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TECHNOLOGY EARLY WARNING SYSTEM – WHITE PAPER

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**The Future of Home Care Revisited:
Integrating Technologies and Systems
to Create a New Medical Home**

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BACKGROUND AND INTRODUCTION

Not surprisingly, much has changed in the five years since appearance of the first TEWS white paper on the future of home health.¹ It explored the likely interplay of growth in telemedicine and ambulatory care, and it correctly forecast the expanding scope and volume of medical services delivered in the home. Four of the paper's five technology predictions effectively "came true." Home monitoring devices, Web-based education and information services, wireless networks, and health-promoting improvements in home design have evolved as expected. Only the adoption of electronic health records has not progressed to the extent predicted in the previous paper.

Reimbursement for the technology component of home care has continued to be a restraining factor, as anticipated in the previous paper. Nevertheless, third-party health plans and consumers' out-of-pocket payments have supported significant growth in the use of technology to enhance the quantity and quality of home health. Today's caregivers are generally believed to be more efficient and effective than they were five years ago—thanks to devices and networks that enhance the flow of information, reduce the risks of errors, and expand the diagnostic and therapeutic services that can be delivered in the home.

The impact of technology on the daily practice of home health care was not addressed in the previous paper. Research reports and expert commentaries circa 2001 implicitly focused on technology's untapped potential to improve existing approaches to home health. Changes in the underlying clinical paradigm were not widely discussed or predicted. However, review of all relevant trends in 2007 suggests a need to consider the

¹ Bauer, JC and PG Bushnell "The Future of Home Telehealth: Unprecedented Opportunities in a Growing Market" (2001, <http://www.bshsi.com/tews/papers.htm>).

future from two perspectives—technological and clinical—because home health is headed in new directions made possible by technological progress and expanding concepts of care. The fundamental meaning of home health five years from now will probably be very different than it was five years ago, and the differences will be more than technological.

This paper explores the interplay between miniaturization of devices, convergence of technologies, evolution of wireless networks, and creation of the medical home as a model for medical care. The most dramatic long-term result of this interplay—a new concept called **hospital-at-home**—is beginning to emerge as medical leaders explore the new realm of possibilities made possible by today’s trends in science and technology. The home is increasingly being visualized as much more than a place for sub-acute care.

“What the patient does at home is more important than what the doctor does in the office”
Daniel C. Davis, MD, FACP

Care that could only be provided in a hospital in the immediate past will be provided in the home in the not-too-distant future. The home is emerging as an important, unique point-of-care in the continuum of health services.

KEY TRENDS IN HOME HEALTH: TECHNOLOGY

From a macro perspective, the future of home health is being shaped in 2007 by the same technologies that were presumably defining change at the beginning of the decade. Wireless networks of portable computers with user-friendly interfaces and multi-media capabilities are constantly increasing the flow of diagnostic and therapeutic information between patients in the home and their caregivers in remote locations. The predicted era of telemedicine has already arrived in home care. Technology has overcome major barriers of place and time—arguably producing the future of home care faster than anyone could have predicted.

However, a closer look at today’s technological progress reveals some new and unpredicted developments with major implications for the future of home health. *Platform convergence* and *miniaturization of devices* are particularly important, as illustrated by descriptions of three different products (at right and on top of the following page) that integrate cellular telephones, sample collection and analysis, and disease management for remote treatment of diabetes.²



² These devices were selected to illustrate significant technological trends. Their inclusion does not indicate endorsement by Bon Secours Health System, Inc. or the author. Neither BSHSI nor the author has financial relationships related to the products.

GlucoPack™

HealthPia America introduces the world's first all-in-one glucometer cell phone and service for managing diabetes remotely. Whether you're guardian, physician or healthcare institution, we can provide your patients or loved ones with 24/7 support and emergency intervention through a GlucoPhone subscription - anytime, anywhere. It's a full disease management system.

How it works

HealthPia has developed a glucose meter (GlucoPack™) that can be fitted onto regular cell phones.



The customer uses the GlucoPack? in the same manner as any standard glucose meter.



www.healthpia.us

These pictures and their accompanying texts suggest remarkable possibilities for the evolution of home care. Although diabetics have been self-monitoring blood sugar for many years, the new devices link seamlessly to clinical records and customized treatment protocols. The cellular telephone is becoming a highly sophisticated platform that facilitates data (i.e., sample) collection, ensures communication between patient and caregiver, and promotes appropriate patient responses (including immediate therapeutic interventions and supportive changes in health behaviors).

As demonstrated in these illustrations, cellular technology is being embedded in a growing array of devices that support home care. However, “plain old telephone service” (POTS) is still an important tool for meeting the medical needs of the significant number of elderly patients who cannot or will not use “high tech” tools. POTS is the most user-friendly technology for many homebound patients, and it will continue to be an important component of home care services.³ Indeed, a review of current trends in technology underscores the importance of providing a choice of technology platforms, from old to new, as a reflection of important differences in consumer preferences and capabilities.

³ Ron Pion, MD, a medical leader in home care for more than three decades, is still actively involved in the development of home services that employ traditional telephony (private communication). Some home health services, such as Tel-Assurance™ by Pharos Innovations (<http://www.pharosinnovations.com>), provide patients with a choice between “plain old telephone service” (POTS) or a Web interface.

mDiabetic Health Services


mDiabetic Telemedicine Suite is a powerful web service for the diabetes community to assist diabetics manage their disease and share personal health records with physicians for remote health monitoring. Patients and physicians now have one central resource for improving health and lowering the costs of health care.

mDiabetic provides easy-to-use tools for diabetic patients and care providers to manage and monitor historical health and lifestyle information. Key elements include:

Patient Health Management	Physician Health Monitoring
Health Logbook Records	Record Monitoring
Lab Records	Lab Record Posting
Email Communication	Email Communication
Appointment Calendars	Appointment Calendars
Record Sharing Option	Point-of-Care Logbook Entry
Educational Resource Library	Patient Surveys
Mobile Diabetes Quiz w/Multimedia Library	Collaboration Notebook
Voice Logbook Entry*	Picture Messaging*
Voice Carb Search Engine*	Home Visitation Records
Personal Mobile Web Page	

*Not available to the public at this time

Patient and Physician services are united for small clinical support or population health management services. Patient sharing options allow records to be shared with one or more people. Physicians, Nurses, Care Managers, and Counselors are able to monitor patient health records using convenient web devices.

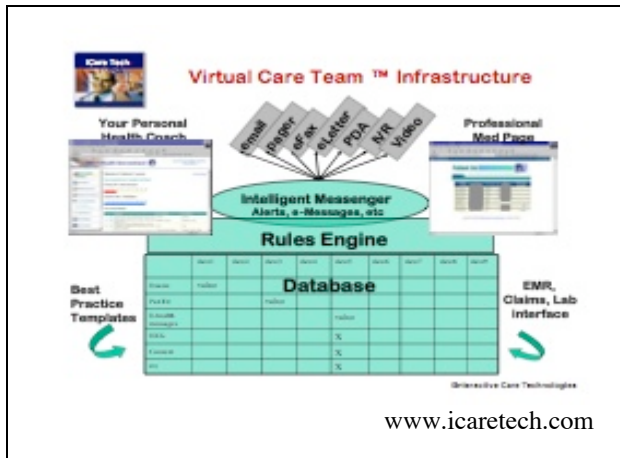


PC phone PDA voice

Mobile Diabetic, Inc provides a valuable resource of mobile health record management and monitoring tools using wireless telemedicine technology in efforts to assist diabetics manage and control their disease and lower the healthcare costs of uncontrolled diabetes.

www.mdiabetic.com

Equally impressive examples of technological integration can be found in a variety of other devices related to home care. For example, a Google™ search for “digital scales” yields links to dozens of products that weigh patients standing, sitting, and lying down and automatically transfer the readings into medical records. Many other high-tech monitors (e.g., stethoscopes, spirometers, pulse oximeters, sphygmomanometers) are also widely available today, along with drug dispensing devices and surveillance monitors.



Although the hardware of home health has progressed impressively over the past five years, many equally important advances have been made in the software that integrates and analyzes health information provided by monitors, patients, and caregivers. The adjacent dashboard shows how networked computers and intuitive interfaces are now being harnessed to bring together in one place all the resources that produce an appropriate treatment plan for an individual patient.

Research studies of home health monitoring devices are beginning to appear in major clinical journals, with some promising reports. For example, one detailed study of ambulatory blood pressure monitors reported that the monitors are “reliable, reasonably convenient to wear, and generally accurate.” It also suggested that monitoring in home settings was a better predictor of hypertension-related risk than conventional, office-based monitoring.⁴ A recent report by the American Hospital Association identified many conditions that can be adequately followed at home with same technologies used in hospital-based clinical observation units (COU).⁵

However, interviews conducted for this paper suggested that many home health technologies are being developed outside the traditional purview of peer-reviewed journals. The marketplace for these products has become highly competitive, often making “speed to market” more important than academic review in the research and development process. A consortium of 22 major technology companies, Continua Health Alliance, was recently created with a specific focus on facilitating development of appropriate devices for home care.⁶ Fortunately, the growing importance of technologies for home care has been accompanied over the past few years by a corresponding

⁴ Pickering, TG *et al* “Ambulatory Blood-Pressure Monitoring” *New England Journal of Medicine* 354(22):2368-74, 1 June 2006.


⁵ Runy LA “Clinical Observation Units” *Hospitals & Health Networks* 80(3):59-65, March 2006

⁶ Clark, D “Corporate Alliance Aims to Ease Use of Technology in Health Care” *Wall Street Journal* 7 June 2006, p. D5. For details of the focus on home care, visit www.continuaalliance.org.

movement for consumer protection. Several resources to guide the purchase of home technologies are now available through government agencies, voluntary health associations, and Consumer Reports. This page from a Food and Drug Administration brochure provides typical consumer information:

Information drawn from *Medical Device Use-Safety: Incorporating Human Factors Engineering into Risk Management*

Make Sure the Medical Device You Choose Is Designed for You



This checklist is designed for health care professionals and patients to use when choosing a medical device that is best for the patient. It is intended to be modified by health professionals to focus on particular devices for certain target populations (e.g., arthritics, diabetics, heart patients).

- 1. Do you have limitations that can affect your use of the device?**
 - Could your health (stress, tired, medication effects, disease) affect the way you use the device?
 - Do you have the physical size and strength (hand strength, lifting ability, and endurance) to use the device?
 - Will you be able to see the display, hear the alarm, and feel the controls (knobs, buttons, switches, and keypads)?
 - Do you have the coordination (manual dexterity, balance) to adjust the controls?
 - Will you be able to understand and use the device?
 - Do you need to remember complex instructions to use the device?
- 2. Is the device right for the environment where you plan to use it?**
 - Does the device have safety features to prevent it from harming your children or pets, and to prevent them from harming the device?
 - Will you be able to hear the device's alarm in a noisy environment?
 - Will the light levels (low or bright) in your environment affect your ability to use the device?
 - Are you using other devices at the same time?
 - Will sources of electromagnetic interference (e.g., Ham radio, AM FM TV broadcast antenna, electrical machinery, hand-held transmitters) affect the device?
 - What things about your home will affect your use of the device (e.g., high heat and humidity, very dry air in the winter, too few electrical outlets, narrow doorways, wood stove heating)?
 - What happens if you put the device in an inappropriate environment?
- 3. Are there device characteristics that can affect its use?**
 - Is the device simple to set up, operate, clean, maintain, and dispose of; and what happens if you don't do these things properly?
 - What replacement parts or batteries are required, how frequently are they needed, how expensive are they, and are there special instructions for safely disposing of the device or its parts?
 - What reading or training is required of you?
 - Are there things about this device that are different from other similar devices you have operated?

Source: http://www.fda.gov/cdrh/humfac/you_choose_checklist.pdf

Interviews with experts in home health also indicated that designers are making devices more user-friendly and patient-focused. Voice recognition and simulation are becoming common features in home health equipment. Information on monitors is increasingly color-coded to highlight its specific importance for the patient, e.g., vital signs displayed

in a green box tell the patient that he or she is doing well, but vital signs in a red box indicate that the patient should immediately call the caregiver's office. In a fully integrated system, the caregiver's office will also receive a message to contact the patient right away when any vital signs enter the danger zone.

According to the consensus apparent in expert interviews and published commentaries, systems integration should be the key differentiator of home health technology in the not-too-distant future. Caregivers and patients want customizable, Web-enabled, user-friendly, interoperable devices designed to meet the health needs of an individual patient. Vendors are clearly being challenged to design and sell products for integrated systems—not niche markets. Technology for the sake of technology is losing its allure. Leaders in home health are focusing attention on hardware and software that work

“The two most promising applications of interactive telecommunications technologies are managing care delivery across the highly complex and fragmented continuum of disparate providers and in managing patient demand for services at the most appropriate place, time, and level of care.”

Ronald J. Pion, MD “Connecting the Dots”
(www.capg.org, March 2003 newsletter)

together to solve clinical problems, improve outcomes, and reduce costs. Their efforts appear to have enough momentum to be a significant force for shaping the future of home care.

The movement toward practical, problem-oriented systems implies growing use of therapeutically focused decision-support tools in the home. Telemedicine was perceived only a few years ago as a viable substitute for traditional face-to-face interaction. The virtual house call was not predicted to change the doctor's role as diagnostician and treatment planner. It would simply allow normal care to be delivered over a distance. However, thanks to emerging technologies, home health tools are starting to make clinical decisions in the home without the presence—physical or virtual—of a clinician. New and emerging devices can follow predetermined protocols to assess a patient and manage his or her care.

Indeed, the question is shifting from whether a human caregiver can be replaced by a device to whether the device should base its decisions on standardized, built-in treatment protocols or orders programmed by each individual patient's caregiver. A variety of approaches can be expected to emerge, given the absence of universally accepted standards of care. Diversity in products and services will also be reinforced by consumer empowerment as patients are expected to pay a greater portion of the costs for their medical services (including home care). Many patients who would prefer “hands on” care in the home are likely to accept virtual presence or automated health services when they consider the difference in price. Third-party insurance can be expected to shift more resources toward technology-based care for the same reason: home health technology is becoming cost-effective. Its promise is reinforced by an equally interesting evolution of the house as a physical facility and social institution. *Home* and *health* are both changing in mutually beneficial ways.

KEY TRENDS IN HOME HEALTH: HOME

For purposes of assessing possible futures for home health in general, the home itself needs to be considered as a dynamic setting for the delivery of medical services. The home is the environment that often harbors the specific causes a patient's health problems, and it is almost always the setting where a patients spends the vast majority of time recuperating from illnesses and injuries (and, sadly, recovering from any adverse affects of institutionalization). The remaining sections of this paper explore the convergence of the *home* in several meanings of the term and relate it to the overall future of home health—technology and all.

“The home and surrounding community will become the central focus of health care delivery in the future. Seeing the patient in the context of daily life will prove to be the key to better outcomes and lower costs for more Americans.”

Allen I. Goldberg, MD, MBA

A semantic distinction is important to the analysis. According to the standard dictionary definition, a home is a house plus the family that lives there, and the family as a social unit is changing dramatically and rapidly in the United States.⁷ (Even pets are now being considered as part of the “family” and the related healing environment.) In-home caregivers are not necessarily family members living in the same residence, and even caregivers who live in the patient's home are less likely to be available due to the increases in the length of the workweek and the number of people holding second jobs. Although these trends are associated with many social and human costs, they are also likely to create more demand for technologies that enhance or replace caregivers in the home. In other words, changes in the home as a social unit are clearly increasing the need for home health technology.

Of course, the home (i.e., house) as a physical structure is also changing. Physical and occupational therapists, psychologists, and a variety of engineers are continuing formal efforts to design spaces that reduce health risks and promote healthy healing.⁸ Location of furniture, layout of rooms and spaces within rooms, Internet connectivity, natural and artificial lighting, heating/ventilation/air conditioning (HVAC), appliances, yards, and other commonplace aspects of daily living are recognized as factors that contribute measurably to health in the home.

Although much of this activity has been motivated in the past by recognition of the social benefits of aging in place, it is likely to attract even more attention and resources in the future due to growing awareness of the looming economic costs of caring for aging baby

⁷ For example, more American women now live without a husband than with one. Roberts, S “51% of Women Are Now Living Without Spouse” *New York Times* 16 January 2007, p. A1.

⁸ The design aspects of home health have been explored in more depth in the previous TEWS paper on home health, available at <http://www.bshsi.com/tews/papers.htm>.

boomers. Policy analysts are nearly unanimous in their belief that the United States has not set aside enough resources to meet the generation's health care needs in expensive hospitals and long-term care facilities.⁹ More health care needs will be met in the home, if they are to be met at all, because the traditional alternative sites of care will be unaffordable or unavailable to many aging Americans. The future demand for home care technology will be substantial, and it is already generating considerable research and development activity.

In general, engineers are harnessing technologies that gather and analyze data in the home to evaluate situations, predict possible problems, and initiate preventive or responsive interventions. Unobtrusive monitors embedded in the floor, talking medical cabinets, strategically located cameras and microphones, badges with RFID sensors that evaluate motion, GPS-based motion and location trackers, wireless "help" button worn around the neck, smart beds that evaluate vital functions, health status monitors in clothing, and pattern recognition technologies are being used to generate daily activity profiles as baselines for identifying deviations from expected behavior, such as experiencing a fall or being stuck in a chair.¹⁰ "Smart" applications notify appropriate caregivers or emergency personnel when data suggest a deviation from acceptable patterns of activity.

One of the leading centers of research and development in "gerontechnology" is the University of Virginia's Medical Automation Research Center (MARC). It has also conducted several studies of consumer acceptance, finding that users generally perceive home monitoring has a positive impact on their lives.¹¹ Another leader in this area, the Age Lab at MIT, is developing links between home health technologies and external support services, such as coordinating home delivery of supplies based on analysis of needs and developing a "safe return device" to locate wandering patients with Alzheimer's disease.¹² The MIT Age Lab is also developing networks to keep seniors actively involved in the labor force—a factor associated with improved health status for persons—and exploring multiple dimensions of longevity.

Research conducted by Pew Internet & American Life Project underscores the importance of a multi-dimensional approach. Acceptance of home technology is not uniform in all senior groups. Some seniors are much more likely than others to embrace

⁹ Rosofsky, I "Escape from the Nursing Home" *New York Times* 16 January 2007, p. A23.

¹⁰ For an illustrated overview of these technologies, see Hoffman, E. "Smart Gadgets for Seniors" *Business Week*, 30 January 2006, http://www.businessweek.com/print/magazine/content/06_05/b3969094.htm

¹¹ Alwan, M *et al* "Psychosocial Impact of Monitoring Technology in Assisted Living: A Pilot Study" and "A Smart and Passive Floor-Vibration Model Based Fall Detector for the Elderly" Papers presented at 2nd IEEE International Conference on Information and Communications Technologies, 24-28 April 2006; Full texts available at <http://marc.med.virginia.edu/projects>)

¹² For detailed descriptions of these technologies, visit <http://web.mit.edu/agelab/projects>.

technology, i.e., to perceive that technology enhances their lives.¹³ However, published reports are beginning to show substantial acceptance of technologies that support independent living in general and home health in particular.¹⁴ Empowerment of the elderly and disabled patients and their families is also motivating the application of many technologies, reinforcing a key objective of health reform.¹⁵

Ironically, some evidence suggests that the biggest bottleneck may be outside the home. Emerging technological capabilities likely exceed the number of medical professionals who are trained to use them in treating older patients at home.¹⁶ Consequently, more technology is needed to increase productivity of home caregivers.¹⁷ The result is a classic “Catch-22.” Most home health agencies would like to acquire the state-of-the-art technologies, but their declining reimbursements and intense competition leave no cushion for making the necessary investments. The situation is made worse by the volume of paper-based transactions. Home health agencies must have large offices for collecting, processing, and storing paper. Nurses and other home health caregivers would not need to waste time and gas to come to a central office if the necessary medical and information technologies were accessible in patients’ homes. The need for investment in information technology infrastructure is widely recognized today. The parallel, but unpublicized, need for home health technology infrastructure may be just as critical for the future.

CONCEPTS CONVERGING ON THE HOME

Research for this white paper produced an interesting and unexpected finding. Many of today’s progressive leaders in home health are also actively involved in one of two parallel attempts to reshape medical care delivery around movements based on the concept of *home*—the medical home and the hospital-at-home. The use of *home* in the respective movements’ identities is the only common link at present because they are motivated by different purposes. However, convergence of the two movements seems

¹³ Melendez, M “Certain Seniors Embrace High-Tech Gear” Newhouse News Service, 11 July 2006; <http://newhouse.com/archive/melendez071106.html>

¹⁴ Snow, R “Safety and Security a Virtual Reality for Seniors” *Spirit: The Magazine of Volunteers of America* Winter 2005:17-20.

¹⁵ For in-depth reviews of the interplay between technological support for the homebound and expected improvements in health care delivery, see Coughlin, J *et al* “Old Age, New Technology, and Future Innovations in Disease Management and Home Health Care” *Home Health Care Management and Practice* 18(3):196-207, April 2006, and Coughlin, J “invention vs. Innovation: Technology and the Future of Aging” *Aging Today* XXVII(2):3-4, March-April 2006.

¹⁶ Gross, J “Geriatrics Lags in an Age of High-Tech Medicine” *New York Times* 18 October 2006, p. A1

¹⁷ The importance of using technology to improve performance and reporting is summarized in an excellent overview article: Waters, RJ and J Eder-VanHook “Technology Essential to Effective Home Care Administration & Patient Care” *Caring* July 2006, pp. 10-17.

inevitable, and the long-term future of home health care is almost certain to be molded in the process.

Several medical specialty associations are positioning the **medical home** as a foundation for health reform. It is based on a belief that each patient should have a single primary care practitioner who coordinates the multiple resources of health and medical care, as summarized in the current position paper from the American College of Physicians (the association representing specialists in internal medicine):

“The advanced medical home acknowledges that the best quality of care is provided not in episodic, illness-oriented, complaint-based care—but through patient-centered, physician-guided, longitudinal care that encompasses and values both the art and science of medicine. Attributes of the advanced medical home include promotion of continuous health relationships through delivery of care a variety of care settings according to the needs of the patient and skills of the medical provider. Physicians are once again partners in coordinating a facilitating care to help patients navigate the complex and often confusing health care system by providing guidance, insight and advice in language that is informative and specific to patients’ needs.”

“In brief, the key practice-based components of the clinical model include encouraging patients to engage in the management of their own health (self-management) and providing them with resources and skills to obtain appropriate health care services; designing the delivery system to assure the provision of effective, efficient clinical care; embedding clinical decision support tools into daily practice; and using information technology to support patient education, patient care planning, coordination of care, and monitoring of performance. The system-level attributes of the clinical model include the use of community resources, partnerships, and policies to support the health system, and the organization of health care to create a culture of safe and high-quality care. These elements of the care model are central to the distinct advantages of a health care delivery system that supports the economic viability of practices structured to be a patient’s advanced medical home.¹⁸

In this model, the primary care practitioner effectively becomes part of the family (which, as noted above, is the defining difference between a house and a home). He or she works in the overall interests of the patient, not in the interests of any particular delivery setting. The patient’s house, a hospital, and all sites in between are encompassed in the delivery model, depending on the patient’s needs. The medical home model is conceptually and culturally quite different from the hospital-centered model of the 20th century.

The **hospital-at-home** movement derives from interest in clinical transformation, not health reform. It is being developed as a solution to the shortage of hospital beds; it is not positioned as a fundamental change in the policy and principles of health care delivery. As shown in this excerpt from a research article, the hospital-at-home started as an experiment to find medical conditions that could be treated appropriately at home when inpatient beds were not available:

¹⁸ American College of Physicians “The Advanced Medical Home: A Patient-Centered, Physician-Guided Model of Home Care Policy Monograph of the ACP; January 16, 2006, p. 3-4

Briefly, a patient requiring admission to the acute care hospital for a target illness was identified in an emergency department or ambulatory site and his or her eligibility status was determined. Nonstudy medical personnel, usually emergency department physicians, made the decision to hospitalize the patient. All patients who were offered but who declined hospital-at-home care were admitted to the acute care hospital.

After informed consent was obtained, the patient was transported home by ambulance. Patients were evaluated by the hospital-at-home physician either in the emergency department or shortly after arriving at home. Patients who required oxygen therapy were sent home with a portable oxygen apparatus pending delivery of home oxygen therapy. The hospital-at-home nurse met the ambulance at the patient's home. The patient had subsequent direct one-on-one nursing supervision for an initial period of at least 8 hours or 24 hours...

When direct nursing supervision was no longer required, the patient had intermittent nursing visits at least daily. The hospital-at-home physician made at least daily home visits and was available 24 hours a day for urgent or emergency visits. Nursing and other care components, such as durable medical equipment, oxygen therapy, skilled therapies, and pharmacy support, were provided by a partner Medicare-certified home health agency, and for some services, such as home radiology, support was provided by independent contractors. A Lifeline device was placed in the home of any patient who did not have a family member present. Diagnostic studies, such as electrocardiography and radiography; intravenous fluids, intravenous antimicrobial agents, and other medications; and oxygen and other respiratory therapies were provided at home. Illness-specific hospital-at-home care maps, clinical outcomes evaluations, and specific discharge criteria were developed and provided a pathway for care. The patient was followed by the same hospital-at-home physician until his or her condition was stable enough for discharge, at which time care reverted to the primary care physician.¹⁹

The report concluded that the hospital-at-home was “feasible, safe, and efficacious for certain older patients with selected acute medical illnesses who require acute hospital-level care.” Several other studies have reached similar conclusions,²⁰ and a three-year Medicare demonstration project is studying the model as a substitute for hospitalization

¹⁹ Leff, B *et al* “Hospital at Home: Feasibility and Outcomes if a Program to Provide Hospital-Level Care at Home for Acutely Ill Older Patients” *Annals of Internal Medicine* 2005;143:798-808, 6 December 2005.

²⁰ For additional information, see Phillips, CO *et al* “Comprehensive Discharge Planning with Postdischarge Support for Older Patients with Congestive Heart Failure” *Journal of the American Medical Association* 291(11):1358-1367, 17 March 2004; Naik, G “Portland Hospital Gives Acutely Ill A Homecare Option: To Free Up Valuable Beds, Care Is Brought to Patient, An Alternative for Elderly” *Wall Street Journal* April 19, 2006, page A1; and Shepperd, S “Hospital at Home: The Evidence is Not Compelling” *Annals of Internal Medicine* 143(11):840-841, 6 December 2005. Although the title of the last citation might imply a negative view on home care as an alternative to hospital care, the analysis addresses methodological problems inherent in early research on the concept. It is a call for more and better research as more home care is substituted for hospital care, not a rejection of the concept.

of the 5% of Medicare patients who incur 45% of the program's costs after admission to the hospital from the emergency department.²¹

The success of established programs in other countries lends strong support to the hospital-at-home movement. For example, France—designated by the World Health Organization as the #1 country for overall health system performance—has operated for more than 20 years a widely respected home-care program for patients with chronic respiratory disease that would generally be treated at a hospital in the United States.²² The French program is often used as an international benchmark of best practices because of its focus on personal services and quality of life.²³ Italy has also developed an excellent national program that uses telemedicine and related communications technologies to support state-of-the-art respiratory care in the home.²⁴ A hospital-at-home service in Israel, the Jerusalem Home Hospital program, has produced significant benefits in terms of outcomes, patient and staff satisfaction, and cost reductions.²⁵

CONCLUSION

Technological advances and new models of care are creating a promising realm of opportunities for the future of home care. At the same time, trends toward more extensive treatment in the home are reinforced by the rising costs of inpatient care, the limited supply of hospital beds, the growth of consumer involvement in health care, appearance of a “stay at home forever” mind set, acceptance of telemedicine, and active leadership by visionary clinicians and professional associations.

However, with the exception of some promising Medicare demonstration projects, the reimbursement system is not currently designed to promote medically appropriate, cost-effective shifts from inpatient and ambulatory care settings to the home. Concerted political action by consumers, caregivers, health systems, and purchasers will be needed to overcome the barriers sooner rather than later for widespread adoption of the emerging

²¹ Kieffman, Sandy “House call make trial comeback” *Contra Costa Times*, 29 December 2006; www.contracostatimes.com

²² Stuart, M and M Weinrich “Integrated Health System for Chronic Disease Management: Lessons Learned from France” *Chest* 125(2):695-703, February 2004.

²³ Goldberg, AI “Integrated System for Chronic Disease Management: Can We Apply Lessons Learned from France?” *Chest* 125(2):365-366, February 2004

²⁴ The evolution of this world-class model for treating chronic respiratory insufficiency (CRI) in the home is described in Dal Negro, RW and AI Goldberg (eds.) Home Long-Term Oxygen Treatment in Italy: The Additional Value of Telemedicine (Springer, 2005; springeronline.com; ISBN 88-470-0388-1). The book is particularly noteworthy for its detailed integration of the medical science and supportive technology of long-term oxygen treatment. This exceptional book provides a comprehensive guide for organizing and operating a home care program.

²⁵ Jacobs, J *et al* “Home Hospitalization: 15 Years of Experience” *Annals of Internal Medicine* 144(6):456, 21 March 2006

model of home health. However, creative and progressive providers can move forward now. Integrated high-tech home health care has passed the “proof of concept” stage.

IMPLICATIONS AND ACTIONS FOR BSHSI

1. Integration of information systems
 - a. Create capability to share data across inpatient and outpatient systems and between BSHSI systems and non-BSHSI systems (e.g., physicians, independent home health agencies)
 - b. Work with vendors to provide integrated, wireless products, data bases, and user-friendly capabilities to deliver care and produce reports
2. Creation of state-of-the-art interfaces to reduce paper, improve accuracy, lower costs, and enhance quality
 - a. Adopt bar-coding and document scanning technologies
 - b. Educate patients and family caregivers in selection and use of appropriate home care technologies
3. Development of virtual office model for home care personnel
 - a. Reduce travel times and eliminate need for office space since caregivers should be out in the community, not in the office;
 - b. Create policies to enable and recognize work outside traditional offices
4. Adoption of appropriate technology as substitute for labor
 - a. Assign high budget priority to labor-saving technologies consistent with clinical criteria
 - b. Participate in research and demonstration projects for new approaches to home care

RESOURCES

- American Academy of Home Care Physicians - <http://www.aahcp.org>
- National Association for Home Care and Hospice - <http://www.nahc.org>
- National Council on Aging - <http://www.ncoa.org/>
- Home Care Technology Association of America - <http://www.hctaa.org>
- Hospital at Home Project - <http://www.hospitalathome.org>
- Medical Automation - <http://medicalautomation.org>
- Center for Aging Services Technologies - <http://www.agingtech.org>
- National Association for Home Care and Hospice - <http://www.nahc.org/>
- U. of Va. Medical Automation Research Center - <http://marc.med.virginia.edu>
- Continua Health Alliance - www.continuaalliance.org
- HomeLink Medical Services – www.homelinkmedical.com
- MIT Age Lab - <http://web.mit.edu/agelab>
- Communications in Health Care Project - <http://www.chestnet.org>

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