearly everyone. I think that trend is going to continue over the next five years to change home care in a remarkable way."

“In three years, the ability to care for people in their own homes will be roughly equivalent to the care [patients] got in the hospital two years ago. If you look at that five-year swing, emerging technologies are lining up and will enable the whole health system to take advantage of those technologies and dramatically improve the ability to take care of people in their homes, monitor them, provide them the assistance they need and enable more people to go home."

THE QUANTIFIED SELF

One key byproduct from the expanding availability of electronic technologies is growth in self-monitoring, not only for medical purposes but general wellness as well - sleep, exercise, diet, mood, etc. This growth not only involves consumers and clients conveying results to their care professionals, but sharing results as well as observations about the process with like-minded individuals.

An infrastructure is now developing around the quantified self practice - the term for the activity - with an international organization and website established for the interest area. (25) The organization sponsors an international conference, and supporters have established chapters throughout the U.S. and worldwide. Participants are not only those interested in general health/wellness or who must perform extensive or complicated personal medical tracking, but also researchers in many disciplines.

Manhattan Research, a global pharmaceutical and healthcare market research/advisory firm, annually conducts a "Taking the Pulse" online survey of how U.S. physicians use the Internet, mobile devices, digital media and other technologies. Its director of physician research recently observed that, “Self-tracking is already a part of the care paradigm and its prevalence is going to accelerate rapidly as digital connection, payment reform, and outcome-focused delivery make advances.” (26)

The Pew “Internet and the American Life” project conducted a "Tracking for Health" survey in 2013, the first broad review of health data tracking among all adults nationally
(not just Internet users). (27) 3,000/+ U.S. adults were surveyed during the late summer of 2012, and among findings were that:

- 45% of those surveyed said they use a smartphone.
- About 11% of all mobile phone users and 19% of smartphone users have at least one health app on their phones. The figures rise to 22% for caregivers, 21% for those with a chronic condition, and 21% for those who faced a major medical crisis in the previous 12 months.
- About 69% of adults monitor at least one health indicator - about 60% track common measures like weight, diet or an exercise routine. 62% of those surveyed have two or more chronic conditions. 33% track systems- or disease-related indicators and 12% monitor indicators for a loved one.
- 21% of those who track their health use some form of technology (which could include peripherals, a website or digital spreadsheet).

A priority for deploying home/community telehealth resources is to support persons with major medical conditions, where boomers/seniors will rapidly become a growing target group. These new electronic technologies may be able to either increase or at least not reduce current levels of independent living, keep certain conditions under better control and make patients more aware and proactive about managing health concerns. People in younger age groups are already attracted to using mobile and/or smart device-mediated resources for prevention and maintaining good health – they are already living digital lifestyles. This trend can only be positive for the technology's overall diffusion.

**REDEFINING “HOME” IN HOME HEALTHCARE**

Certain types of care in the future will continue being provided to persons at home, particularly for those with serious chronic conditions and/or frailty. The historic delivery model of nurses and other medically credentialed staff providing direct-contact assistance will continue, with some functions extended by ability to perform them using home-based remote telehealth resources.

However, the growth of sensor- and smart device-mediated m-health capabilities is blurring care delivery boundaries - these resources provide some forms of assistance similar or even identical to what home care agencies may provide. With parallel or even overlapping capabilities now existing, the "home" designation is too narrow a focus - a phrase such as home/community healthcare, home/community telehealth or home/mobile telehealth may be a better alternative. Another term now characterizing this evolution is person-centered care.

To further complicate affairs, home healthcare agencies going forward may not be the only providers delivering assistance to people at home or in the community. Physicians and other medical specialists may have historically relied on them as the conduit for
assisting post-acute stay patients or those with chronic conditions. However, some physicians and hospitals are responding to a number of trends and expanding from institutional-based services to delivering care at home as well.

In a reflection of "what goes around comes around," some physicians are returning to making house calls, which was a practice common up through approximately the late 1950s to early 1960s. The practice since the late 1990s has seen an increase in usage due in part to Medicare increasing the permitted billing rate. (28) These days, physicians also may not operate individually as in the past, but as members in a wide range of new partnership configurations aimed at delivering more coordinated care at lower costs.

Accountable care organizations/ACOs are a visible form of these new partnerships. (29) They’re established in line with provisions of the federal "Patient Protection and Affordable Care Act of 2010," informally known as the Affordable Care Act (or Obamacare). ACOs bring together groups of physicians, hospitals and other healthcare providers to coordinate delivery of high-quality care for Medicare patients. The goal in these alliances is to avoid duplicating services, prevent medical errors, limit rehospitalizations and deliver proper, timely care. Alliances share any costs savings with the Medicare program.

One significant feature in current authorizations is that ACOs are to use telehealth, remote monitoring and other technologies to better coordinate care. (30) A disincentive, though, is that home healthcare agencies aren’t eligible ACO partners. (31) Physicians and other providers who in the past might have referred patients needing acute-care follow up to home healthcare agencies now instead may directly respond to patients' service needs.

Another evolving approach is “hospital at home” programming, a concept employed in other countries that's emerging in the U.S. (32) Care for chronically ill persons with acute but stable medical problems is reoriented by having physicians and other care providers treat a patient in a familiar, comfortable setting while assessing how well the patient functions there. Seniors are a prime target population for this programming, particularly those with multiple chronic conditions. The ability to potentially avoid hospital-acquired illnesses such as urinary and other types of infections is one key benefit; another important one is minimizing disorientation and other cognitive problems that may contribute to delirium.

An example of one general approach is to admit patients to the hospital for a few inpatient days (sometimes following an emergency department visit) where they receive daily doctor visits and multiple daily checks by nurses and aides. Necessary personnel, medications, equipment and other supports are assembled during that time, and the person is then transferred home where acute-level care continues.

The Wall Street Journal reported at the beginning of 2013 on a New Mexico hospital-at-home program serving patients within a 25-mile radius of the facility. (33) Persons who are sick enough to require hospitalization for conditions such as pneumonia, congestive
heart failure and urinary tract infections receive daily visits from a doctor and visits once or twice a day from nurses who administer infusions and perform routine lab tests/procedures. The hospital published a study in the journal, "Health Affairs," showing that program costs were 19% lower for its patients when compared to similar patients, due in part to shorter stays and fewer test.

THE HEALTHCARE TECHNOLOGY GROWTH ENGINE

Healthcare management is big business not only in the U.S. but worldwide. The "wireless world" has become the launch platform for continuing waves of product development - new devices and new approaches, new ways of better using existing devices and approaches. Telehealth-related research and development has become an economic growth engine - not only in "hard" equipment or devices but "soft" biosensing capabilities in furnishings, clothing, personal effects, etc.

Key players in wide-ranging and sometimes very disparate fields are expanding and/or seeking out strategic alliances to capitalize on the potential digital healthcare represents. Telecommunications carriers have set up new divisions focused on healthcare as well as the smart home product/service market. Device manufacturers are aligning with telecommunication carriers to systematically integrate technologies into senior housing and assisted living settings – an example here is a partnership between Minnesota-based Healthsense, a vendor of sensor monitoring system, and Verizon. (34)

Another rapidly expanding area of activity involves seasoned healthcare industry personnel teaming up with socially oriented venture capitalists to set up centers that nurture promising product concepts and bring them to market. They’re called by a number of names – accelerators, incubators, academies, institutes. Some target telehealth or health-related developments, others foster new businesses in many fields and have created a telehealth segment. They provide enrollees with many types of assistance - legal or financial expertise, market connections, access to financing and research facilities. The supporting businesses ultimately may take a financial stake in a new firm or purchase the entity.

An example of an accelerator with well-known parentage is "StartUp Health," a program of General Electric's "healthyimagination" initiative. (35) AARP as part of its "Innovations @50+" program (started in 2011) has agreed to partner with StartUp enrollees in its new track of research focused on products for persons ages 50+. AARP will also offer seniors'-targeted master classes for StartUp companies to encourage concept identification. (36)

Products coming out of this tech pipeline will continue flowing at a rate that likely will continue growing indefinitely. Some of the resulting, expanding array will only serve to further promote opportunities connected with home/community health telehealth and applications there.
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Typical features</th>
<th>Product examples</th>
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<tbody>
<tr>
<td><strong>Health monitoring/management</strong></td>
<td></td>
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<tr>
<td>Vital signs monitoring</td>
<td>In-home – central console supports array of peripheral devices for tracking weight, blood pressure, blood sugar, blood oxygenation, breathing, etc. Systems also typically provide video connection. Mobile – miniature peripherals connect with smart devices to perform the same as above. Apps can track, analyze, store/forward various vital signs data.</td>
<td>• Bosch Health Buddy</td>
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<td>• Cardiocom Commander</td>
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<td>• GE-Intel HealthGuide</td>
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<td>• GrandCare</td>
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<td>• Honeywell HomeMed</td>
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<td>• IBGStar Glucose Monitor</td>
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<td></td>
<td></td>
<td>• Asthamapolis</td>
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<td></td>
<td></td>
<td>• iHealth Blood Pressure/O2 monitor</td>
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<tr>
<td>Telerehabilitation</td>
<td>In-home – computer-based programs and/or video interaction guides/measures exercise and movement. Many integrate Microsoft’s “Kinect” gaming program.</td>
<td>• 5Plus Therapy</td>
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<td></td>
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<td>• Home Therapy Team</td>
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<td></td>
<td></td>
<td>• Jintronix</td>
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<td></td>
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<td>• MIRA Rehab</td>
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<td></td>
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<td>• MotionCare 360</td>
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<td></td>
<td></td>
<td>• Reflexion Health</td>
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<tr>
<td>Telementalhealth</td>
<td>In-home and mobile – therapy typically involves computer-based program and/or video interaction with care personnel.</td>
<td></td>
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<tr>
<td>Medication adherence/management</td>
<td>In-home – storage units that dispense, reorder, manage, etc.</td>
<td>• GlowCaps, GlowPack</td>
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<tr>
<td></td>
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<td>• iReminder</td>
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<td></td>
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<td>• Med Folio</td>
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<td>• Med Minder Adherence System</td>
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<td>• MedPartner</td>
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<td>• Senticare</td>
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<td>• TabSafe</td>
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<td>• Talking Rx</td>
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<td></td>
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<td>• e-Pill CADEX wristwatch monitor</td>
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<tr>
<td></td>
<td></td>
<td>• PillJogger</td>
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<tr>
<td>Mobile - apps that can track med usage, refill prescriptions, locate stores. Often are integrated into care management apps.</td>
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</tr>
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</table>
### Activity/safety monitoring

<table>
<thead>
<tr>
<th>Sensor monitoring system</th>
<th>In-home system – array of small radio frequency identification devices track activity patterns/variances, follow up on alerts. Many temporarily attach to walls, doors, appliances, plumbing, etc.</th>
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</thead>
<tbody>
<tr>
<td>Smart home features</td>
<td>In-home - Products similar to the above installed in home appliances, fixtures, structure and/or specialized fixtures. May integrate with sensor systems monitoring security, energy use, automated controls (e.g., heating).</td>
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<tr>
<td>PERS/fall detection</td>
<td>In-home and mobile – person wears monitoring device in various styles - pendant, wristwatch-style, belt clip, etc. Some models detect if/when fall occurs. Some equipment operates in-home/immediate vicinity; other can also be used when mobile. Some products incorporate wander guard function.</td>
</tr>
<tr>
<td>Wander guard</td>
<td>In-home and mobile - Various types of equipment for monitoring a person’s location. Some designed for in-home use. Others set a mobile electronic “geoperimeter,” send an alert if a person moves beyond. Some products incorporate PERS/fall detection functions. Sensors now being imbedded in various articles of clothes - e.g., shoes.</td>
</tr>
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</table>

### Caregiver support

<table>
<thead>
<tr>
<th>In-home and mobile – computer programs and apps for various aspects of care management – helping to hire care staff, tracking meds, health appointments, records, etc.</th>
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<tr>
<td><strong>Care Linx</strong></td>
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<td><strong>Communications</strong></td>
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<td>---------------------</td>
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<tr>
<td><strong>In-home and mobile</strong> – accommodate hearing/vision limitations in using communications tools – adapted landline phones, easy-to-use cell/smart devices, devices that convert text to speech, smart device apps to adapt phone for hearing aid use.</td>
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| • Clarity  
• Clear Sounds  
• Doro  
• Great Call  
• Hearing Loss Simulator  
• Hearing Pro Test  
• Intel Reader  
• iTalk Reminder |
CHAPTER 2
TRENDS INFLUENCING
HOME TELEHEALTH ADOPTION

The first chapter provides an overview of how technology advances create promise for telehealthcare at home and in the community. It also highlights ways these advances are realigning and redefining historic boundaries in healthcare delivery. Some of these components are at a “macro” level involving legal and regulatory decision-making or evolving professional practices. Others are at the implementation level involving very specific financial, operations and/or organizational challenges when incorporating the technologies into direct care delivery.

Fully delivering on potential here will involve a long-term effort to align and mesh an extremely wide array of interlocking, “moving parts.” This second chapter will highlight a number of prominent "macro" trends, and how they may both promote but at the same time also hinder home/community telehealth’s expansion.

HEALTHCARE CRISIS/REFORM

We’ve got a very serious healthcare problem in this country. Millions go uninsured, while costs continue to rise relentlessly. Inpatient hospital care has been identified as the single biggest category of U.S. medical costs, accounting for nearly one in three dollars spent. (1) Emergency department use has also become a major cost category for reasons including inability to schedule prompt primary care appointments and physicians referring patients for more thorough testing. Recent senior-related findings include that:

- The congressional Medicare Payment Advisory Commission reported in a 2012 study that emergency department visits by nearly 60% of persons receiving Medicare and 25% of hospital admissions potentially could have been prevented by better home or outpatient care. (2)

- A Rand Corporation study of emergency department usage and related hospital admissions reported in 2013 that 60% of Medicare beneficiary (and 47% of Medicaid beneficiary) inpatient admissions come through the emergency department. (3)

- Some hospitals are setting up specialized emergency departments for seniors because their multiple chronic illnesses, vulnerability to delirium, hearing issues and other characteristics differ greatly from departments' more conventional trauma services. (4)

The Affordable Care Act is directed at making significant changes in many aspects of healthcare delivery, including insurance availability and coverage, operation of the massive Medicare and Medicaid programs and reorienting the historic fee-for-service delivery model. ACA-related provisions are already elevating the demand/need for
telehealth technologies through mandates as well as a large number of demonstrations testing out new organizational and operational approaches.

**Avoiding rehospitalizations**

A high-priority ACA provision is directed at reducing Medicare-related hospital readmissions. The federal Centers for Medicare and Medicaid Services/CMS report that nearly one in five Medicare patients discharged from a hospital - approximately 2.6 million seniors - is readmitted within 30 days at a cost of over $26 billion annually. (5) Rehospitalization can have many causes, including insufficient directions at discharge, the amount and quality of aftercare follow-along and too-rapid release to nursing home rehabilitation and/or home.

In response to this situation, an ACA component added authorizations to the Social Security Act setting penalties when Medicare-eligible persons with heart failure, heart attack and pneumonia are readmitted. (Medicare reimbursement data rates for these conditions from 2007 to 2009 indicated return rates of 24.8%, 19.9% and 18.3%, respectively. (6)) Even where appropriate, a prime reason for focusing on hospitalization and rehospitalization is that treatment costs for Medicare patients with the targeted conditions are greater than the federal reimbursements hospitals receive.

CMS has tracked and reported 30-day readmission rates for a number of years. Affected hospitals starting in the fall of 2012 are penalized 1% of their Medicare reimbursements, with the penalty rising to a 2% maximum in October 2013 and 3% in October 2014. (7) Penalizing for readmission has been controversial because it's argued that reasons vary greatly among a group of hospitals, particularly “safety-net” institutions. Additionally, the focus doesn't pick up costs such as repeat emergency department visits that still may frequently occur in connection with acute healthcare use. However, rehospitalization costs are both significant and can be measured and tracked.

In a related Minnesota example, the Allina healthcare system and other hospitals throughout the state have been experimenting with ways to smooth discharge transitions. (8) They've formed a statewide collaborative called RARE ("Reducing Avoidable Readmissions Effectively") which starting in January 2011 and has reduced admissions by approximately 2,600. Staff is assigned to serve as transition coaches to facilitate the process and identify and resolve difficulties.

Impact from the penalty is now rippling through the hospital and post-discharge network in the form of new, different and/or additional support measures. Home/community telehealth will be an extremely important tool here because it can monitor patients’ status very closely and provide timely intervention. It is very likely that researchers are presently collecting data documenting such outcomes.

**Demonstration projects**

Beyond the push to avoid rehospitalizations, the Affordable Care Act's implementation
involves many other wide-ranging efforts a recently established “Center for Medicare and Medicaid Innovation” is overseeing. Some involve new reimbursement approaches and accelerated adoption of innovative practices. Others involve demonstrations that may directly increase demand for home telehealth, including:

- The “Community Care Transition Program”/CCHT is a component in the ACA’s "Partnership for Patients.” (9) It involves collaborations around the country that through 2016 will test models for improving hospital-to-community care transitions and avoiding rehospitalization of high-risk Medicare beneficiaries. Among community partners are hospitals, nursing homes, home health agencies and Area Agencies on Aging - the Twin Cities-area Metropolitan Area Agency on Aging is a participant.

- The “Independence at Home Demonstration” started in 2012 and will operate for three years, initially involving 16 organizations and 10,000 participants. (10) Home-based primary care teams directed by physicians and nurse practitioners will tailor assistance, with the goals of reducing hospitalizations, improving patient and caregiver satisfaction and lowering Medicare costs. Participating organizations will receive incentive payments after meeting quality measures and minimum savings requirements. Remote patient monitoring is an allowable practice. (11)

**Insurance reimbursement**

In the case of Medicare, telehealth reimbursement barriers were unfortunately written into statutes over a number of years. They originally permitted only a narrow focus on live interaction (no "store-and-forward" technology) and on patients residing in rural areas with health professional shortages. Changes in 2008 did expand the range of permissible sites to skilled nursing facilities, hospital dialysis centers and community mental health centers. (12)

For Medicaid, most states allow some form of home telehealth reimbursement in their basic State Plan assistance or in their Home and Community-Based Waiver programming. The technologies most commonly permitted are personal emergency response systems/PERS and devices monitoring a range of vital signs. Remote activity/safety sensor monitoring systems may require approval from the federal Centers for Medicare and Medicaid Services. (Chapter 6 reviews this issue in greater detail.)

ACA consumer protection provisions unfortunately also may have created unintended consequences for health insurers considering home telehealth coverage. (13) They must maintain a "medical loss ratio" - the amount spent on direct patient care - at 85%, allocating a maximum 15% of gross receipts to administrative overhead, profit and salaries. Remote patient monitoring technologies have been categorized as an administrative expense that must be counted against an organization's 15% ceiling.
Insurance companies as a result may be reluctant to approve using the technologies unless the Act is modified to class the equipment as patient care. A similar Catch-22 also reportedly affects Medicare-certified providers using home telehealth systems - equipment costs must be logged on the Medicare cost report as an office, not patient, expense. (14)

**SENIOR/BOOMER HEALTHCARE NEEDS**

The boomer demographic imperative has received considerable attention in the recent past, and its compelling statistics are widely known. However, it is significant to consider the implications its numbers have for healthcare demand and costs going forward, relative to the incidence and prevalence of seniors' chronic conditions.

Some chronic conditions are due to living a long life - they're anticipated as part of the aging process. Others may come from not heeding prevention recommendations in earlier years or due to genetics, environmental or any other number of reasons. Whatever their cause, many seniors have them, and often more than one. The federal Centers for Disease Control and Prevention reports (15) that: more than 75% of total U.S. medical care costs are spent on chronic diseases, that nearly one-half of American adults having at least one condition, that approximately 45% of persons ages 65/+ have two or three conditions and approximately 15% have four or more. (16)

Heart and circulatory problems - e.g., congestive heart failure, heart attacks, high blood pressure, strokes - form a cluster of very prevalent seniors' disabilities. Other major ones include pulmonary conditions (e.g., bronchitis, emphysema, asthma) and diabetes. The Centers for Disease Control and Prevention has studied their prevalence for adults age 65 and older along with cancer and kidney disease. Results show that the incidence of seniors with two or more of these conditions increased from 37.2% in 2000 to 45.3% in 2010 (17) - the conditions are affecting seniors at an increasing rate.

Cognitive disabilities are an additional, growing concern. The Alzheimer's Association in March 2013 released a report estimating that one in three seniors dies displaying aspects of the disease or another form of dementia. (18) Over 5 million people are presently affected by the dementias, and this number is expected to reach approximately 14 million in 2050. They are now the sixth leading cause of death in the U.S, a figure which doesn't reflect dementias' contribution to deaths recorded as due to other conditions.

Multiple chronic conditions often cause serious healthcare complexity. Those affected are more at risk for hospitalization, and they often need a greater number of practitioner visits. Seniors with multiple conditions may not only require a larger number of prescriptions resulting in higher annual drug costs, but interactions among medications can exacerbate existing conditions and sometimes trigger new ones. The overall character of seniors' healthcare needs, the size of the boomer tsunami and the next major macro-level issue - aging in place - will almost certainly combine to create major, growing demand for home/community telehealth resources going forward.
AGING IN PLACE

Current younger seniors in their late 60s to early/mid-70s and the wave of boomers joining them are clear in their preference to age in place during their older years. Boomers in particular can be expected to proactively pursue this goal in ways their parents and grandparents didn't. What it means to achieve aging in place has many outcomes, though.

The intent in some situations is to remain in a current housing unit - i.e., "age in this place." In other cases, the desire is to move to a different housing arrangement - perhaps downsize - but remain in the same neighborhood and/or town. Or, it means aging in this place for part of the year, then in another location for the balance. The term in still other cases means aging "anywhere but assisted living or a nursing home."

The aging-in-place preference has been chronicled for many years by AARP in trend reports periodically issued on the subject. One of the recent national random sample surveys in this series conducted in 2010 (19) found that:

- 88% of those ages 65/+ strongly or somewhat agreed with the statement, "What I'd like to do is stay in my current residence as long as possible."

- 92% of those ages 65/+ strongly or somewhat agreed with the statement, "What I'd really like to do is remain in my local community for as long as possible."

The state Department of Human Services obtained pertinent Minnesota statistics on this preference in a survey conducted in 2010. (20) The project was an outgrowth of the Department's "Transform 2010" initiative that during the latter half of the previous decade promoted policy and programs responding to boomer demographic trends. Better data on boomers' concerns across a range of life issues was a priority need for Transform follow-along efforts, and the Department supported a survey involving 10,000 Minnesota boomers.

Up to 3,800 participated - a very positive survey response. Two of the most pertinent housing responses connected with aging in place were:

<table>
<thead>
<tr>
<th>Expect to remain in current housing (n: 3,787)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>2.6%</td>
</tr>
<tr>
<td>1-4 years</td>
<td>12.9%</td>
</tr>
<tr>
<td>5-9 years</td>
<td>16.9%</td>
</tr>
<tr>
<td>10-19 years</td>
<td>25.5%</td>
</tr>
<tr>
<td>20 years or more</td>
<td>27.3%</td>
</tr>
<tr>
<td>Don't know</td>
<td>14.9%</td>
</tr>
</tbody>
</table>
The recent recession negatively affected many boomers' retirement investments and home valuations, and this situation in the near future may reinforce the remain-in-place desire for some who lack other financial options. When coupled with ever-escalating long-term care costs, telehealth capabilities and trends like provider house calls and hospital-at-home assistance, it’s reasonable to expect that boomers will receive a major amount of their healthcare in the future at home or when mobile in the community.

GEOGRAPHIC/WORKFORCE DISPARITIES

Another compelling characteristic supporting home/community telehealth's use is its ability to reduce geographic service delivery complications. Given Minnesota's size and development pattern, seniors in many small communities beyond the Twin Cities area already make up a large percentage of the local population, and these figures are projected to increase in the decades ahead. They often must travel long distances to reach larger regional centers or county seats for hospital, clinic, specialist, etc., services. The mirror side of this problem is its impact on home healthcare agencies' capabilities to provide conventional in-home services.

Workforce shortages create a similar disparity - either insufficient numbers of certain practitioners or care workers in the state, or more likely, uneven distribution. Certain specialized care resources are understandably concentrated in large population centers, again, requiring sometimes lengthy travel to obtain treatment or assistance. While it won't supplant the need for direct provider contact in a medical setting or a residence, home/community telehealth can be a capable adjunct for responding to both these problems.
CHAPTER 3 – OPERATIONAL CHALLENGES

The previous chapter highlights overarching trends that individually and collectively influence home/community telehealth adoption. Additional factors at the operations level further affect practitioners’ and organizations’ abilities to incorporate telehealth into service delivery. This chapter will profile many of the prominent ones.

HEALTHCARE DECISION-MAKING INSTABILITY

The environment for healthcare decision-making unfortunately has been destabilized for a number of years by forces including:

- Waiting on the outcome from the Affordable Care Act debate, then major shifts connected with its and other reform efforts’ implementation
- Potential Medicare and Medicaid redesigns which would disrupt long-standing practices and reimbursement expectations
- The still-evolving and uneven recovery from the recent recession
- The ever-growing pipeline of electronic devices that hold promise but also potential for rapid obsolescence

All these factors combine to give care organizations compelling reasons to proceed very carefully in making home telehealth equipment investments. Many administrators as a result have taken a very prolonged “wait and see” position - for what the economy does, what course competitors pursue, potential impacts from reductions in public program revenues.

The unfortunate reality is that the healthcare environment will continue encountering disruptions like these in the foreseeable future. Proceeding cautiously may seem like a safe course of action, but gaining exposure to and experience in working with home telehealth technologies, even if not extensive or optimally successful, may be vital for some organizations’ survival. There may be no good point or time for committing; the further decisions are delayed, the further back organizations may end up on the operations curve.

PRACTITIONER LICENSURE

States exercise a public safety responsibility in approving licenses for a range of healthcare professionals practicing within their borders. Professionals wanting or needing to practices in more than one state typically must obtain a license in each location. Telehealth affords the ability to readily connect to consult, diagnose, prescribe and even operate nationwide and around the globe. As a result, medical professionals
and others operating telepractices for many years have come up against barriers states' licensing laws create.

Some states have legislated provisions facilitating interstate telehealth practice through legislation and practitioner credentialing. The impediment licensure creates has received considerable attention over the years, with bills periodically proposed in Congress to set overriding national standards. Debates have been strident because such actions would directly oppose states' historic regulatory rights.

**TELECOMMUNICATIONS REGULATION/EXPANSION**

Broadband coverage/connectivity - whether nationally, throughout a state or in a particular location - is another issue greatly affecting home/community telehealth adoption. Policies regulating interstate and international telecommunications are the responsibility of the Federal Communications Commission/FCC. It has been contending with many complex issues and pressures as newer conveyance methods proliferate.

Broadband expansion efforts benefitting telehealth have been in progress over many years, although at a too-slow pace for many advocates. The FCC has awarded competitive grant funds for communities - rural, in particular – to develop/enhance regional and state communications infrastructure in support of expanded capabilities. It developed a national broadband policy plan where telehealth communications have an integral role.

Since the 1990s, the FCC has pursued policies subsidizing telecommunications services for public rural healthcare providers and nonprofits. Efforts have included subsidizing rates to make them comparable to those in urban areas, giving rural providers a reduction in Internet rates and providing pilot funding to subsidize constructing regional or state healthcare broadband networks and Internet connections.

The Commission began providing a new form of assistance at the end of 2012 called the "Healthcare Connect Fund." (1) It will aid rural recipients in building networks, purchasing broadband services from a range of carriers, and/or upgrading transmission speed. Non-rural providers will also be eligible at a lower priority. The FCC estimates that this assistance will reduce rural healthcare providers’ costs by 50%. The Commission has also launched a pilot to gauge if connectivity via the Fund can be brought to skilled nursing facilities at a reasonable rate. (2)

In response to continuing pressure regarding the increasingly important wireless broadcasting role in healthcare delivery, the FCC formed the "mHealth Task Force" in mid-2012. This group has already made a large number of recommendations for ways the Commission can accelerate m-health adoption, including the priority recommendation that the Commission hire a permanent director for healthcare. (3)
In a proactive decision, the FCC in 2012 also approved a policy allowing more intensive use in a section of the overall telecommunication bandwidth for what are called "medical body area network"/MBAN devices. (4) This new capacity has been termed bodycasting, and the U.S. is the first country to allocate bandwidth spectrum in this manner. The devices making prime use of it include some outlined in the first chapter that are core to home and community telemonitoring.

DATA ISSUES

There are at least four major concerns surrounding data generated by home/community telehealth equipment - collection, management, consent and security. Collection and management these days typically become issues of electronic health record/EHR integration and compatibility with larger administrative systems’ records management procedures and technology.

In some cases, agencies using home/community telehealth equipment may retain/manage the data internally. In other cases, vendors from whom devices were purchased or leased provide data analysis/management services. Cloud computing - where individuals' or organizations' electronic data and programs are stored and handled by remote servers - is an additional management element becoming more prevalent.

Data security extends from the collection point to parties along the way and which parties in the ultimate stored format are authorized to view/analyze it. The Office for Civil Rights in the federal Department of Health and Human Services is responsible for enforcing the applicable federal law approved in 1996 - the "Health Insurance Portability and Accountability Act"/HIPPA. HIPPA provisions also cover aspects of confidentiality. Agencies incorporating telehealth into delivery of home/community support services must deal with all these trends and requirements. They have additional, emerging concerns where extent of data knowledge relative to care provided presents potential legal liabilities.

DEVICE REGULATION

The federal Food and Drug Administration/FDA is responsible for evaluating and sanctioning medical devices, including home telehealth equipment. Manufacturers must adhere to its regulations in readying products for market, and the review process can take many months. When a system of components is involved - hardware, software and peripherals - devices must be reviewed as a whole and reapprovals must be on the same basis. (5) To expedite the process, the Agency has begun approving telemedicine software systems as medical device systems, which avoids the testing and approval a whole-system review requires.

The FDA in 2010 initiated a "Medical Device Home Use Initiative" focused on safe residential use. (6) Major components include giving manufacturers guidance on obtaining clearance/approval for devices intended for home use, creating a labeling repository with manufacturers’ information on file for public and professional use and increasing the public's awareness of benefits and risks with devices used at home. At the
beginning of 2013, the agency also issued draft standards for regulating medical devices intended for home use. (7)

A current debate involves mobile health wireless apps used with smart devices. At issue is whether or not apps are "medical devices" that should come under the Agency’s review authority. This controversy has generated considerable attention and concern within the past couple years as the volume of apps covering health, fitness and/or medical tasks has grown tremendously.

**DEVICE INTEROPERABILITY**

The history of consumer electronics has involved intense competition between/among vendors' offerings, where device incompatibility has sometimes been the outcome. The industry learned from experience how these expensive and disruptive battles have an adverse impact on the buying public. The positive outcome has been that manufacturers now are more inclined to collaborate on basic technology features and protocols, which is what took place in the early days of telehealth expansion - major global device manufacturers agreed to work together to create compatible, "level playing field" technical standards.

The organization Continua (8) was established to develop and implement health/wellness technology interoperability guidelines. Examples of approved standards include the decision to use the Bluetooth protocol for wireless technology connections and a Good Housekeeping-type logo for certified devices. Continua focuses efforts in three broad market areas - chronic conditions, seniors and fitness/health/wellness. The association currently has around 200 healthcare and manufacturing members.

**FINANCING**

There are a number of funding concerns connected with incorporating home/community telehealth equipment into an agency's service delivery. They include covering costs for acquisition, operations (including staff training and data management), repairs and communications connections. Some federal and/or philanthropic monies have been available over time to defray particular types of expenses (e.g., device acquisition) for services delivered in particular locations (e.g., rural areas where healthcare needs are underserved - a Medicare program standard).

If telehealth equipment's acquisition characteristics were similar to conventional business operations where costs and benefits are considered over a 10- or 20-year period or longer, decision-making could be more straightforward. As with choices involving computers and other types of electronic equipment, committing is complicated by the concern that technology will quickly appear on the market post-purchase with better features and lower prices.

Some vendors address this issue by offering attractive trade-in/trade-up terms. One other advance is the emergence of companies offering "telehealth as a service," effectively
becoming an organization's telehealth department. An online industry resource, "Home Care Technology Report," in 2012 identified a sample of eight organizations around the country following this business model. (9) Their services range from only supplying equipment, to handling installations at patients' homes, receiving and following up on patient monitoring data and sometimes handling care planning/coordination as well. Markets served by these firms ranged from a metropolitan area to nationwide.

Ohio-based VRI, Inc. is an example of one of these businesses, offering a turnkey-type of arrangement with the vital signs monitoring equipment it carries. (10) VRI purchases equipment from various vendors, and clients lease only the devices needed. Its equipment managers educate patients and staff about features and operations. The company care center provides patients with monitoring reminders as necessary and responds to alerts - a patient's medical staff is contacted for help with minor issues, and emergency services are immediately contacted when serious problems develop. The company removes equipment and sterilizes it for reuse when it's no longer needed. VRI provides oversight services for approximately 90,000 clients.

**OPERATIONS, ORGANIZATIONAL CULTURE**

The different types of electronics surrounding our lives bring with them many demands. We have to master operations and use often requires adapting practices and routines that may have been part of our personal or professional lifestyles for many years. We're often caught juggling between holding onto aspects of the old while we shift over and fully commit to the new - whether or not to keep the landline phone or continue receiving print copies of the daily newspaper.

Organizations incorporating home/community telehealth technologies into service delivery face parallel concerns. A range of administrative procedures may have to be revised or ultimately replaced, perhaps not successfully on the first try. Staffing patterns or even staff numbers may have to shift considerably, along with changes in how certain professionals must perform their jobs. Both these issues may lead to internal tensions and impact on morale. It may be necessary to operate duplicate functions for a period, such as continuing to keep certain written patient records while also capturing them electronically.

Successfully incorporating telehealth technology depends not only on cost considerations but also subjective factors like practitioner acceptance/support and the presence of "champions" and practice leaders. Staff training becomes very important, not only at start up but for ongoing use as well - adjustments for upgrades, switches in connections, revised records retention and software adjustments. A definite cost to consider is the amount of time new tasks may require within already-overextended schedules.

**PROPOSED FEDERAL LEGISLATION**

In response to a number of the challenges outlined in this chapter, Congress is again
considering telehealth-related legislative proposals. Among noteworthy bills are:

- **The Telehealthcare Promotion Act of 2012 (H.R.6179),** which was introduced at the very end of the 112th Congress in 2012 and reintroduced early in 2013. It was submitted by Representative Mike Thompson (D-CA), who had experience in working on the issue as a lawmaker in his home state. (11)

  The bill would increase access to telehealthcare for persons insured through Medicare, Medicaid, Veterans Affairs, TRICARE (active military), federal employee health plans and the Children’s Health Insurance Program. It would eliminate a number of impediments that for many years have restricted telehealth expansion, including:

  - No covered benefits would be excluded solely due to delivery via telecommunications;
  
  - Healthcare providers would only need licensing in their home states to perform telehealth in other states;
  
  - Medicare restrictions on where (only rural) and how doctors-patients must interact (directly) would be eliminated.

  The bill also contains a number of new pilot programs and expansion of existing innovative care delivery techniques.

- **The Fostering Independence through Technology Act (S596),** authored by Senators Amy Klobuchar (D-MN) and John Thune (R-SD), was introduced in the U.S. Senate in March 2013. (12) Its ultimate goal is to reduce hospital admissions and other Medicare costs by creating a pilot program enabling home health agencies to purchase and incorporate remote patient monitoring into care delivery. It has been introduced since 2005.

- **The Healthcare Innovation and Marketplace Technologies Act (HR6626),** sponsored by Representative Mike Honda, was introduced at the end of the 2012 session and reintroduced in June 2013. (13) It would establish an Office of Wireless Health in the federal Food and Drug Administration/FDA. The bill wouldn't expand the Agency's mobile health industry regulation, but would promote coordination among federal agencies and the industry in guiding expansion of m-technology opportunities. It would also coordinate development of privacy regulations, offer competitive awards, provide financing to stimulate innovation and train employees in technology use.

**HOME/COMMUNITY TELEHEALTH ADOPTION**

A survey conducted in 2012 by Lori Orlov of “Aging in Place Technology Watch”
reflects the collective impact that challenges outlined in this and the previous chapter are having on the extent of home-based telehealth adoption. (14) 315 supervisors of home care, home healthcare and geriatric care management organizations (with responsibility for approximately 34,500 workers around the country) were contacted. The inquiry focused on technologies their workers have and use, what they recommend and data captured/reported.

More than half the respondents indicated familiarity with telehealth technologies, although few indicated employing systems in care delivery. Personal emergency response system pendants/watches were the device most frequently recommended to families - by 53% of the respondents - and medication dispensers (not remotely monitored) were recommended by 52%. 25% said that they didn't record data from devices but wished they did.

Specific equipment used in care delivery (n=234):

- Blood pressure monitor - 14%
- Weight scales - 13%
- Pulse oximeter - 12%
- Blood sugar glucometer - 9%
- Other - 9%
- Medication dispenser - 6%
- Thermometer - 3%
- Tehealth kiosk - 1%
- 0% - 20%

A prime thrust of the report was Orlov’s perception of the need to create "healthcare information networks" - enabling easy migration of data as patients increasingly move back and forth among medical, rehabilitation and home care settings. Orlov's comments on the findings in her blog were that:

"In 2012, we surveyed home care, home health care and geriatric care managers about their use of technology in their practices. The result we found is that there is little use made of in-home technology today, at least not telehealth and chronic disease monitoring tech, and even less use of video communication with either the care recipient or the family." (15)

The survey didn't explore reasons for telehealth’s low adoption rate. It's almost certain that many of the issues identified in the previous and this chapter play a role, particularly depending on the size of an agency and whether it has free-standing operations or is part of a larger structure such as an integrated healthcare system or major nursing home and/or assisted living organization.

Agencies connected with the latter benefit from the economies-of-scale "rising tide" that come from having a larger parent organization that can afford incorporating a range of technologies to achieve operations efficiency. Far smaller agencies may not be capable
of making such a commitment due to upfront and ongoing costs. This would almost certainly be the case where many clients are on Medicare and Medicaid, given the continual rate reductions these programs have been experiencing. Presence or absence of some form of electronic health records is also a key factor.
CHAPTER 4 -
EFFICACY AND COST-BENEFIT

EFFICACY

The issue of efficacy in telemedicine was raised when its technologies and connections were first introduced decades ago. However, there's widespread acceptance at this point, as established by the proliferation of many subspecialty fields, the tremendous growth in equipment and investment overall, and federal and state efforts to develop broadband infrastructure.

Questions were similarly raised more recently regarding whether or not medical/health concerns, activities and safety could be effectively tracked remotely in homes. There's general acceptance that the technologies typically used in remote vital signs monitoring and sensor monitoring systems are effective. If issues are raised, they may involve questions about if specific algorithms designed into systems are optimal (which is a vendor-specific concern).

Where efficacy issues may still arise is in the mobile telemedicine/telehealth field. For examples, news stories have highlighted and research efforts have explored if certain smartphone-based telemedicine approaches are effective in diagnoses requiring high visual precision - e.g., if phone screens are adequate for reading electrocardiograms or for teledermatology wound analysis. However, the FDA continues to approve a range of miniature peripherals for cellphone and smartphone-based remote vital signs monitoring.

To further establish efficacy, Johns Hopkins School of Public Health announced in May 2013 that it is setting up an online mHealth evidence data base. (1) Its goal is to identify, categorize and rate both peer-reviewed research and "grey" literature - evaluations, project reports, white papers, blog posts, discussion boards, etc. - available worldwide. The initiative has support from the U.S. Agency for International Development/AID.

THE COST-BENEFIT RIDDLE

Establishing costs and benefits for telehealth in general and home telehealth in particular has faced challenges since the various technologies were introduced. Perhaps the greatest challenge involves exactly which costs and whose benefits are considered.

The approach conventionally employed in evaluating home telehealth is very clinically and business oriented. Healthcare professionals, researchers and practitioners typically review it according to "hard," direct acquisition/operational costs and reimbursement opportunities. They follow business accounting "return on investment"/ROI calculations - a performance measure where the benefit of an investment is divided by its cost to yield a ratio compared against ratios for other opportunities available for using the funds.

These calculations use dollar values that are concrete or can be readily factored. Among typical categories healthcare administrators and researchers use in this approach are:
• Equipment
• Installation
• Transmission linkage, operations center/s
• Monitoring
• Maintenance
• Repairs, upgrade
• Staffing
• Training
• Data management

Home remote monitoring cost/benefit studies are often based on ability to reduce or avoid a certain set of outcomes – e.g., emergency department use, hospitalization and/or nursing home admissions. Care administrators then use these measures for determining if home telehealth monitoring service delivery is cost-effective for their organizations. Results may be geographically specific, given that costs for equipment, staffing, travel/transportation and other major elements vary from one part of the country to another.

These measurements often yield readily quantifiable cost savings for many research projects. However, there are other costs that could and should be considered as well, but assigning dollar values may be difficult due to their qualitative character. An additional limitation is where costs are borne by one sector or bureaucracy while benefits accrue to another, or where costs are borne by parties at the state or local level but savings accrue to a federal or national-level entity.

One set of qualitative measures relates to avoiding or reducing adverse outcomes, such as:

• Short- and long-term negative health impact when one or more conditions escalates
• Escalation triggering a new acute or chronic condition
• Complications requiring new medications or increased medication dosage
• Repeated doctor/clinic appointments and follow ups
• Exposing fragile person to adverse weather or illnesses for frequent care travel
• Travel time and expense - for patients, for caregivers
• Lost caregiver work time

A second set of qualitative measures involves types of social benefits, such as:
• Positive impact on local economies when patients remain in and support sparsely-populated communities where they have been long-term residents.

• The "ripple effect" where reduced burden on family members and others providing care extends into many areas of their lives - e.g., personal and work schedules, reduced stress levels, etc.

• Positive socialization and enhanced mental health when relatively isolated persons and remote healthcare providers systematically interact by phone, computer and/or video. For example, the Mayo Clinic in the mid-2000s conducted home telehealth demonstrations in southeast Minnesota serving persons with early-stage Alzheimer's. Staff reported anecdotes of how some of the elderly men participating paid particular attention to their appearance and looked forward to their remote video visits with the younger women nurses caring for them.

• Goodwill from home telehealth monitoring. The business concept of "goodwill" recognizes an asset that isn't tangible/concrete but still has a reasonable value - a prime example is a company's/brand's reputation with investors, clients and customers.

  One type of home telehealth goodwill is patient/caregiver satisfaction, particularly where the service represents the difference between relative independence and relocating to a care setting. Another aspect is enhanced provider reputation for offering services seen as innovative - when seniors know of relatives, friends and neighbors using the technology, they consider it as a benchmark for services they want to receive as well.

It’s no accident that social democracies such as Britain and various European countries embrace home telehealth technologies – their healthcare insurance, regulation and financing practices are considerably different than those in the U.S. Prevention is an important goal in these locations, and the federal government through Affordable Care Act provisions is in part using the influence Medicare and Medicaid to shift in this direction. As it does so, incentives for prevention and other “softer” factors are being incorporated into conventional healthcare cost/benefit equations that will very likely shift how they're calculated in the future.

Laurie Orlov (“Aging in Place Technology Watch”) captured the dilemma of how the conventional cost-benefit research mindset impedes the new paradigm’s potential (2) in observations that:

"There are plenty of technologies out today that could help in the care of frail and at-risk seniors, whether in a hospital, in a skilled nursing facility, or in assisted living. Insurance companies - giants like Humana, for example - along with hospitals, Medicare, and everybody else are also in the yet-another-research-study mindset before
committing themselves to inclusion of telehealth technology in their strategies.”

“With everyone waiting for the Godot of studies to end all studies, medications are routinely mismanaged, patients fall out of bed, changes in vital signs are missed, and risk reduction and prevention treatments continue to depend on the labor of an ever-scarcer population of skilled people who deliver most of that care face-to-face. Can it be that so many other aspects of our lives are dramatically altered when a technology is introduced (books, travel, communication, car safety) and yet we continue to stumble along in a paper-and-person and nearly technology-free health system?”

**RESEARCH LIMITATIONS**

A large and steady output of research has been produced for many years about the telehealth field. Projects involving efficacy and cost-benefit may not be in the majority, though, because they require a fairly significant infrastructure - e.g., acceptable research design, data collection, data analysis, staffing, etc. This likely explains why a good portion of published research focuses on:

- Meta-analyses
- Assessing a technology's clinical vs. home impact
- Patient, caregiver and/or staff satisfaction
- Efficacy among a number of technologies for a particular task -- e.g., phone prompts by person vs. text, phone vs. computer/Internet data reporting
- Reviewing performance for technical aspects of a protocol - e.g., use of anticoagulants
- Recommendations for administrative best practices
- Projects' participant attrition and reasons for it

When research studies do focus on home/community telehealth cost/benefit outcomes, some researchers and funders may not accept positive results for a number of reasons. One is study size, which sometimes is extremely to relatively small for a given target population. Another is length of analysis, which may be short term - a few weeks to a few months vs. more longitudinal attention. The protocol followed also may involve practical reporting of an experience instead of the gold standard relying on a random control group.
Some studies are sponsored by device manufacturers, where outcomes may be discounted due to perceived bias. However, product vendors along with the federal government may be the parties in the best financial position to undertake substantially sized initiatives. Vendors often partner with one or more respected outside parties to conduct a major research project in order to neutralize potential objections.

**COST-BENEFIT REVIEWS**

With the above perspectives in mind, the balance of this chapter will highlight a range of home telehealth monitoring research findings. Because of differences among healthcare systems around the world - e.g., telecommunication capabilities, protocols, technology used, regulations, reimbursement, etc. - it was judged most appropriate to concentrate on U.S.-based research.

Two approaches have been followed. An initial section provides narratives on projects with noteworthy outcomes, even if efforts weren't conducted along formal research lines. These write-ups are followed by a grid with summaries from abstracts for a large number of pertinent published research projects.

**Britain's "Whole System Demonstrator Program"**

Although the focus of articles reviewed for this report is U.S. research, a major British effort must be highlighted due to its scope. Britain's National Health Service began a "Whole System Demonstrator Program" in 2008, testing the impact of telehealth and telecare on use of secondary healthcare and mortality. (3) 3,230 persons with diabetes, chronic obstructive pulmonary disease or heart failure were recruited from 179 general practices to participate in the trial. The main outcome was avoiding hospitalizations, which showed lower admissions, lower mortality and lower emergency department use for the telehealth intervention group. Length of hospital stay was also shorter for the intervention group.

Initial findings indicated that telehealth delivered a 15% reduction in emergency department visits, 20% reduction in emergency admissions, 14% reduction in elective admissions, 14% reduction in bed days and an 8% reduction in tariff costs. A 45% reduction in mortality rates was also reported. The study concluded that home telehealth is associated with lower mortality and emergency admission rates. A subsequent short-term study of Demonstration participants found those using telehealth didn't reduce life anxiety or depression in the process. (4)

**Veterans Health Administration telehealth successes**

Many people have the mindset that large bureaucracies, particularly the federal government, are incapable of performing cutting-edge work. It would surprise them to learn that the Veterans Health Administration in the Department of Veterans Affairs is a
national, even international, leader in incorporating telehealth technology into its service delivery.

A number of factors contribute to this situation. VHA's website (5) indicates it's the country's largest integrated healthcare system, including 152 medical centers, nearly 1,400 community-based outpatient clinics, and community living centers and other resources. In providing care to over 8.3 million veterans annually, VHA early on developed and began using electronic health records, the backbone for e-health in general and telehealth in particular. The fact that the VHA is a "single-payer" managed care system means it avoids many of the extremely fragmented civilian healthcare system’s inefficiencies.

Medical practitioners in its system also have the advantage of being able to design policy strategies and develop initiatives without two major barriers civilian counterparts have faced for years - covering costs for equipment, transmissions, etc., and a 50-state medical licensure checkerboard curtailing practice across state lines.

A likely explanation for why VHA’s experiences aren't better known is because it effectively operates in parallel with the publicly supported systems in each state. That characteristic may complicate ability to replicate certain of its successes, but there are many other areas where social services and healthcare personnel around the country could benefit in learning about VHA's telehealth experiences.

VHA has focused for a number of years on responding to the retiring baby boomer generation demographic imperative. It faces a caseload where the number of aging veterans with multiple, chronic conditions will significantly increase in the years ahead, and is using telehealth to gain both operating efficiencies and provide better care. As a measure of the extent of adoption, the Veterans Administration announced at the end of 2012 that over 460,000 veterans used its telehealth services in 2011; it will work to double that number by the end of 2013. (6)

**Care Coordination/Home Telehealth Program**

Given the size of its operations, VHA is very well positioned to track and report on both technology performance and outcomes. In that capacity, it conducted within the past decade a noteworthy and significant U.S. telehomecare cost/benefit study.

VHA in mid-2003 began operating "Care Coordination/ Home Telehealth”/CCHT to deliver care to veterans with chronic conditions and avoid unnecessary long-term care admissions. (7) Program participation grew from 2,000 at its start to 31,570 in 2007, and it is now a routine non-institutional care service. The VHA has trained 5,000 staff to implement it.

Data for 17,025 CCHT patients during the 2003-2007 study period showed a 25% reduction in number of bed care days, 19% reduction in hospital admissions and mean
participant satisfaction scores of 86% after enrollment. The cost per patient per year was $1,600, significantly lower than a hospitalization or nursing home placement.

CCHT’s performance was profiled in a study released early in 2013 by the Commonwealth Fund, a private foundation with a mission to promote high-performance healthcare systems. (8) It reported that reductions in bed days of care were achieved in excess of 40 percent on pre-enrollment figures for the CCHT population, and the reduction from 2004 to 2007 was significant across eight primary conditions. Over 70,000 receive the service in 2012.

Telementalhealth

Another facet of VHA programming involves telementalhealth offered through more than 800 community-based outpatient clinics where many veterans obtain their primary care. This programming had over 140,000 encounters in fiscal year 2011 where providers at 150 hospitals delivered care involving 55,000 veterans at more than 500 clinics, and an aim was to increase care to 200,000 in 2012. (9) Services delivered remotely include individual, couples', group family and behavioral therapy, psychological testing and medication management. Since mid-2012, co-payments have been eliminated for veterans connected by videoconferencing from home with VA professionals.

Overall, the VA provided mental health services in 2011 to 1.3 million veterans, and it began an initiative that year to significantly expand telehealth staffing capacity. (10) Video services to vets at home are projected at 2,000 patients by the end of fiscal year 2012, including many that will employ a new video Internet protocol.

A recent study conducted by the director of the Administration's national telementalhealth center and associates corroborates the effectiveness of this care delivery. (11) The research team reviewed records for over 98,600 VA patients requiring mental health services and new to the telementalhealth program during 2007-2010. These patients on average had 24% fewer psychiatric hospital admissions during their first six months in the program, compared with in-person care received in the six months preceding entering the program. These patients also in their first six months had 27% fewer total days of psychiatric hospitalization compared with the six months preceding entering the program. During this same period, VA patients receiving standard care had no change in their rate of psychiatric hospitalization or length of stay.

Home-Based Primary Care Program

As a further example of flexible programming, VHA for decades has operated a "Home-Based Primary Care Program" using telecare resources. (12) It serves veterans for whom periodic doctor visits are inadequate and who typically have complex conditions putting them at risk of hospitalization or nursing home placement. Care teams make an average of three site visits per month, and involve doctors, nurses, social workers, dietitians, pharmacists and psychologists.
The program currently serves approximately 12,000 veterans annually through 116 sites - participants have an average of 19 diagnoses and regularly take 15 medication prescriptions. A VA study of the program in 2007 found that participant hospital days of care dropped 69% and there was a 27% reduction in admissions.

**VA InnoVAtions initiative and the VA Center for Innovation**

"VAi2" is a high-priority effort begun early in 2010. (13) It's aimed at obtaining new, innovative ideas that will advance the Agency's ability to proactively respond to current and upcoming service delivery challenges. It prioritizes, funds, tests and implements innovations judged most promising for improving service quality, upgrading operations and reducing or controlling delivery costs. Telehealth strategies are a focus of its efforts. Since its start, it has funded over 120 innovations, and its efforts in the fall of 2012 were incorporated into a VA "Center for Innovation" which will support this outreach long term.

An example of one funded innovation is an initiative by SweetSpot Diabetes Care. It will remotely monitor veterans with diabetes, starting with a pilot in Dayton, OH. (14) Vets will send blood glucose readings to the VA medical records system from home, and VA providers will monitor the data for rising readings where potential complications may occur. The data will also be available via cloud-based computing to facilitate vets getting specialist care in their locales if needed.

**VA use of mobile technologies**

A recent example of the VA's interest in exploring the use of mobile technologies is the "Clinic at Hand" program which began in 2012. (15) Veterans' families received 1,000 Apple iPads loaded with apps to help them provide care and connect with veterans' doctors. Later efforts will pilot other devices and operating systems.

**Partners Health Care**

The Commonwealth Fund also reported on telehealth efforts promoted by Partners Health Care, a major integrated healthcare system in the Boston, MA metropolitan area. Its Center for Connected Health is a national cutting-edge promoter of telemedicine and telehealth through researching, developing, testing and implementing patient-centered healthcare solutions.

The Center’s "Connected Cardiac Care Program"/CCHP began as a demonstration providing home telemonitoring and education for patients with heart failure, and was expanded across the Partners' network. (16) Approximately 1,200 patients as of early 2013 had been enrolled in the CCCP, and the Center for Connected Health reported the following findings:

- 51% reduction in heart failure hospital readmissions
• 44% reduction in non–heart failure hospital readmissions
• Improved patient understanding of heart failure and self-management skills
• High levels of clinician and patient acceptability and satisfaction
• Recent case study cost savings -
  • $1,500/patient costs for the program, $9,655/patient saving from reduced hospitalization = $8,155/patient net savings
  • Total savings: $10,316,075 for 1,265 monitored patients since 2006 (which factor in costs for running the program, marketing, telemonitoring nurse support, technology)

NewCourtland Life and Healthsense

The majority of home telehealth research project focus on studies involving vital signs monitoring. A recent study evaluated use of remote sensor activity/safety monitoring systems involved NewCourtland Life in Philadelphia, PA and Healthsense, a Mendota Heights, MN vendor of home telehealth products. New Courtland is a "Program for All-Inclusive Care for the Elderly"/PACE, a capitated reimbursement care model providing seniors vulnerable to nursing home placement with individualized healthcare and social services.

The two organizations partnered in 2008 and operated a demonstration for approximately two years where the Healthsense “e-Neighbor” remote sensor monitoring system was used to support seniors discharged from nursing homes who relocated to a NewCourtland housing development. (17) Study findings reported:

• 33 individuals moved from nursing homes to NewCourtland Square, where e-Neighbor systems were installed in their units. Annual costs reported for the 26 units were: $39,000 for technology and $249,600 for home care - a total cost of $288,600 - versus $2,135,250 for nursing home residency (based on a $225/day charge). Projected annual savings were $1,846,650.

• NewCourtland also provides two- to three-person residential care homes. Sensor monitoring systems were installed in the units of up to eight persons either discharged from nursing homes or at high risk of admittance. Annual costs reported for these seven units/rooms were: $10,500 technology cost and $219,500 for home care - a total of $229,500 - versus $574,875 for nursing home residency, with a resulting projected annual savings of $345,375.

• A PACE member living in the home of a daughter was prone to nighttime wandering. The daughter sought nursing home placement, but staff installed a system so she could continue living with her daughter. Annual costs reported
were: $1,500 for technology and $9,600 for home care - an $11,100 total - versus $82,125 for nursing home residency, for projected annual savings of $71,025.

HealthPartners Research Foundation

Health Partners Research Foundation (St. Paul, MN) conducted a telemonitoring study of cardiac patients where results were reported in 2012 at the American Heart Association's Quality of Care and Research Scientific Sessions. (18) The study found that patients receiving care via telemonitoring and with regular pharmacist follow-up support were more likely to have lowered blood pressure than patients receiving traditional care.

The study involved 450 patients with uncontrolled high blood pressure who had periodic appointments with their primary care providers. 222 received just this traditional care, while 228 also used telemonitoring to take their pressure at home and forward results to a secure site where pharmacists followed up with them every two to four weeks. These participants over the course of the study received more medications than those in the control group.

Of the 222 patients receiving traditional care, 45% saw their blood pressure lowered over a six-month period. However, approximately 72% of the telemonitoring group lowered their blood pressures to desirable levels during the time period, and also reported remembering and more consistently taking their medications than those in the control group.

St. Alexius Medical Center

St. Alexius Medical Center (Bismarck, ND) and Great Plains Telehealth Resource and Assistance Center (Minneapolis, MN) developed a research project to determine if home telehealth could improve access and care, and reduce costs and hospital readmissions for patients living in rural areas in North Dakota, South Dakota and Wyoming.

The hospital instituted a "Telehealth Home Care-Coordinated Disease Management Demonstration" for rural patients with chronic heart failure, chronic obstructive pulmonary disease and diabetes. (19) The project ran from January 2011 thru April 2012, and involved 38 patients with an average age of 79. All had one or more chronic conditions, and were enrolled an average of 97 days. The only patient rehospitalized was within 30 days of enrollment. 92% of the participants when surveyed responded that telehealth could improve their health, 83% said it could reduce healthcare costs, 84% responded that the equipment was easy to use, and 93% perceived that it's an easy form of healthcare delivery.

PUBLISHED RESEARCH STUDIES

The following summaries highlight either pertinent research abstracts or full study reports covering both a range of chronic conditions and a range of home telehealth technologies.
Articles were drawn from those published in the industry's two major journals - "Telemedicine and e-Health," issued by MaryAnn Liebert Publishing (U.S.) and "Journal of Telemedicine and Telecare," originally published by the Royal Society of Medical Journals (U.K.), now by SAGE Publications. These were supplemented with entries from other research journals along with noteworthy research reported in the press or by industry sources.

The decision was also made to focus on reports published in approximately the past five years. The field is moving so quickly that although a large number of studies were conducted in the later 1990s and early-to-mid 2000s, equipment and strategies have evolved considerably. Reports involving conditions not necessarily considered a component in seniors' home healthcare - e.g., telementalhealth - have also been included because they may become so going forward.

<table>
<thead>
<tr>
<th>Research article title</th>
<th>Purpose, background, outcomes</th>
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<tr>
<td><strong>Telemedicine for Recently Discharged Older Patients</strong> <em>(Telemedicine and e-Health, Volume 16 Issue 1, February 2, 2010, pg. 49-55)</em></td>
<td>An observational study of 851 predominantly elderly, recently discharged persons enrolled in a two-month study. They received a nurse visit (including patient education) up to three times per week and daily home telemedicine monitoring of all vital signs. Readmission rate was 13% and mortality 2%; treatment goals were met 67%, compliance rate was 77%, average improvement in nine quality-of-care measures was 66%. This model of care was accepted and produced excellent short-term clinical outcomes.</td>
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<td><strong>Authors:</strong> Cardozo, Steinberg</td>
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<td><strong>Telemonitoring Improves Home Health Utilization Outcomes in Rural Settings</strong> <em>(Journal of Telemedicine and Telecare, accepted February 6, 2011)</em></td>
<td>Study examined the hypothesis that rural telehomecare accompanying conventional home care will result in less hospitalization and more discharge to the community. Five rural home health agencies participated. 1, 419 patients comprised the test group that was telemonitored daily from October 2006 - May 2009. A control group of 1,502 was selected backwards from September 2006. Both groups had home care for about 50 days. Home telemonitoring was found to reduce the odds of hospitalization (OR=0.59, P&lt;0.001) and to increase the odds of community discharge (OR=1.36, P=0.003).</td>
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<td><strong>Authors:</strong> Golbeck, Hansen, Lee, Noblitt, Christner, Pinsonneault</td>
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<tr>
<td><strong>St. Vincent's Home</strong></td>
<td>A remote monitoring program was implemented to study</td>
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### Telehealth for Congestive Heart Failure Patients


**Authors:** Whitten, Bergman, Meese, Bridwell, Jule

whether patients (n=50) had enhanced clinical outcomes and perception of this form of care. Results showed significant physical, behavioral and emotional improvements in: shortness of breath, managing oral medications, engaging in moderate activities, amount of energy, leg/ankle swelling, need to sit/lie during the day, fatigue, need for hospitalization, treatment side effects, anxiety. Interviews showed patients found the service easy to use and that this form of care was as good as in person.

(NOTE: St. Vincent's (Indianapolis, IN) conducted a subsequent study involving patients with congestive heart failure and/or COPD; many also had additional chronic conditions. Approximately 300 individuals were enrolled in the program immediately following hospital discharge from 10 participating hospitals in the St. Vincent network. The study also had extra equipment capacity as well as nursing time, so the pilot was expanded to include persons with other complex conditions.

Initial results show a study group 75% reduction in 30-day readmission rate compared with those in the control group and an 85% reduction compared to the national average. A significant example involved a patient who prior to the project had 13 heart failure admissions in one year at a $156,000 cost for the system. She had no admissions during 11 months of project participation.)

### Impact of Blood Pressure Telemonitoring on Hypertension Outcomes: A Literature Review


**Authors:** AbuDagga, Resnick, Alwan

Five major databases from 1995-2005 were searched for evidence of blood pressure monitoring on blood pressure control for subjects with hypertension as a primary diagnosis. 15 articles met review criteria. Blood pressure telemonitoring resulted in reduction of blood pressure in all but two studies. Across studies, systolic pressure declined by 3.9 to 13.0mm Hg and diastolic declined by 2.0 to 8.0mm Hg - this magnitude of effect is comparable to those in efficacy trials of some antihypertensive medications. Some of studies also included secondary outcomes, e.g., healthcare utilization and costs. Compliance among participants was favorable.

### Home-Based Preventative Care in High-Risk Dialysis Patients: A Pilot Study


Pilot study to determine if home-based preventive care using telehealth technology improves healthcare outcomes, quality of life and is cost effective due to proactively managing underlying chronic conditions. 44 dialysis patients participated - 19 in a remote technology group (mean age
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<th>Study Title</th>
<th>Authors</th>
<th>Summary</th>
<th>Notes</th>
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<tr>
<td>Health, Volume 17, Issue 4, May 25, 2011</td>
<td>Authors: Perman, Wada, Minatodonai, Halliday, Miyamoto, Lindo, Jordan</td>
<td>Hospitalizations, hospital days, emergency room visits, usual care costs and customary charges were significantly less for those in the remote technology vs. usual care group. Quality of life remained the same for the usual care group from outset to study midpoint, decreased slightly for the technology group. Results suggest telehealth technology can play an important role in improving health outcomes and cost of care for end-stage renal patients.</td>
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<td>Managing Heart Failure Patients After Formal Homecare</td>
<td>Authors: Dansky, Vasey</td>
<td>Study to determine if using telehealth equipment after discharge from formal home healthcare improves clinical outcomes, self-management. Patients recruited from ten home health agencies nationwide; monitored them to 180 days after discharge. All used the Health Buddy (Bosch) telehealth system during formal health services. Patients were randomly assigned to telehealth and control group upon discharge; those in the former continued with the technology, those in the latter had no further intervention. Patients in telehealth group showed greater improvement in respiratory status and activities of daily living. None were hospitalized (vs. 28% in the control group) or used the emergency room (vs. 26.1% controls with at least one visit) during the study. Telehealth patients more likely reported tracking their weight and increasing their diuretic dose following ankle swelling, sudden weight gain, shortness of breath. Results suggest patients with heart failure may benefit from continuing to use telehealth equipment after post-home health services.</td>
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<td>Percepti on, Satisfaction and Utilization of the VALUE Home Telehealth Service</td>
<td>Authors: Finkelstein, Speedie, Zhou, Potthoff, Ratner</td>
<td>Randomized, controlled trial evaluating perception, satisfaction and use of home telehealth services from home care agencies. Control subjects continued receiving usual care, intervention subjects supplemented usual care with a web portal providing videoconferencing and electronic messaging, access to health-related services and general Web access. No significant perception differences at inception regarding technology between the two groups. At 60 days, the intervention group was significantly more positive towards technology, perceived it met expectations, and would recommend it to others. Intervention group made fewer emergency department visits, more eye doctor visits, fewer</td>
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University of Minnesota) visits in all categories of home care services, and less transportation service use. Results suggest frail elderly can adopt home telehealth technologies which may enable them to maintain independent living.

**Use of the Internet to Remotely Monitor Heart Failure**
(Telemedicine and e-Health, Volume 16 Issue 1, February 2, 2010)

**Authors:** Biljana, Kaan, Araki, Ignaszewski, Lear

Investigation of if using a web site for monitoring patients with heart failure could be as effective as use of in-home telemonitoring equipment. 20 participants were recruited from those newly referred to a heart function clinic; 17 completed the study. Weight and symptoms were entered on the web site, with a nurse tracking change in participant health status for six months. Self-care, quality of life, six-minute walk test and N-terminal prohormone brain natriuretic peptide were assessed.

Significant change was observed in maintenance subscale of Self-Care of Heart Failure Index. There was a trend toward improvement on confidence subscale of Self-Care of Heart Failure Index, Minnesota Living With Heart Failure Questionnaire, walking test and NT-proBPN. Participants and nurses demonstrated favorable web site uptake. Results showed favorable Web site acceptance/use and associated with improved self-care skills. Further investigation with larger population warranted.

**Feasibility and Impact of Telemonitor-Based Depression Care Management for Geriatric Homecare Patients**
(Telemedicine and e-Health, Volume 17 Issue 8, September 22, 2011)

**Authors:** Sheeran, Rabinowitz, Lotterman, Reilly, Brown, Donehower, Ellsworth, Armour, Bruce

Objective was to test feasibility, acceptability and preliminary clinical outcomes from using homecare monitoring technology to deliver depression care management. Three stand-alone nonprofit agencies (New York, Vermont, Miami) participated. 48 English- and Spanish-speaking elderly homebound homecare service clients were recruited, participated for a minimum of three weeks.

Evidence-based depression care management was adapted for incorporation into telemonitoring platform. In-home interviews gathered data on diagnosis, severity, patient satisfaction. Telehealth nurses and patients reported high levels of protocol acceptance. 17 patients had major depression criteria at baseline and were in the mild range at follow up. Preliminary outcomes suggest this method improves depression severity, although findings require testing in a randomized clinical trial.

**Evaluating the Evidence Base for the**
MEDLINE, EMBASE and CINHAL databases were searched for randomized controlled trials involving home
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<tr>
<td>Use of Home Telehealth Remote Monitoring in Elderly with Heart Failure</td>
<td>remote monitoring of patients with congestive heart failure (excluding monitoring solely involving telephones and studies not presenting outcomes related to healthcare utilization). Nine studies met the selection criteria, with greatly varying interventions. Six of the nine suggested a 27%-40% reduction in overall admissions. Two demonstrated a 40%-46% reduction in admissions; two other studies showed similar but not statistically significant trends. Three of the nine studies suggested significant reduction in mortality - 30%-67% - and three showed significant healthcare cost reduction. Two studies suggested a 53%-62% reduction in bed days of care. Two showed significant reduction in number of emergency room visits. Four showed significant overall outcome improvement using telemonitoring. These data suggest telemonitoring is a promising strategy, with more data needed targeted to population, technology, monitoring frequency/duration, and optimal combination of case management and monitoring for consistent, improved outcomes.</td>
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<td>Authors: Dang, Dimmick, Kelkar</td>
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<td>Effectiveness of Home Telehealth in Comorbid Diabetes and Hypertension: A Randomized, Controlled Trial</td>
<td>Objective was to evaluate efficacy in using nurse-managed home telehealth on critical need to control hypertension in veterans with diabetes. A randomized, controlled clinical trial compared two remote monitoring intensity levels and usual care. Intervention subjects had decreased hemoglobin A1c during first six months vs. control group, but groups were comparable six months after intervention withdrawal. High-intensity subjects had a significant decrease in systolic blood pressure compared to other groups at both six and twelve months. Adherence improved for all groups, with no significant difference among them. Finding was that home telehealth provides a practical, innovative strategy for increased early detection of major clinical symptoms requiring intervention.</td>
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<td>Authors: Wakefield, Holman, Ray, Scherubel, Adams, Hillis, Rosenthal</td>
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<td>Diabetes Management via Mobile Phones: A Systematic Review</td>
<td>Purpose was to analyze peer-reviewed research articles addressing mobile phones' common uses/functions in monitoring/managing diabetes, their potential clinical role, and current state of research on the subject. Articles from 2000-2010 were identified; twenty-one were analyzed for the review. The majority approached phone use from patients' perspectives. Over 50% of the studies involved patients with</td>
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<td><strong>Authors:</strong> Holtz, Lauckner</td>
<td>Type 1 diabetes. 71% of the studies used a study-specific phone app with supplementary features and texting. Outcomes varied considerably, with positive trends in improved self-efficacy/self-management and hemoglobin A1c. Review results indicated mobile phones may help persons with diabetes manage their conditions; however, many lacked sufficient samples or intervention lengths to determine if results were clinically significant. Suggested future research: integration into a healthcare practice, provider perceptions, cost.</td>
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| **Integrated Telehealth and Care Management Program for Medicare Beneficiaries with Chronic Disease Linked to Savings** *(Health Affairs, Volume 30 Issue 9, 2011, pgs. 1689-1697)* | Study examined the impact of the Health Buddy (Bosch) care coordination approach for chronically ill Medicare beneficiaries. Patients in two clinics in the northwest U.S. were in the intervention group, compared with a matched control group, as a part of a Centers for Medicare and Medicaid study, "Care Management for High Cost Beneficiaries."

The evaluation found significant savings - 7.7%-13%/person/quarter ($312-$542) among patients using the home telehealth system during a two-year study period. Findings suggest carefully designed/managed care management programs incorporating telehealth can help reduce healthcare expenditure, warranting further assessment by Medicare. Results also indicated that the intervention may have contributed to significant mortality differences between the two groups, which future research should explore. |
| **Authors:** Baker, Johnson, Macaulay, Birnbaum | --- |
| **Healthcare via Cellphones** *(Telemedicine and e-Health, Volume 15 Issue 3, April 21, 2009, pgs. 231-240)* | Study reviewed 25 research projects on voice and text messaging efficacy in care management and outcomes. 20 randomized controlled studies and five controlled studies were identified. 19 assessed outcomes of care and six processes of care. Selected studies encompassed over 38,000 participants (10,374 adults and 27,686 children) in 12 clinical areas and 13 countries.

Message frequency ranged from five per day to weekly. Significant improvements noted were in medication compliance, asthma symptoms, HbA1C (hemoglobin/diabetes related), stress levels, smoking cessation rates, and self-efficacy. Process improvements included fewer failed appointments, faster diagnosis and treatment and improved teaching and training. The study concluded that cell phone |
Reliability and Validity of Gait Analysis by Android-Based Smartphone
(Telemedicine and e-Health, Volume 18, Issue 4, May 2012, pgs. 292-296)

Authors: Nishiguchi, Yamada, Nagai, Mori, Kajiwara, Sonada, Yoshimura, Yoshitomi, Ito, Okamoto, Ito, Muto, Ishihara, Aoyama

Smartphones have built-in accelerometers - devices used to measure rapid position changes - which now are being installed in personal emergency response systems (PERS). The researchers developed a phone gait analysis application and evaluated the reliability and validity of using smartphones in assessing gait patterns. Results highly correlated with those obtained from a control tri-axial accelerometer.

Use of Remote Monitoring to Improve Outcomes in Patients with Heart Failure: A Pilot Trial (International Journal of Telemedicine and Applications, published online May 19, 2010)

Authors: Kulshreshtha, Kvedar, Goyal, Halpern, Watson

Pilot trial of whether or not remote monitoring could be successfully implemented for ambulatory patients recently hospitalized for heart failure. 150 patients from Massachusetts General Hospital were randomized to an intervention group (n=82) and a control group (n=68). Vital signs over six months were transmitted to a nurse coordinating care with a physician.

Participants had a lower all-cause readmission rate compared to the control group, although not statistically significant. Heart failure-related readmission rates were similarly reduced. The trial demonstrates remote monitoring can be successfully implemented for ambulatory patients with heart failure, and may reduce readmissions.

Home Telehealth Improves Clinical Outcomes at Lower Cost for Home Healthcare
(Telemedicine and e-Health, Volume 12 Issue 2, 2006, pgs. 128-136)

Authors: Finkelstein, Speedie, Potthoff

Study involved a randomized controlled trial for persons receiving skilled nursing care at home, and three groups were established. Monitoring group M received skilled home nursing visits, videoconference virtual visits and vital signs monitoring. Video intervention group V received skilled home nursing visits and videoconference virtual visits. Control group C received skilled home nursing visits.

Results at six months included: 42% of C, 21% of V and 15% of M were admitted to nursing homes or hospitals. Participants in the M and V groups had better activity of
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<td><strong>Home Telemental Health Implementation and Outcomes Using Electronic Messaging</strong> (Journal of Telemedicine and Telecare, accepted July 2011)</td>
<td>Study was done in conjunction with home electronic messaging program begun in 2007 by the VA Connecticut Healthcare System. 76 patients used a home messaging device for at least six months where they received daily questions covering disease management protocols, alerts, education via a landline phone. A nurse practitioner evaluated the data daily and did follow up. Diagnoses of those participating included: schizophrenia, post-traumatic stress disorder, depression, substance abuse. In the six months prior to enrollment, 42 patients were hospitalized for 46 admissions and 47 had a total of 80 emergency room visits. During the study period, six were hospitalized for nine admissions and 16 had a total of 32 emergency room visits. Participants indicated when surveyed a high level of satisfaction with the program.</td>
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<td><strong>Proactive Integrated Care Improves Quality of Life in Patients with COPD</strong> (European Respiratory Journal, Volume 33 Issue 5, 1031-1038, May 1, 2009)</td>
<td>Self-management strategies, which can improve health outcomes in chronic obstructive pulmonary disease, typically focus on improvement and not early detection/treatment. A randomized (U.S.) clinical trial evaluated whether integrating self-management with proactive remote monitoring could increase health-related outcomes, addressing complications from unreported exacerbations and delayed treatment. 40 Stage 3 or 4 chronic obstructive pulmonary disease (COPD) patients were randomized to receive proactive integrated or usual care for three months. Primary outcome was change in quality of life and secondary was change in healthcare costs. The intervention group improved their quality of life (10.3 units on the St. George's Respiratory Questionnaire) vs. 6 units for the control group. Intervention healthcare costs declined by $1,401, control group costs had a $1,709 increase, and nine exacerbations (seven unreported) were found in intervention participants. Proactive integrated care has the potential to improve COPD</td>
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<td><strong>Home Telehealth in High-Risk Dialysis Patients: A Three-Year Study</strong> (Telemedicine and e-Health, Volume 19 Issue 7, 520-522, July 2013)</td>
<td>Larger-sample continuation of a previous pilot project demonstrating improved health outcomes and cost savings with home telehealth and nurse oversight of persons undergoing chronic dialysis for end-stage renal disease. 99 patients in study - 43 in remote technology group, 56 in usual care group. All outcomes measures were significantly lower for the technology vs. usual care group: hospitalizations (1.8 vs. 3.0), ER visits, number of days hospitalized (11.6 vs. 25). Cost analyses were similarly significant for the technology vs. usual care group - hospitalizations and ER use ($66,000 vs. $157,000) Conclusion is that current results support previous findings that home telehealth can contribute to improved health outcomes and care costs for this population.</td>
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<td>Authors: D. Minatodari, S. Berman</td>
<td>outcomes through self-management and early detection.</td>
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CHAPTER 5 -
MINNESOTA RESOURCES, CHALLENGES

STATE LAWS

General statutes

No definition for telemedicine or telehealth was found when state statutes were scanned. No statutory requirements were found in a number of other potential policy areas such as: requirements connected with informed consent, regulations requiring private payers/insurers to permit services, limitations on the location where services can be delivered or special licensing requirements for interstate practitioners.

- M.S. 147.032 (1) addresses interstate practice of telemedicine. It allows physicians in other states who want to deliver services by telehealth to do so if they have an unrestricted license in good standing in their home state, don't open an office or meet patients or receive calls from them within Minnesota and annually register with the state Board of Medical Practice.

  Physicians aren't required to register if their services: respond to an emergency, are provided less than once per month or serve fewer than 10 patients annually, or when the services involves consulting with a Minnesota physician who has ultimate diagnosis/care authority.

- M.S. 151.37 (2) sets requirements for prescribing legend medications (which by federal law must be dispensed by prescription). It identifies the set of medications affected, and stipulates that a prescription must be based on a documented patient evaluation which must include an examination able to adequately establish a diagnosis and identify underlying conditions and potential treatment to avoid. These requirements apply when a referring provider performs an in-person examination where a consulting practitioner provides services and issues a prescription/order via telemedicine (Subd. 2(e)(5)).

Medicaid-related statutes

Three statutes were located that permit use of/reimbursement for telehealth through the state's Medicaid program:

- M.S. 256B.0625 Covered Services - Subd. 3b Telemedicine consultations. (3) Consultations via two-way, interactive video and store-and-forward technology are covered, and the physician must provide a written opinion for the patient's record. A maximum of three consultations are permitted per person per calendar week, and payment is at the full allowable rate.
M.S. 256B.0625 Covered Services - Subd. 46. Mental health telemedicine. (4) Mental health services otherwise covered in a direct, face-to-face encounter may be provided by interactive video and at the full covered reimbursement rate, when appropriate for a person's condition and needs. Equipment used must comply with Medicare standards in effect at the time.

M.S. 256B.0653 - Home Health Agency Services. Subd. 4. Skilled nurse visit services. (5) Visits are permitted when prior authorization is approved and at a limit of two per patient per day. Delivery must be by live interactive audiovisual, augmented by store-and-forward technology. Visits are permitted when a patient's condition can be measured and assessed without a hand's-on encounter.

Special conditions for residential programs

M.S. 245A.11, Sect. 7a. Alternate supervision technology; adult foster care license. (6) The Department of Human Services can allow an adult foster care provider to use remote monitoring technology to replace staff providing on-site nighttime supervision. The monitoring technology must alert the license holder if an incident occurs jeopardizing the health, safety or rights of a foster care recipient. The section sets out a range of procedures the license holder must develop, document and retain on file.

MEDICAID REGULATIONS

The "Minnesota Health Care Provider Manual" covers the following telehealth issues:

- Physician and Professional Services. (7) Referring parties can be physicians and physician assistants, nurse practitioners and clinical nurse specialists, certified nurse midwife, podiatrist or mental health professionals. Consulting parties must be either a physician or oral surgeon. Physicians' consults performed via two-way interactive video or store-and-forward technology can be reimbursed.

Prior authorization is required for telehealth performed by providers not located in Minnesota or adjacent counties in other states. Reimbursement is also permitted for two-way interactive video in an emergency department, including if a physician isn't present at the referring site but nursing staff is handling care. Payment is limited to three consultation sessions per week, or for only one reading/interpretation of diagnostic tests.

- Home Care. (8) Delivery can be reimbursed to a site other than where the practitioner is located when the service is within the professional scope of
practice of a healthcare professional. It must receive prior authorization, and is currently only approved for skilled nursing visits.

- **Elderly Waiver and Alternate Care.** (9) Telehomecare delivery is permitted in both programs.

- **Home and Community-Based Services.** (10) There are four disability Waivers - Community Alternatives for Disabled Individuals, Community Alternatives for Care, Brain Injury and Mental Retardation/Developmental Disabilities. Remote monitoring technology acquisition is permitted under Environmental Accessibility Adaptations and ongoing monitoring costs are permitted under Specialized Supplies and Equipment and 24-Hour Emergency Assistance.

(As a point of clarification, reimbursement for remote monitoring equipment with a health/medical focus - such as vital signs monitoring - is to come through basic state Medical Assistance programming. Activity/safety monitoring reimbursement - such as emergency response or sensor monitoring - is to come through the Waivers (and potentially Alternate Care).

**PRIVATE HEALTH INSURANCE REIMBURSEMENT**

It is not known to what extent insurers and managed care organizations in Minnesota cover home telehealth, and if so, which devices are permitted and arrangements required. Managed care organizations would be the most likely group to permit them, given their broadly standardized member policies and emphasis on prevention. Unless no use/reimbursement is permitted, fee-for-service payers' policies may be difficult to assess due to their many group contracts.

**STATUS OF TELEHEALTH IN HOME CARE/ HOME HEALTH**

Perhaps the most basic piece of information needed about the status of in-home telehealth in Minnesota is its adoption rate and surrounding circumstances. Have home care, home healthcare and geriatric care management organizations incorporated telehealth into their service delivery? If so, issues to explore include:

- Number involved and length of time
- Device/s used
- Vendor/s
- Connection adequacy
- Electronic health records, integration experiences
- How capital expenses have been met
- Adequacy of public, private reimbursements
- Delivery costs trends
- Outcomes achieved
- Level of receptivity
- Training scope and extent

As points of reference, the Minnesota Department of Health’s Web-based provider directory (11) and staff indicate that over 1,800 agencies deliver licensed home care services throughout the state. The Minnesota Home Care Association (12) represents approximately 250 of the state’s home care agencies, and a number of geriatric care management organizations operate within the state.

Representatives for all three of the above groups were contacted to inquire about availability of data profiling use of telehealth resources in home/community care delivery. These contacts/organizations knew of no data sources covering trends, and it's very timely to consider conducting surveys through them for this purpose. An alternate approach could be to review billing records connected with the state’s general Medicaid and Medicaid Waiver programs. Current categories for claims and reporting in the latter, though, are in groupings covering a number of services/devices that are too broad to yield desired data.

OTHER MINNESOTA RESOURCES

Broadband coverage

Connect Minnesota is a nonprofit that monitors availability of broadband capacity and usage characteristics in partnership with the state Department of Commerce. It reported early in 2013 that the state has a 78% access rate, as compared to 72% in 2011. (13) It also reported that 51% (approximately 2.1 million) of the state’s adults use the Internet on cellphones, laptop or tablet computers; the previous year's survey been 39%. (14)

A Connect Minnesota priority is to maintain updated maps showing coverage characteristics throughout the state, such as density of households served/unserved, delivery speeds, presence of multiple providers in an area, growth/expansion. Maps are available for counties, congressional districts and statewide. They show that the seven Twin Cities metropolitan area counties are technically covered, other than small areas in southeast Dakota County and northeast Washington County.

The organization performs periodic residential and business usage surveys, and one in 2011 showed the following breakdowns for Minnesota adults using the Internet at home or outside to access e-health assistance: (15)
### Users' locations

<table>
<thead>
<tr>
<th>Users' locations</th>
<th>e-Health access usage rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide (1.9 million)</td>
<td>55%</td>
</tr>
<tr>
<td>Cellphone statewide (346,000)</td>
<td>27%</td>
</tr>
<tr>
<td>Urban/suburban (1.5 million)</td>
<td>57%</td>
</tr>
<tr>
<td>Cellphone urban/suburban (277,000)</td>
<td>28%</td>
</tr>
<tr>
<td>Rural (424,000)</td>
<td>50%</td>
</tr>
<tr>
<td>Cellphone rural (69,000)</td>
<td>23%</td>
</tr>
<tr>
<td>Age 65/+ (176,000)</td>
<td>56%</td>
</tr>
<tr>
<td>Disabled residents (262,000)</td>
<td>66%</td>
</tr>
</tbody>
</table>

Beyond connectivity are equally important issues requiring attention, including choice, reliability and affordability. The Dayton Administration in 2011 established a "Governor's Task Force on Broadband" with the primary goal of identifying and recommending actions to correcting broadband access and adoption disparities within the state. (16) Its 2012 report recommended options including tax credits to stimulate installation in unserved and underserved areas, coordination among rural public installation efforts (e.g., hospitals, schools, libraries, public safety facilities) and coordinating broadband deployment and highway construction projects.

The Blandin Foundation has also been instrumental for many years in encouraging telehealth adoption. It initiated a "Minnesota Intelligent Rural Communities Initiative" in 2011 with federal financial assistance. (17) The effort's goals are to provide training, education, technical assistance and pursue efforts to remove broadband adoption barriers in the 80 Greater Minnesota counties. The foundation has sponsoring conferences, and served as a facilitator - its website (18) provides information on use, access and trends in the state, particularly rural.

### Telehealth networking efforts

There are a growing number of states around the country where telemedicine and telehealth delivery are priority components in developing a broadband infrastructure "backbone." The infrastructure in some cases enhances an already strong healthcare delivery system, it's aimed in other cases at making up for deficiencies. Minnesota has no statewide network, but a group of organizations with existing telemedicine systems applied in 2007 for grant funding the FCC had available to construct statewide or regional broadband telehealth networks.

This effort is called the "Greater Minnesota Broadband Telehealth Initiative" (19, 20), and has been a partnership among:

- Minnesota Telehealth Network (which evolved from University of Minnesota rural connections via federal grants)
- Medi-sota Network (southwestern Minnesota)
North Regional Health Alliance (Minnesota and North Dakota)

SISU Medical System (northeast Minnesota)

Minnesota Association of Community Mental Health Facilities/MACMH (linking mental health centers in the state)

The effort envisions creating connections to link the various partners' existing systems to deliver telehealth and facilitate health information exchange, improve access for patient care, and reduced barriers and increase coordination in serving rural areas. There are broadband hubs and "points of presence" in Duluth, Brainerd, Willmar, Grand Forks, Minneapolis, and at 80 of the partnering providers' participating sites.

Great Plains Telehealth Resource and Assistance Center

The federal Department of Health and Human Services approximately a decade ago provided funding to establish twelve regional programs around the country encouraging development of telehealth infrastructure and capacity, particularly in rural areas. Minnesota is served by the Great Plains Telehealth Assistance and Resource Center/GPTRAC, which began operating in 2006 and is located at the University of Minnesota. (21)

GPTRAC serves six Midwest states - North and South Dakota, Nebraska, Minnesota, Iowa and Wisconsin. It provides technical supports for a range of organizations at all stages of program development/operation. It assists in identifying grant and other sources of capital funding, fosters collaborations, tracks regional resource growth and provides various types of educational opportunities for industry professionals.

Great Plains staff was contacted about the status of Minnesota home/community telehealth activities, particularly whether many home care, home healthcare and/or geriatric care management organizations have sought technical assistance for developing programming. Staff indicated that this provider segment unfortunately isn't very large and few have been involved in GPTRAC offerings, although the Center is available and willing to provide assistance.
CHAPTER 6 -
TELEHEALTH AMONG THE STATES

It's often useful in our federal system to assess if other states have best practices in various issue area that Minnesota could adopt or pursue. Reviewing telehealth in this manner is complicated by the nature of the field, where individually complex disciplines - medicine and long-term care, telecommunications, technology diffusion, federal/state/ local policy - all intersect and create unique conditions in each state. A second complication is how developments in all these areas are taking place at ever-increasing speed. A third is the fact that the other states are all continually developing their own practices.

Obtaining up-to-date data as a result has been extremely difficult as has maintaining currency. The lack of timely information on states' affairs in the past few years led the federal government, key research and trade associations to undertake major data gathering and analyses projects. Among them have been:

- The "CAST Analysis of State Payments for Aging Services Technologies" (1) was issued in 2011 by the Center for Aging Services and Technologies and reviewed states' Medicaid reimbursements. CAST is a coalition of about 400 organizations that support developing, evaluating and promoting a range of technologies enhancing the aging experience. It's affiliated with the long-term care trade association, Leading Age.

- The "50-State Medicaid Statute Survey" (2), which was issued in 2011 by the Center for Telehealth and e-Health Law/CTEL, another key national resource in the field.

Both these reviews obtained very useful data, but they were one-time surveys. Another important national resource in the field - the Center for Connected Health Policy/CCHP - fortunately launched a website at the start of 2013 where it has committed to respond to this shortcoming. (3)

CCHP is funded by the federal Department of Health and Human Services to serve as the "National Telehealth Policy Resource Center." Among key tools, the website has an interactive map where each state's existing telehealth policies are extensively profiled and an interactive tracker profiling states' pending laws and rules.

Immediately preceding the website launch, the National Center also released a report - "State Telehealth Laws and Reimbursement Policies - A Comprehensive Scan of the 50 States and the District of Columbia" - containing the data used to set up the website's interactive state trackers. (4) The report reviews both state laws and regulations in general, and then those specifically affecting a state's Medicaid program administration.
CCHP SUMMARY FINDINGS

Evaluators aggregated data across all the states in 12 review categories to produce the following profile:

<table>
<thead>
<tr>
<th>Telehealth feature</th>
<th># states</th>
<th>Additional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition for the practice</td>
<td>50</td>
<td>Vary from a narrow definition for telemedicine while using telehealth to encompass it along with other services (whether in statute or states' Medicaid regulations)</td>
</tr>
<tr>
<td>Some form of telehealth reimbursement</td>
<td>44</td>
<td>Six additional states have Medicaid managed care plans that weren't reviewed, so this total may be larger</td>
</tr>
<tr>
<td>Only reimburse for live video</td>
<td>44</td>
<td>Ranges from permitted with no distinction among services to limiting to one type of service</td>
</tr>
<tr>
<td>Reimburse for store-and-forward</td>
<td>7</td>
<td>‘This method is expressly prohibited in some states' definition of telehealth</td>
</tr>
<tr>
<td>Reimburse for remote patient monitoring</td>
<td>7</td>
<td>Permitted by states’ Medicaid programs - AK, CO, KS, MN, NY, UT, WA</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Permitted by states' Departments of Aging Services - PA, SC, SD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other states reimburse for home health, but no definition could be located to determine if remote monitoring was included</td>
</tr>
<tr>
<td>Reimburse for video, store-and-forward, remote monitoring</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>Reimburse for transmission and/or facility fee</td>
<td>17</td>
<td>Some may follow the Medicare policy of only doing so for an originating site</td>
</tr>
<tr>
<td>Location limitations</td>
<td>-</td>
<td>It wasn't established how many states may follow the Medicare policy of only reimbursing for persons located in rural/underserved areas or where significant distance may be involved. It also wasn't established how many may limit what is a permissible originating/distant site, where the home may be excluded.</td>
</tr>
<tr>
<td>Consent</td>
<td>30</td>
<td>No mention in state law or Medicaid policy</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Required in state law, but not in Medicaid policy</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Required in Medicaid policy, but not in state law</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Required in both Medicaid policy and state law</td>
</tr>
<tr>
<td>Telepharmacy</td>
<td>50</td>
<td>Appears permitted throughout the states, with differing standards on how the required provider/patient relationship is established</td>
</tr>
<tr>
<td>Licensure</td>
<td>9</td>
<td>Some form of special licensure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laws for an unidentified number of states don’t specifically address licensing but make allowances for contiguous states or allow temporary licensure under certain conditions</td>
</tr>
<tr>
<td>Private payers</td>
<td>16</td>
<td>Laws exist affecting their reimbursement, although not necessarily mandating</td>
</tr>
</tbody>
</table>

**CCHP REMOTE MONITORING FINDINGS**

One of the specific categories CCHT tracked was policies in the 10 states (including Minnesota) where remote monitoring is permitted and reimbursed through Medicaid programming. The following were the findings:

<table>
<thead>
<tr>
<th>State</th>
<th>Remote monitoring - policy or comments about status</th>
<th>Information source/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>AK Medicaid reimburses for services delivered through self-monitoring</td>
<td>AK Dept of Health and Social Services, AK Medical Assistance Provider Billing Manuals, Section 1: Physician, Advance Nurse Practitioner, Physician Assistant: Services, Policies and Procedures</td>
</tr>
<tr>
<td></td>
<td>To be eligible for self-monitoring or testing, service must be via telemedicine application based in recipient's home, where the provider is only indirectly involved in provision.</td>
<td>AK Admin. Code, Title 7, 110.625(a)</td>
</tr>
<tr>
<td>CO</td>
<td>CO Medical Assistance program will reimburse at a flat fee set by state board when the patient:</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Is receiving home health provider services for congestive heart failure, chronic obstructive pulmonary disease, asthma or diabetes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Requires doctor or podiatrist-ordered monitoring at least 5x/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Has been hospitalized two/more times in past 12 months due to conditions related to the disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Misses no more than 5 sessions in a 30-day period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Home has space for equipment and full transmission capability.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional restrictions apply as per state statutes. Additionally, Medicaid home health reimburses only if the patient has no other insurance</td>
<td></td>
</tr>
<tr>
<td>KS</td>
<td>KS Medicaid reimburses for home telehealth using real-time, interactive audiovisual equipment for monitoring significant change in health status, timely assessment of chronic conditions or providing other skilled nursing services. Must be performed by an RN or LPN. Agencies may bill skilled nursing services on the same day as telehealth services.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eligible reimbursements:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Prescribed by physician</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Medically necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Beneficiary consent signed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A skilled nursing service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Not exceeding 2/wk. for non-Home- and Community-Based Service patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dept. of Health and Environment, Kansas Medical Assistance Program, Provider Manual, Home Health Agency</td>
<td></td>
</tr>
<tr>
<td>MN</td>
<td>Telehomecare is reimbursed in Elderly Waiver (EW) and Alternative Care (AC) programs. Reimbursement is only for skilled nurse visits.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telehomecare is defined as use of telecommunications technology by a home healthcare professional to deliver home healthcare services within the professional’s scope of practice to a recipient located at a site other than the site where the practitioner is located.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MN Dept. of Human Services, Provider Manual, Elderly Waiver (EW) and Alternative Care (AC) Program</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Information</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>NY</td>
<td>NY is in the process of updating its Medicaid telehealth reimbursement policies. Managed care reimbursement is optional. Review of 18 managed care plans found telehealth coverage for at least six providers: <a href="http://www.health.ny.gov/health_care/medicaid/program/medicaid_health_homes/">NY Dept. of Health, Medicaid Health Homes</a></td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>The Dept. of Aging, Office of Long-Term Aging offers TeleCare services under the Aging and Waiver program - technology with services permitting those with chronic conditions to remain independent using in-home technology for measuring/monitoring health status, sensor and activity monitoring, medications dispensing/monitoring. <a href="http://www.health.ny.gov/health_care/medicaid/program/medicaid_health_homes/">PA Dept. of Aging, Office of Long Term Aging, APD #09-01-05</a></td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>Bureau of Long-Term Care Services offers telemonitoring to maintain/promote health status of Medicaid Waiver participants via monitoring of body weight, blood pressure, oxygen saturation, blood glucose levels, basic heart rate information. <a href="http://www1.scdhhs.gov/openpublic/insidedhhs/bureaus/BureauofLongTermCareServices/telemonitoring.asp">SC Health and Human Services, Bureau of Long Term Care Services</a></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>Dept. of Health and Human Services/Adult Services and Aging reimburses for home-based system providing daily monitoring of clinical data such as heart rate, blood pressure, oxygen saturation, temperature, weight, and that can act as a medication reminder. Staff determines if telehealth can be accessed through Medicare or other resources and isn't available through any other funding source. Standards are set out for what health status a patient must have to be eligible, what types of patients are appropriate, specific procedures that must be followed in the monitoring practices. <a href="http://dss.sd.gov/elderlyservices/services/telehealth.asp">SD Dept. of Social Services, Dept. of Adult Services &amp; Aging, Telehealth Technology</a></td>
<td></td>
</tr>
<tr>
<td>UT</td>
<td>Reimbursement is available through UT Medicaid Telehealth Skilled Nurse Pilot Project for Patients in Rural Areas. Patient eligibility related to condition (limited to diabetes), geographic location, frequency of service need, set out, along with home health agency delivery <a href="http://www.utah.gov/contentPages/healthCare/medicaidPrograms/telv330-219.htm">UT Admin. Code R414-42-2.</a></td>
<td></td>
</tr>
</tbody>
</table>
WA Medicaid permits remote monitoring for patients diagnosed with unstable condition and at risk for hospitalization or a more costly level of care. Limited to one interaction/day, based on licensed practitioner’s care plan. Eligible and ineligible services set out.

**ADDITIONAL STATES USING REMOTE MONITORING RESOURCES**

The CCHP report did not identify that Alabama or Wisconsin permitted in-home monitoring, yet one of the other reports cited earlier - the Center for Telehealth and e-Health Law’s "50-State Medicaid Statute Survey" - indicated that these states permit it as well. The CTEL report findings for these states were:

<table>
<thead>
<tr>
<th>State</th>
<th>Medicaid telehealth reimbursement standards (general)</th>
<th>Medicaid home care telehealth and/or remote monitoring reimbursement standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>Reimburses for services provided by psychiatrists and providers specializing in dermatology if the recipient of the services does not have access to a provider of that service within 50 miles of their residence.</td>
<td>Reimburses for in-home monitoring systems to physicians enrolled in the Patient 1st program (Alabama’s primary care case management program). The monitoring program enables a patient to record certain vital signs and/or test results at home and transmit data to a central repository so primary medical provider can monitor patient’s condition.</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Reimburses for a wide range of health services provided via telemedicine as long as the provider is licensed in-state. Covered services include mental health/substance abuse treatment, care provided by physician assistants, nurse midwives, nurse practitioners, and rural health clinic services.</td>
<td>Wisconsin’s Family Care Waiver program covers some telehealth services provided in the home.</td>
</tr>
</tbody>
</table>
REMOTE MONITORING FOR
PERSONS WITH DISABILITIES

Much of the remote monitoring research and tracking focuses on using technologies in assisting seniors. However, various forms of telehealth assist younger persons with a range of disabilities and are a component of a state's overall telehealth practices. Researchers focusing on seniors’ affairs may unfortunately miss these data.

That appears to be the case for the CCHT survey profile for Minnesota, which didn't include a description of how use of remote monitoring technology is permitted as an alternative for overnight supervision in adult foster care homes, as highlighted at the beginning of this chapter. At least two other states - Indiana and Ohio - have been federally approved to reimburse for use of remote activity/sensor monitoring in Medicaid Waiver programming for persons with a developmental disability. (5, 6)

HOME TECHNOLOGIES OTHER THAN
REMOTE MONITORING

The CCHT report captured data on states' remote monitoring practices, but didn't break out the type of technologies involved. However, the Center for Aging Services Technologies' 2011 review focused on state Medicaid reimbursements rates for a range of technologies and in the process identified what types are permitted. It found that 44 states (including Minnesota) allowed reimbursements for various forms of personal emergency response systems/PERS and 16 (including Minnesota) reimbursed for various forms medication management (e.g., reminders, automatic dispensing, etc.)

STATE FEATURES OF NOTE

Although drawn from a number of sources, the preceding information provides a basic profile of the extent states have laws and regulations in place to promote telehealth services. Virtually all have some form of telehealth authorization. When it comes to its standing relative to other states in other areas, the CCHP and CAST reports highlight that Minnesota is in the relatively small group of states with Medicaid regulations reimbursing for remote monitoring and among the 16 reimbursing for various forms of electronic medication management.

Additional information on some of the states authorizing remote monitoring was located in the report, "Home Telehealth in California: Benefits and Opportunities - White Paper," issued by AgeTech California. (6) This project gathered data to compare California’s features with those of other states'.

New York has taken what may be one of the more coordinated and comprehensive approaches integrating telehealth into care delivery. Its legislature enacted a Medicaid "Home Telehealth" program as an 18-month pilot starting in 2007. (7) The program included remote vital signs monitoring, patient education, medication management, equipment maintenance, and was adopted in 2009 as a part of the state's general Medicaid
program. Eligible providers are home health agencies and community-based long-term home health programs or programs affiliated with a nursing home or hospital.

New York began implementing a "Health Home" program for those with complex medical, behavioral and/or long-term needs via the medical home care management model, with a care manager coordinating services among multiple providers. A tiered reimbursement system is used that provides different rates for levels of connectivity and class of telehealth devices involved.

Pennsylvania is another state that appears to have incorporated home telehealth technology into a coordinated delivery approach. (8) It began its "TeleCare Program" as a Medicaid Waiver demonstration in 2007, and received federal approval to include it in the state's Waiver program in 2008. Services include remote vital signs monitoring, activity sensor monitoring, personal emergency response devices and medication dispensing/management.

Eligible providers (depending on technology) include Medicare-certified home health agencies, personal care/homemaker providers, pharmacies, hospitals. Participation extends beyond Medicaid-eligible clients via the sliding-scale "Options" program - no cost for those at 125% federal poverty level, 100% for those at 300% level. In what may also be an unusual arrangement, Area Agencies on Aging manage reimbursement for installation and monthly fees.
CHAPTER 7 - OBSERVATIONS AND RECOMMENDATIONS

This report has been prepared to give readers a working knowledge about many facets of the expanding home/community telehealth field. A particular objective has been to look across affairs and at the status in Minnesota to determine what efforts need to be initiated to advance adoption here in the state.

As shown throughout the report, this field has a great number of “moving parts.” Some with a critical impact on expanding and enhancing capabilities also have impediments that will take a considerable effort over many years to resolve. Just a couple examples include concerns as central as modifying Medicare’s various limitations on the technology’s application, and not only continuing to expand broadband resources in Minnesota, but making sure they’re both reliable and affordable.

The following issues appear to be key next steps to pursue in supporting home/community telehealth adoption in the state.

PROMOTING TELEHEALTH IN HOME AND GERIATRIC CARE

The smart device and biosensing revolutions are reframing aspects of the point of care assistance that in the past couldn't be envisioned as flexible or mobile is now becoming both. Persons with medical support needs, potentially even fairly significant ones and even when fairly elderly, will increasingly be able to get out and about while still receiving care.

Home care and home healthcare agencies' service delivery will still remain extremely important, and they likely will remain the predominant providers of this form of care even as reform efforts evolve. As highlighted in Chapter 5, though, the status of home telehealth within the industry in Minnesota - extent and character of existing use or interest in/capability for developing capacity - is unknown.

A very first task should be to survey the state's home and geriatric care providers to obtain benchmark data about receptivity to incorporating telehealth into care delivery and key barriers curtailing it. Results would identify priority issues requiring attention in order to expand capacity. Another possible step would be to survey assisted living "early adopters" about experiences with incorporating technologies into their care settings. The goal would be to identify their decision-making processes, key outcomes, major challenges faced and how they have been addressing them.
LEARNING FROM THE VETERANS
HEALTH ADMINISTRATION

As profiled in Chapter 4, the Veterans Health Administration has extensive experience resulting in considerable success with many large-scale telehealth initiatives. The Minneapolis VA Health Care System for many years has participated in the "Care Coordination and Home Telehealth" program which the chapter profiled, and some of its staff has been actively involved in national VHA telehealth system developments. Organizations interested in promoting home/community telehealth within Minnesota should do outreach with Health Care System staff to learn more about its local and national efforts and partnering opportunities that may be present.

HOME TELEHEALTH IN STATE POLICY

Chapter 6 highlights how home telehealth services are being used in other parts of the country. Virtually all states have authorized using some types of technologies, but the process in many cases may have been on an incremental basis – e.g., responding to provider authorization requests as they work with certain devices. There are examples of some states, though, where decisions about where, when and how to deploy home telehealth technologies have been handled more holistically.

Such an approach requires a systems-type focus on how the technologies should be integrated into different aspects of care delivery to most fully realize cost savings and other available benefits. It requires committing resources for an oversight infrastructure - planning, analysis, networking, training, etc. - and acknowledging that the commitment is a long-term one. As the array of devices and their capabilities continue growing, they’re no longer disparate novelties but practical tools that can and should be deployed in a comprehensive and coordinated manner.

Each state may have to reach an adoption “tipping point” before it considers following this approach. It may come in conjunction with significant budget reductions, cost-cutting efforts, or as the scope and character of Medicaid changes within federal entitlement reform efforts. Alternately, it may come from officials who have the foresight to understand and act upon irrevocable changes underway in healthcare delivery. Minnesota should explore as soon as possible how it could become an “early leader” by laying groundwork to pursue such a proactive strategy.

SUPPORTING TELEHEALTH AS A SERVICE,
PROMOTING REWARDS AND INCENTIVES

Device/system affordability is a very major hurdle organizations face when considering incorporating technologies into care delivery. Part of the problem is the absolute cost, and a second critical factor is potential rapid obsolescence due to rapid technology advances. The historic lack of reimbursement rewards and incentives is a third deterrent, such as when providers using the technologies achieve operating efficiencies and/or
prevention savings, but financial benefits accrue to public programs and/or public/private insurers. Many organizations may be choosing not to make any commitment because of these realities.

Chapter 3 highlights how some vendors are responding to the obsolescence concern by offering attractive trade-in/trade-up terms. Another promising option is where vendors lease products and provide services effectively as a care provider's outsourced telehealth department. Depending on leasing rates, this "telehealth as a service" approach may be an extremely practical way to respond to adoption deterrents. The number of firms working in this market segment nationwide as well as in Minnesota is unknown.

As recommended earlier, key home care service providers should be surveyed to learn to what extent financing concerns are slowing device/system adoption in the state. If so, interested stakeholders - e.g., the Department of Human Services, health insurers, provider trade associations - should collaborate to explore if "telehealth as a service" vendors can be encouraged to operate and/or expand in Minnesota. If advancing the extent of home telehealth usage is judged as a clear public policy benefit - whether overall or for the state Medicaid program in particular - some form of public/private venture or public incentives could also be explored.

A related issue involves the historic return-on-investment method for calculating costs and benefits, and promoting research and demonstrations to expand this metric. When looked at even for a single provider, there are non-ROI benefits that may justify incorporating the technologies into care delivery. Two highlighted in Chapter 4 are patient and family satisfaction levels and providers acquiring a reputation for delivering benchmark-level care. Both these factors provide attractive marketing opportunities.

Additional benefits from multiple social accounting standpoints have received little systematic recognition to date largely because of the difficulty in measuring them. For example, many of the technologies prevent or limit conditions from escalating, medication costs from increasing, and/or treatment scope from expanding. While these are critical outcomes, qualitative results here don't meet the hard data measures "evidence-based practice" seeks.

One response could be for state stakeholders interested in advancing telehealth use to sponsor projects where before-and-after data at least could be available to research. For example, forward-thinking employers could be approached to partner in monitoring caregiver employees' time away from work, travel costs, etc., prior to technology use and then at intervals once in use.

Similarly, subsidized senior housing providers have residents who cycle back and forth among their apartments, hospitals, nursing homes and rehab facilities. A study could document housing providers' cash flows (including vacancy payments) before and after incorporating telehealth into residents' in-home support. Small-town pharmacies and other local businesses could be additional parties in such an assessment - documenting
the financial impact as residents reduce or eliminate services when absent from their homes vs. outcomes when maintained with telehealth.

HOME TELEHEALTH ASSISTANCE CENTER

The telehealth device marketplace is confusing for the typical caregiver, even for the typical provider. Developments take place so frequently and across so many market segments that it’s difficult monitoring availability, features and comparative costs. Quality/reliability data on certain products – particularly those of well-known companies - are available from research and user reports/ratings. However, data on other products – particularly the flood of smart device apps - either don't exist or are only available in anecdotal reports posted on websites or blogs.

Users need help in making wise decisions. Providing such help long term is extremely important for advancing the technology’s adoption and realizing benefits it can yield. A proactive strategy to do so would be to organize a virtual technical assistance center. Such a resource could target serving individuals and caregivers of various income levels, or operations could be expanded to additionally assist staff of public, private and nonprofit agencies.

Among functions a virtual center could perform would be to:

- Monitor promising products in the development/regulatory pipeline, those coming to market, changes made to existing product lines, key legislative and regulatory actions, in-state broadband expansion issues.

- Determine what performance-type data are available for various products, and if necessary, supplement gaps by performing basic, selective testing/screening. Given the profusion of devices and products in some categories, simplified buyer/user recommendations could be prepared.

- Develop and offer “how-to” workshops for technologies that relatively skilled do-it-yourselfers could install and operate.

- Offer periodic/annual “roundup” presentations for consumers and practitioners highlighting broad industry trends, projections, new products, etc.

- Monitor best practices other states have developed.

Home/community telehealth technologies will occupy a growing role in healthcare delivery in the future, and it’s in many organizations’ interests to collectively establish and back such a resource. Organizations involved in oversight or service delivery for the Medicaid population – the state Department of Human Services, counties, the various health plans – could benefit by having timely information federal regulators seek, and in setting rates and approving provider device requests. Outreach could assist not only those with low incomes/assets, but those at a more moderate level who might otherwise
excessively spend down resources and need to enroll in public programs. Feasibility should be assessed by approaching likely stakeholders to gauge interest and willingness to collaborate on funding, probably on a subscription basis. This service would directly benefit backers by keeping them apprised of major affairs in the field, greatly minimizing expenses otherwise required if done individually. California is one state with many telehealth resources supports that could be looked to as an example.
END NOTES

CHAPTER 1


8) GlowCaps/Pack: http://www.vitality.net/glowcaps.html


11) Smarthome: http://www.smarthome.com


25) Quantified Self: http://quantifiedself.com


CHAPTER 2


6) Kumar Dharmarajan, MD, MBA; Angela F. Hsieh, PhD; Zhenqiu Lin, PhD; Hector Bueno, MD, PhD; Joseph S. Ross, MD, MHS; Leora I. Horwitz, MD, MHS; Jose Augusto Barreto-Filho, MD, PhD; Nancy Kim, MD PhD; Susannah M. Bernheim, MD, MHS; Lisa G. Suter, MD; Elizabeth E. Drye, MD, SM; Harlan M. Krumholz, MD, SM., "Diagnoses and timing of 30-day readmissions after hospitalization for heart failure, acute myocardial infarction, or pneumonia," Journal of the American Medical Association, January 20/30 2013, http://jama.jamanetwork.com/article.aspx?articleid=1558276#qundefined

7) "What the Affordable Care Act says about readmissions," Hospital and Health Networks, http://www.hhnmag.com/hhnmag/jsp/articleDisplay.jsp?dcrpath=HHNMag/Article/data/03MAR2011/0311HHN_Inbox_correction&domain=HHN MAG

9) "Community-Based Care Transition Program," CMS.gov (Center for Medicare and Medicaid Services), http://innovation.cms.gov/initiatives/CCTP/index.html


14) Ibid.


CHAPTER 3


CHAPTER 4


10) "VA to increase mental health care access through 200,000 telemental health consultations in 2012," U.S. Department of Veterans Affairs, Office of Public and Intergovernmental Affairs, June 20, 2012, http://www.va.gov/opa/pressrel/pressrelease.cfm?id=2335


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1) MS147.032: https://www.revisor.mn.gov/statutes/?id=147.032
2) M.S. 151.37: https://www.revisor.mn.gov/statutes/?id=151.37
3) M.S. 256B.0625: https://www.revisor.mn.gov/statutes/?id=256B.0625
4) ibid
5) M.S. 256B.0653: https://www.revisor.mn.gov/statutes/?id=256B.0653
6) M.S. 245A.11: https://www.revisor.mn.gov/statutes/?id=245A.11


11) Minnesota Department of Health home care provider directory: http://www.health.state.mn.us/divs/fpc/directory/showprovideroutput.cfm

12) Minnesota Home Care Association website: www.mhca.org


17) “CK Blandin Foundation, Minnesota Intelligent Rural Communities,” Broadband USA Connecting America’s Communities, http://www2.ntia.doc.gov/grantees/CKBlandin

18) Blandin on Broadband website: http://blandinonbroadband.org/2013/07/02/blandin-broadband-enews-july-2013/


21) GPTRAC: http://www.gptrac.org

CHAPTER 6


3) Center for Connected Health Policy: http://www.telehealthpolicy.us


7) ibid, pg. 7

8) ibid, pg. 6


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APPENDIX

ELECTRONIC HEALTH/WELLNESS
PRODUCT LISTINGS

Three broad types of electronic health/wellness products are marketed for use at home and when mobile:

- Individual equipment and coordinated systems
- Smart devices (smartphones, tablets, etc., sometimes specially adapted) and peripheral equipment developed to use with them
- Smart device applications (apps)

Products respond to an extremely wide range of needs, and have been grouped into the following categories:

1. Activity/safety sensor monitoring - tracking movement, daily routines
2. Caregiving - services, supports
3. Communications - modified/adapted equipment
4. Emergency/fall monitoring - often linked with wander monitoring
5. Hearing/vision - supports
6. Medication adherence/management
7. Physical functioning - rehabilitation, sleep monitoring, etc.
8. Robotics - monitoring and care-providing devices
9. Vital signs monitoring - e.g., heart, lungs; blood oxygen, sugar, pressure levels; certain medication levels
10. Wander monitoring - often linked with emergency/fall monitoring

The following listings profile a sample of currently available products and their capabilities. A grid for each of the above categories provides information on: product and manufacturer names, a short summary of features and Web addresses where more information can be obtained. Summaries of features and capabilities have been taken from manufacturers' information. Each category listing is grouped by: in-home equipment/systems, smart devices/peripherals, and/or apps. Inclusion in a listing implies no endorsement.
# 1) **ACTIVITY/SAFETY SENSOR MONITORING - EQUIPMENT**

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambio Remote Health Monitoring System</strong> <em>(Ambio Health)</em></td>
<td>Activity/safety monitors (motion, door/window) for purchase a la carte. Customer decides when alerts should be issued, can receive by telephone, text or e-mail. System also sells vital signs monitoring peripherals that automatically record/store readings on company's computer server, where users can view results, print, etc. Family members can log in to check user's status. Care center sends reminder messages for readings and/or if missed.</td>
<td><a href="http://ambiohealth.com">http://ambiohealth.com</a></td>
</tr>
<tr>
<td><strong>Artemis</strong> <em>(Independa, Inc.)</em></td>
<td>Multi-function monitoring support system. &quot;Artemis&quot; component uses a range of sensors to monitor user and home environment, also monitor a range of vital signs. &quot;Angela&quot; component provides social engagement/caregiver interaction/entertainment via specially adapted LG televisions and Samsung Galaxy tablets.</td>
<td><a href="http://www.independa.com">http://www.independa.com</a></td>
</tr>
<tr>
<td><strong>BeClose Senior Safety System</strong> <em>(WH Interactive LLC)</em></td>
<td>Family/caregiver-operated system uses sensor devices placed throughout a home to monitor an array of conditions. Units gather data on typical activity patterns, forwards to Web charts tracking daily routine. Alerts sent when typical patterns change significantly.</td>
<td><a href="http://beclose.com">http://beclose.com</a></td>
</tr>
</tbody>
</table>
| **Close By Network**  
(Background Network) | Families choose what to monitor in home, using sensor devices tracking an array of conditions. Monitoring data sent to care center's computer server, which alerts designated members of user's Care Network when normal conditions change, there's no movement/activity or the user activates a help button. Care Network can be notified by e-mail or text. | [http://www.closeby.com](http://www.closeby.com) |
| --- | --- | --- |
| **eNeighbor/ S.E.N.S.System**  
(Healthsense, Sengistix, LLC) | Sengistix uses the eNeighbor monitoring system Healthsense markets for senior living/care settings in its "Secure Environmental Network of Support"/S.E.N.S.system for homes. Sensors monitoring a range of conditions are placed throughout a residence. Activity/safety data tracked by care center, including auto fall detection, wandering. Alerts sent to notify caregivers when major changes occur in standard activity patterns. | [http://www.sengistix.com](http://www.sengistix.com) |
| **Family Link**  
(iKare Corporation) | Remote monitoring/communication system tracks motion in room where located. Also a one-touch interface for seniors and family/caregivers to connect - e-mail messages, photo sharing, video chat. | [http://www.familylink.net](http://www.familylink.net) |
| **GrandCare**  
(GrandCare Systems LLC) | Multi-function monitoring/support system. Activity/safety component uses sensor devices to track not only a range of user conditions, but home temperatures, lighting controls, phone caller screening. Caregivers receive alerts if/when activity patterns/in-house conditions change. Other system components involve caregiver/user communications, location monitoring, vital signs data gathering, medication management, socialization/entertainment. Caregivers access various features via online "Care Menu" - add messages, view trend data, set up rules for receiving alerts. | [http://www.grandcare.com](http://www.grandcare.com) |
| **Iris**  
| **(Lowes)**  
<table>
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<tbody>
<tr>
<td>Set of &quot;sensor kits in a box&quot; provide a range of &quot;smart home&quot; functions controllable by mobile devices. Kits for safety/security (with video add-on capability - streaming, recording), remote controls/scheduling for appliances, etc., energy management, door remote locking/unlocking. Newer care kit uses a range of sensor monitors to alert when help is needed or daily routines change.</td>
<td><a href="http://www.lowes.com/cd_Iris_239939199">http://www.lowes.com/cd_Iris_239939199</a></td>
</tr>
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</table>

| **Lively**  
| **(Lively)**  
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<tbody>
<tr>
<td>Multi-function monitoring/support system. Artfully designed monitoring units track activity/safety - e.g., pill container use, eating, if/when person is farther than 400 feet from base unit. Sends periodic reminders/alerts  Social network component also available.</td>
<td><a href="http://www.mylively.com/">http://www.mylively.com/</a></td>
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| **Nonnatech**  
| **(Nonnatech)**  
<table>
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<tr>
<td>Family caregiver-directed system monitors user from computer or phone using wireless streaming video. Automatically notifies caregivers on mobile phone or computer via text or e-mail of user's status. Can purchase a base unit and different types of sensors individually. Can create rules for turning devices on/off, grouping devices, connecting with other family members.</td>
<td><a href="http://www.nonnatech.com/Home_Page.htm">http://www.nonnatech.com/Home_Page.htm</a></td>
</tr>
</tbody>
</table>

| **Sonaba Wellbeing Monitor**  
| **(poms)**  
<table>
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<tbody>
<tr>
<td>poms - peace of mind. Multi-function monitoring system, activity/safety component tracks daily routines and uses device to monitor for emergencies; follows up as required. Other components include automatic medication reminder, social communication features, digital photo frame, remote setup, daily caregiver updates.</td>
<td><a href="http://sonamba.com">http://sonamba.com</a></td>
</tr>
</tbody>
</table>

| **WellAware**  
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>System uses array of sensors to monitor activity patterns, sleep</td>
<td><a href="http://www.wellawaresystems.com">http://www.wellawaresystems.com</a></td>
</tr>
</tbody>
</table>
Systems
(WellAware Systems) quality. Alerts sent to care center when standard patterns change; caregivers receive reports highlighting trends/changes. (Note - purchased by Healthsense in July 2013.)

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
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<tbody>
<tr>
<td>Presence (People Power)</td>
<td>Converts old Apple devices into security cameras for use with wi-fi - one device is set up as the camera, one as the monitor. Can be programmed for video clips.</td>
<td><a href="https://itunes.apple.com/us/app/presence-by-people-power/id618598211?mt=8">https://itunes.apple.com/us/app/presence-by-people-power/id618598211?mt=8</a></td>
</tr>
<tr>
<td>Monitoring Home (APPFlyer)</td>
<td>Converts iPhone into a monitoring camera that can face detect before uploading to Facebook or DropBox for remote review. Can program camera intervals from five seconds to 24 hours. Camera screen can be set on auto-hide so use isn't visible.</td>
<td><a href="https://itunes.apple.com/us/app/monitoring-home/id510325018?mt=8">https://itunes.apple.com/us/app/monitoring-home/id510325018?mt=8</a></td>
</tr>
</tbody>
</table>

1) **ACTIVITY/SAFETY SENSOR MONITORING - SMART DEVICE APPS**
## 2) CAREGIVING - SERVICES

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care Family (Care Family)</td>
<td>Provides caregivers nationwide with expertise on a wide range of issues - companions, personal care, medical support. Assists in finding, hiring and managing the right caregiver. Handles payment, taxes, insurance, etc.</td>
<td><a href="https://www.carefamily.com">https://www.carefamily.com</a></td>
</tr>
<tr>
<td>CareLinx (CareLinx, Inc.)</td>
<td>Assists in locating reputable caregivers - family completes survey, CareLinx staff assists with referrals. For annual membership fee, family receives background checks, pre-screened caregivers/profiles (e.g., education, work experience, availability, reviews). Caregiver and family set payment rate. Company handles liability insurance, taxes, screening, paperwork; charges 15% per invoice for services.</td>
<td><a href="http://www.carelinx.com">http://www.carelinx.com</a></td>
</tr>
<tr>
<td>CareTree.Me (CareTreeMe)</td>
<td>Software to facilitate homecare. Family creates account and enters profile of care recipient - e.g., personal information, medications, important documents. Other key parties have access, receive e-updates, etc., with security filtering for what's provided. Once care staff hired, they document arrival/departure, receive messages/tasks; system calculates billable hours.</td>
<td><a href="http://www.caretree.me">http://www.caretree.me</a></td>
</tr>
<tr>
<td>DementiaGuide (Dementia)</td>
<td>Website and smart device app capture data on person's condition so caregivers can track progress, become</td>
<td><a href="http://www.Dementia">http://www.Dementia</a> Guide.com</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td>Website</td>
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</tr>
<tr>
<td>Guide, Inc.</td>
<td>Collectively informed and better plan for care. Provides background on the condition, strategies to manage day-to-day circumstances, understanding for better communicating about symptoms and how they change, disease management techniques. Site identifies important information to share with medical personnel, other care providers and family members.</td>
<td></td>
</tr>
<tr>
<td>eCaring (eCaring LLC)</td>
<td>Software for recording, monitoring, managing health at home - icon-based care tracker. System includes Care Tracker, Care Journal, Care Alerts, Care Portrait with key data for all users, Care Payroll Module for care personnel time documentation.</td>
<td><a href="http://ecaring.com">http://ecaring.com</a></td>
</tr>
<tr>
<td>Lotsa Helping Hands (Lotsa Helping Hands, Inc.)</td>
<td>Assists in bringing together volunteers through online communities that organize/provide support for caregivers. Provides a location for persons interested in/willing to volunteer services.</td>
<td><a href="http://www.lotsahelpinghands.com">http://www.lotsahelpinghands.com</a></td>
</tr>
<tr>
<td>Making Care Easier (Making Care Easier)</td>
<td>Care management platform in Internet, also versions for Apple and Android devices. Provides location for family, friends, caregivers to coordinate care, maintain relations. Family &quot;dashboard&quot; becomes central location for information about care needs, tasks, actions, care and emergency plans. Site provides how-to suggestions, advice. Online community of caregivers/experts for providing assistance in development. Also has information on useful products/services.</td>
<td><a href="http://www.makingcareeasier.com/families">http://www.makingcareeasier.com/families</a></td>
</tr>
</tbody>
</table>

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## 2) CAREGIVING - SMART DEVICE APPS
(See VITAL SIGNS MONITORING - SMART DEVICE APPS section for related listings)

<table>
<thead>
<tr>
<th>App Name</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care First SymptomChecker</td>
<td>Developed by healthcare provider serving Maryland, parts of Virginia and Washington, D.C. Designed for when users are traveling or doctor's office closed. Assists in making a decisions about level of care (if any) needed, provides relief for minor illnesses/injuries. Based on protocols used by physicians/nurses in 10,000 practices and 400 nurse call lines in the U.S. and Canada. For Apple devices.</td>
<td><a href="http://itunes.apple.com/us/app/carefirst-symptomchecker/id411717364?mt=8">http://itunes.apple.com/us/app/carefirst-symptomchecker/id411717364?mt=8</a></td>
</tr>
<tr>
<td>Care Partners Mobile</td>
<td>Keep track of what's needed to care for elderly parents. Creates a shared to-do list and reminder calendar for invited network of caregivers - allows those participating to make</td>
<td><a href="http://www.lifelinesys.com/content/resources/carepartners-mobile">http://www.lifelinesys.com/content/resources/carepartners-mobile</a></td>
</tr>
<tr>
<td>App Name</td>
<td>Description</td>
<td>Website/Store Link</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| CareCoach (Verilogue, Inc.)   | Uses supportive care team of friends, family, advisors to assist patients in having productive healthcare appointments. Patient can seek team advice/input on questions to ask doctors, record outcomes from doctor visits and share with family or caregivers on secure website, CareCoach.com. For Apple devices. | [http://www.carecoach.com/home](http://www.carecoach.com/home)  
<p>| CareSync (Continuum Labs, Inc.) | For family health records - collect, organize, store, share healthcare information. Use Visit Manager to organize for appointments. Track medications, conditions, allergies, manage contacts. For Apple devices. | <a href="https://itunes.apple.com/us/app/caresync/id635439202?mt=8">https://itunes.apple.com/us/app/caresync/id635439202?mt=8</a> |</p>
<table>
<thead>
<tr>
<th><strong>Application</strong></th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>iCam</strong>  (SKJM LLC)</td>
<td>For use when care recipient has computer, webcam - allows monitoring multiple live feeds over wi-fi or cellular. Record, play back events, can set up for motion detection. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/icam-webcam-video-streaming/id296273730?mt=8">https://itunes.apple.com/us/app/icam-webcam-video-streaming/id296273730?mt=8</a></td>
</tr>
<tr>
<td><strong>iTriage</strong>  (iTriage, LLC)</td>
<td>Stores personal health data (including insurance information), medical conditions, medication data. Site provides lookups on doctors, facilities, medical symptoms/conditions, medications, procedures. In Apple and Android device versions.</td>
<td><a href="https://play.google.com/store/apps/details?id=com.healthagen.iTriage&amp;hl=en">https://play.google.com/store/apps/details?id=com.healthagen.iTriage&amp;hl=en</a></td>
</tr>
<tr>
<td><strong>myFamily</strong>  (LyfeChannel)</td>
<td>Helps families manage health and prevention information personalized for each family member. Can customize prevention information, save relevant tips and tools, create personal health alerts/reminders, track medical checkup/vaccination/prescription information. For Apple devices.</td>
<td><a href="http://lyfechannel.com/healthfinder_app/">http://lyfechannel.com/healthfinder_app/</a></td>
</tr>
</tbody>
</table>
## 3) COMMUNICATIONS - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
</table>
| **Amplified Phone with Big Button, Braille**  
(Clarity Products) | Jumbo keys with Braille characters, electronic voice repeats numbers after dialing. 35-37 dB amplifier. Hearing aid-compatible, bright ring flasher, loud ringer (up to 85 dB) with adjustable ring tones. Digital processor minimizes background noise. 10-number memory speed-dial keys announced either in pre-recorded or user's voice. Three-number, one-touch programmable emergency keys. | [http://clarityproducts.com](http://clarityproducts.com) |
| **AmpliVoice 50 Talking Caller ID Amplified Telephone**  
(Sonic Alert) | Land line style; can set up to meet needs of persons with vision and/or hearing impairments. Can log 64 incoming calls, 30-number ID of incoming calls. Audible number read-back for calls placed, three auto-dial keys. Amplifies up to 40dB, hearing aid compatible, large keypad and numbers. Visual/sound ringer (up to 50dB). | [http://www.sonicalert.com/products-amplified-phones-AmpliVOICE50.html](http://www.sonicalert.com/products-amplified-phones-AmpliVOICE50.html) |
| **Big Button Photo Dialer**  
(Innovative Technology Electronics Corp.) | Unit can direct dial up to 24 numbers by pressing large photos/picture keys (2”x3”) instead of phone keypad. Keys can be modified for Braille. Unit can adapt to any speed dial phone, including cordless. Good for seniors, persons with disabilities, children. | [http://www.sharperimage.com](http://www.sharperimage.com) |
| **CareLine Home** | Corded or cordless handset phones, both with larger buttons. | [http://www.vtechphones.com/careline/carelin](http://www.vtechphones.com/careline/carelin) |
| **Safety Telephone Systems**  
(VTech) | Corded version has speed-dial photo buttons for frequently called numbers. Call voice announce, digital answering system, volume boost, emergency button pendant that calls two numbers, two programmable buttons, 50-number programmable phone book, audio boost. | e-home-safety-telephone-system |
|---|---|---|
| **ClearSounds Freedom Deluxe Phone**  
| **Doro Secure 740**  
(Doro) | Company with cellphones designed for seniors. Model 740 has simple menus, touch screen, sliding keypad for text messaging. Large text, clearly labeled menu. Five-megapixel camera takes pictures and doubles as magnifying glass. | http://www.dorousa.com |
| **Ensemble**  
(Clarity) | Amplified phone that incorporates 7" screen Android pad. Caller's speech routed through captioning company (Clear Captions), appears on screen as well as is amplified in phone headset. Adjustable font, sound level. Clarity customer service can remotely adjust phone features for users. | http://clarityproducts.com |
| **Galaxy Note II**  
(Samsung) | Large touch screen (5"+) can be used with stylus. Easy Mode feature - simplifies home screen in providing access only to key functions. | https://www.samsung.com/global/microsite/galaxynote/note2/spec.html?type=find |
| **Independa**  
(Independa, Inc.) | Multi-purpose care suite. "Angela" interface connects with special LG ProCentric Healthcare TVs or Samsung's Galaxy Tab2 tablets. Caregiver Web program can enter text displays over normal TV broadcast. Single-touch access to video chat, simple e-mail, daily schedule, prompts, alerts, med reminders caregivers can enter via Smart Calendar. TV has custom-designed camera, microphone, point-and-click Magic Remote, large screen fonts, higher contrast/ brighter colors for seniors' vision. Is also the portal for vital signs and home sensor monitoring via "Artemis" system component. | http://www.independa.com |
|---|---|---|
| **Invisible Clock II Personal Timer**  
(Time Now Inc.) | Belt-mounted unit with both beeping and vibrating alarm. Can set up to 12 daily alerts. Countdown timer can be set for a single or repeating alert. Also contains Stopwatch function. | www.invisibleclock.com/ |
| **iTalk Reminder**  
(Neutrano) | Reminder alarm clock using voice recognition technology. User speaks and clock sets up to 10 reminder messages, syncs with alarm function. Can be used for many scheduling needs, such as medication reminders. | http://italkreminder.com/ |
| **Jitterbugs**  
(Great Call) | Button-style (Jitterbug) and touch screen-style (Jitterbug Plus - adapted Android-based Kyocera Milano model). Has keyboard, yes/no navigation buttons; Plus has camera. Long-life battery. Can load with Great Call apps - "Meds Coach," "Urgent Care" (emergency response), live nurse contact. | http://www.greatcall.com |
| **Kind Reminder**  
(Kind Reminder) | Pendant records messages in a familiar voice to play on demand. Operated by pressing single large button. Can reduce person's anxiety and caregiver's need to repeat messages. | www.kindreminder.com/ |
| **Large Display Talking Caller ID**  
(Emerson) | Desktop unit like a small computer screen. Has three-line display for text/messages, caller ID. | http://www.harriscomm.com/index.php/large-display-talking-caller-id.html#.UeH7Gqzhfbo |
|---|---|---|
| **LivelyGram**  
(Lively) | Uses paper, ink and the mail to communicate. Circle of family/friends share photos, messages, status updates. Service compiles content, forwards to user approximately semi-monthly. | http://www.mylively.com |
| **Motiva**  
(Philips Healthcare) | Turns home TV into patient's personal healthcare channel/virtual coach. Delivers educational videos on demand, provide timely reminders (medications, etc.). Provides feedback on vital signs measurements, health-related surveys for patient understanding/compliance. Connection with family/friends enables support network to connect on daily health needs. | http://www.healthcare.philips.com/us_en/products/telehealth/products/motiva.wpd |
| **Pal**  
(Clarity Products) | Cellphone modified for seniors' use. Easy-to-read screen, amplified sound/adjustable tone control, programmed emergency help button, sends/receives text messages. | http://clarityproducts.com |
| **Pantech Flex**  
(AT&T) | Cellphone with Easy Experience mode for simple, clean home screen for seniors - large fonts, clear icons, quick access to phone, camera, messages, menu, Web and contacts, app shortcuts. Also has voice commands and dialing. Android operating system. | http://www.att.com/shop/wireless/devices/pantech/flex-gray.html#fbid=CxNGjx2kY5B |
| **Presto and HP Printing Mailbox**  
(Hewlett Packard) | Presto Service receives e-mail, digital photo and other digital content, converts into printouts without the need for computer or Web connection. HP Printing Mailbox receives/prints Presto Service messages. Shares a standard phone line, uses | http://www.presto.com/ |
<table>
<thead>
<tr>
<th><strong>Product</strong></th>
<th><strong>Description</strong></th>
<th><strong>Website</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>VibraLITE3 (Global Assistive Devices, Inc.)</td>
<td>Vibrating reminder alarm wristwatch unit (also has chimes). Auto reload timer for reminders.</td>
<td><a href="http://www.globalassistive.com">http://www.globalassistive.com</a></td>
</tr>
<tr>
<td>VideoCare (HomeCare California)</td>
<td>Touch screen with two-way video, doesn’t require keyboard, mouse or any computer skills. Can be connected with wireless vital signs monitoring peripherals. Approved network members send user photos or videos from smart devices. Also serves as secure Internet portal for sharing pictures, data. Management handled remotely by caregivers/family via cloud-based computer server.</td>
<td><a href="http://www.homecare-california.com">www.homecare-california.com</a></td>
</tr>
<tr>
<td>Wireless Carrier for Vision Impairment (Odin Mobile)</td>
<td>First mobile phone carrier to target persons with vision impairments. Access-friendly hand unit, user guides are text-to-speech friendly. Customer service can remotely connect with unit to provide assistance.</td>
<td><a href="http://odinmobile.com">http://odinmobile.com</a></td>
</tr>
</tbody>
</table>
### 4) EMERGENCY/FALL MONITORING - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5Star Urgent Response</strong></td>
<td>Personal profile put on record, pressing button contacts care center for help. Device tracks person using GPS, displays on online locator map. Optional UrgentCare app can access nurses 24/7 (doctor, if necessary); has symptom checker, medical dictionary. 5Star function integrates into Great Call's Jitterbug line of mobile phones.</td>
<td><a href="http://www.greatcall.com">http://www.greatcall.com</a></td>
</tr>
<tr>
<td><strong>Active Care MiniPAL</strong></td>
<td>PAL = Personal Assistance Link. Operates with GPS and advanced triangulation Alert unit worn on pendant or belt. One-button connection to care center for emergency/fall help and fixing person's location.</td>
<td><a href="http://activecare.revinteractive.com/pal">http://activecare.revinteractive.com/pal</a></td>
</tr>
<tr>
<td><strong>Alert1 Medical Alert System</strong></td>
<td>Pendant- or belt-style alert unit (extra for spouse), base station (plugs into phone jack and outlet). 24/7 care center emergency monitoring service. 24-hour battery backup. Care center notified of low battery.</td>
<td><a href="http://www.alert-1.com">http://www.alert-1.com</a></td>
</tr>
<tr>
<td><strong>AmberSelect</strong></td>
<td>Monitors for inactivity, falls, environment (smoke, water, intruders, carbon monoxide). Initiates emergency call and picks up incoming calls when wearing remote transmitter. Two-way speakerphone, up to 16 customizable reminders. Local and remote programming via computer or telephone line, 24-hour backup battery.</td>
<td><a href="http://www.visonic.com/Products/Wireless-Emergency-Response-Systems/AmberSelect">http://www.visonic.com/Products/Wireless-Emergency-Response-Systems/AmberSelect</a></td>
</tr>
</tbody>
</table>
| **Attentiv**  
(Cardioicom) | Multi-function care system. Attentiv component provides emergency response and 24/7 health monitoring. Connects with Linkview component for vital signs, NetResponse component for daily check ins/education, TeleResponse component providing comparable services for users who only have telephone. | http://www.cardiocom.com |
| **Automatic Fall Detection**  
(VRI) | Pendant-style alert device worn by user, base unit connects to electric outlet. Detects falls when no sudden movement occurs within 10 seconds. Alert sent to care center; care staff talks with patient and contacts caregiver, neighbor, emergency personnel as required. 600-foot range. Compatible with VRI Cellular Medical Alarm. | http://monitoringcare.com |
| **Care Innovations Link**  
(GE-Intel Care Innovation) | Base unit plugs into phone land line and power outlet. Alert device worn on pendant, wrist strap, belt clip. Alerts sent to care center, follow up as required with personal contacts, emergency responders. | http://linkmedicalalert.com |
| **Depend One**  
(Depend One LLC) | Two-way voice pendant, optional belt or wrist adapter available, base unit plugs into electrical outlet. 600-foot range. 30-hour battery backup; automatically recharges when power restored. Optional house key lockbox for emergency responders. | https://www.dependone.com/ |
| **eCare+Voice**  
(Spectraforce Technologies) | Phone with GPS and cellular technologies - used for emergency assistance in home and outdoors. SOS button connects 24/7 to Secureus care center via two-way voice communication. Person's location shown on Internet map. Cord-free charging available. User receives low battery alert. | http://ecaregps.com |
| **Freedom Alert2 System**  
(EmoryDay LLC) | Pendant- or belt-style alert unit, base station. Device connects with existing phone, mounts on wall or worn as pendant. No monitoring center - one of four contacts notified. (or 911 when none available). 600-foot range, long-life battery. | https://www.freedomalert-911.com/ |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------|
| **GoSafe**  
| **Guardian Alert911**  
(EmoryDay LLC) | Pendant or belt clip alert device, base station plugs into phone jack. Two-way voice communication to 911. | https://www.guardianalert-911.com/?x=bab |
| **Life Alert Product Suite**  
(Life Alert) | Life Alert Medical Alarm - pendant- and wristwatch-style alert units for medical problems and/or intruders.  
Emergency Phone Help - small cellphone alert unit with GPS for contacting the help center from anywhere in the U.S. Phone never needs charging, battery lasts 10 years.  
User Cell/Smartphone Emergency Protection - user's current cellphone can be set up for speed dial to help center. App provided for smartphone to reach center.  
Fire, CO2 Protection - Company can also provide special detectors that contact help center if they sense fire and/or CO2; center talks with user or contacts emergency services if no response. | http://www.lifealert.com/ |
<table>
<thead>
<tr>
<th><strong>Life Alert 50+ Full Protection</strong> - package provides all of the above services.</th>
</tr>
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<tbody>
<tr>
<td><strong>Life Station Medical Alert System</strong> (Medical Alert)</td>
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<tr>
<td><strong>Lifecomm</strong> (Verizon Telematics)</td>
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<tr>
<td><strong>LifeGuardian Medical Alarm System</strong> (LifeGuardian Technologies, LLC)</td>
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<tr>
<td><strong>Lifeline Medical Alert</strong> (Philips Healthcare)</td>
</tr>
</tbody>
</table>
| **LifeLink Prodigy Medical Alarm System**  
Matrix Interactive LLC | Pendant-style alert unit (wristwatch-style coming in 2013), two-way communication through base unit - goes through call list when activated, pressing panic button three times calls 911. 300-foot range. | http://www.lifelinkmedicalalert.com |
|---|---|---|
| **LifeStation**  
LifeStation Inc. | Pendant- and bracelet-style alert unit (extra available for additional resident). Base unit plugs into electric outlet and phone jack. Care center staff responds to alert requests. 400-foot range. Automatic weekly testing, battery backup. Optional house key lockbox for emergency responders, extra wall-mount buttons for bathroom, hallway. | http://www.lifestation.com |
| **Lifestream MobileHelp**  
| **Lifetrac Mobile**  
Secura Trac | GPS locator phone worn on pendant, belt, in pocket. Alerts go to contacts chosen, 911. When SecuraFence electronic boundary ("geoperimeter") set, alerts sent when person crosses. Phone stores contacts/phone numbers, has three programmable speed-dial numbers. Personalized website provides satellite map when tracking, historical data. | http://www.lifetrak.com |
| **Link to Life Detection Suite**  
Fall Detection Systems | Fall Detection System - pendant-style alert unit, base unit. Care center receives alerts; center contacts user, designated caregiver or emergency services for follow up. Options include intrusion detection, inactivity monitoring, lockbox for | http://www.falldetectionsystems.com/index.html |
<p>| <strong>Medical Alert System, Digi Alert (VRI)</strong> | Medical Alert model for phone with land line service, Digi Alert model designed for use with digital phone service or VOIP (voice over Internet protocol). Pendant alert device - when activated, care center contacts to check on assistance needed. Care center alerted when battery low. Compatible with VRI Automatic Fall Detection device. 600- to 800-foot range. | <a href="http://monitoringcare.com">http://monitoringcare.com</a> |
| <strong>Medical Home Alert System, MobileAlert (Medical Alert Systems by Connect America)</strong> | In-home and mobile models for emergency response. In-home has base unit with two-way voice and speakerphone capability, backup battery, delayed silent alarm feature, Braille characters on important buttons. MobileAlert model uses GPS technology. For both, call center contacted when button pushed, sends assistance needed - family, emergency services, etc. | <a href="http://www.medicalalert.com/">http://www.medicalalert.com/</a> |
| <strong>MediPendant (MediPendant)</strong> | Pendant-, belt clip-, wristwatch-style alert device for contacting care center staff. 600-foot range. Staff have | <a href="http://www.medipendant.com/">http://www.medipendant.com/</a> |</p>
<table>
<thead>
<tr>
<th>Service Name</th>
<th>Description</th>
<th>Website Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>MobileCare Monitor</td>
<td>Wristwatch-style unit for emergency alert to care center, auto fall detection (also monitors gait), notes when device isn't being worn. Data can be combined with vital signs data obtained via wireless peripheral devices. Care center alerts sent to designated caregivers via smart devices, can be viewed on Web site. Can integrate with electronic door locks. Medications logging/reminders.</td>
<td><a href="http://www.aframedigital.com/">http://www.aframedigital.com/</a></td>
</tr>
<tr>
<td>MobileHelp</td>
<td>Wristwatch- or pendant-style unit. Three system models, use wireless cellular, GPS, so user can summon help anywhere. Classic model is for in-home use. Solo model is for home use when phone line isn't available. Duo model is for when phone line available and for when mobile (with GPS). Honeywell HomeMed product - device integrates with other products in the company's Lifestream Management Suite.</td>
<td><a href="http://mobilehelpnow.com">http://mobilehelpnow.com</a></td>
</tr>
<tr>
<td>Numera Libris</td>
<td>System integrates mobile emergency response, two-way voice, automatic fall detection, GPS location tracking. Libris also connects with Numera Net computer platform to accept vital signs data from a range of vendors' wireless health devices, can then forward to family, professionals, etc.</td>
<td><a href="http://numera.com">http://numera.com</a></td>
</tr>
<tr>
<td>Nurse Alert</td>
<td>24-hour emergency nursing service, accessed via app for Apple, Android, Blackberry smart devices. Provides 24/7 Nurse Triage Call Center service wherever user is located.</td>
<td><a href="http://www.nurse-alert.com">http://www.nurse-alert.com</a></td>
</tr>
<tr>
<td>QMedic</td>
<td>Wristwatch-style unit for emergency monitoring - base unit connects to phone line. Call center available 24/7 at button press. Alert sent to Apple or Android smart devices for</td>
<td><a href="http://www.qmedichealth.com">http://www.qmedichealth.com</a></td>
</tr>
<tr>
<td>Medical Alert System</td>
<td>Details</td>
<td>Website</td>
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<td>----------------------------------------------</td>
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<tr>
<td><strong>Rescue Alert Medical Alert System</strong></td>
<td>Pendant- and wristwatch-style alert unit, two base unit models - standard for phone line, advanced for cable- and Internet-based phone service. Periodic testing. Both have two-way voice, 600-foot range. Standard base has 60-hour backup battery, advanced unit has 90-hour.</td>
<td><a href="http://www.rescuealert.com">http://www.rescuealert.com</a></td>
</tr>
<tr>
<td><strong>ResponseLINK Medical Alert System</strong></td>
<td>Pendant- or bracelet-style alert unit, base has emergency and general help buttons for contacting care center, speed dial for programmed phone numbers. 24-hour backup battery, care center notified of low charge. Adjustable volume control, programmable reminders.</td>
<td><a href="http://www.responselink.com/">http://www.responselink.com/</a></td>
</tr>
<tr>
<td><strong>Senior Safety</strong></td>
<td>Pendant- and wristwatch-style alert unit, two systems. Basic alert system has two-way voice in the base, 24-hour backup battery, auto notification for low batteries 300- to 400-foot range. Advanced system has 600-foot range, 60-hour backup battery, compatible with all home phone service, family check-in capability through speakers, can answer telephone with &quot;help&quot; button, care staff trained as emergency technicians.</td>
<td><a href="http://www.seniorsafety.com/">http://www.seniorsafety.com/</a></td>
</tr>
<tr>
<td><strong>SenseAFall</strong></td>
<td>Device worn like a pager, automatically senses for falls, connects to care center for follow up. Uses cellular</td>
<td><a href="http://www.24eight.com/products.html">http://www.24eight.com/products.html</a></td>
</tr>
</tbody>
</table>
| **Sonitor Technologies**  
(Sonitor Technologies, Inc.) | triangulation and GPS to locate user, creates computer map. Usable in home and outdoors. Battery lasts five-seven days between charges, gives low battery alert. | http://www.sonitor.com |
| --- | --- | --- |
| **SureResponse**  
| **Telecare/PERS Solution**  
(Tunstall Healthcare) | Pendant-, wristwatch- and/or belt clip-style mobile system using GPS for location. Backup telephone cable also provided for when within range of the home docking station (to conserve battery). Pressing alert button connects with care center, staff contacts family, other caregivers. SureResponse Online Internet portal used to manage user profile/alerts and set up authorized caregivers. | http://americas.tunstall.com/pages/Telecare-PERS |
## 5) HEARING - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetone HL Bedside Fire Alarm</td>
<td>Plug-in designed to provide specialized fire alert for persons with hearing impairments. Works in conjunction with standard (T3) fire alarms - continually monitoring, when heard, HL unit sends three signals - flashing text on device screen, 90dB alarm at a special frequency and vibrating bed shaker. Battery backup. Easy-to-read display, can also be used as a daily alarm clock.</td>
<td><a href="http://lifetonesafety.com">http://lifetonesafety.com</a></td>
</tr>
</tbody>
</table>

## 5) HEARING - SMART DEVICE APPS

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td>BioAid (University of Essex, UK)</td>
<td>Uses phone's audio feed from built-in microphone, amplifies and plays through headphones. Amplifies soft sound, de-amplifies loud ones. Also permits users to save profiles for amplification needed in different settings (e.g., TV, restaurant). For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/bioaid/id577764716?mt=8">https://itunes.apple.com/us/app/bioaid/id577764716?mt=8</a></td>
</tr>
<tr>
<td>HearingAmp (Medicom Corp.)</td>
<td>User can amplify/filter sounds in environment - uses phone's microphone to tune sounds. Preset frequency profiles provided;</td>
<td><a href="https://itunes.apple.com/us/app/hearingamp/id536166856?mt=8">https://itunes.apple.com/us/app/hearingamp/id536166856?mt=8</a></td>
</tr>
</tbody>
</table>
users can modify these or create new ones. For Apple devices.

| Hearing Loss Simulator (Starkey Laboratories) | User chooses prerecorded, common sounds to simulate specific hearing losses; option available to record user's or another's voice for playback through the different losses. Also includes graphics on loudness/frequency of the common sounds, speech and individual speech sounds. Compatible with Apple iPad. | https://itunes.apple.com/us/app/hearing-loss-simulator/id398352094?mt=8 |
| Hearing Test #1 (Aveos) | Tests ear sensitivity for 20 frequencies between 100 Hz and 17 KHz, compares the results. For Apple devices. | https://itunes.apple.com/us/app/hearing-test-1/id350730542?mt=8 |

5) VISION - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
</table>
| **Eye-Pal**  
(ABISee, Inc.) | Lightweight, portable USB scanner/reader - converts print to speech, text files or refreshable Braille. Works with both Mac and PC computers. | http://www.abisee.com/ |
| **Intel Reader**  
| **KNFB Reader**  
(K–NFB Reading Technology, Inc.) | Mobile software - smart device user takes photo of print to be read. Software employs character recognition for converting text to speech for reading contents out loud. Also displays print on device's screen and highlights words as spoken. For Nokia devices. | http://www.knfbreader.com |
| **myVisionTrack**  
(Vital Arts and Science) | Enables patients with retinal disease (diabetic retinopathy, macular degeneration) to perform regular home self-screenings. Software compares current to past results, physician automatically notified of significant changes. Results also forwarded to patient's electronic health record. Currently only cleared for prescription use - manufacturer distributes preloaded on Apple iPhones. Downloadable version of software to come. | http://myvisiontrack.com/myvisiontrack/ |
| **NetraG**  
(EyeNetra) | From MIT Media Lab research. Enables user to self-exam, get a prescription, identify providers. Creating Internet site for patients, doctors to connect worldwide via mobile app (Test2Connect). | http://eyenetra.com/ |
| **Optelec Clear Reader+Basic**  
<table>
<thead>
<tr>
<th><strong>Product/vendor</strong></th>
<th><strong>Characteristics, features</strong></th>
<th><strong>Web address</strong></th>
</tr>
</thead>
</table>
| **Optelec ClearView**  
| **Optelec Compact**  
| **VictorReader Stream**  
(Humanware) | Hand-held media player. Download documents and MP3s on stream for reading/navigating. Has text-to-speech function for reading in text format such as Bookshare. Integrated microphone also available for recording notes. | <http://www.humanware.com/microsite/stream/index.html> |
| **ZoomText 10 Magnifier**  
(aisquared) | Enlarges, enhances computer screen contents. ZoomText software available that combines enlarging technology with reading tools so user can see/hear program actions, record on mobile device, focus in on specific text zones. ZoomText Keyboard also sold with large, easy-to-read keys and a number of keys controlling ZoomText functions. | <http://www.aisquared.com> |

## 5) VISION - SMART DEVICE APPS

<table>
<thead>
<tr>
<th><strong>Product/vendor</strong></th>
<th><strong>Characteristics, features</strong></th>
<th><strong>Web address</strong></th>
</tr>
</thead>
</table>
| **Vision Aid**  
(Action!) | Supports mobile users with reading difficulties or low vision via main smartphone functions - call, write e-mails or text messages, checking phonebook. Functions to come include: calculator, calendar, optical character recognition, magnifying glass, text editor. For Apple devices. | <https://itunes.apple.com/us/app/vision-aid/id632709230?mt=8> |
<table>
<thead>
<tr>
<th>App Name</th>
<th>Description</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VisionAssist</strong></td>
<td>Converts smart device into hand-held electronic magnifier. Designed for persons with low vision from macular degeneration, glaucoma, diabetic retinopathy, cataracts, color blindness. Can connect with Apple devices, big-screen TV or computer monitor for enlarged viewing.</td>
<td><a href="https://itunes.apple.com/us/app/visionassist/id502356279?mt=8">link</a></td>
</tr>
<tr>
<td><strong>VisionSim</strong></td>
<td>Developed so persons with normal vision can experience nine degenerative eye conditions - age-related macular degeneration, cataracts, chronic open-angle glaucoma, corneal edema, diabetic retinopathy, homonymous hemianopia, macular degeneration, retinal detachment, retinitis pigmentosa. Severity can be manipulated, still images can be saved/shared. Also provides background on the conditions. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/visionsim-by-braille-institute/id525114829?mt=8">link</a></td>
</tr>
</tbody>
</table>
6) MEDICATION ADHERENCE/MANAGEMENT - EQUIPMENT

<table>
<thead>
<tr>
<th>Product, vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AdhereTech</strong> (Adhere Tech, Inc.)</td>
<td>Cellular connection in unit vs. cap or bottom attachment. Wireless pill bottle continuously measures exact number of pills in bottle (check for accidental overdose), use monitored by care center, uses text message or automated phone call to give reminders. Company can offer computer program interface to other vendors for customization.</td>
<td><a href="http://www.adheretech.com">http://www.adheretech.com</a></td>
</tr>
<tr>
<td><strong>Dispense-a-Pill</strong> (HealthOneMed)</td>
<td>Dispensing/storage/monitoring. Unit can store up to 90-day supply of eight medications. Built-in alarm, low pill supply warning. Phone call alerts for missed dosage. Battery backup.</td>
<td><a href="http://www.healthonemed.com/">http://www.healthonemed.com/</a></td>
</tr>
<tr>
<td><strong>EMMA</strong> (InRange System)</td>
<td>&quot;Electronic Medication Management.&quot; Modeled after skilled nursing medication dispensing process. Dosing instructions sent from facility's server to EMMA unit at home. Audio/video alert at dose time, patient activates. Doses can be adjusted remotely, new medications sent by mail. Produces reports for caregivers.</td>
<td><a href="http://www.inrangesystems.com/#1">http://www.inrangesystems.com/#1</a></td>
</tr>
<tr>
<td><strong>Beep 'n Tell</strong> (ePill, LLC)</td>
<td>Bottle with multiple reminder alarms, chip for recording prescription information. Times chosen between doses, replacing cap resets alarm. Personal message (e.g., from caregiver) can be entered and played back as needed.</td>
<td><a href="http://www.epill.com">http://www.epill.com</a></td>
</tr>
<tr>
<td>ePill CADEX Alarm and Medical ID Databank (ePill, LLC)</td>
<td>Wristwatch-style reminder. Can program up to 12 beeping sound reminders, including text message on display with medication name/strength, other instructions. Databank stores important health information - name, phone number, diagnoses, allergic reactions, emergency contacts, list of medications, blood type, doctor/insurance information.</td>
<td><a href="http://epill.com">http://epill.com</a></td>
</tr>
<tr>
<td>GlowCap, GlowPack (AT&amp;T Vitality)</td>
<td>Wi-fi-enabled medication containers - GlowCap is a medication bottle; GlowPack for blister packs, inhalers, injection solutions, ointments, etc. Dosing schedule entered with care center, glow or sound emitted when should be taken. Message sent to care center when opened for adherence tracking. Flashing light, ring tone or call to user's phone provided for missed dose. Pressing special button on unit connects with pharmacist for reorders. Physician reporting also provided.</td>
<td><a href="http://www.vitality.net">http://www.vitality.net</a></td>
</tr>
<tr>
<td>Med eMonitor System (InforMedix)</td>
<td>Unit for storing/monitoring medications and providing information on protocol to follow. Five electronically monitored compartments - when lid lifted, action time/date stamped to create journal. When unit placed in cradle, data uploaded to monitoring center.</td>
<td><a href="http://www.informedix.com">http://www.informedix.com</a></td>
</tr>
<tr>
<td>MedFolio Pillbox (MedFolio)</td>
<td>Storage/dispensing unit, designed by pharmacist. Stores and identifies medications, can be transported. Audio, visual, text reminders, remote adherence tracking via company computer site.</td>
<td><a href="http://www.medfoliopillbox.com">http://www.medfoliopillbox.com</a></td>
</tr>
<tr>
<td>MEDGlider MedPort System (ePill, LLC)</td>
<td>Container for organizing a week of medications. Provides up to four daily reminders by voice, sound or light, large display. Reminder unit slides on container top.</td>
<td><a href="http://www.epill.com">http://www.epill.com</a></td>
</tr>
<tr>
<td><strong>Medication Dispensing Service</strong> (Philips Healthcare)</td>
<td>Bottle cap records when bottle opened. Unit also available with optional beeping/flashing reminder feature and optional room temperature monitor.</td>
<td><a href="http://informationmediary.com/ecap/">http://informationmediary.com/ecap/</a></td>
</tr>
<tr>
<td><strong>MedMinder</strong> (MedMinder Inc.)</td>
<td>Storage/dispensing/monitoring unit. Support center programs dispensing schedule, caregiver or patient fills multi-day, multi-dose cups. Caregiver alerts when dose missed, at refill time. Connects to user’s phone line.</td>
<td><a href="http://www.medminder.com">http://www.medminder.com</a></td>
</tr>
<tr>
<td><strong>MeDose</strong> (ePill, LLC)</td>
<td>Wristwatch-style unit uses vibration or sound to provide up to six daily reminders, can count down/count up, auto reset interval timer, auto calendar.</td>
<td><a href="http://www.epill.com/medos.html">http://www.epill.com/medos.html</a></td>
</tr>
<tr>
<td><strong>MedPartner Medication Reminder</strong> (Honeywell HomeMeds)</td>
<td>Plugs into outlet, has battery backup. Provides voice instructions and visual cues to alert user when to take medications, number of pills, correct bottle.</td>
<td><a href="http://www.hommed.com">http://www.hommed.com</a></td>
</tr>
</tbody>
</table>
| **MedReady**  
(MedReady, Inc.) | Carousel-style storage/dispensing/monitoring unit. Models have different types of alerts - one sends daily compliance via the Internet, flashing light for those with hearing impairments. Models connect with care center via phone line, cellular. | http://www.medreadyinc.net |
| **MedSignals**  
(LIFETECHniques) | Storage/dispensing/monitoring unit, sits in cradle connected to phone and electric outlet. Differs from most - stores each medication in separate compartment vs. each day's dose/s. Electronic voice advises number of pills to take from container with lighted indicator. Provides alerts when medications should be taken, records time when lid opened, uploads to company's server, charts tracking patient and caregivers available. | http://www.medsignals.com |
| **MedSmart**  
(AMAC) | Storage/dispensing/monitoring. Locked unit provides up to six daily reminders. Monitoring by phone, e-mail, text. Care center reporting to caregivers, other parties. Compliance Dashboard chart shows adherence over time. | http://www.amac.com/medsmart.cfm |
| **Ontime Rx**  
(AmeliaPlex, Inc.) | Text screen device that alerts when medication dose scheduled, displays drug name/dosage/prescribed directions, reminders for refills and other health tasks. | http://www.ontimerx.com |
| **PillStation**  
(Senticare) | Storage/dispensing/monitoring unit. Photo shot as medication taken to confirm, document correctness. Customized reminders via pill bin lights. Glow on unit indicates if taken as required. 24/7 button for contacting call center. Works with wired/wireless connections. | http://www.senticare.com |
| **Proteus**  
(Proteus Biomedical) | First microchipped (sand grain size) pill approved by FDA. Taken with other medications to show adherence. Stomach | http://proteusdigitalhealth.com |
acid creates current to operate - data broadcast to adhesive-backed skin patch that sends to smart device or via Web to doctor. Ingestion day/time as well as heart rate, temperature and body position recorded.

<table>
<thead>
<tr>
<th><strong>Rx Timer Cap</strong></th>
<th>Pill bottle with digital timer on cap shows how long since the medication was taken last.</th>
<th><a href="http://www.rxtimercap.com/">http://www.rxtimercap.com/</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rx Timer Cap, Inc.)</td>
<td>Unit that organizes, reminds, dispenses, tracks. Connects to phone line, notification by text, e-mail or talking with call center staff. Simple MedII combines the unit and personal emergency response function.</td>
<td><a href="http://www.vaica-usa.com">http://www.vaica-usa.com</a></td>
</tr>
<tr>
<td><strong>TabSafe</strong></td>
<td>Medication storage/dispensing/monitoring unit. Cartridges prefilled by pharmacist with medications, can be stacked as many as four high and locked inside dispenser cabinet. Medications dispensed in varying combinations at set times of day. Physician and pharmacist can make changes remotely through phone line. Remote caregiver/family notified by phone line if doses missed.</td>
<td><a href="http://www.tabsafe.com">http://www.tabsafe.com</a></td>
</tr>
<tr>
<td>(Tab Safe Medical Services, Inc.)</td>
<td>Device with maximum 60-second voice recording capacity attaches to standard pill bottle. Records medication name and other helpful information, instructions by caregiver or pharmacist that can be accessed at any time by pressing special button. New message recorded each time prescription refilled. 85dB playback for persons with hearing impairments.</td>
<td><a href="http://www.talkingrx.com/">http://www.talkingrx.com/</a></td>
</tr>
<tr>
<td><strong>Talking Rx</strong></td>
<td>Storage/dispensing unit - can remain unlocked or locked until time for dose. Spinning carousel connects to smart device app with schedules, calendar, ability to notify family/caregiver</td>
<td><a href="http://my-ubox.com">http://my-ubox.com</a></td>
</tr>
<tr>
<td>(Talking Rx, Inc.)</td>
<td></td>
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</tbody>
</table>
network if dose/s missed.

| **WatchMinder 2 (Watchminder)** | Wristwatch-style unit alerts user to take medications, check an appliance or perform a certain procedure (e.g., change wound dressing). Memory has series of health-related reminders that can be incorporated - e.g., time to do exercises. | http://watchminder.com/ |

6) **MEDICATION ADHERENCE/MANAGEMENT - SMART DEVICE APPS**

<table>
<thead>
<tr>
<th><strong>Product, vendor</strong></th>
<th><strong>Characteristics, features</strong></th>
<th><strong>Web address</strong></th>
</tr>
</thead>
</table>
| **Care4Today Mobile Health Manager**  
(Jannsen Research and Development, LLC) | Secure website and app that enables user to store vital information and receive medication reminders, refill prescriptions, set up provider appointments, store important medical contact information. For Apple devices. | https://itunes.apple.com/us/app/care4today-mhm/id594525004?mt=8 |
| **Medication Tracker**  
| **MediSafe Virtual Pillbox**  
| **Personal Caregiver**  
(Personal Caregiver, Inc.) | Assists in tracking medications/reminders for up to three people. Refill reminders based on usage, alerts for missed doses. Database with 17,000+ medications. Premium version includes FDA recall alerts, more detailed medication information. | [http://www.personalcaregiver.com/](http://www.personalcaregiver.com/) |
| **Pilljogger, MedWheel**  
(Pilljogger) | Device and app for med tracking, reminders. MedWheel is carrying case designed for back of smartphone - coordinates with Pilljogger app to show compliance. For Apple devices. | [http://www.pilljogger.com](http://www.pilljogger.com) |
| **Prescription Manager**  
| **Prescription Pill Identifier**  
### 7) PHYSICAL FUNCTIONING - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
</table>
| **Accusom Deliver**  
(NovaSom) | FDA-cleared home testing kit for obstructive sleep apnea, specialists at company website access/analyze data. Sleep specialists can order home test through company, which ships device to patient; staff helps patient through process involves measuring overnight 12 physical/neurologic factors. | [http://www.novasom.com/hst-order.htm](http://www.novasom.com/hst-order.htm) |
| **Jintronix Rehabilitation System**  
(Jintronix, Inc.) | Uses Microsoft Kinect to give patients immediate follow up, measures range of motion and other functions, monitors rehab progress, prescribes new/customized activities. | [http://jintronix.com](http://jintronix.com) |
| **Lark Pro**  
(Lark) | Provides sleep coaching - learn sleep type, seven-day sleep assessment, sleep profile developed over time. Provides sleep actigraphy tracking (used by sleep clinics to track activity and how much time slept), sleep data summary. Has silent vibration alarm clock with audio backup. (Original product of the National Sleep Foundation.) | [http://lark.com](http://lark.com) |
| **LifeGait**  
(MiniSun) | Palm-sized device performs gait analysis in many settings. Detects over 40 types of physical activity/postures, records amount/intensity/type of body motion, provides 17 gait measures, analyzes behavior, plays back video clips of daily activities, provides ECG reading, estimates energy | [http://www.minisun.com/ideea_overview.asp](http://www.minisun.com/ideea_overview.asp) |
<table>
<thead>
<tr>
<th><strong>MIRA</strong>  (MIRA Rehab, Ltd.)</th>
<th>Uses Microsoft Kinect to make home physical therapy exercises into medical video games. Provides therapist with performance data (e.g., range of motion, level of objective reached), limb/body angle measurements that otherwise would require direct contact for measurement. Can help therapist with rehab scheduling, working with multiple clients.</th>
<th><a href="http://www.mirarehab.com">http://www.mirarehab.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nova Som HST</strong>  (Nova Som)</td>
<td>Home Sleep Test product for obstructive sleep apnea, uses chest, finger and breath sensors. Sends gathered data via smartphone for same-day diagnosis. Company mails system directly to user on doctor's order.</td>
<td><a href="http://novasom.com">http://novasom.com</a></td>
</tr>
<tr>
<td><strong>Rehab Measurement Tool</strong>  (Reflexion Health, Inc.)</td>
<td>Uses Microsoft's Kinect to track patient's therapy adherence. Online instructional videos and resource materials available. Software instructs patient on exercises through animations and measures if done correctly. Therapists can prescribe preloaded exercises or design individually.</td>
<td><a href="http://reflexionhealth.com">http://reflexionhealth.com</a></td>
</tr>
<tr>
<td><strong>SleepTrak</strong>  (iMPak Health)</td>
<td>Uses credit card-sized near-field communication (NFC) device worn on arm cuff. (NFC allows electronic devices to establish radio communication by touching or coming close together.) Transmits data to user's computer for self-tracking, can pair with NFC-enabled smart devices.</td>
<td><a href="http://impakhealth.wordpress.com/about/">http://impakhealth.wordpress.com/about/</a></td>
</tr>
</tbody>
</table>
viewed on PC or mobile devices, or integrated into electronic health records.

| **SleepMapper (Philips Respironics)** | Continuous positive airway pressure (CPAP) product transmits data to healthcare providers who check in with patients at home, adjust equipment and modify therapy. Philips now making data available to patients to help with compliance. For Apple and Android products. | http://www.sleepmapper.com/ |

7) **PHYSICAL FUNCTIONING - WEB SITES, SMART DEVICE APPS**

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prime Wellness (Prime Wellness)</strong></td>
<td>Online program creates exercise regimen helping older adults to avoid falls. Taught by physical therapist.</td>
<td><a href="http://primewellness.com">http://primewellness.com</a></td>
</tr>
<tr>
<td><strong>RehabMinder Therapy Assistant (Rehab Minder Pty Ltd)</strong></td>
<td>Hand and upper limb exercise database that can be animated. Can create an existing hand therapy program on the device or create with therapist; who can review on device as rehabilitation progresses. Injury profile prepared for specific body part and exercises matched to it; can create multiple profiles. Glossary of terms, helpful resource materials available.</td>
<td><a href="https://itunes.apple.com/us/app/rehab-minder-therapy-assistant/id647025352?mt=8">https://itunes.apple.com/us/app/rehab-minder-therapy-assistant/id647025352?mt=8</a></td>
</tr>
<tr>
<td><strong>Theravid (Theravid, Inc.)</strong></td>
<td>Injury rehabilitation website. Online portal provides access to physical and occupational therapists, orthopedic surgeons, primary care doctors, chiropractors and trainers - professionals develop individualized program, send workout reminders.</td>
<td><a href="http://www.theravid.com">http://www.theravid.com</a></td>
</tr>
<tr>
<td>Secure messaging system.</td>
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</tbody>
</table>
## 8) ROBOTICS - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carebot</strong> (Gecko Systems - US)</td>
<td>Family care and personal assistance robot. Answers questions, helps with daily living activities, provides reminders. Video enables virtual visits between user and circle of support. Provides emergency notifications. Technology transfer to wheelchairs - CyberMobility.</td>
<td><a href="http://www.geckosystems.com">http://www.geckosystems.com</a></td>
</tr>
<tr>
<td><strong>Double Robotics</strong> (Double Robotics - US)</td>
<td>&quot;Wheels for the iPad.&quot; Puts an Apple iPad on adjustable shaft and wheels to enable flexible movement for teleconferencing, telecommunications. Weighs 15 pounds. Control can be coordinated for multiple Double units in any locations. Shaft can adjust Pad in approximately four- to five-foot range.</td>
<td><a href="http://www.doublerobotics.com/">http://www.doublerobotics.com/</a></td>
</tr>
</tbody>
</table>
| **GiraffPlus**  
(Orebro University, Sweden) | Robot developed by team of European researchers with Swedish lead. Monitors vital signs, sleep patterns, basic activities interacts with care user. In final clinical trials. | [http://www.giraffplus.eu](http://www.giraffplus.eu) |
| **Hector**  
(CompanionAble Consortium) | Robot developed by team involving University of Reading (UK) and European partners. Responds to voice activation, keeps daily routines, provides reminders, detects falls, assists remote control center. Final clinical trials in 2012. | [http://www.companionable.net](http://www.companionable.net) |
| **Helios**  
(Hello Labs - US) | Portable telepresence robot and app using Apple and Android smartphones. Only need Web browser, connection. Turn on app, put phone in device, remote user takes control of device. Remote input sent with their video feed as screen markers, Helios sensors interpret as commands. Software developers can also develop targeted programming. | [http://launch.hellolabs.co](http://launch.hellolabs.co) |
| **Kompai**  
[http://www.mobiserv.eu](http://www.mobiserv.eu) |
| **vGo**  
(vGo - US) | Robot do various types of examinations, enable telepresence exchange between user and remote parties via wi-fi. (e.g., now being used to connect sick children with teachers, classmates). Remote control center computer adjusts tilt and camera zoom. Four feet tall, weighs 18 lbs. | [http://www.vgocom.com](http://www.vgocom.com) |
## 9) VITAL SIGNS MONITORING - EQUIPMENT

<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Features</th>
<th>Web address</th>
</tr>
</thead>
</table>
| **Ambio Remote Health Monitoring System**  
(Ambio Health) | Multi-function system tracking vital signs and activity/safety. System sells vital signs monitoring peripherals that automatically record/store readings on company's computer server where users can view results, print, etc. Family members can log in to check person's status. Care center sends reminder messages for readings and/or if missed. | [http://ambiohealth.com](http://ambiohealth.com) |
| **BAM TLC Smart Bed System**  
(BAM Laboratories) | BAM - Body and Motion; TLC - Touch-free Life Care. Pad device placed under bed mattress pad, tracks heart conditions/data - e.g., rate, breathing, motion/ movements/ position change, presence in bed. Company's computer server evaluates data, packages into reports, resource materials. Gives immediate motion and bed exit alerts to minimize falls. Care personnel receive timely data via computer or mobile smart device. | [http://www.bamlabs.com](http://www.bamlabs.com) |
| **Cardiocom Suite**  
(Cardiocom) | Multi-function care system. LinkView component has touch screen base, interactive video, measures vital signs. "Attentiv" component has personal emergency response and around-the-clock health monitoring. NetResponse Web system for daily health checks, education, receives vital signs data from any Internet-enabled smart device or computer. TeleResponse is system for daily health checks, education and vital signs data entry for those who only have telephone. | [http://www.cardiocom.com](http://www.cardiocom.com) |
<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
</table>
| **CardioNet MCOT**  
*(CardioNet)* | Company provides mobile cardiac telemetry - patient's sensor sends passive wireless message on abnormal heart beats. MCOT model can receive video support, interface can enables communicating in multiple languages. Up to 30 days of continuous monitoring and data storage, provides video support. | [https://www.cardionet.com/index.htm](https://www.cardionet.com/index.htm) |
| **Care Innovations Guide**  
*(Intel-GE Care Innovations)* | In-home care management touch screen device/application, connects with desktop computers, notebooks, tablets. Supports videoconferencing, a range of vital signs monitoring equipment, patient-specific educational content. Care personnel notified if data or user's answers to daily queries indicate serious changes. | [http://www.careinnovations.com/products/guide-disease-management#/homeapp_t](http://www.careinnovations.com/products/guide-disease-management#/homeapp_t) |
| **Gensis Touch,**  
**Genesis DM**  
*(Honeywell Home Med)* | Touch screen model gathers vital signs information, transmits to Honeywell's Lifestream Management Suite for care staff assessment/follow up as required. Also can provide education and videos. Genesis DM console model provides disease-specific assistance through guided screenings, related educational materials. | [http://homemed.com](http://homemed.com) |
| **GrandCare**  
*(GrandCare Systems)* | Multi-function system. Seniors relay vital signs data, track medication schedule and movements around home on Web-based touch screen. System uses 28-compartment automatic medication dispensing/storage unit that can provide reminders with instructions, prompts if not taken (records when opened/closed). System also has personal emergency response component, social connections - music, photos, messages, Skype video. | [http://www.grandcare.com](http://www.grandcare.com) |
| **Health Buddy System**  
| (Bosch Healthcare) | Healthcare provider daily sets up T400 model console unit to receive monitoring session - gathers vital signs (using a range of vendors' wireless equipment or entered by user), reviews symptoms, completes standard assessment surveys, receives behavior reinforcement education materials. Completed session forwarded to healthcare provider for review/follow up; new session developed/sent for the next day. | [http://www.bosch-telehealth.com/en/us/products/health_buddy/health_buddy.html](http://www.bosch-telehealth.com/en/us/products/health_buddy/health_buddy.html) |
| **Health e-Care System, Healthy e-Chair**  
| **Healthyanywhere**  
| (Biosign Technologies) | Health-at-Home system has touch screen base unit and peripheral devices that gather data on various vital signs. Also provides access to educational/nutritional content, information exchange between patients and providers. | [http://www.biosign.com/healthanywhere.aspx](http://www.biosign.com/healthanywhere.aspx) |
| **Ideal Life**  
| (Ideal Life) | Range of vital signs monitoring devices that communicate through base unit (Pod) - Gluco-Manager (blood sugar), BP (blood pressure)-Manager, Body-Manager (scale), Step-Manager (pedometer), Body-Manager Plus (chair scale), Breath-Manager (respiratory peak flow meter). Partnership in 2013 with ADT to integrate into its "Pulse" system for home security monitoring option. | [http://www.ideallifeonline.com](http://www.ideallifeonline.com) |
| **Independa Suite**  
### Lifeview
(American Telecare)
- Component provides social engagement/caregiver interaction via specially adapted LG televisions and Samsung Galaxy tablet. (Messages appear over regular programming.) Caregiver/user can video chat, exchange reminder notes, give medication prompts, simple e-mail/Web browsing.

[http://lifeviewtransforms.com](http://lifeviewtransforms.com)

### mymedic
(Tunstall Healthcare)
- Desktop console unit where user receives daily prompt to take vital signs (using a range of peripheral devices transmitting by wireless, infrared, cable), data transmitted to care center for analysis/follow up with user and doctor. Large color display, soft-touch buttons.

[http://americas.tunstall.com/pages/Telehealth-Products](http://americas.tunstall.com/pages/Telehealth-Products)

### Numera Libris, Numera Home Hub
(Numera, Inc.)
- Multi-function system - integrates telehealth vital signs data with emergency response service, locational tracking, auto fall detection. Numera Libris telehealth component designed to connect/obtain data from peripheral devices manufactured by many vendors. Home Hub works with phone lines, cellular mobile or broadband connections.

[http://numera.com](http://numera.com)

### PhysioGlove
(Commwell)
- Glove-shaped unit fits over patient's/caregiver's hand and takes electrocardiogram remotely, sends via smart device to healthcare providers. Glove also can track a range of additional vital signs.

[http://www.commwell.com](http://www.commwell.com)

### SimplyHome
(SimplyHome)
- Suite of products to promote independent living - console and peripherals for monitoring blood pressure, oxygenation, glucose, weight; medication dispenser, emergency response

[http://simply-home.com](http://simply-home.com)
<p>| <strong>Telehealth Advisor</strong>&lt;br&gt;(McKesson) | monitor, electronic controls for managing environment, hand's-free headset. | System includes Bosch Health Buddy console unit and two-way communication of vital signs, educational and compliance information between home and care provider. | <a href="http://www.mckesson.com/telehealth/">http://www.mckesson.com/telehealth/</a> |
| <strong>TeleStation</strong>&lt;br&gt;(Philip) | Core console unit for company's remote patient monitoring system. Transmits vital signs (measured wirelessly or entered manually), provides two-way communication between user and care provider. Unit prompts user to answer customized health survey questions. | <a href="http://www.healthcare.philips.com/us_en/products/telehealth/products/telestation.wpd">http://www.healthcare.philips.com/us_en/products/telehealth/products/telestation.wpd</a> |
| <strong>VitalPoint Home Monitor</strong>&lt;br&gt;(CJPS Medical Systems) | &quot;H20 connectivity&quot; - from user's Home 2 healthcare Office. Desktop display unit for monitoring multiple vital signs. Large touch screen, voice schedule reminder, messages from healthcare providers, illustrations for taking vital signs measurements and reporting symptoms. Operates via phone line, Internet connection or cellular. Monitor can track more than one user. | <a href="http://www.cjps.com/medicalsystems/vitalpointhome/literature.php">http://www.cjps.com/medicalsystems/vitalpointhome/literature.php</a> |
| <strong>Viterion V200</strong>&lt;br&gt;(Bayer-Panasonic) | Desktop console for taking a range of vital signs measurements, data sent via Viterion TeleHealthcare Network to company's server where healthcare personnel can access. (Note: company sold in mid-2013; system status to be determined.) | <a href="http://www.viterion.com/index.cfm">http://www.viterion.com/index.cfm</a> |</p>
<table>
<thead>
<tr>
<th>Product/vendor</th>
<th>Features</th>
<th>Web address</th>
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</thead>
<tbody>
<tr>
<td>Asthmapolis (Propeller Health)</td>
<td>GPS-enabled inhaler and app, can track air, etc., conditions that may affect/trigger an asthma attack.</td>
<td><a href="http://www.asthmapolis.com">http://www.asthmapolis.com</a></td>
</tr>
<tr>
<td>BGM Blood Glucose Meter (Telecare)</td>
<td>Cellular blood glucose meter - takes readings, sends to company's computer server, two-way communication for user and healthcare professional, can enter into electronic health records. Don't need a cable or another smart device to use.</td>
<td><a href="http://telecare.com">http://telecare.com</a></td>
</tr>
<tr>
<td>Blood Pressure Dock (IHealth Labs)</td>
<td>User's blood pressure monitor inserted into device to measure/track pressure numbers, heart rate, pulse wave. Results forwarded via Apple device to iHealth mobile app. Dock doubles as smart device charging station.</td>
<td><a href="http://www.ihealthlabs.com">http://www.ihealthlabs.com</a></td>
</tr>
<tr>
<td>Blood Pressure Monitor (Withings)</td>
<td>Tracks, stores data, can e-mail to doctor. For Apple devices.</td>
<td><a href="http://www.withings.com">http://www.withings.com</a></td>
</tr>
<tr>
<td>ECG Check (Cardiac Designs)</td>
<td>First FDA-cleared, over-the-counter heart electrocardiogram. Wraps around smartphone, sends readings to phone, then to company server or care provider. Readings displayed on screen, stored/transmitted, checked by company. Provides stoplight-color status. Can rapidly check for rhythm problems.</td>
<td><a href="http://www.cardiacdesigns.com">http://www.cardiacdesigns.com</a></td>
</tr>
</tbody>
</table>
| **e-Thermometer**  
(Kinsa Health) | Thermometer unit plugs into Apple device, operates using phone's battery. | http://www.kinsahealth.com |
| **Genesis Meter**  
(Genesis Health Technologies) | For testing blood sugar - blood drop placed on test strips inserted into unit, readings display on unit and sent to user's "myGHR" online account in company's computer server. Can store up to 450 readings. | http://www.genesishealthtechnologies.com/GenesisMeter.aspx |
| **igBS Star**  
(AgaMatrix, Sanofi) | Blood glucose meter that can be used independently or also connects by app with Apple devices for displaying/communicating data. Test strip inserted into device, blood drop applied, reading display/stored. | http://www.ibgstar.us |
| **iPhone ECG**  
(AliveCor) | First FDA-approved mobile heart electrocardiogram monitor - currently by prescription for tracking (not diagnosis); over-the-counter version coming in 2013. | http://www.alivecor.com |
| **iSPO2**  
(Masimo) | Meter that plugs into smart device, measures blood perfusion (how well capillaries transport), oxygen level, pulse. | http://www.masimo.com |
| **Life Vest**  
(Zoll) | Wearable monitors for sudden cardiac arrest - shock delivered if one occurs. Can use following a heart attack, before/after bypass surgery or stent placement. Also suitable for patients with certain heart conditions (e.g., cardiomyopathy or congestive heart failure). Can also be used as temporary safeguard while physician evaluates patient's long-term risk/treatment plans. | http://lifevest.zoll.com |
| **Meter Sync Cable**  
(Glooko) | Cable compatible with 20 standard blood pressure cuffs. Records, tracks pressure reading, carbohydrate intake, insulin | http://www.glooko.com |
dose. Can send results to doctor.

| **My GlucoHealth**  
| **(Entra Health Systems)** | Test strip inserted into device, results in three seconds. Data sent to company computer server for analyzing/forwarding to healthcare professionals. Reminders given on food intake, medication adherence. | http://myglucohealth.net |
| **New-Generation Cane**  
| **OneTouch VerioSync System**  
| **(Life Scan)** | Glucose monitoring device - data sent to app, sends to smart device, alerts user if irregular patterns detected. 14-day summary displayed, stores up to 2,500/one year of events/results. Notes can be inserted to accompany readings. For Apple devices. | http://www.onetouch.com/?utm_campaign=Tier%201%20-%20Verio%20Sync&utm_source=google&utm_medium=cpc&utm_content=General%20EXACT&utm_term=onetoche%20verio%20sync%20system |
| **Scanflo**  
| **(Scanadu)** | For analyzing urine. User buys disposable cartridge, software tests for a number of conditions (e.g., pregnancy related, kidney failure, urinary tract infection). | http://www.scanadu.com/scanflo |
| **SCOUT**  
| **(Scanadu)** | Device held to temple, provides range of vital signs in five seconds- heart rate, breathing rate, blood pressure, heart electrocardiogram, body temperature, blood oxygen level. Data uploaded to computer application. | http://www.scanadu.com/scout |
| **Smart Body Analyzer**  
| **SmartSlipper, SmartInsoles**  
(24Eight) | Shoe inserts that monitor foot pressure, gait, for fall detection. | http://www.24eight.com/products.html |
| --- | --- | --- |
| **SureSense Rx**  
| **Tinke**  
| **uCheck**  
(Biosense Technologies) | Urinalysis by cellphone for kidney, also possibly bladder and liver problems. Takes photo of strip, compares to color grid, reports results. For Apple products, Android version coming. | http://www.uchek.in |
| **Wireless Blood Pressure Monitor**  
(iHealth Labs) | User can track blood pressure numbers, heart rate, pulse wave; share results with family or doctor, chart results, track daily activity/diet. | http://www.ihealthlabs.com |
| **Wireless Body Analysis Scale**  
(iHealth Labs) | Measures, track nine body composition characteristics on iHealth mobile app. Can be used on or offline. Logs daily calorie intake. Unit can track data for up to 20 users. | http://www.ihealthlabs.com/wireless-body-analysis-scale-feature_27.htm |
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<tr>
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<tr>
<td><strong>Wrist Blood Pressure Monitor</strong>&lt;br&gt; (iHealth Labs)</td>
<td>Unit wirelessly tracks readings, physical activity, daily diet. Can share results with doctor, family, chart results</td>
<td><a href="http://www.ihealthlabs.com">http://www.ihealthlabs.com</a></td>
</tr>
<tr>
<td><strong>Wrist Ox2 Model 3150</strong>&lt;br&gt; (Nonin)</td>
<td>Fingertip device gathers blood oxygen data, sends to wristwatch-style tracking unit. Transmits recorded readings to user's computer or smart device. Unit can store 270 hours of readings at one-second resolution for later analysis by physician. Can be used with company software for walk, sleep tests.</td>
<td><a href="http://www.nonin.com">http://www.nonin.com</a></td>
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### 9) VITAL SIGNS MONITORING - SMART DEVICE APPS

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<thead>
<tr>
<th>Product/vendor</th>
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<tr>
<td>Application</td>
<td>Description</td>
<td>Website</td>
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<tr>
<td><strong>Asthma MD</strong> (Mobile Breeze)</td>
<td>Keeps a journal, graphs trends to share with doctor, tracks triggers. Interested users can submit data to participate in asthma research project. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/asthmamd/id349343083?mt=8">https://itunes.apple.com/us/app/asthmamd/id349343083?mt=8</a></td>
</tr>
<tr>
<td><strong>Asthma Puff Counter</strong> (WarSoft)</td>
<td>For albuterol and steroid use monitoring over time. Graphs show usage, severity, etc. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/asthma-puff-counter/id601942071?mt=8">https://itunes.apple.com/us/app/asthma-puff-counter/id601942071?mt=8</a></td>
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<tr>
<td><strong>AsthmaCheck</strong> (mutterelbe medical UG)</td>
<td>Developed by pulmonary specialists. Records medication peak flow, provides review statistics to transmit by e-mail, provides medication/refill reminders. Periodically runs five-point symptom checker (following Global Initiative for</td>
<td><a href="https://itunes.apple.com/us/app/asthmacheck/id381131894?mt=8">https://itunes.apple.com/us/app/asthmacheck/id381131894?mt=8</a></td>
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<tr>
<td><strong>Asthma/GIMA protocols). For Apple devices.</strong></td>
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| **Blood Pressure Tracker**  
| **Blood Sugar Tracker**  
| **Blood Sugar Tracking**  
| **CardioSmart Med Reminder**  
| **Caretalk**  
| **COPD Tracker**  
<table>
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<tr>
<th><strong>App</strong></th>
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<tr>
<td><strong>Coumadin</strong>&lt;br&gt;(Clinical Cliffs)</td>
<td>Calculates coumadin loading and maintenance doses for two different anti-coagulation therapies. App originally designed for healthcare professionals, but adapted as become more active in treatment. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/coumadin/id303861701?mt=8">https://itunes.apple.com/us/app/coumadin/id303861701?mt=8</a></td>
</tr>
<tr>
<td><strong>Diabetes Companion</strong>&lt;br&gt;(dLife)</td>
<td>Tracks/manages blood glucose level - records carbohydrates, insulin, blood glucose data over time, logs meals and meter readings, provides daily to monthly reports, can e-mail data. Provides access to dLifeTV show - 400 videos on living with diabetes, 4,000 expert questions and answers, recommendations for 9,000 good recipes and 25,000 specific foods. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/diabetes-companion/id360403719?mt=8">https://itunes.apple.com/us/app/diabetes-companion/id360403719?mt=8</a></td>
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<tr>
<td><strong>Emergency Helper</strong>&lt;br&gt;(coravy Ltd.)</td>
<td>Preset message for sending emergency e-mail to contacts and maps location if device user is unable. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/emergency-helper/id411876311?mt=8">https://itunes.apple.com/us/app/emergency-helper/id411876311?mt=8</a></td>
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<tr>
<td><strong>Application</strong></td>
<td><strong>Description</strong></td>
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<tr>
<td>Emergency Lock Screen (PSchaschl)</td>
<td>Operates like a medical alert bracelet if smart device is locked and user impaired - important information inserted into customizable picture accessible on the lock screen. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/emergency-lock-screen/id509849333?mt=8">https://itunes.apple.com/us/app/emergency-lock-screen/id509849333?mt=8</a></td>
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<tr>
<td>HeartWorks60 (Pointer Software Systems, Ltd.)</td>
<td>Tracks heart rate data obtained from chest strap monitors designed to Bluetooth Smart and ANT+ wireless standards. Can record for many hours, saves data in enlargeable graph. Can keep records for multiple sessions. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/heartworks60/id460962986?mt=8">https://itunes.apple.com/us/app/heartworks60/id460962986?mt=8</a></td>
</tr>
<tr>
<td>Medication Manager and History Tracker (eMedical Companion, Inc.)</td>
<td>Tracks medication intake history, adds new medications. Stores medication bottle pictures, provides refill reminders; can add dosages, schedule, starting/ending date. E-mails records for up to six family members to healthcare professionals. Password protected. For Apple devices.</td>
<td><a href="https://itunes.apple.com/us/app/medication-manager-history/id382200355?mt=8">https://itunes.apple.com/us/app/medication-manager-history/id382200355?mt=8</a></td>
</tr>
</tbody>
</table>
| **OnTrack Diabetes**  
| **Pain Care**  
| (Ringful LLC) | Users can track pain levels, location, duration, mood and more; can share data with a physician or other parties. For Apple and Android devices. | https://itunes.apple.com/us/app/pain-care/id347787779?mt=8 |
| **Spot a Stroke F.A.S.T**  
<p>| (American Stroke Association) | Borrows from app developed by the Australia National Stroke Association. F - check face for ability to smile/droop on one side; A - ask to raise arm/see if drops, S - speech slurring, T - importance of time in contacting 911. Also has information on dealing with/preventing a stroke, nearby hospital locations, 911 hotline connection. For Apple and Android devices. | <a href="https://itunes.apple.com/us/app/spot-a-stroke-f.a.s.t/id594995265?mt=8">https://itunes.apple.com/us/app/spot-a-stroke-f.a.s.t/id594995265?mt=8</a> |</p>
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<tr>
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<th>Characteristics, features</th>
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<tr>
<td>CA100 (Pioneer Medical Systems)</td>
<td>Low-cost wander management. Small, portable - no hard wiring, can move to any room. One controller can monitor multiple doors, more than one vulnerable person can be monitored. Ankle cuff monitoring device.</td>
<td><a href="http://www.pioneeremergency.com/">http://www.pioneeremergency.com/</a></td>
</tr>
<tr>
<td>Caretrax (Caretrax)</td>
<td>System works with telemetry, has two tiers of monitoring. Home option triggers alarm when a wireless &quot;geofence&quot; boundary is passed, searches in one-mile vicinity. Responder option (police, fire) uses transmitter bracelet assigned unique frequency for tracking when local officials participate in Project Lifesaver and are contacted about wander incident. (System's original target population was persons with autism.)</td>
<td><a href="http://www.caretrak.com">http://www.caretrak.com</a></td>
</tr>
<tr>
<td>Comfort Zone (Alzheimer's Assn.)</td>
<td>GPS/cellular locational monitoring where family chooses options price tiered by distance. Monitoring center provides assistance 24/7. Subscription also includes Medic Alert - access to stored emergency health records - and Safe Return- medallion with emergency number and contacts for vulnerable person. Wandering or medical emergencies reported to 24-hour emergency response center Community &quot;Safe Return&quot; network (local Association, law enforcement personnel) is activated. When individual located, personnel call medallion's emergency contacts.</td>
<td><a href="http://www.alz.org/comfortzone">http://www.alz.org/comfortzone</a></td>
</tr>
<tr>
<td></td>
<td>Association also offers lower-priced service combining Medic Alert</td>
<td><a href="http://www.alz.org/care/dementia-">http://www.alz.org/care/dementia-</a></td>
</tr>
</tbody>
</table>
| **Door and Window Wireless Wander Alarm**  
(Seniors Super Store) | with the Safe Return program.  
http://www.seniorssuperstores.com/ | medic-alert-safe-return.asp#works |
|-------------------------|--------------------------------------------------------------------------------|----------------------------------|
| **Freedom**  
(Lok8u) | Door sensor unit mounts on bedroom or other key interior, and/or exterior door. When door opened, send signal to caregiver's remote monitoring unit (chime or vibration).  
| **Keruve Direct Family Locator**  
(Vision Localization System) | Uses proprietary radio frequency identification technology and global positioning. Vulnerable person wears a watch transmitter with emergency button. When alert triggered, caregivers go to secure customer computer portal for mapping readouts.  
http://www.seniorssuperstores.com/ | http://www.keruve.com/?gclid=CMKVmKbD87cCFUaZ4AodAksAzQ |
| **Lifecomm mPers**  
(Hughes Telematics, Inc.) | Designed for persons with first-stage Alzheimer’s. Person wears GPS watch with safety lock. Caregiver has portable, small-screen tracking unit that displays map with person's tracked location.  
| **Navistar GPS Footwear System**  
(Aetrex Worldwide, Inc.) | Wristwatch-style tracking unit using GPS provides two-way communication, auto fall detection. (Purchased by Verizon in 2013; market return/features to be determined.)  
<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Website</th>
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<tbody>
<tr>
<td>Personal Locator Service, Smart Shoes (GTX Corp.)</td>
<td>Company partnering with Google Maps for creating displays of locations identified by GPS for GTX-enabled products. One example is &quot;Smart Shoes&quot; with imbedded sensors that track user location.</td>
<td><a href="http://www.gpsshoe.com/smart_shoe_google_premier_api.cfm">http://www.gpsshoe.com/smart_shoe_google_premier_api.cfm</a></td>
</tr>
<tr>
<td>Smart Door Monitor (Smart Caregiver Corp.)</td>
<td>Anti-wandering products - door monitoring system (wristband sensor triggers alarm), weight-sensing floor mats, motion-sensing monitors.</td>
<td><a href="http://www.careelectronics.com/">http://www.careelectronics.com/</a></td>
</tr>
<tr>
<td>Traxxit360 (Traxxit Technologies)</td>
<td>Company operates in multiple markets - e.g., uses for locating children, pets, assets, etc. Units monitor geographic location and altitude. Users register devices, set boundaries, provide cellphone number/s for receiving alert e-mails or texts via &quot;My Traxxit&quot; software.</td>
<td><a href="http://www.traxxit.com">http://www.traxxit.com</a></td>
</tr>
<tr>
<td>TriLock Personal Locator (iLoc Technologies)</td>
<td>Uses cellular and global positioning technology for wander management where multiple geofence zones can be set. Also provides fall detection/alert. Has bi-directional voice capability, SOS check-in button. Can be set up on website or smart device.</td>
<td><a href="http://www.iloctech.com/triloc">http://www.iloctech.com/triloc</a></td>
</tr>
<tr>
<td>WanderCARE100 (Care Electronics, Inc.)</td>
<td>Subscribers set range for monitoring. Vulnerable person wears WanderCare transmitter (with unique electronic code) on wrist, ankle, belt or in special fanny pack. If person moves out of pre-set zone and doesn't return within 15 minutes, alarm sounds for caregiver. Person can be tracked up to one mile. WanderCARE can also connect to a voice dialer that can notify up to four persons/pagers.</td>
<td><a href="http://www.careelectronics.com/">http://www.careelectronics.com/</a></td>
</tr>
<tr>
<td>Wherifone GPS Locator Cellphone</td>
<td>Cellphone equipped with GPS enables tracking person on outline map or location can also be obtained by text message. Three easy-</td>
<td><a href="http://www.mightygps.com/wherify.htm">http://www.mightygps.com/wherify.htm</a></td>
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for Seniors
(Whereify)
dial numbers can be programmed, 20-number phone book. Model also manufactured for children.

10) **WANDER MONITORING - SMART DEVICE APPS**

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<tr>
<th>Product/vendor</th>
<th>Characteristics, features</th>
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<tr>
<td>TellMyGeo (Iconosys)</td>
<td>Vulnerable person's smartphone can be set to send regular GPS alerts to caregiver's phone. Simple buttons for emergency use. Medical history can also be stored for use by emergency responders. For Android devices.</td>
<td><a href="http://tellmygeo.com">http://tellmygeo.com</a></td>
</tr>
<tr>
<td>GeoFence (MobSafety.net)</td>
<td>GPS tracker that gives real-time information on location of vulnerable person carrying smartphone who has left a designated geofence area. For Android devices.</td>
<td><a href="https://play.google.com/store/apps/details?id=com.gpit.android.lifestyle.mob">https://play.google.com/store/apps/details?id=com.gpit.android.lifestyle.mob</a> SAFETY.geofence&amp;hl=en</td>
</tr>
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