Compendium of Candidate Technology Profiles

2008-2009

Prepared by the New England Healthcare Institute

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Acknowledgements

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As part of its eHealth Initiative, MTC has been working collaboratively with the New England Healthcare Institute (NEHI) on many areas of health care technology since 2003. The *FAST* Initiative implements a key recommendation contained in the MTC/NEHI October 2003 report, *Advanced Technologies to Lower Health Care Costs and Improve Quality*, which called for Massachusetts to establish a "trusted third party" that would demonstrate the costs, benefits and barriers involved in the implementation of the most promising technologies.

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Finally, the views expressed herein are solely those of the New England Healthcare Institute and not intended to represent those of our sponsors, members or advisors.

Executive Summary

The United States is the world leader in the development of innovative health care technologies, yet our health care system struggles to identify and adopt beneficial technologies in a timely manner. In 2005, the New England Healthcare Institute (NEHI), in partnership with the Massachusetts Technology Collaborative (MTC) and the Health Technology Center (HealthTech), created the Fast Adoption of Significant Technologies (*FAST*) initiative to address this health care technology adoption gap. **The goal of *FAST* is to identify and support the adoption of medical technologies that are not widely disseminated despite evidence of their potential to improve patient outcomes *and* lower overall healthcare costs**.

In this report, NEHI presents the findings of the 2008 technology scan process. This year's scan focused on telemedicine technologies that address chronic disease. Chronic disease is of particular concern because of the growing prevalence of illnesses such as diabetes and heart disease and the mounting costs these conditions generate in the health care system. Currently, 133 million Americans live with at least one chronic disease and their care accounts for more than 75 percent of the nation's $2 trillion medical care costs.

During this years' scan process, the *FAST* team reviewed over 100 health care technologies which were narrowed to the eleven most promising candidates. For each of these eleven candidates, NEHI conducted in-depth literature reviews and expert interviews to develop the technology profiles that are presented in this interim report.

Each of the eleven promising technologies matches well with existing and planned NEHI initiatives. For example, NEHI's ongoing project examining non-urgent use of Emergency Departments has identified a number of potential strategies to reduce unnecessary ED visits, including the use of telemedicine technologies. Several of this year's profiled technologies have direct applicability to ED overuse, including Nursing Home Physician eVisit, Web Based eVisit and Tele-Wound Care. NEHI's work on redesigning primary care also has parallels to the candidate technologies; Web Based eVisit, School Based Telemedicine, and Interactive Health Support Platform are technologies which could support new models of primary care, improving access to quality care while reducing costs.

The selection of the two to four most promising technologies will occur at the formal Steering Group meeting in early 2009.Once the final selections have been made, Detailed Technology Analyses will be developed, followed by the convening of expert Working Groups to examine the evidence base for the technologies and determine the most appropriate actions to promote their adoption, including demonstration projects and policy activities.

Introduction to FAST

New medical technologies are tools that have the potential to both reduce costs and improve outcomes; yet they also contribute to increases in U.S. health care costs. The challenge is to identify and foster the appropriate use of valuable and cost-saving technologies by diverting our limited health care resources to high-value innovations that safe lives and safe money.

The Fast Adoption of Significant Technologies (*FAST*) Initiative is a project of the New England Healthcare Institute (NEHI), in partnership with the Massachusetts Technology Collaborative (MTC) and the Health Technology Center (HealthTech). *FAST* is designed to identify and advance medical technologies that are not widely used despite evidence of their potential to both improve patient outcomes and lower total health care costs.

The *FAST* process provides a vehicle for payers, providers and other parties in the heath care system to:

- Select emerging technologies with the potential to improve patient outcomes and produce cost savings;
- Identify the highest value application of the technologies;
- Define the barriers to adoption in large populations; and
- Accelerate the pace of broader dissemination.

Technologies are identified and reviewed based on their potential to meet the following *FAST* criteria:

- There is a substantial patient population that could benefit from the technology;
- The technology significantly improves patient outcomes;
- The technology reduces overall costs of care;
- There is low market penetration in high-value uses;
- There are barriers to broader dissemination that can be addressed.

The FAST Process

The *FAST* initiative is built around a rigorous and replicable process designed to identify, assess and aid the adoption of transformational technologies in health care.

Broadly, the *FAST* initiative process is comprised of three steps:

- Step 1: SCAN
- Step 2: SELECT
- Step 3: ACT

Step 1: Scan

NEHI staff scan a variety of sources, including existing reviews from several technology assessment organizations, to identify a set of promising technologies. The source technology assessment organizations include HealthTech, the California Technology Assessment Forum (CTAF), the National Institute for Health and Clinical Excellence (NICE) in the United Kingdom, the Blue Cross Blue Shield Association Technology Evaluation Center (TEC), and the ECRI Institute, as well as other sources.

The result of this scan is a set of promising technologies for which additional research in the form of literature reviews and expert interviews are conducted to complete a *FAST* technology profile. The profiled technologies are then presented to the *FAST* Steering Group for discussion and scoring. (Full details of the scoring criteria, including changes for this year's scan, are included in Appendix I.) Each of the technologies also receives a NEHI staff score which counts as one score in the Steering Group collective scores.

Step 2: Select

The *FAST* Steering Group is a national panel of experts in technology assessment and telemedicine. Full membership details are provided in Appendix II. In December 2008, the eleven technology profiles, along with the scoring criteria, were distributed to the Steering Group members for their review. Group members were asked to pre-score the technologies based on the ability of each to improve the quality and reduce the cost of care and the likelihood that NEHI can affect further adoption of the technology. These pre-scores are provided later in this report.

In early 2009 the profiled technologies will be presented in a webinar by NEHI staff to the Steering Group, who will discuss and then score the technologies a second time. The final Steering Group scores, along with NEHI staff and partner input, are used to select technologies which receive further detailed evaluation. This second analysis focuses on developing a deeper understanding of the technologies' potential and barriers though additional research and expert interviews.

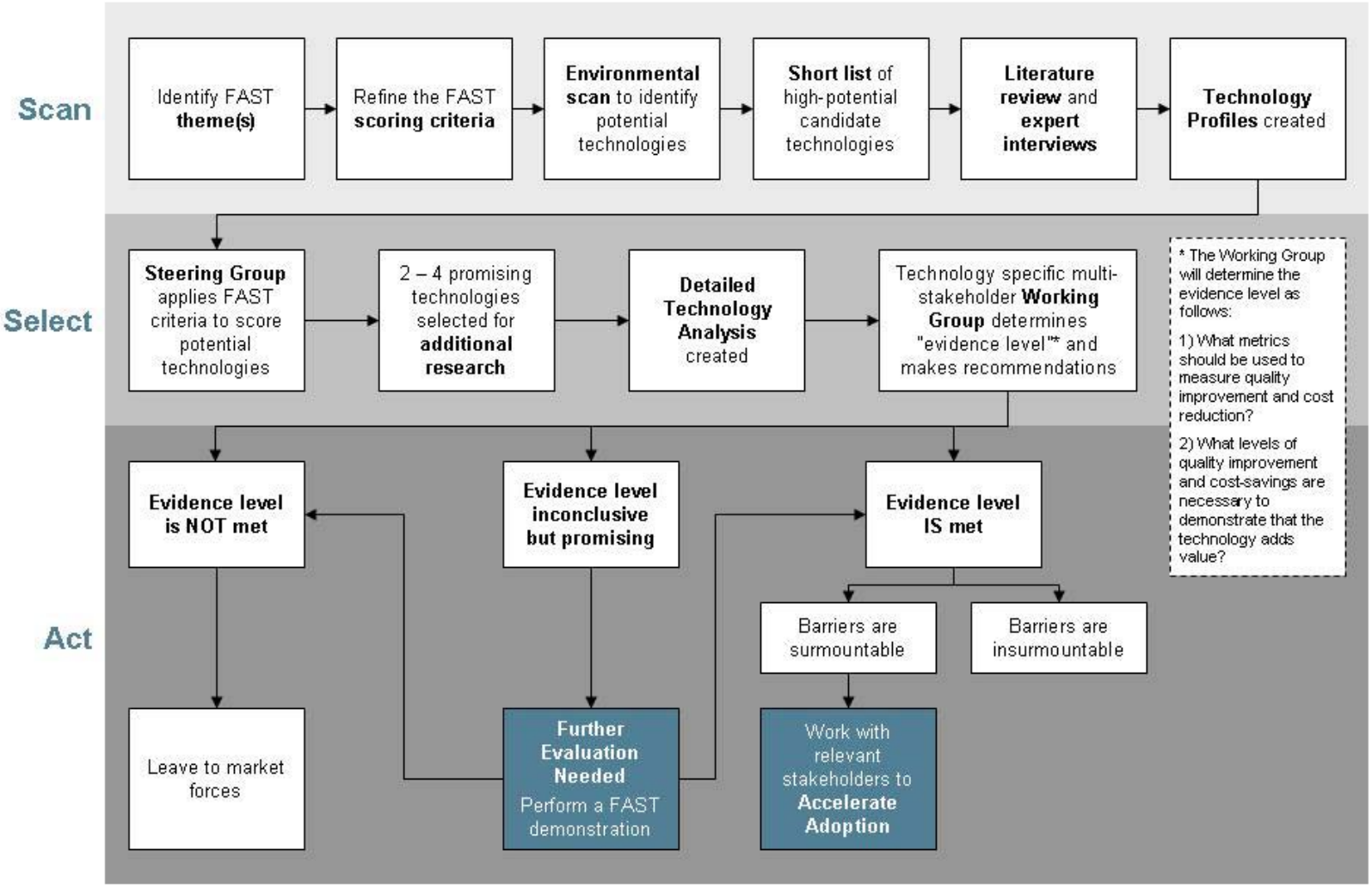
Step 3: Act

Upon completion of the detailed analysis, NEHI and its partners determine if there is sufficient evidence to support the value of the technology and whether or not the barriers are surmountable. If the technology is determined to have strong potential,

NEHI targets the barriers through demonstration projects, policy development, and multi-stakeholder efforts to foster coverage and reimbursement by payers, adoption by providers, and access for patients.

A graphical depiction of the *FAST* process is shown on the next page.

Figure I: *FAST* Process Diagram



2008-2009 Themes: Telemedicine and Chronic Disease

In a first for the *FAST* initiative, this year's scan focused on a specific themes: telemedicine technologies and treatments that address chronic diseases. Each was selected because of their relevance to current conditions and issues with the U.S. health care system.

Telemedicine

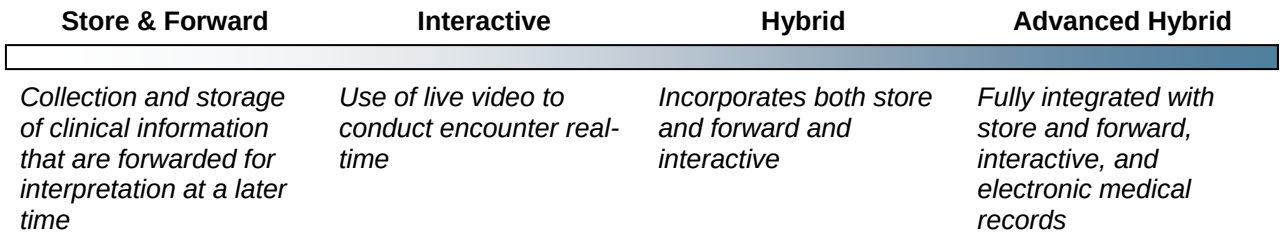
Unlike past scans which focused broadly on many (and varied) medical technologies that decreased cost and increased quality of care, this year's scan focused on technologies that do so through the use of telemedicine. The selection of a theme was driven by a desire to increase our focus on a particular set of innovative technologies which address a single, pressing concern to the U.S. health care system.

For the purposes of the scan, *FAST* used the Institute of Medicine's (IOM) definition of telemedicine[1]:

> *"The use of electronic information and communication technologies to provide and support health care interaction when distance separates the participants."*

The IOM's definition of telemedicine is not intended to indicate a homogeneous set of technologies; in reality there is a continuum of telemedicine technologies and approaches. Most analysts' descriptions of the continuum focus on the "bandwidth" or the capacity for data transfer of an electronic communications system. A bandwidth based telemedicine continuum is presented below.

Figure II: Telemedicine Continuum



For purposes of this scan, technology bandwidth, application, and setting will not be used to narrow the scope, rather they will be considered for post scan classification.

Chronic Disease

[1] Institute of Medicine. Telemedicine: A Guide to Assessing Telecommunications in Health Care. Field MJ, ed. Washington D.C.: National Academy Press, 1996.

In previous scans, technologies that addressed any medical condition were considered. For 2008-2009, the focus has been narrowed to telemedicine technologies that address chronic diseases.

Chronic diseases, including cardiovascular conditions, diabetes, chronic respiratory diseases, and certain cancers are among the most costly, deadly and debilitating medical conditions facing Americans. According to the Centers for Disease Control and Prevention[2]:

- In 2005, 133 million people, almost half of all Americans, lived with at least one chronic condition.
- Chronic diseases account for 70 percent of all deaths in the United States.
- The medical care costs of people with chronic diseases account for more than 75 percent of the nation's $2 trillion medical care costs.
- Chronic diseases account for one-third of the years of potential life lost before age 65.

Despite their prevalence and impact, chronic diseases can be, in large measure, managed and their impact mitigated though prevention, early detection, and management. This year's *FAST* scan endeavors to identify telemedicine technologies that assist in the care of chronic conditions and consequently reduce the burden of these diseases on the U.S. health care system.

[2] National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control, "Chronic Disease Overview" http://www.cdc.gov/nccdphp/overview.htm. Accessed 12/01/08.

Scoring Criteria

As in the past, identified technologies were scored on five criteria. For the 2008-2009 scan, the criteria have been modified to achieve greater coherence with the *FAST* goals of clinical benefit, cost savings, system relevance, and surmountable barriers.

The 2008-2009 *FAST* scoring criteria are:

- **User Satisfaction:** Patient and provider satisfaction with the technology and its usability.
- **Clinical Outcomes:** Clinical outcomes, including patient functional status and disease burden, in comparison to those outcomes achieved by the current standard of care.
- **Financial Analysis:** Total net value, or return on investment, to the health care system of using the technology for an episode of care.
- **Policy Relevance:** The relevance of this technology and/or the condition(s) it treats to fundamental and emerging concerns in the health care system. Topics of high policy relevance are likely to receive substantial media coverage and consideration by state or national policymakers.
- **Potential for Impact:** The ability for NEHI, its members and partners to impact positive change (i.e. expanded use of the technology) in a reasonable time frame.

The possible score for each criteria ranges from 0-3 (0 is lowest, 3 is highest), yielding a cumulative score from 0-15 (15 being a perfect score). A more detailed breakdown of the scoring criteria is included as Appendix I.

Technology Profiles

The 2008-2009 *FAST* scan has identified and profiled 11 telemedicine technologies which address the health care needs of chronic disease populations. These telemedicine technologies can be grouped into three categories:

- Care management and monitoring;
- Diagnostics; and
- Remote health services.

Care Management and Monitoring	Diagnostics	Remote Health Services
Medication Adherence Management	Tele-Stroke	Nursing Home Physician eVisit
Cell Phone Compatible Remote Glucose Monitoring	Teleophthalmology for Diabetic Retinopathy	Interactive Health Support Platforms
Tele-Wound Care		Web-based eVisit
Telemedicine Enabled Home Hemodialysis		School-Based Telemedicine
		Telepsychiatry

Profiles of each telemedicine technology follow. The scores included in each technology profile were generated by the *FAST* team and reflect their views on the technologies.

Medication Adherence Management

OVERVIEW

Medication use, both prescription and over-the-counter, is at an all-time high in the U.S. and continues to grow. At the same time, patient adherence to medication use remains a major problem with patients missing and skipping doses, failing to complete regimens and other non-compliant behavior. NEHI's study on "Waste" finds that under-use of drugs and other therapies to manage chronic conditions leading to acute conditions and hospitalization contributes to $5.5 billion dollars of waste annually. The root causes of non-adherence are complex and require varied solutions; patients' inability to afford medications is a key driver of non-adherence which can not be addresses through technology.

Technology to promote medication adherence ranges from very simple to very complex; different solutions are appropriate for different patient needs. For purposes of this review, only adherence technologies that include the ability to communicate data remotely to a health care professional will be considered. Within this category, most technologies contain a physical container to hold the medication(s), an electronic system to remind patients of doses and to record results, and a communications system to transmit the resulting data to a health care provider(s), caregivers, and other interested parties.

The GloCap system is the simplest technology; it promotes medication adherence by providing a reminder cap with can be fixed to any standard prescription bottle. The PillStation has the ability to monitor if the patient has taken their medication, if they are double dosing, or missing pills. In the INRange system, the medications are loaded into the system in blister packs and dispensed in appropriate quantities to the patient at designated times.[1]

TARGET POPULATION

- 3.8 billion prescriptions were purchased in the United States in 2007.[2]
- The average number of retail prescriptions per capita was 12.6 in 2007, up from 8.9 in 1997.[3]
- The portion of the population with a prescription drug expense in 2005 was 59 percent for those under age 65, and 91 percent for those 65 and older.[4]
- Two in three patients leave the doctor's office with a prescription.[5]
- In 2006, on average, 29 pecent of adults or 66 million Americans were taking five or more medications. The number of adults on multiple medications had increased steadily since 2000. [6]
- In 2007, 51 percent of insured Americans were taking prescription drugs to treat at least one chronic condition.[7]

ADOPTION & BARRIERS

Use:

- Remote medication monitors are not currently reimbursed by payers, including CMS and large private insurers. Products are only available through pilot programs, clinical trials, and direct consumer purchase.

Barriers to Adoption:

- "Current methods of improving adherence for chronic health problems are mostly complex and not very effective, so that the full benefits of treatment cannot be realized."[8]
- Some products have ease of use issues: EMMA requires specialized blister packs of medication, not standard bottles.
- Limited Outcomes Data: Small sample sizes (10-50 patients per study) limits applicability of outcomes data (adherence rate increases).
- Cost of Devices and Service:
  - EMMA - $200 per month per unit to lease[9]
  - PillStation: $250-300 to purchase a PillStation plus a $60/month monitoring charge
- Costs are not currently directly reimbursed.
  - GlowCaps Connect business plan calls for large chain pharmacies to pay for devices, provide them free to customers with the expectation of more revenue from refills and visits to pharmacy driven by coupons.[10]

USER SATISFACTION

- Data on patient satisfaction for telemedicine medication adherence strategies is very limited due to low dissemination and lack of published trials.

CLINICAL OUTCOMES

- Deaths from medication mistakes at home increased from 1,132 deaths in 1983 to 12,426 in 2004, a sevenfold increase (adjusted for population growth).[11]
- In a national survey of adults, 49 percent said they had forgotten to take a prescribed medication and 24 percent had taken less than the recommended dosage.[12]
- Interventions that promote adherence can help close the gap between the clinical efficacy of interventions and their effectiveness when used in the field, and thus increase the overall effectiveness and efficiency of the health system.[13]
- High medication adherence (80 percent+) resulted in a statistically significant reduction in hospitalization compared to lower adherence rates for patients with diabetes, hypertension, hypercholesterolemia, and CHF.[14]
- Average medication adherence rates increased from a baseline of 40 percent to over 92 percent in a small sample rural diabetes trial using Med-eMonitor.[15]

FINANCIAL ANALYSIS

- Based on a meta-analysis of more than 500 studies spanning half a century, Dimatteo found an average non-adherence rate of 24.8 percent.[16]
- Average estimated return-on-investment for a 20 percent increase in medication adherence (not limited to telemedicine interventions):
  - Diabetes: 7.1 to 1; Hypertension: 4.0 to 1; Hypercholesterolemia: 5.1 to 1 [17]
- No published cost savings data from telemedicine medication adherence studies.

POLICY RELEVANCE

- Failure to adhere to prescribed medication is considered a primary barrier to achieving clinical outcome goals in major chronic diseases.
- Increasing the effectiveness of adherence interventions might have a far greater impact on the health of the population than any improvement in specific medical treatments.[18]

POTENTIAL IMPACT

- Advanced technology approaches to improve medication adherence are not yet sufficiently mature to estimate clinical benefits and return on investment.
- Usability and design issues are a key barrier to use and are beyond the capacity of *FAST* to address.

FAST STAFF RECOMMENDATION

The failure of chronic disease patients to adhere to prescribed medications is widely considered to be a pressing health concern, but telemedicine technologies that address medication adherence are not yet mature in approach, design, and use. Given the paucity of clinical trial data, it is difficult to predict the potential benefits of high-technology approaches to medication adherence problems versus traditional behavioral modification approaches. More effectiveness studies based on real-world use, and consequently time, is required to determine the potential usefulness of telemedicine approaches to addressing this critical health issue.

Medication Adherence Management

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**1**	**Low**
Clinical Outcomes	**2**	**Low**
Financial Analysis	**2**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**3**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**9**	

Manufacturer(s): Vitality [GloCaps Connect] approval 6/06; InforMedix [Med-eMonitor] released 7/07; INRange Systems [EMMA]; eMedonline [Leap of Faith Technologies]; SentiCare [PillStation]

Cell Phone Monitored Remote Glucose Management

OVERVIEW

Poor control of blood glucose levels in people with Type 1 or Type 2 Diabetes is linked to cardiovascular disease and other complications.[1] Between 1999 and 2004, only thirty percent of adults age 40 and over living with diabetes had a hemoglobin A1c level that was optimally controlled.[2] Improving blood glucose control may help prevent people with diabetes from developing heart and blood vessel disease, blindness, nerve damage, heart disease, stroke, and kidney failure. [3] Cell Phone Compatible Remote Glucose Monitoring may be able to promote control of HbA1c.

There are two types of Cell Phone Monitored Remote Glucose Management technologies. The first includes a glucose meter that can be fastened to regular cell phones for easy monitoring of glucose levels. The device is used the same as other glucose meters. Software allows the cell phone to interface with the glucose meter to test and read the glucose level. The test results are stored in the cell phone and can also be sent to an online medical management center. Some systems also provide disease management centers which analyze the test results and provide professional medical management to the subscriber (Confidant and GlucoPhone).

The second type of monitoring system is not attached to the cell phone. However, the software allows the cell phone to connect to a signal given off by Bluetooth glucose meters. The cell phone reads and inputs information from the meter. The software provides real time feedback on what the user should eat or ways to stabilize their blood glucose level. This information can also be sent to a management center which logs the information. After six weeks, the "log" of the patient's readings is sent to the patient's care provider.

TARGET POPULATION

- 23.6 million people—7.8 percent of the population—have diabetes; 90 percent of those with diabetes have Type 2 diabetes.
- 1.6 million new cases of diabetes were diagnosed in people aged 20 years or older in 2007 alone.

ADOPTION & BARRIERS

Barriers to Adoption:

- Direct costs are unknown.
- Direct and indirect savings are unknown.
- Both manufacturers' devices have been approved for distribution by the FDA, but no specific launch dates have been articulated.
- The U.S. cell phone market and network is highly fragmented and cannot support the universal use of this technology.

USER SATISFACTION

- In a study of adolescent users, participants found the cell phone attached glucose monitor easy to use and useful in their diabetes management.[4]

CLINICAL OUTCOMES

- One study on Type 1 Diabetics found the use of cell phones to monitor blood glucose had a patient adherence rate of 85 percent and an acceptance rate of 100 percent. Data transmission via mobile phone was successful on the first attempt in 96.5 percent of cases. Thus, using the cell phone as patient terminal seems to provide an easy-to-use solution for patient-centered data acquisition in the management of Diabetes Type 1.[5]
- A Korean study found that type 2 Diabetic patients who used cell phone glucose monitor improved and maintained glycemic control.[6]

FINANCIAL ANALYSIS

- The cost of treating the complications of diabetes averages $10,000 per patient per year, with patients paying nearly $1,600 of that out of their own pockets.[7]
- Total direct and indirect costs of diabetes are $174 billion per year
- Cost of device and net value is not available in the literature.

POLICY RELEVANCE

- Diabetes is becoming increasingly prevalent in the United States. The number of patients newly diagnosed with diabetes tripled from 493,000 in 1980 to 1.4 million in 2005.
- A study conducted by the World Health Organization estimated as many as 30.3 million Americans will have diabetes in 2030, if current trends continue.
- Remote monitoring is an emergent interest in the health care community.

POTENTIAL IMPACT

- Substantial barriers in the U.S. cell phone industry limit NEHI's potential for impact for this technology. At present, only certain providers and models are compatible with remote cell phone glucose monitoring equipment. While this may change in the future if the technology sees wide-spread adoption, it is not likely to occur in the short-term. However, the cellular communication platform presents an interesting opportunity for the development of future remote physiological monitoring technologies of becoming more portable and convenient for the increasing technology savvy population.

FAST STAFF RECOMMENDATION

Cell Phone Monitored Remote Glucose Management provides an innovative solution to the problem of controlling blood glucose levels. Yet, given the current fragmentation in the U.S. cell phone market, this technology is only available through certain cell phone providers and only for particular cell phone models; it cannot be used universally on any cell phone. Cell phone technology lacks the necessary maturity for it to flourish in the present market. Significant data suggesting any increase health quality provided by the cell phone monitor or any notable reduction in costs is also insufficient.

Cell Phone Monitored Remote Glucose Management

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**1**	**Low**
Clinical Outcomes	**2**	**Med**
Financial Analysis	**1**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**0**	
***FAST* PROFILE SCORE (Max = 15)**	**6**	

Manufacturer(s): GlucoPhone

Tele-Wound Care

OVERVIEW

Chronic wounds, also known as ulcers, are wounds that have a biological or physiological reason for not healing. Chronic wounds include venous ulcers, diabetic ulcers and pressure ulcers (bed sores). In addition, many post-surgical patients have wounds which require careful management. Traditionally, chronic wound care is provided by generalist nurses in home- or community-based settings, with periodic in-person support from specialist in would care. While 25 percent of U.S. home care referrals are for wounds, less then 0.2 percent of registered nurses are wound-care certified.

Tele-wound care uses digital imaging, utilizing a specialized or consumer digital camera or cameraphone, and an internet-based system to allow images and other clinical information to be shared with a remotely located wound care specialist (nurse or physician). Some systems (Pixalere) also provide case management and decision support tools to assist front-line caregivers.

TARGET POPULATION

- An estimated 1.3 to 3 million U.S. individuals are believed to have pressure ulcers. As many as 10 percent to 15 percent of the 20 million individuals with diabetes are at risk of developing diabetic ulcers. Many more have had venous ulcers or wounds that result from arterial disease.[1]
- About 25-50 percent of wound care patients are appropriate for tele-wound treatment.[2]

ADOPTION & BARRIERS

Use:

- "Currently, only a few pilot programs are in existence. Tele-wound care has yet to achieve the popularity and recognition of its other telemedicine predecessors among members of the health care industry and public alike."[3]

Barriers to Adoption:

- Traditional digital cameras require uploading at a central office for later review; the resulting time lag reduces the applicability of recommendations.
- Current mainstream cell phone cameras do hot have sufficiently high resolution for clinically acceptable images. Advanced cell phones with high resolution cameras are expensive ($250+) while existing home health agency cell phones are often acquired for no cost.
- Need to integrate tele-wound care system with home health provider IT systems (EMR)
- Costs of tele-wound care are borne by home health providers, while savings from reduce hospitalizations accrue to payers.

USER SATISFACTION

- Exit surveys indicated that 98.2 percent of patients were satisfied with tele-wound care.[4]

CLINICAL OUTCOMES

- Emergency department visits among established tele-wound patients averaged of 0.45 visits compared to 2.82 for non-tele-wound patients during the two-year study of nineteen patients.[5]

FINANCIAL ANALYSIS

- Chronic wounds costs in the United States range from $20 billion to $25 billion annually.[6]
- The average U.S. hospital annually incurs between $400,000 and $700,000 in direct costs to treat pressure ulcers, a substantial portion of which is not reimbursable.[7]
- Reduction in face-to-face wound care consultations with physicians resulted in 46 percent decrease in transportation costs.[8]
- Total direct costs for established tele-wound patients were 56 percent lower than non-tele-wound patients ($26,526 vs. $60,527).[9]

POLICY RELEVANCE

- Shifting care of chronically ill and elderly patients to home care settings is key to many health care reform strategies
- Prevention of hospitalization and reduction in emergency department usage
- Pressure ulcers are “never events” in hospitals

POTENTIAL IMPACT

- Opportunity to partner with Partners Home Health which has previously piloted Tele-Wound technology
- Key barrier of cell phone cost could be offset in pilot by partnership with manufacturer, inclusion of broader study of benefits of real-time broadband connected home health workers

FAST STAFF RECOMMENDATION

Tele-wound care appears to have substantial promise in improving outcomes and financial savings, though conclusions are hampered by small sample sizes in clinical trials. A moderate sized home care pilot program in partnership with a cell phone manufacturer and/or service provider could improve the quality of evidence for tele-wound care and make a broader business case for the benefits of a “connected” home health workforce.

Tele-Wound Care

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Low**
Clinical Outcomes	**3**	**Low**
Financial Analysis	**3**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**11**	

Manufacturer(s): Pixalere [Pixalere Wound Management Solution], Aranz Medical Ltd. [Aranz Medical Silhouette] approval 6/29/2007

FAST
Fast Adoption of Significant Technologies

Technology Profile

Telemedicine-Enabled Home Hemodialysis

OVERVIEW

Hemodialysis for renal failure is traditionally performed at a specialized center 3 times a week for 3-4 hours per treatment. In contrast, home hemodialysis, performed 6-7 times a week, has been shown in small studies to improve medical outcomes, enhance patient well-being and reduce overall system costs – yet its use is extremely low in the United States.

Telemedicine may enable increased use of home hemodialysis by supporting patients in conducting their treatment at home, providing them with expert guidance and a "safety net" of assistance in the event of a problem. Less intensive projects monitor data from the dialysis machine while advanced versions collect physiologic data from the patient and provide a real-time audio/visual link between the patient and remote support staff. In addition, telemedicine may be beneficial in allowing nephrologists to remotely consult with patients in dialysis centers, primary care settings and even in the home.

TARGET POPULATION

- Patients with End Stage Renal Disease (ESRD): 2005 - 484,995; 2020 (est.) - 784,613
- ESRD patients on hemodialysis: 2005 – 327,754; 2020 (est.) - 533,800[1]
- Approximately 15 to 30 percent of hemodialysis patients may be appropriate for treatment at home.[2]

ADOPTION & BARRIERS

Use:

- 2,455 patients use home hemodialysis in the U.S.; 0.7 percent of total patients receiving hemodialysis in all settings[2006][3]
  - Rise in diabetes and hypertension will likely lead to an increase in hemodialysis
- Survey of nephrologists found that home hemodialysis is considered the most underused dialysis modality.[4]
- Two known programs use telemedicine/telemonitoring in home hemodialysis
  - University of Toronto/Bell Labs: dialysis machine monitoring plus advanced telemonitoring (RPM, webcam)
  - NxStage pilot: remote monitoring of dialysis machine parameters

Barriers to Adoption:

- Providers: Limited awareness and lack of reimbursement for home dialysis providers
  - Medicare reimbursement not sufficient to cover costs of extra (>3 per week) hemodialysis treatments; cost accrues to dialysis provider while cost savings from reduced hospitalizations are realized by insurers.
  - Medicare and most private payers do not pay for "Paid dialysis aides to help with home dialysis"; Industry believes that this would preclude reimbursement for remote monitoring staff
  - Complex financial incentive and professional relationship structure of dialysis care incent in-center dialysis over other modalities
  - Many large nephrology practice groups have financial stake or direct professional affiliation (medical director) with dialysis clinics.
  - Limited physician awareness: 50 percent of NxStage patents are associated with less than 5 percent of practicing nephrologists.[5]
- Patients: Concern with "going it alone"
  - Top reasons why ESRD patients do not choose self-care dialysis modality: #2 "Patient should not be unsupervised" [53 percent] and #3 "Lack of self-efficacy in performing self-care" [50 percent]
  - Labeling requirements that partner/helper is present: NxStage's website "A patient should not dialyze alone, regardless of whether they are 'trained and qualified.'"

USER SATISFACTION

- Anecdotal (small pilot study) evidence of positive patient and family member response to home hemodialysis.[6]
- When offered, patients prefer the option of home hemodialysis to in-center treatment.[7]

CLINICAL OUTCOMES

- Home hemodialysis adjusted (adjustments for age and gender) standardized mortality ratio (SMR) of 0.495, mortality is 50 percent lower than expected ($p<0.0001$) and this reduction was consistent and significant across gender and across all age groupings with significant patient representation[8]
- Survival of patients utilizing short daily home hemodialysis was similar to that of age-matched recipients of deceased donor renal transplants.[9]
- 34 percent of NxStage home hemodialysis users work for pay, compared with 7 percent of all dialysis patients.[10]

FINANCIAL ANALYSIS

- Total Medicare expenditures for hemodialysis: $17 billion; per patient per year: $71,889 [2006][11]
- Hospital admissions reduced from 1.2 to 0.56 admissions per patient per year with daily home hemodialysis.[12]
- Kaiser Permanente statistics suggest a reduced need for hospitalization in home dialysis patients, "potentially saving $10-20,000 in annual health care costs per patient."[13]
- A 2007 analysis comparing home hemodialysis with dialysis at hospitals and clinics, reported that home hemodialysis costs between $34,000 and $37,000 annually, while in-center dialysis costs $59,000 and $100,000 per year[14]

POLICY RELEVANCE

- Treatment of ESRD is paid for largely by Medicare; costs as well as direct (hemodialysis) and indirect (other health care expenses) savings would accrue to a single payer. Medicare ESRD Spending: $23 billion or 6.4 percent of total [2006][15]
- The ESRD coordination period, where private payers and Medicaid are responsible for coverage prior to Medicare coverage, lasts 30 months. Monthly inpatient/outpatient expenditures for patients on hemodialysis who are covered by an employer group health plan (EGHP), for example, are nearly twice those for patients with Medicare as their primary payor, at $8,340 versus $4,300.[16]
- Rise in diabetes and hypertension will likely lead to an increase in hemodialysis use

POTENTIAL IMPACT

- Home hemodialysis barriers (reimbursement, physician awareness, and financial incentive) need to be resolved before considering the barriers of adopting the telemonitoring component; however, home hemodialysis does not fit the telemedicine theme of this year's *FAST* selection. Further investigation could be addressed through other NEHI initiatives.

FAST STAFF RECOMMENDATION

Increased use of home hemodialysis, including supporting telemedicine technology elements, presents a substantial opportunity to improve outcomes and reduce costs for many patients suffering from ESRD. However, the barriers to this shift are considerable and will likely not be solved by technology approaches alone. The further development of telemedicine enabled home hemodialysis, in conjunction with policy action to reduce reimbursement and structural barriers to home hemodialysis use, offers the best opportunity to further the adoption of this treatment modality.

Telemedicine-Enabled Home Hemodialysis

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**3**	**Low**
Clinical Outcomes	**3**	**Med**
Financial Analysis	**3**	**Med**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**2**	
***FAST* PROFILE SCORE (Max = 15)**	**13**	

Manufacturer(s): NxStage Medical, Inc. [System One] Approval: June 29, 2005; Fresenius Medical Care [2008K at Home] Approval: April 16, 2000; B. Braun Medical Inc. [Dialog+]

Tele-Stroke

OVERVIEW

Studies have shown that stroke diagnosis and intervention are highly time sensitive and should be done by certified neurologists. Interventions, such as tPA and clot retriever procedures need to be administered within a three hour window; however, tPA can be harmful when administered to misdiagnosed stroke patient. Many people do not live close enough to hospitals with qualified specialists 24/7 to receive specialist care. Tele-stroke technology makes specialists available to remote locations and is an alternative to having an on-call or staffed hospital specialist.

Tele-stroke is a computer software, telephone/video conferencing platform and data compression for CT scan transmission system that enables access to a neurological specialist remotely. It can be used not only to determine if a patient is a candidate for tPA but also to rule out stroke as the cause of exhibited symptoms.

TARGET POPULATION

- Each year about 780,000 people experience a new or recurrent stroke. Stroke accounted for approximately 1 of every 16 deaths in the United States in 2004 (150,074 deaths).[1]
- The mean per stoke patient lifetime cost of ischemic stroke in the United States is estimated at $140,048. This includes inpatient care, rehabilitation, and follow-up care necessary for lasting deficits.[2]
- While comprehensive screening by a specialist can be used for all stroke patients, tPA is appropriate for 5 to 10 percent of stroke patients.

ADOPTION & BARRIERS

Use:

- Partners Tele-Stroke Program: 13 hospitals in MA and VT.
- REACH: 68 hospitals in CA, FL, GA, NY, TN, SC and WY.
- Brain Saving Technology: 50 hospitals in MA, NJ, CA, TX, VA, FL

Barriers to Adoption

- High capital costs and monthly maintenance fee; without convincing ROI, community hospitals have struggled to justify the expenditure;
- Lack of coverage and reimbursement by most plans for neurologist consultations by telemedicine (e.g. Mass Medicare will cover only for patient in rural areas);
- Literature identifies scheduling difficulties regarding maintaining 24/7 specialist coverage; not yet confirmed by providers or tele-stroke companies;
- Literature identifies lack of clinical standards for telemedicine care for stroke; not yet confirmed by providers or tele-stroke companies
- Uncertain liability and malpractice insurance coverage for remote neurologist specialist and on-site clinicians acting on specialist advice;
- Uncertainty related to licensure of remote neurologist specialist practicing across state lines.

USER SATISFACTION

- Patients considered the tele-stoke consultation “as good as face-to-face” 86 percent of the time.
- In one study, 100 percent of physicians (both stroke specialist neurologists and emergency physicians) believed the tele-stoke system improved patient care.

CLINICAL OUTCOMES

- An average 75-year-old patient given tPA after stroke can expect 3.357 quality-adjusted life years (QALY) after stroke compared to 3.225 QALYs with standard treatment; this difference amounts to 48 days.[3] A more recent study continued to show improved outcomes with the administration of tPA.[4]
- The Tele-stroke "door-to-needle" time was 106 (± 22) minutes. While this is lengthy compared with recommended targets, it is consistent with the actual treatment times of many community and academic facilities. Tele stroke door-to-needle time could likely be lowered with focused efforts.[5]

FINANCIAL ANALYSIS

- System Cost:
  - $25,000 to $40,000 initial set up fee, and;
  - Monthly service fee based on number of beds, and;
  - Per consultation fee
- Incentive for hospital = $11,000-$14,000 reimbursement per TIA stroke admission minus $4,000-$5,000 cost per admission.
- Neurologists earnings are similar in command center setting compared to traditional hospital practice
- Tele-stroke is less expensive than hiring additional on-site neurologists

POLICY RELEVANCE

- The prevalence of stroke and its risk factors are on the rise.
- Appropriate administration of tPA can mitigate a feared outcome (permanent disability) of a much feared medical condition.
- Enhanced stroke care through stroke center certification is a likely policy issue for many states in the next few years; tele-stroke is key to widespread stroke center certification efforts.

POTENTIAL IMPACT

- Massachusetts is a national leader in tele-stroke care, spurred on by state regulation of Stroke Centers and the presence of two large tele-stroke care providers (Partners TeleStroke Center and Brain Saving Technology)
- Primary barriers to uptake are modifiable policy issues (i.e. stroke center regulation) and awareness in other states.

FAST STAFF RECOMMENDATION

Tele-stroke care is a mature technology which addresses a treatment gap in a condition with substantial morbidity, mortality, and cost. Data on quality and value are positive and evidence is relatively strong. Massachusetts, in particular, has been a leader in the use of public policy to drive adoption of tele-stroke care. Expansion of this technology will require policy action to increase state and national certification of stroke centers, with telemedicine as an option for the provision of key services in underserved areas.

Tele-Stroke

FAST Criteria	Score (0-3)	Strength of Evidence
Patient Satisfaction	**3**	**Med**
Clinical Outcomes	**3**	**High**
Financial Analysis	**3**	**High**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**3**	
Potential for Impact	**3**	
***FAST* PROFILE SCORE (Max = 15)**	**15**	

Manufacturer(s): TeleStroke Network [Mass General Hospital/Partner's Health]; *REACH* [Medical College of Ga., Dept of Neurology]; Stroke Respond [InTouchTechnologies Inc./Santa Barbara CA]; Brain Saving Technologies (aka Specialists on Call)

Teleophthalmology for Diabetic Retinopathy

OVERVIEW

Diabetic Retinopathy is typically asymptomatic in its early stages. Its asymptomatic nature makes it the leading cause of new cases of blindness among adults 20–74 years of age, but there are treatments available to slow the progression of diabetic retinopathy. In order for the treatments to be effective, patients must be identified and treated in the early stages of the disease. To achieve early detection, patients with diabetes should be routinely evaluated to detect disease.[1]

Teleophthalmology for Diabetic Retinopathy uses a digital camera with special computer software to transmit photographs of a patient's eye to a specialist reading center. Specially trained ophthalmologists interpret the images and send a report to the patient and primary care physician. The report includes the level of diabetic retinopathy, presence of any non-diabetic eye disease and a recommended course for treatment.

TARGET POPULATION

- Nearly all patients who have type 1 diabetes for around 20 years will have evidence of diabetic retinopathy. Up to 21 percent of people with type 2 diabetes have retinopathy when they are first diagnosed with diabetes, and most will eventually develop some degree of retinopathy.[2]
- In the United States, diabetes is responsible for 8 percent of legal blindness, making it the leading cause of new cases of blindness in adults 20-74 years of age. Each year, between 12,000 to 24,000 people lose their sight because of diabetes.[3]

ADOPTION & BARRIERS

Use:

- Teleophthalmology is virtually non-existent in the United States.
- EyeTel Imaging, Inc. started in 1996, since then the device has been cleared for use by the FDA.
- EyeTel Imaging, Inc. was acquired by NeuroMetrix, Inc. in December 2007.

Barriers to Adoption:

- PCPs may be unwilling to pay for the teleophthalmology device and services.
- Few studies have been conducted on the cost-effectiveness of the device.

USER SATISFACTION

- In a pilot project, teleophthalmology was used to conduct retinal examinations of diabetic patients in the Alta municipality of Norway. The patients expressed a high degree of satisfaction with the telemedicine examination.[4]

CLINICAL OUTCOMES

- One study involved the set-up of a teleophthalmology device in the offices of 51 primary care physicians. 2,771 patients with diabetes who had not undergone an eye examination in the past year were imaged. Of those patients, 71 (3 percent) were recommended for urgent referral and 468 (17 percent) were recommended for non-urgent referral. [5]

FINANCIAL ANALYSIS

- Direct medical costs of diabetic retinopathy are estimated at $493 million per year.[6]
- Estimated costs of blindness for one adult (age 21-64) was $11,896 in 1990 or $19,913 in 2008 dollars.[7]
- Diabetic eye examinations cost an average of $8.17 per patient per month.[8]
- Teleophthalmology for evaluation of diabetic retinopathy was found to be cost-effective compared to the traditional technique for prison inmates (Tele: $882 per QALY vs. Non-Tele: $947 per QALY).[9]
- While limited studies are available on the cost effectiveness of the teleophthalmology procedures, one study suggested that the system "appeared to be economically viable when imaging as few as one patient with diabetes per day" in a primary care provider setting.[4]
- Cost of unit is unknown.

POLICY RELEVANCE

- Retinopathy is prominent in the diabetic population, which is ever-increasing.
- Ability to increase screening frequency and efficiency can increase the chance of identifying retinopathy in its early stages allowing for timely treatment. Early treatment could lead to a substantial decrease in blindness caused by retinopathy.

POTENTIAL IMPACT

- Device is ready for sale and distribution in the United States. Potential for partnering with NeuroMetrix, Inc. or Joslin. Cost barriers for PCPs are a notable obstacle.

FAST STAFF RECOMMENDATION

Teleophthalmology, which confronts the serious but arrestable nature of diabetic retinopathy, offers significant promise in diabetes care. While there is little doubt that this technology increases the quality of chronic disease care, cost-effectiveness studies are lacking. More research on the cost-effectiveness of teleophthalmology, for both the patient and primary care provider, is necessary for the successful adoption of this technology in the primary care setting.

Teleophthalmology for Diabetic Retinopathy

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Low**
Clinical Outcomes	**3**	**Low**
Financial Analysis	**2**	**Med**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**2**	
***FAST* PROFILE SCORE (Max = 15)**	**11**	

Manufacturer(s): EyeTel Imaging, Inc. (a subsidiary of NeuroMetrix, Inc.); Joslin Vision Network

Nursing Home Physician eVisit

OVERVIEW

Few physicians make routine visits to skilled nursing facilities (SNFs). In order for most of the elderly SNF population to receive care, they must travel to receive physician services. Since approximately 80 percent of SNF residents are mobility impaired or require assistance with ambulation, this process can be arduous for the patient.[1] Lack of access to a physician also results in overuse of the Emergency Department (ED) among the elderly. In 2002, 58 percent of adults over the age of 75 had at least one visit to the ED, compared to 39 percent of those of all ages.[2]

The eVisit provides a potential solution to the problem of physician shortage in SNFs and can provide increased, 24/7 on-call physician coverage and timelier access to a physician. Nursing home eVisits may also prevent unnecessary ED visits and hospitalizations common among the elderly population.

TARGET POPULATION

- In the United States, 1.5 million people inhabit 17,000 nursing homes.[3]
- Massachusetts nursing home resident payer mix: 64 percent Medicaid, 14 percent Medicare and 22 percent private. (Consistent with U.S. mix)
- Most nursing home residents are Medicaid beneficiaries.
- Nearly 75 percent of the elderly population has a chronic illness, 50 percent have at least two.[4]

ADOPTION & BARRIERS

Use:

- 1 facility in Massachusetts by PhoneDoctoRx
- 1 facility in WI
- ME, MI and possibly many other states have small pilot programs

Barriers to Adoption:

- Payers do not pay for physician telemedicine services, thus SNFs have to bear the cost of telemedicine consults.
- Staff at the SNF will need training on using and troubleshooting the equipment. The use of videoconferencing also requires the staff to take on new, additional duties.
- Initial set-up of equipment in one study cost $10,000, likely incurred by the SNF.
- A study to track hospitalization of the SNF is needed to truly understand the full ROI.

USER SATISFACTION

- Positive patient and family satisfaction
- Clinical staff express high satisfaction and prefer telemedicine solution to traditional models of care
- Potential to create higher job satisfaction in turn lowering nursing turnover rates

CLINICAL OUTCOMES

- Improved access to PCP and better monitoring of the population
- Timely treatment
- At one 110-bed SNF, 2,500 calls were taken in one year. Of those, 37 percent were urgent cases where ED visit was avoided.

FINANCIAL ANALYSIS

- Medicare ED payment for a mid-level visit is $130 in 2008
- Basic life support transportation Medicare payment = $175
- A New York state study suggests that of all nursing home hospitalizations that occurred in 2004, 40 percent were avoidable. Aversion of hospitalizations would amount to $223M in cost savings (based on estimate of ~$12,000 cost per hospitalization).
- Cost of initial equipment = ~$10,000
- Management fee structure = $2/bed/day (~$80K per year for an average SNF of 110 beds)
- Total 1st year cost to SNF= $90,000 (equipment plus management fee); Total savings from reduced ED visits alone is approximately $283,000; net savings to system is $193,000 (not including savings from reduced hospitalizations) per 110-bed SNF.

POLICY RELEVANCE

- Annual cost of non-urgent ED use is over $20 billion annually and is a significant policy issue; elderly patients living in nursing home account for $0.5B in annual costs.[5]
- Elderly adults living in nursing home are 3 times more likely to visit the ED than elderly adults living in the community
- There is a strong movement towards paying for quality, which started in the acute hospital setting and is expected to expand to other care settings.

POTENTIAL IMPACT

- The opportunity is available to partner with Phone DoctoRx, a provider of Nursing Home Physician eVisit technology.
- Initial equipment costs pose a barrier which could be offset by substantial net savings.
- Given current Medicare/Medicaid payment structure Medicare reimbursement for nursing home eVisits is unlikely.

FAST STAFF RECOMMENDATION

Nursing home physician eVisits have the potential to substantially reduce the non-urgent ED visits and, potentially, hospitalizations made by nursing home residents. It also provides a convenient way for patients who would otherwise need assistance with ambulation to see a physician. More research needs to be done on the cost-effectiveness and net savings accrued by using the eVisit system, and on the validity of the presumed benefits of the system.

Nursing Home Physician eVisit

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Low**
Clinical Outcomes	**2**	**Med**
Financial Analysis	**3**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
NEHI Potential for Impact	**3**	
***FAST* PROFILE SCORE (Max = 15)**	**12**	

Manufacturer(s): PhoneDoctoRx; E-TeleHealth [Samsung and University of Iowa]; Homegrown video conferencing technologies

Interactive Health Support Platform

OVERVIEW

Interactive Health Support Platforms provide a telemedicine tool for patients to take an active role in the management of their chronic diseases. Interactive Health Support Platforms are small portable stations used by the patient, from the comfort of their own home to monitor their overall health. The results of their at-home management can be transferred to a health professional for further review.

The Health Buddy monitor is used in conjunction with clinical information databases, health management programs, and decision support tools as part of a system for health improvement. The Health Buddy appliance asks the patient a series of questions about vital signs, symptoms and behaviors. Patients respond by pushing one of the four blue buttons on the Health Buddy appliance, which then provides education, reinforcement and messages that prompt patient action. During a session, patients may also be prompted to take required measurements with medical devices including blood glucose meters, weight scales, peak flow meters, and blood pressure cuffs. After a patient completes a session, the Health Buddy appliance automatically dials a toll-free number and sends the information to a secure data center. Authorized health professionals are then able to access the patient's information.

The American TeleCare LifeView Video Patient Station combines video telehealth and patient monitoring to provide remote case management for patients with chronic diseases. The technology includes two-way video/audio interface, medical peripherals, and monitoring algorithms. While at home, the patient sits in front of the unit and interacts with a clinician, most often a nurse, using the two-way video/audio. As instructed by the clinician, the patient uses the peripherals including blood pressure cuffs, pulse oximeters, stethoscopes, weight scales, or blood glucose meters to obtain vital signs. Patients may also obtain readings from the peripheral devices, as well as go through a series of on-screen questions, on their own (in lieu of a live interaction). The results are stored and then transferred to the clinician.

TARGET POPULATION

- This technology can be used to manage many chronic illnesses including heart failure, depression, diabetes, hypertension, and chronic obstructive pulmonary disease. The technology may also be used for weight management.
- The ideal users of the technology is are patients with more than one chronic disease and benefit from holistic wellness management – an estimate of 62 million people, almost half of all Americans, live with more than one chronic condition.[1]

ADOPTION & BARRIERS

Use:

- Health Buddy: The Health Buddy technology is currently being used by the Department of Veterans Affairs in 50 different health management programs across 18 Veteran Integrated Service Networks.
- Health Buddy: The technology is also being used in Medicare High Risk Demonstration project – approximately 1,000 patients in CA are enrolled in this program,
- Health Buddy is also covered by Blue Cross of CA and made available to its beneficiaries
- ATI: An estimated 500 units are currently in use in the United States
- ATI: Centura Health at Home, Colorado's largest health care system, is currently offering this technology to their Medicare members with heart failure, COPD, and diabetes (167 members currently).

Barriers to Adoption:

- In fee-for-service population, there is no coverage for the technology and no reimbursement for the remote monitoring service unless the patients live in a rural area.
- Private payers or large employer may cover the technology and service; however, contracts need to be negotiated individually.
- For home health agencies, the cost of technology and monitoring service outweighs the savings of fewer home visits.
- Current home health reimbursement system does not incentivize better outcomes in order to defray the cost of implementing tele-medicine technologies. The communications infrastructure is not in place for wide spread adoption

USER SATISFACTION

- Increased patient compliance and understanding of their condition
- Reduced travel time and expenses for both patients and clinicians (for home visits)
- Patients find the technology convenient and easy to use

CLINICAL OUTCOMES

- Health Buddy – a pilot of patients with co-morbid chronic conditions shows approximately a 50 percent reduction in hospital readmission and significant reduction in ED use over a 6-month study period.
- ATI: A pilot study at Centura Health at Home in Colorado found that the use of this technology with congestive heart failure patients reduced hospital readmissions by 90 percent and ED visits by 100 percent over 6 months.[2]

FINANCIAL ANALYSIS

- The medical care costs of chronic illness account for more than 75 percent of the nation's $2 trillion medical care costs.[3]
- Health Buddy: A meta-analysis of three programs using the Health Buddy appliance to manage heart failure patients showed that hospitalizations and emergency room visits decreased by 69 percent with an annual savings of $8,263 per patient.[4]
- Health Buddy – initial technology purchase cost and monthly service cost depend on the level of monitoring needed. Company does not publically share this information.
- ATI: The per unit cost is between $5,500 to $6,500 and is expected to last for 5 years. This cost does not include the cost of communications, doctor and nurse time, or the cost of installation.
- ATI: The pilot study also resulted in a 73 percent overall reduction in total charges including the cost of telehealth.

POLICY RELEVANCE

- The heart of a chronic disease management program is patient wellness, an approach that empowers patient behavior modification by teaching and adopting healthy behaviors to which aims to keep people out of the hospital by staying healthy, and more importantly, by empowering them to adopt healthy behaviors to stay healthy.

POTENTIAL IMPACT

- Published studies have shown improvement in clinical and financial outcomes, and current ongoing studies also display similar positive trends. The larger trials, such as the VA Health Buddy study, will soon be published. The results should be widely disseminated to larger payer and provider groups to encourage collaborative approaches to evaluate strategies for wider adoption.

FAST STAFF RECOMMENDATION

Currently, the small size of the installed base and outcomes data limit implementation activities. However, information from larger trials should soon be available and next steps may include determination of the target population for large scale implementation, payer education, and identification of and work to address barriers to adoption.

Interactive Health Support Platform

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Med**
Clinical Outcomes	**3**	**Med**
Financial Analysis	**3**	**Med**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**1**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**10**	

Manufacturer(s): Health Hero and American TeleHealth

Web Based eVisit

OVERVIEW

Web-based video conferencing eVisit attempts to mimic the experience of an in-person physician office visit, and then exceed it by providing on-demand care. The eVisit software allows health plans to connect their membership and provider networks to conduct health service in a low cost, at home setting.

The patient can log online from a computer anytime and select from a panel of available physicians, and the system will preferentially drive patients to their regular PCPs if their physicians are online. The system provides the eVisit physician with to access summaries from previous online conversations and data from electronic feeds containing claims, pharmacy benefit management data, and predictive modeling information.

Ideally, all providers, PCPs and specialists, in the contracted plan should participate in order to create a comprehensive virtual health care environment.

TARGET POPULATION

- Members of a contracting health plan in search of non-life threatening urgent care services

ADOPTION & BARRIERS

Use:

- Blue Cross Blue Shield of Hawaii has agreed to make American Well's services available to its 710,000 members beginning in its next open enrollment period in January 2009.
- Aetna of California, Florida, and Washington and Cigna have also agreed to offer web-based eVisits through RelayHealth beginning in January of 2009.

Barriers to Adoption:

- New to the market; limited clinical outcome and cost data
- No data yet on patient acceptance
- Not a direct-to-consumer or direct-to-provider product, requires contracts with payers
- Patient concerns regarding privacy and confidentiality of information. Plan and provider concerns regarding liabilities associated with inadequate protection of confidentiality.
- EMR and EHR integration must be a pre-requisite for continuity of care from on-line provider to PCP

USER SATISFACTION

- Recent limited data from users in Hawaii show that patients experience improved access to primary care physicians, more timely treatment, and added convenience.

CLINICAL OUTCOMES

- Clinical outcomes are not yet available.

FINANCIAL ANALYSIS

- An actuarial analysis estimated that the online care option, when used with a commercial group medical benefit plan, reduces the first dollar actuarial benefit per member per month cost by $2.98, or 1.1 percent.
- When used with a Medicaid benefit plan, the same analysis found that the online care option reduced the first dollar actuarial benefit per member per month cost by $5.50, or .9 percent. [1]

POLICY RELEVANCE

- Studies suggest that physician shortages will become more severe as our population grows older. If online consultation can leverage the current physician workforce more efficiently and provide necessary care in a timely manner, then this technology has the potential to reduce the nation's primary care shortage.

POTENTIAL IMPACT

- Clinical outcomes and financial analysis are needed for proof of concept.

FAST STAFF RECOMMENDATION

Web-based e-visit technologies are worth more extensive evaluation of their role in providing primary and non-life threatening urgent care. As web technology advances, there's significant opportunity to move health care delivery to the on-line platform. A few key issues must be understood: 1) Is the quality of online care equal to face-to-face care, and if so, under what conditions? 2) Is creating a new platform for care a net cost addition or reduction to the system? 3) How will on-line consultations integrate into the traditional care continuum?

Web Based eVisit

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Low**
Clinical Outcomes	**1**	**Low**
Financial Analysis	**2**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**3**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**9**	

Manufacturer(s): American Well, RelayHealth

School Based Telemedicine

OVERVIEW

School Based Telemedicine consists of a telemedicine station placed in the school that provides families with an effective alternative to deal with common illness or chronic condition monitoring for children. This allows for provider visits without needing to physically transport them to medical offices and allows for timely treatment before an illness becomes more serious. There is a potential application in low-income districts to increase access to care. School Based Telemedicine can:

- Provide for a prescription to be waiting for parents at their pharmacy when they leave work, alternatively have it delivered to the childcare center or school to start immediate medication if appropriate after a telemedicine visit.
- Provide comprehensive records (including pictures) of an illness evaluation as part of the child's permanent medical record residing with the physician.
- Allow a doctor or nurse practitioner to check the child to be sure it's appropriate for the child to return to the daycare center after an absence due to illness.
- Allow the child to actually stay in childcare or school despite illness because diagnosis and treatment was carried out quickly as result of a telemedicine visit.
- Avoid parents' missing work time to treat the chronic illness.
- Avoid an unplanned visit to a doctor's office, after-hours clinic, or even the emergency department.

TARGET POPULATION

- Children and youth with special health care needs comprise 25 percent of children in the US.

ADOPTION & BARRIERS

Use:

- Telemedicine visits have been available in selected Rochester, NY urban/suburban area daycare and school settings since May 2001. As of January 2006 over 3,500 visits have been completed (a majority in the past 12 months).
- Additional programs are in Kansas City, KS and the University of California at Davis Pediatric Telemedicine Program

Barriers to Adoption:

- School systems face budget constraints
- The technology requires a critical volume of visits to make the system cost effective
- Need more comprehensive data on clinical outcomes and return on investment (ROI)

More research is needed to determine reduction in ED visits, continuity of care for chronic disease, and comparison of consults in school setting versus primary care setting.

USER SATISFACTION

- Parents report saving an average of 6 hours of work time for each telemedicine visit.

CLINICAL OUTCOMES

- 95 percent of the telehealth visits were completed without the need for an in-person visit.
- Overall, this program has demonstrated a 63 percent reduction in absence due to illness at participating childcare centers.

FINANCIAL ANALYSIS

- System costs include: initial capital cost, maintenance fee, and cost of technician operating the system
- Average cost of TeleAtrics consultation is $57
- One study found that a high volume of consults is needed to make TeleKidsCare cost effective. A 2003 estimate of total, average, and marginal cost curves for the TeleKids ambulatory pediatric telemedicine practice found that average costs of a telemed consult and a medical center pediatric ambulatory consult were approximately equal -- a little more than $153. At 200 consults, telemedicine was estimated to be equal to or less costly than conventional ambulatory care visits by 9.5 percent.[1]

POLICY RELEVANCE

- Access to primary care in low income communities is a concern throughout the country.
- Children and youth with special health care needs are those at "increased risk for chronic physical, developmental, behavioral, or emotional conditions that require health and related services of a type or amount beyond that required of children generally." More than 12 million (about 25 percent) U.S. children meet this definition.
- Identifying ways to reduce emergency department overuse is a significant policy concern.

POTENTIAL IMPACT

- Immediate impact is limited to studying the capacity for adoption in Massachusetts. If the need for this technology exists in Massachusetts, a potential demonstration project could be launched with schools, community health centers or minute clinics in the state.

FAST STAFF RECOMMENDATION

This technology needs to be more extensively profiled before concluding its potential. Until the market response and desire for this technology can be gauged, it is difficult to speculate potential for impact and ROI.

School Based Telemedicine

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Low**
Clinical Outcomes	**1**	**Med**
Financial Analysis	**1**	**Med**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**7**	

Manufacturer(s): Tele-Atrics [NY]; Tele-Kidcare [KS]

Telepsychiatry

OVERVIEW

Telepsychiatry is the use of a specific form of video conferencing to provide psychiatric services including diagnosis and assessment, medication management, and individual or group therapy. It has been recognized as a vehicle to provide psychiatric services to patients living in remote locations or otherwise underserved areas.

Telepsychiatry can be used in place of face-to-face psychiatry in the management of mental illness. Adherence rates to telepsychiatry programs are comparable to those of face-to-face programs.

Telepsychiatry technology can also be used as a psychiatric evaluation and prescreening tool for use in emergency departments.

TARGET POPULATION

- An estimated 26.2 percent of Americans ages 18 and older — about one in four adults — suffer from a diagnosable mental disorder in any given year. When applied to the 2004 U.S. Census residential population estimate for ages 18 and older, this figure translates to 57.7 million people.[1]
- Telepsychiatry technology is anecdotally reported to be most efficiently used in population setting where access to psychiatry care is challenged, such as prisons, rural EDs, and immigrant communities with special language needs.

ADOPTION & BARRIERS

Use:

- Telepsychiatry has been in existence since at least 1959. In 2000, there were 43 telepsychiatry programs around the world.2[2]
- "Telepsychiatry is an increasingly common method of providing expert psychiatric treatment and diagnosis to patients at a distance from the source of care." [3]

Barriers to Adoption:

- Only five states (LA, CA, OK, TX and KY) have passed legislation mandating private payer reimbursement of telemedicine.
- Many states have at least one private payer that covers the use of telemedicine, including telepsychiatry. Still, the reimbursement policies are inconsistent from payer to payer and state to state.

USER SATISFACTION

- Several recent studies have shown patient satisfaction with telepsychiatry to be the same as satisfaction with face-to-face treatment.[3,4,5]

CLINICAL OUTCOMES

- Studies have shown the clinical outcomes of treatment through telepsychiatry to be the same as treatment with face-to-face psychiatry.[3 4 5]
- Telepsychiatry has been shown to be an efficient way to provide psychiatric evaluation in emergency departments.

FINANCIAL ANALYSIS

- The available research on the cost of telepsychiatry does not reveal any conclusive findings on net savings to the system – in person and virtual visits have similar cost structure.
- The cost of telepsychiatry may be less than in-person treatment if the physician had to travel 22 miles or more to see the patient for treatment, such as prison and community-based settings.[5]

POLICY RELEVANCE

- Mental disorders are fairly common among people in the U.S. population and often treatable through psychiatry.
- Estimated costs of mental disorders top $193 billion dollars per year in lost earnings alone.[6]
- Mental illness is the second leading cause of disability in the United States.[7]
- Access to psychiatry care and diagnosis can be challenging for prisons, immigrant communities and rural EDs.

POTENTIAL IMPACT

Providing specialist care to under-served population is a policy interest; however, the implications of insufficient psychiatry care in under-served population are not well understood. In-depth study to reveal benefit of increased psychiatry services is needed to advocate the need to create coverage for the service.

FAST STAFF RECOMMENDATION

There is a broad collection of studies on telepsychiatry. These studies reveal that the use of telepsychiatry is successful in treating mental disorders, but they lack significant evidence that telepsychiatry reduces the cost of psychiatric care. While providing access to care to under-served population conceptually provides value, however, we need to first understand the problems resulted from lack of access and how they can be resolved by telepsychiatry.

Telepsychatiatry

FAST Criteria	Score (0-3)	Strength of Evidence
User Satisfaction	**2**	**Med**
Clinical Outcomes	**1**	**Med**
Financial Analysis	**1**	**Low**
Implementation Criteria	**Score (0-3)**	
Policy Relevance	**2**	
Potential for Impact	**1**	
***FAST* PROFILE SCORE (Max = 15)**	**7**	

Manufacturer(s): DIANAssociates, Inc.

Barriers to Adoption of Telemedicine Technologies for the Treatment of Chronic Diseases

The decision to focus this year's scan on a single theme, telemedicine technology for the care of chronic illness, offers a unique opportunity to evaluate barriers to adoption common to telemedicine as a whole. In this section, we summarize those challenges in five categories:

- Lack of clinical outcomes and financial analyses
- Financial barriers
- Information technology infrastructure
- Cultural resistance
- Legal and licensure barriers

A chart detailing the barriers for each of the eleven profiled technologies is presented in Appendix III and in each of the *FAST* Technology Profiles.

Lack of Clinical and Financial Outcomes

The health care industry is inundated by new technologies – they compete with similar technologies, and the truly innovative technologies often have to compete with the status quo and challenge the way that care is delivered currently. In order to successfully disseminate a new innovation, we must first and foremost demonstrate effective clinical outcomes and clear financial return on investment (ROI) to prove the case. Having convincing clinical and financial studies can also mitigate downstream barriers described in later sections.

The challenge to provide convincing outcomes faced by any new technology is two-fold:

- Clinical and financial data collection are time consuming, and many new technologies simply have not been on the market long enough to complete these analyses, and;
- The industry as a whole has not set clear standards to signal the appropriate level of outcomes necessary to prove efficacy.

The technologies profiled in this scan vary in the level and quality of outcomes analysis, and, for the most part, can benefit from having clear guidelines to approach their studies.

Financial Barriers

Financial barriers can be further divided into subcategories:

- Coverage and reimbursement for technology: Coverage and reimbursement barriers are reported as the most common barriers for all new technology. Without the support of 3rd party payers, implementation costs are shouldered by the technology implementer alone. None of the profiled technologies currently have coverage and reimbursement from insurers.

- Coverage and reimbursement for service: In addition to the coverage and reimbursement barriers for the technology, coverage and reimbursement for professional services provided through telemedicine pose additional layers of challenge. These services do not meet most payers' coverage and reimbursement guidelines.
- Capital investment and maintenance/operating costs: In the climate of lean margins, capital investment and ongoing maintenance costs are often deal breakers for implementing new technologies. All profiled technologies fight an upward battle to justify the capital and maintenance costs in the environment of no 3rd party financial support.
- Misalignment of risk and benefit: In a fee for service reimbursement system that does not pay for care coordination across provider settings, there is little incentive for clinicians to adopt technologies that improve care coordination and downstream outcomes. Most of our profiled technologies can potentially prevent rehospitalization, thus improve health outcomes and reduce costs for the system.

Information Technology Infrastructure

Due to the lack of uniform standards for health information technology system, interoperable connectivity is often an issue that many of our profiled technologies have to resolve. Experts consider interoperability to be one of the major stumbling blocks for large scale deployment of telemedicine.

Electronic medical records are now considered a necessity to implement telemedicine. It enables continuity of care from office to remote setting and gives stronger validity to care provided remotely.

The two IT agendas described above are significant undertakings for the industry and are consuming much of providers' IT budget and resources; thus, any new technology projects will be competing with these critical infrastructure priorities in the next few years.

Cultural Resistance

In many ways telemedicine challenges the status quo of care delivery. It is important to assess each technology's acceptance by patients and their families and by providers or caregivers. The profiled technologies report no significant cultural resistance at this point.

Legal and Licensure Barriers

The nature of telemedicine is to provide care or consultation remotely. Current state-by-state provider licensure requirement poses a challenge to telemedicine providers. In order to provide care across state lines, telemedicine providers either have to acquire licensure in other states or establish a satellite operation in each state.

Appendix I: 2008-2009 Technology Scoring Criteria

***FAST* Criteria**	**Score (0-3)**
User Satisfaction Patient and provider satisfaction with the technology and its usability. **0** = Dissatisfaction; **1** = Moderate satisfaction; **2** = High satisfaction of technology; **3** = High satisfaction of technology and user constituency pushing for adoption.	**0-3**
Clinical Outcomes Clinical outcomes, including patient functional status and disease burden, in comparison to those outcomes achieved by the current standard of care. **0** = Poorer outcomes; **1** = Equivalent clinical outcomes; **2** = Moderately improved clinical outcomes; **3** = Substantial improvement in clinical outcomes.	**0-3**
Financial Analysis Total net value, or return on investment, to the health care system of using the technology for an episode of care. **0** = Net additive value (negative ROI); **1** = Equivalent total value (neutral ROI); **2** = Enhanced total value (slightly positive ROI); **3** = Substantially enhanced total value (highly positive ROI).	**0-3**
Implementation Criteria	**Score (0-3)**
Policy Relevance The relevance of this technology and/or the condition(s) it treats to fundamental and emerging concerns in the health care system. Topics of high policy relevance are likely to receive substantial media coverage and consideration by state or national policymakers. **0** = No policy relevance; **1** = Limited or niche policy relevance, policy action unlikely; **2** = Moderate policy relevance, some policy action possible in short to medium term; **3** = High policy relevance, substantial policymaker and public interest, likely to be focus of significant policy action in short term.	**0-3**
Potential for Impact The ability for NEHI, its members and partners to impact positive change (i.e. expanded use of the technology) in a reasonable time frame. **0** = Change unlikely; **1** = Change possible, timeframe 3-5 years; **2** = Change possible, timeframe 2-3 years; **3** = Change likely in the short term (less than 2 years), strong opportunity to leverage NEHI members and national partners.	**0-3**
Preliminary Rating (15 = strongest potential to meet criteria)	**0-15**

Appendix II: Steering Group Members

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Massachusetts Technology Collaborative

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Director, Life Sciences and Health
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David Whitlinger
President and Chair of the Board
Continua Health Alliance
Director, Healthcare Device Standards and Interoperability
Intel Corporation

Cecelia Wu
Program Director
New England Healthcare Institute

Charlotte Yeh, MD
Chief Medical Officer
AARP

Appendix III: Barriers to Adoption of Telemedicine Technologies Chart

	Medication Adherence Management	Cell Phone Glucose Monitoring	Tele-Wound Care	Telemedicine Enabled Home Hemodialysis	Tele-Stroke	Tele-ophthalmology	Nursing Home eVisit	Interactive Health Support Platform	Web-based eVisit	School Based Telemedicine	Telepsychiatry
Evidence Barriers											
Availability of clinical outcomes	No	No	Fewer hospitalizations	Improvement in patient care	Yes	Increased screening rate	Fewer ER visits; hospitalization study required	Reduce rehospitalization and ED visits	No	No	No
Availability of convincing financial outcomes	No	No	Savings on a PPPY basis	Lower cost setting	No	No	ER avoidance savings	Net savings from reduction of hospitalization and ED visits	Lower cost setting; but no data showing long term savings	Lower cost setting	Small cost savings from reduced travel
Financial Barriers											
Availability of insurance coverage	No	No	No	Medicare covers cost of home dialysis but not home monitoring	No	No	No	Must contract	Must contract	?	No
Insurance reimbursement: none or insufficient to cover cost	No	No	No	Insufficient: covers home dialysis but not monitoring	No	No	No	Must contract	If contracted, then reimbursement is sufficient	?	No
Capital expenses	Low to Mid-range	Low	Low but must be absorbed by HHA	Equipments are leased	High and must be absorbed by contracted hospital	Mid-range and must be absorbed by physician office	Mid-range	Mid-range	Some initial setup fee that must be absorbed by insurer	Mid-range	Low
Operating expenses or fee	Management fee	Service subscription fee	No	Professional fee required	Hospitals must pay a professional fee	Physician office must pay a per consult fee	Per bed day fee	PMPM fee	Insurer: PMPM fee; Member: per visit co-pay	Per consult fee	Per consult fee
Misalignment of expenditure and benefit	Yes	N/A	Yes; HHAs responsible for full cost, insurers receive benefits.	Yes; providers responsible for full cost, insurers receive benefits.	Yes; hospitals responsible for full cost, insurers receive benefits.	Yes; physicians responsible for full cost, insurers receive benefits.	Yes; SNFs responsible for full cost, insurers receive benefits.	Yes	No	No	No
Cultural Barriers											
Patient/Family Resistance	N/A	No	No	No	No	No	No	No	N/A	No	Some level of consultative interaction is lost
Physician Resistance	N/A	N/A	No	N/A	No	No	No	No	N/A	No	No visit check-in visits
Legal and Licensure Barriers											
Telemed MD requires license in patient jurisdiction	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital/clinic privileges required (for distant MDs	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No
Liability: issue of extending malpractice to cover tele-med consults?	No	No	No	No	No*	No	No	No	No	No	No
Information Technology Barriers											
Organization's IT innovation budget and administrative resources focused elsewhere(eg. eHR)	No	No	Yes	No	Yes; many competing IT efforts in hospitals	No	Yes	No	No	Yes; schools must justify the program spending.	No
Requires interoperable IT infrastructure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EMR is prerequisite	Yes	Yes	Ideally	Ideally	Yes	Ideally	Ideally	Yes	Yes	Ideally	Ideally

* In most states, telemedicine services that involve a video feed are included under standard malpractice insurance coverage

Medication Adherence Management

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> 21 CFR 880.6315 Remote Medication Management System
> Identification. A remote medication management system is a device composed of clinical and communications software, a medication delivery unit, and medication packaging. The system is intended to store the patient's prescribed medications in a delivery unit; to permit a health care professional to remotely schedule the patient's prescribed medications; to notify the patient when the prescribed medications are due to be taken; to release the prescribed medications to a tray of the delivery unit accessible to the patient on the patient's command; and to record a history of the event for the health care professional. The system is intended for use as an aid to health care professionals in managing therapeutic regimens for patients in the home or clinic.

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Research Update

Fast Adoption of Significant Technologies

FAST: Unleashing the Power of Medical Technologies

Established in 2003 through a partnership between the New England Healthcare Institute (NEHI) and the Massachusetts Technology Collaborative (MTC), the Fast Adoption of Significant Technologies (FAST) initiative identifies and supports the adoption of underutilized health care technologies. To close the gap between technology discovery and health care system adoption, FAST focuses on promoting those technologies that are not widely used despite evidence of their potential to improve outcomes for large patient populations and lower overall health care costs.

FAST Focus: Stem the Tide of Chronic Disease

The FAST search for promising technologies initiated in 2008 was focused on identifying telemedicine technologies – electronic information and communication technologies that provide and support health care interaction when distance separates the patient from the provider – that are specifically used to treat chronic disease. More than 133 million Americans currently live with at least one chronic disease, and the growing prevalence of chronic diseases such as diabetes and heart disease accounts for more than 75 percent of the nation's $2 trillion in medical care costs. Telemedicine technologies have been shown to greatly improve the care of chronic disease, ultimately reducing its burden to the overall health care system.

The FAST team reviewed over 100 health care technologies in this area, narrowing them to the 11 most promising candidates and conducting in-depth research on each of the eleven finalists.

Rating Promising Technologies

The 11 technologies were selected and ranked based on the following FAST criteria:

- User Satisfaction – Patient and provider satisfaction with the technology and its usability.
- Clinical Outcomes – Outcomes using the technology, in comparison to outcomes achieved using the current standard of care.
- Financial Analysis – Total return on investment to the health care system of using the technology for an episode of care.
- Policy Relevance – Relevance of the technology to fundamental concerns in the health care system; likelihood of receiving substantial media coverage and attention from policymakers.
- Potential for Impact –The ability of NEHI, its members and partners to facilitate expanded use of the technology in a reasonable timeframe.

Full profiles for the 11 finalist technologies, described on the reverse, are available at www.nehi.net.

FAST Finalist Technologies

The *FAST* initiative has identified and profiled the following 11 telemedicine technologies that address the health care needs of chronic disease populations. In late 2008, the *FAST* Steering Group ranked most promising technologies among these 11 finalists, listed below in order of priority.

In 2009, the *FAST* initiative will determine the most appropriate actions to promote their broader adoption, including demonstration projects and policy activities.

Rank	Technology	Application	FAST Assessment
1	Interactive Health Support Platform	Small, portable telemedicine tool providing remote case management for patients with chronic illnesses.	Small size of installed base and outcomes data limit immediate implementation; next steps may include determination of the target population and payer education.
2	Tele-Stroke	System incorporating video conferencing and imaging, allowing remote specialist to diagnose stroke symptoms and prescribe treatment.	Mature technology with substantial evidence supporting effectiveness. Will require policy action to increase use in underserved areas.
3	Nursing Home eVisit	Provides remote access to physicians for patients at skilled nursing facilities, addressing a physician shortage.	Technology has potential to reduce non-urgent ED visits and hospitalizations; more research is needed on cost-effectiveness.
4	Telemedicine Enabled Home Hemodialysis	Supports patients in conducting home hemodialysis for renal failure by providing monitoring and support.	High potential to improve outcomes and reduce costs for renal disease patients; barriers must be addressed through policy action and technology development.
5	Telepsychiatry	Use of video conferencing to provide psychiatric services including diagnosis, medication management and therapy.	Studies show technology is successful in treating mental disorders, but lack evidence that the technology reduces costs.
6	Tele-Wound Care	Uses digital imaging to transmit chronic wound data from patients to remotely located wound care specialists.	Substantial promise in improving outcomes and financial savings, though hampered by small sample sizes in clinical trials.
7	School Based Telemedicine	Telemedicine station in school settings allows for remote treatment of common or chronic illnesses.	Technology requires more extensive profiling and market assessment before its value can be fully determined.
8	Tele-ophthalmology	Uses digital camera and software to transmit photographs of patients' retinas to remote ophthalmologists to diagnose diabetic retinopathy.	Offers significant promise in diabetes care; more research is needed on the cost-effectiveness of the technology to increase its adoption.
9	Medication Adherence Management	Communicates data from patients to health care professionals to improve patient adherence to medication.	Lack of clinical trial data makes it difficult to predict potential benefits of telemedicine in increasing patient medication adherence.
10	Cell Phone Glucose Monitoring	Uses ubiquitous cellular technology to allow easy blood glucose measurement and monitoring to promote better management of diabetes.	Barriers include inconsistencies in the U.S. cell phone market and insufficient data on the technology's effectiveness.
11	Web-based eVisit	Virtual health care environment providing on-demand access to primary care.	Requires more extensive evaluation on user satisfaction, continuity of care and quality of outcomes.