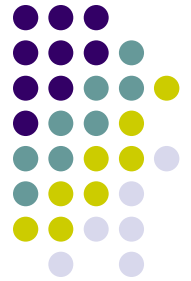


Technology and Health: Innovations in Home Telehealth



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NINR 20th Anniversary Scientific Symposium

Nursing Research: Looking to the Future

October 11, 2006



Push To Adopt Telehealth In Home Health Will Continue In 2006 (from Medical News Today, January 15, 2006)

- during 2006, CMS will continue a push toward telehealth for home health agencies
- HHAs have found that telehealth complements - but does not replace – their other services. It facilitates more timely visits based on patient need
- the effectiveness of telehealth, combined with skilled nurse management and evidence based best practices, is demonstrated by a dramatic decrease in the number of hospitalizations and emergency room visits and in reduced hospital length of stay

Home Telehealth Market Could Reach \$2.1 Billion by 2010 According to New Study (from: eWeek, June 30, 2006)

- technological advances are making over the home health industry
- still, home health technology faces triple hurdles:
health plans often don't cover it; caregivers don't advocate for it; and most current products are too expensive and hard to use
- many insurerswant manufacturers to provide evidence of savings.
But many home technology companies are undercapitalized..
Many small companies have the expertise but not the financial resources to sponsor large-scale studies

What is home telehealth?



- **Remote** care delivery between a health care provider/system and a patient in her/his place of residence, which may include
 - physiological **monitoring**
 - two-way audio-video interaction (**virtual visits**)
 - environmental monitoring (**smart homes**)
- Using POTS or broadband **connectivity**



Home TeleHealth “Equipment”

- Monitoring devices
- Camera
- CODEC/MODEM
- Computer/Monitor
- Transmission media
- Internet provider

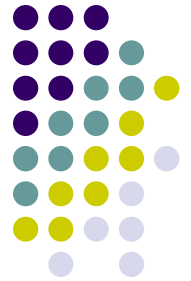
Home telehealth programs may use some or all of the above equipment to achieve their goals



Potential for Home TeleHealth

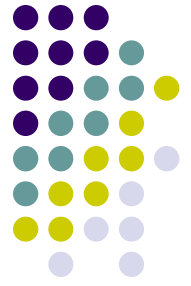
- Improved access to care
 - Continuity of care
 - Self-care training
- Disease prevention and management
 - Observation
 - Monitoring
 - Treatment
- Health education
- Socialization

Is the time right for home telehealth?



- **Pushing** the issue – a problem in need of a solution
 - Aging population
 - Looming provider shortage
 - Costly centralized healthcare
 - Move toward patient empowerment
 - Outsourcing health management to patients at home
- **Pulling** the issue –potential solutions to identified problems
 - Information technology
 - Fast, secure telecommunications
 - Inexpensive, easy to use monitoring devices
 - Mounting evidence of benefits-cost, access, quality

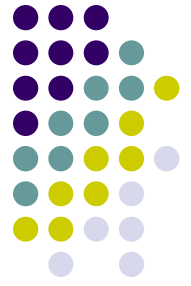
Telemedicine Integrated Home Monitoring Solution from American Telecare, Inc



Patient Video Monitoring Station



Telemedicine – Integrated Home Monitoring Solution from American Telecare, Inc



Central Nursing Station



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Case Study 1 - LTHMP

Lung Transplant Home Monitoring Program

Timely information

- > Early detection
 - > Early intervention
 - > Improved status
 - > Lower cost

- University of Minnesota, Minneapolis MN
- Supported in part by NIH Grant R01 NR02128



Home Monitoring

- Spirometry (FVC maneuver): FVC, FEV1, MEFR, PEFr
- Vital signs: BP, temp, HR, wt
- Symptoms: cough, sputum, wheeze, dyspnea
- Status: well being, stress, exercise
 - Measurements recorded daily
 - Transmitted/reviewed weekly

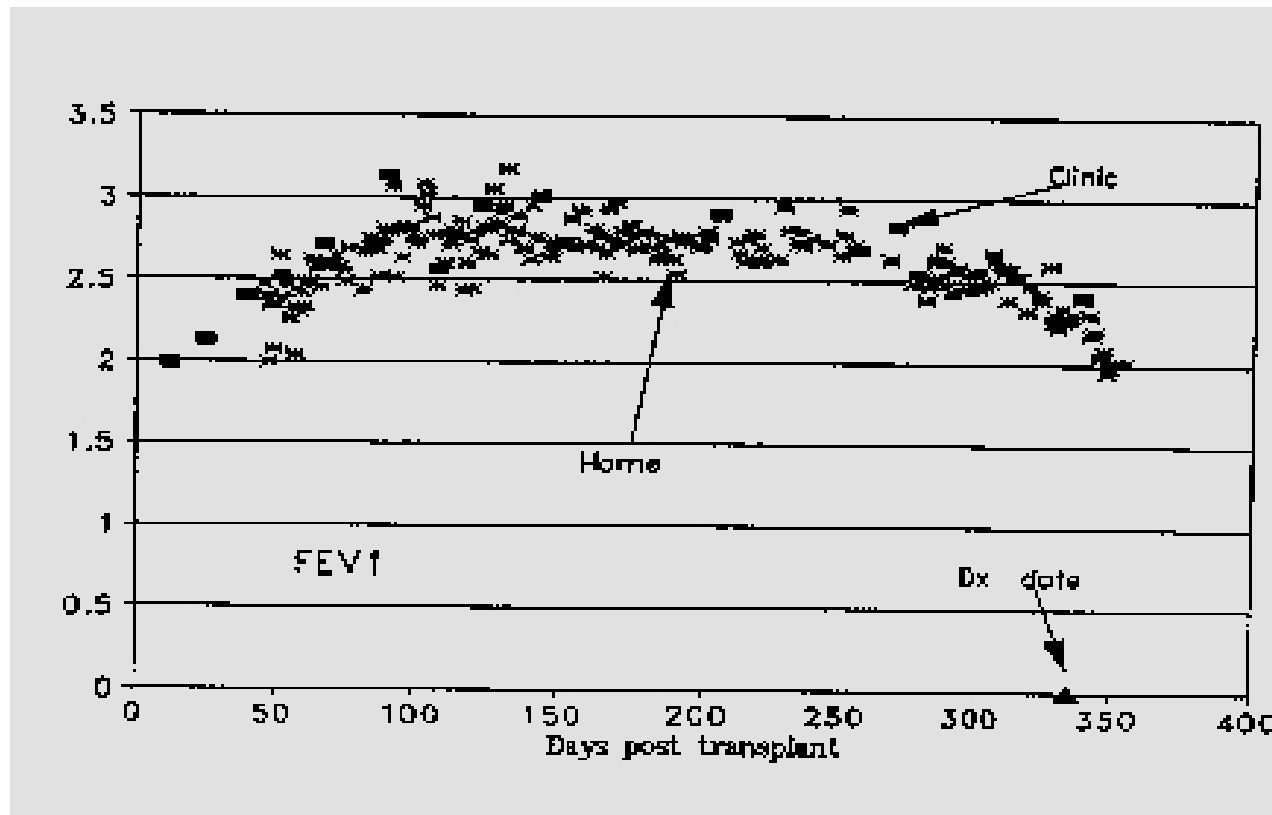


Home Spirometer from QRS Diagnostic



Typical Data

Home and clinic FEV₁ for one subject



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Lessons learned

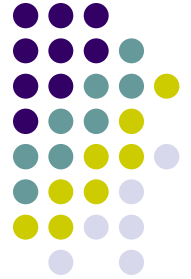
Success

- Patients can do it
- Provider acceptance
- Patient satisfaction
- Early detection
- Decision algorithms

Concerns

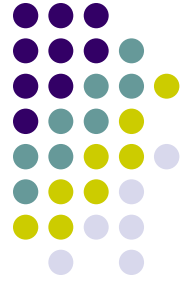
- More data, more often
- Adherence – long term
- Provider acceptance
- Reimbursement

Case Study 2 - TeleHomeCare



A randomized controlled trial to determine if a program using **POTS** combining **videoconferencing**, **Internet access**, and **physiological monitoring** within a **home health care** setting can:

- increase **access** to care
 - improve patient **satisfaction** with care
 - improve **quality** of care
 - reduce **cost** of care
- University of Minnesota, Minneapolis MN
- Supported by Grant # 27-60-98031 from the TOP, Dept of Commerce and matching funds from program clinical and industry partners



TeleHomeCare RCT

Subjects

Home Health Care patients with:

- congestive heart failure
- chronic obstructive pulmonary disease
- chronic wound care
- other qualifications
- av age (72 - C, 79 - V, 73 - M)
- 12 mo. study + 6 mo. follow-up

Study Groups

- Control (19)
 - Home Health Care
- Video (14)
 - Home Health Care
 - Video conferencing (+ Internet access)
- Monitor (20)
 - Home Health Care
 - Video conferencing (+ Internet access)
 - Monitoring equipment

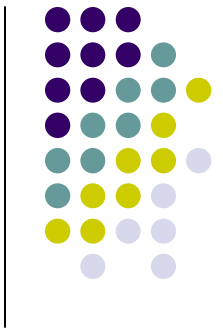
TeleHomeCare at Home



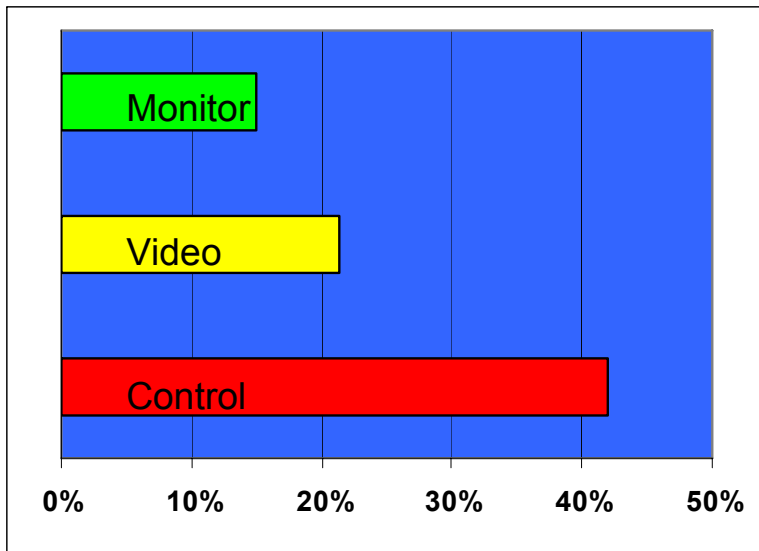
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Results

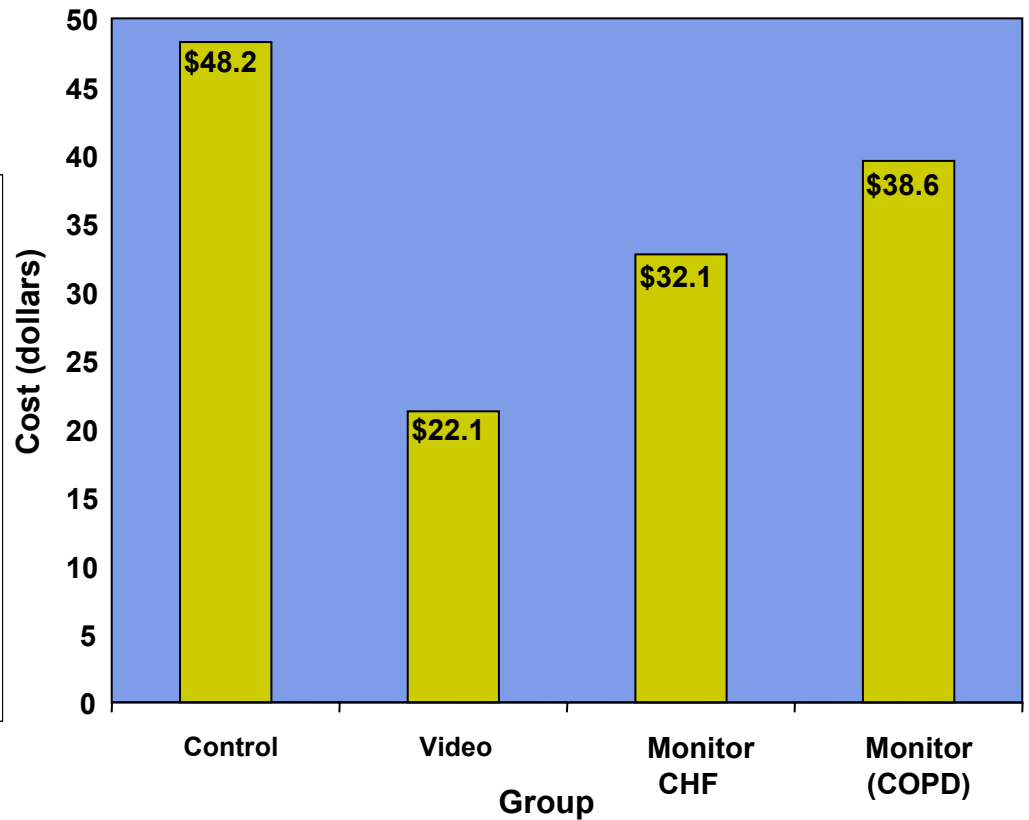
Access ↑ Satisfaction ↑
Quality ↑ Cost down ↓



Discharge to a higher level of care



Average cost of visits





Case Study 3 - VALUE

Virtual Assisted Living Umbrella for the Elderly

A randomized controlled trial to determine if a program using **broadband** to deliver health care **virtual visits**, **physiological monitoring**, an **assisted living service ordering portal**, and **Internet access** provide an

- **assisted living alternative** that will enable frail elderly to remain **living independently** in their **own home**
- University of Minnesota, Minneapolis MN
- Supported by Grant # 27-60-03010 from the TOP, Dept of Commerce and matching funds from program clinical and industry partners

VALUE RCT



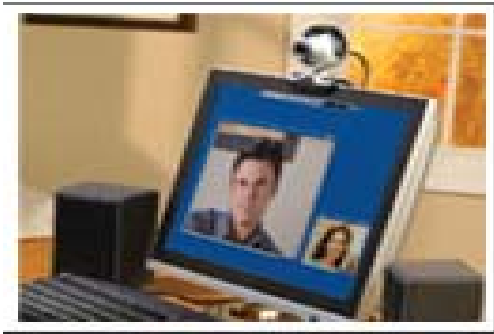
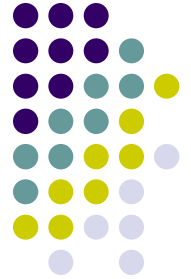
Subjects

- >60 years
- living independently
- limited mobility
- chronic disease
- broadband available
- 9 months in study

Study Groups

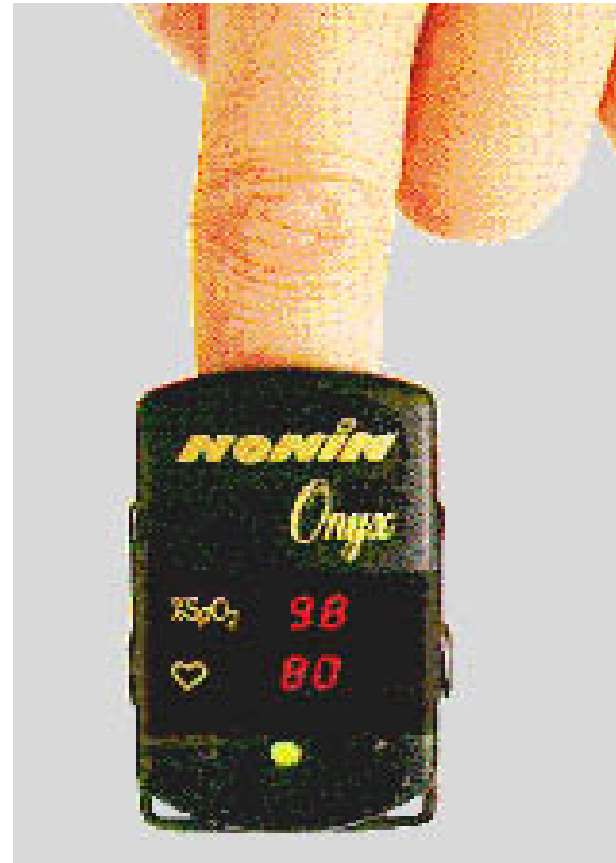
- Controls (50)
 - usual independent living arrangements
- Intervention (50)
 - VALUE workstation
 - AL service portal
 - home monitoring
 - health care virtual visits

VALUE Workstation: PC, monitoring devices (eg Spirometer, Pulse Oximeter)



From PolyCom
PVX

Broadband: DSL, cable
Other monitors: glucometers, BP
cuff, scale



VALUE – Service ordering portal



The screenshot shows the VALUE portal interface. At the top, there are logos for VALUE, the University of Minnesota, and Tri-County Hospital. The user's name, Len Actor, and a Logout button are in the top right. A prominent orange banner reads "VALUE-Virtual Assisted Living Umbrella for the Elderly". Below this, a personalized welcome message says "Dear Len: Welcome to your personal VALUE Portal!". A section identifies the project nurse as Kristi, with a small photo of her. A sidebar on the left contains buttons for Message, Services, Coupons, Education, Contact, and Welcome. The main content area provides instructions for each: 0 new messages, service options, coupons (marked as NEW!), educational materials, contact information for Tri-County Hospital Home Health Care, and a return to the welcome page. A weather forecast for 43 degrees is shown at the bottom left. The footer contains copyright information for the University of Minnesota (©2004), a link for "Trouble seeing the text?", contact information for the University of Minnesota, a privacy link, the motto "The University of Minnesota is an equal opportunity educator and employer.", and a "Last modified on 19-Dec-04" timestamp.

VALUE UNIVERSITY OF MINNESOTA Tri-County Hospital Len Actor Logout

VALUE-Virtual Assisted Living Umbrella for the Elderly

Dear Len: Welcome to your personal VALUE Portal!

Your VALUE project nurse is Kristi.

Message You have 0 new messages. To send a message, select "**Message**" on the left.

Services Select "**Service**" on the left for service options and orders.

Coupons Select "**Coupon**" on the left to request some available coupons. **NEW!**

Education Select "**Education**" on the left for educational materials.

Contact Select "**Contact**" on the left for contact information of Tri-County Hospital Home Health Care.

Welcome Select "**Welcome**" on the left to return to this page at any time.

43 forecast... Now you can request **Prescription Refill** from the "**Service**" on the left. **NEW!**

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VALUE – Available services

The screenshot shows the VALUE web portal interface. At the top, there are logos for VALUE, the University of Minnesota, and Tri-County Hospital. The user is identified as Len Actor, with a Logout button. The main heading is "VALUE-Virtual Assisted Living Umbrella for the Elderly". A personalized message reads: "Dear Len: Please request, change, or cancel your services here:". Below this, a list of services is displayed with interactive buttons:

Home Delivered Meals	new request	change	cancel	
Congregate Dining	new request	change	cancel	
Transportation	new request	change	cancel	
Grocery Delivery	local grocery store information			
Home Maintenance	new request	change	cancel	
Nursing Consultation	new request	change	cancel	confirm
Prescription Refill	refill prescription		NEW!	

On the left side, there is a navigation menu with buttons for Message, Services, Coupons, Education, Contact, and Welcome. Below the menu is a weather forecast icon showing "57 forecast...". At the bottom, there is a footer with copyright information: "©2004 Regents of the University of Minnesota. All rights reserved." and "The University of Minnesota is an equal opportunity educator and employer." Links for "Trouble seeing the text?", "Contact U of M", and "Privacy" are also present. The page was last modified on 19-Dec-04.



Lessens learned (to date)

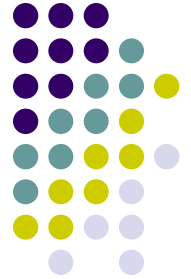
Success

- Frail elderly can do it
- Portal design
- VVs are highlights
- Nurse buy-in
- Client satisfaction
- Supports independent living ??? (Study not completed until June 2007)

Concerns

- Computer anxiety
- Vision, manual dexterity
- Measurement complexity
- Changing ordering behaviors
- Broadband availability
- Cost
- Sustainability

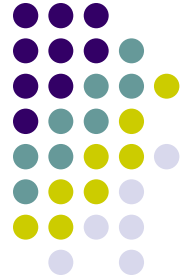
Home Telehealth Challenges



Technical

- What variables
- Simple, inexpensive, unobtrusive instrumentation
- Wireless standards
- Telecommunication service
- Data overload
- Clinical decisions

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People

- Patient selection
- Patient satisfaction
- Tech anxiety
- Adherence (short, long term)
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Societal

- Licensure
- Medico-legal
- Reimbursement
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Home Telehealth Challenges



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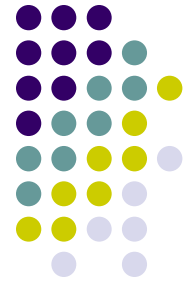
Societal

- Licensure
- Medico-legal
- Reimbursement
- Sustainability

Business Plans

- Models
 - Revenue generation
 - Cost avoidance
- Payer source
 - Reimbursement -insurance
 - Out-of-pocket
 - Provider

Monitoring Pulmonary Function



- Progression of devices for home monitoring of pulmonary function in our studies

Voldyne Exercise
Inspirometer



1980s

Home Spirometer
by QRS Diagnostic



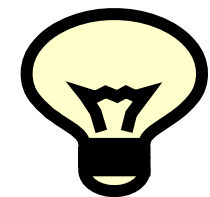
1990s

SpiroCard by
QRS Diagnostic



2000s

Next ?





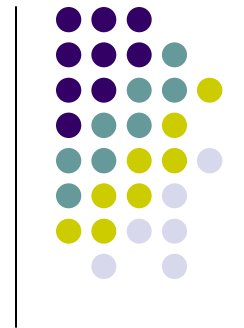
Thank You

Primary co-investigators:

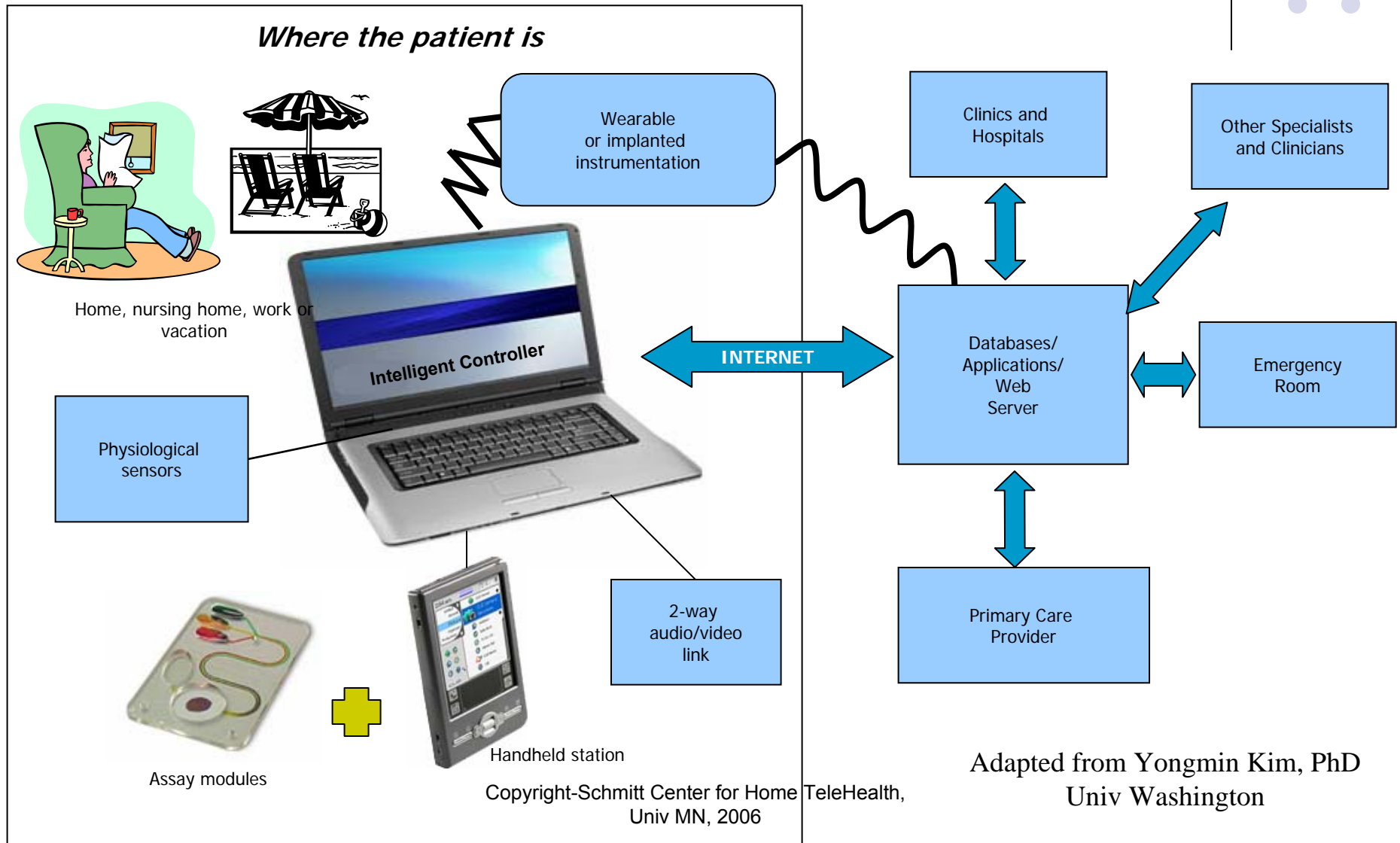
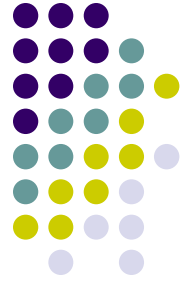
- LTHMP: Marshall Hertz, MD; Mariah Snyder, PhD, Ruth Lindquist, PhD; William Robiner, PhD;
- TeleHomeCare: Stuart Speedie, PhD, George Demiris, PhD; Sandra Potthoff, PhD
- VALUE: Stuart Speedie, PhD, Edward Ratner, MD, Sandra Potthoff, PhD

Many graduate research assistants

Contact: stan@umn.edu



HOME TELEHEALTH





Equipment - Subject's Home

Internet Home Equipment

Also includes telephone and TV

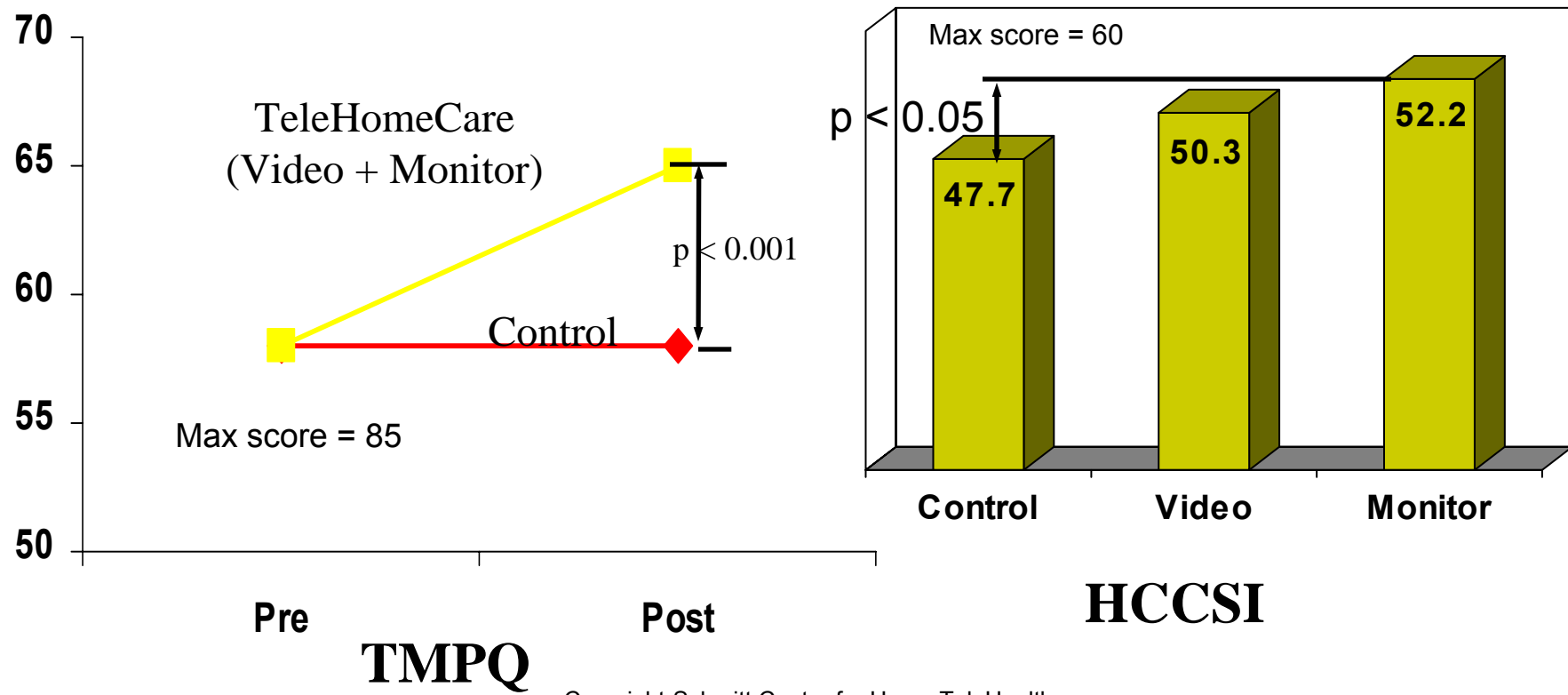


Monitoring Equipment

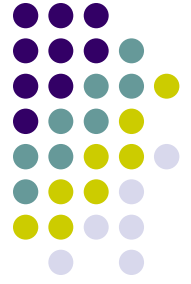
Also includes a scale and blood pressure cuff



Patient Satisfaction



TMPQ Issues



- *Patient can explain problem over TV
- ***Nurse can understand problem over TV**
- **Equipment difficulties; trust equipt*
- *Increases patient access to care
- *Exam not as good over TV
- *Able to monitor patient's condition
- *Patient/nurse discussion OK over TV
- *Can improve pts general health
- ***Saves nurse time**
- **Saves patient time*
- *Reduces patient costs
- *Missing physical contact
- *Threatens confidentiality
- **Violates patient privacy*
- **Easier to contact nurse*
- *Convenient hlth care

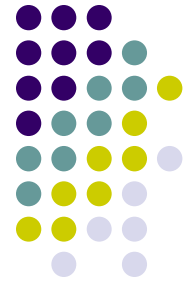
Note:**BOLD**>perception increased; *italic*>perception decreased



HCCSI Questions

- Attention to concerns
- Dependability of staff
- Respect shown by staff
- Knowledge of health problems
- **Choices about care**
- **Feeling safe**
- **Know contact person**
- Ability to meet needs
- Response to concerns
- **Scheduling**
- Consistency in staffing

VALUE – Ordering meals



VALUE   Len Actor [Logout](#)

VALUE-virtual Assisted Living Umbrella for the Elderly

 **Request Home Delivered Meal** - Please answer the following 3 questions:

1. Day of Meal:

2. Dietary Choices:

3. Mechanical Soft (Ground Meat/Soft Vegetable):

[Message](#)
[Services](#)
[Coupons](#)
[Education](#)
[Contact](#)
[Welcome](#)

 50 forecast...

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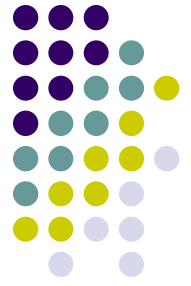
VALUE – Full Study Preliminary Results

Portal use during one typical week of activity (Feb 27 – March 5, 2006)



- 25 active subjects (17 F, 8 M; avg 80.3 yo, 62-93 yo range) had 222 log-ins
- 20 virtual visits
 - 5 VVs missed (2 tech problems, 3 subj cancellations)
- 15 messages (to/from nurse – portal orders, VV scheduling, hlth issues, training/testing)
- 23 service order testing/placing
- 16 access resource links (health & aging, specific disease, local news/area resources, personal interests)
- Remainder for general web browsing

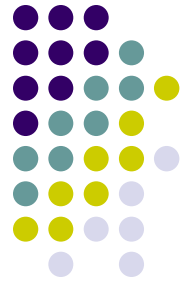
VALUE – Preliminary conclusions



- There is community need and acceptance of the VALUE concept
- Nurses and patients can successfully interact in a virtual visit
- Portal design is acceptable
- Elderly subjects can use Web portal
- Elderly concerns about computer use/training
- Difficult to change established ordering habits
- Broadband access can be a problem

Areas where technology can help:

- Emergency help
- Assistance with hearing and visual impairment
- Prevention and detection of falls
- Temperature monitoring
- Automatic lighting
- Monitoring of physiological parameters
- Stove and oven safety control
- Property security
- Intruder alarm
- Reminder system announcing upcoming appointments or events
- Timely and accurate information on adverse drug events and contra-indications



Demiris G, Rantz M, Aud M, Marek K, Tyrer H, Skubic M, Hassam A. Older adults' attitudes towards and perceptions of "smart home" technologies. *Medical Informatics and the Internet in Medicine* 2004; 29(2): 87-94.

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Case Study 4 – Smart Homes

Smart Home Residences

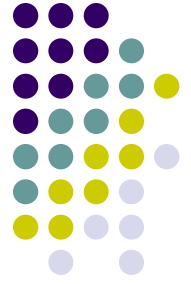
- equipped with unobtrusive technology that enhances safety of patients at home by monitoring health, activity level, and environment
- monitors are part of the structure, not subject specific.

Tiger Place (field study site), MU Sinclair School of Nursing, University of Missouri, opened in April 2004, is built on the Aging in Place concept. Investigators are studying smart home technology related to

- gait analysis
- prevention of falls
- activity levels
- sleeping patterns

Adapted from George Demiris, PhD, University of Missouri





Results – Smart homes

- Themes
 - Positive attitude towards smart home technologies in general
 - Focus on detection rather than prevention (reactive vs. proactive)
 - No interference with daily activities
 - Appreciation of the value of detection and response to emergencies
 - Falls major concern
 - Privacy issues (balance between safety and privacy)
 - Customizing how the information is being handled
 - Concern about false alarms

from George Demiris, PhD, Univ Missouri

Integrated Sensor Network

