Patient, heal thyself
The Role of mHealth in Self-Care

Joseph A. Cafazzo, PhD PEng
Lead, Centre for Global eHealth Innovation, University Health Network
Senior Director - Medical Engineering and Healthcare Human Factors
Assistant Professor, IBBME and HPME, Faculty of Medicine, University of Toronto
The Big 6

60% of all spending in Chronic Disease

Diabetes
High Blood Pressure
Kidney Disease
Heart Failure
Lung Disease
Mental Health
Current care models focus primarily on acute care.
Can we suppress these acute events?

Individual's Health Status

- Well
- Chronic
- Acute

Service Levels

- independent living
- supported living
- dependent living

Age Categories:
- age: 0 - 35
- 36 – 65
- 66 – 80
- 80 & Up
‘Shift Left’ of Healthcare through Technology\textsuperscript{1}

\begin{itemize}
\item **HOME CARE**
  \begin{itemize}
  \item Healthy, Independent Living
  \item Community Clinic
  \item Chronic Disease Management
  \item Doctor’s Office
\end{itemize}

\item **RESIDENTIAL CARE**
  \begin{itemize}
  \item Assisted Living
  \item Skilled Nursing Facility
\end{itemize}

\item **ACUTE CARE**
  \begin{itemize}
  \item Specialty Clinic
  \item Community Hospital
  \item ICU
\end{itemize}
\end{itemize}

\textsuperscript{1} from Intel, and Center for Aging Services Technologies (CAST)
Patient-Provider Feedback Loop

1. Gathering data
2. Interpreting information
3. Acting on results
4. Communicating back to patient
Remote Monitoring and Self-Care
Joseph Hayduk, 86, is heart failure and uses a device that transmits his vital signs to a RN at Meridian Health. The RN calls all 18 patients in program daily.

The New York Times  Feb 13, 2009
Members take their own measurements at home using the Philips Patient Telemonitoring Set. Results are automatically transmitted via modem using an ordinary home telephone line to a dedicated server. A care manager reviews patient information, and follows up with a phone call to members or their physician, as needed.
Physicians’ concerns

• Reimbursement and liability

• Accuracy of self-recorded data

• “Neurotic”, “self-obsessed” behaviour

• Change in patient/physician relationship

• Completeness, accuracy and authenticity of personally-controlled EHRs
Forces Affecting the Diffusion of Health Technologies

Evidence of Effectiveness/Cost-effectiveness

Magnitude Of Effect

Political Will

Ease of Use And Safety

Affordability

End-Users/Hospital profile/Domino effect

Industry

Public/Societal
Shea et al. Study

Research Paper

A Randomized Trial Comparing Telemedicine Case Management with Usual Care in Older, Ethnically Diverse, Medically Underserved Patients with Diabetes Mellitus

Steven Shea, MD, Ruth S. Weinstock, MD, PhD, Justin Starren, MD, PhD, Jeanne Teresi, EdD, PhD, Walter Palmas, MD, Lesley Field, RN, MSN, Philip Morin, MS, Robin Goland, MD, Roberto E. Izquierdo, MD, L. Thomas Wolff, MD, Mohammed Ashraf, BA, Charlyn Hillman, MPA, Stephanie Silver, MPH, Suzanne Meyer, RN, Douglas Holmes, PhD, Eva Petkova, PhD, Linnea Capps, MD, Rafael A. Lantigua, MD, for the IDEATel Consortium

Abstract Background: Telemedicine is a promising but largely unproven technology for providing case management services to patients with chronic conditions who experience barriers to access to care or a high burden of illness.

Methods: The authors conducted a randomized, controlled trial comparing telemedicine case management to usual care, with blinding of those obtaining outcome data, in 1,665 Medicare recipients with diabetes, aged 55 years or greater, and living in federally designated medically underserved areas of New York State. The primary endpoints were HgbA1c, blood pressure, and low-density lipoprotein (LDL) cholesterol levels.

Results: In the intervention group (n = 844), mean HgbA1c improved over one year from 7.35% to 6.97% and from 8.35% to 7.42% in the subgroup with baseline HgbA1c ≥7% (n = 353). In the usual care group (n = 821) mean HgbA1c...
Shea et al. Study

- RCT, n=844, 1 year duration
- Poor, under-served, minority population
- Study noted improvements in:
  - HgA1c
  - Blood pressure
  - LDL cholesterol levels
Telemonitoring in Patients with Heart Failure

Sarwat I. Chaudhry, M.D., Jennifer A. Mattera, M.P.H., Jeptha P. Curtis, M.D.,

In summary, a telemonitoring strategy failed to provide a benefit over usual care in a setting optimized for its use. Previous claims of success of similar strategies, based on studies with small populations of patients and methodologic weaknesses, are not supported by the results of our large, multicenter trial.
Structured telephone support or telemonitoring programmes for patients with chronic heart failure (Review)

Authors’ conclusions

Structured telephone support and telemonitoring are effective in reducing the risk of all-cause mortality and CHF-related hospitalisations in patients with CHF; they improve quality of life, reduce costs, and evidence-based prescribing.
A Randomized Trial Comparing Telemedicine Case Management with Usual Care in Older, Ethnically Diverse, Medically Underserved Patients with Diabetes Mellitus

STEVEN SHEA, MD, RUTH S. WEINSTECK, MD, PHD, JUSTIN STARREN, MD, PHD, JEANNE TERESI, ED, PHD, WALTER PALMAS, MD, LESLEY FIELD, RN, MSN, PHILIP MORIN, MS, ROBIN GOLAND, MD, ROBERTO E. IZQUIERDO, MD, L. THOMAS WOLFF, MD, MOHAMMED ASHRAF, BA, CHARLYN HILLMAN, MPA, STEPHANIE SILVER, MPH, SUZANNE MEYER, RN, DOUGLAS HOLMES, PHD, EVA PETKOVA, PHD, LINNEA CAPPS, MD, RAFAEL A. LANTIGUA, MD, for the IDEATel Consortium

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Cost of intervention:

$3,425 US

per patient
Spyglass Study of 100 Care Organizations

“A few barriers have to be removed for remote monitoring to really take hold... the cost of devices and peripherals at about $3,000 to $5,000 now has to come down to a more affordable price of $300 to $500.”

“They should be sold through stores like Wal-Mart or Best Buy”
Summary

Weight 154.4 (-0.2)
BP 105
78
Pulse 74 /min
Sympt. Abnormal

Contact HF Clinic/ family
Dr. Go to Emerg Dept if you feel you should
Press 1 for menu
Clinical trials

- Diabetic hypertension pilot - complete
- Blood sugar and hypertension - complete
- Gestational diabetes pilot - complete
- Diabetic hypertension RCT - complete
- Congestive heart failure RCT - complete
- Gestational diabetes RCT - complete
- Adolescent type 1 diabetes pilot - complete
Clinical trials

Gestational diabetes RCT
Diabetes Management System
Blood Pressure automatically transmitted to BlackBerry
Blood Sugar readings automatically sent to BlackBerry
Results can be graphed to show progress and trends.
Clinical trials

Diabetic Hypertension  RCT
Pilot Results
Diabetic Hypertension

Intervention group (55 patients)

Control group (55 patients)
Intervention group (55 patients) vs Control group (55 patients)

- Systolic: -9.1 mmHg
- Diastolic: -3.2 mmHg

Control group: no change
What else did we learn?

the physicians weren’t responsible for the improvement

no additional meds
no significant changes in management
What else did we learn?

the mechanism appears to be patient self-awareness, accountability

an adherence mechanism is important

giving them a monitor isn’t enough
Hypothesis

the monitor isn’t enough

passive monitoring doesn’t work

“active” monitoring is required
Clinical trials

Heart Failure RCT
RCT Study design

- N=100
- duration 6 months
- daily measurements before 10 am - reminder call
- alert algorithm - messages direct to cardiologist
- control group - usual care
RCT Results

Congestive Heart Failure

- **BNP**: 150 pg/mL
- **LVEF**: 7.4%
- **self-care**: 7 points

no change in the control group
RCT Results
Congestive Heart Failure

no improvement in re-hospitalization
The changing role of physicians

• Lead role in*
  • treating acute problems
  • diagnosing and developing initial treatment plan of chronic conditions
  • managing difficult chronic cases

• Devolve to health care team and patient self-care:
  • day-to-day management of chronic conditions
Published data: NHD and Clinical outcomes

- Improved Patient Health
  - Normalization of blood pressure without the need for anti-hypertensive medications
  - Normalization of abnormal wall thickness of the heart
  - Restoration of impaired heart function
  - Improvement in peripheral circulation
  - Improvement in sleep quality
  - Improvement in nutritional determinants
  - Elimination of dietary restriction
- Patient autonomy
- Cost effective modality

Pierratos et al: JASN, 1998
Patient-Perceived Barriers to NHD
(Cafazzo and Chan, 2007)

- Perceived burden on family members
- Fear of self-cannulation
- Fear of a catastrophic event in the absence of nursing support
- Low self-efficacy
Sample Session Summary to BlackBerry

Sent: Sat Feb 04 06:52:47 2006
Subject: Dialysis Session End: **Patient Name**

*** Final Dialysis Readings ***
Total Weight Loss: 3.00 kg
Total Blood: 141.50 L
Total Dialysis time: 7.90 hrs.
Initial Time: 2/3/2006 | 10:42 PM
End Time: 2/4/2006 | 6:36 AM

**** Session Averages ****
Venous Pressure Sensor: 123.2 mmHg
Arterial Pressure Sensor: -146.2 mmHg

*** Physiological parameters ***
HR: 67.5 bpm (on for 90% of session)
SpO2: 96.3 % (on for 90% of session)

*** Yellow Alerts ***
10:42:28 PM | ! Ven Pressure Alarm - Present
From: RedAlerts@telemonitoring.ca
Date: Monday, May 1, 2006 4:03 AM
To: ppicton@telemonitoring.ca, jal@telemonitoring.ca, "Cafazzo, Joe", "Chan, Christopher",
tech@telemonitoring.ca, cestridge@telemonitoring.ca
Subject: [FULL MESSAGE: AlarmPowerON|0|BLDM004|]
Medical Body Area Network (MBAN) Platform for Ambulatory Monitoring (AM)

Investigators

Joseph Cafazzo, UHN and U of T
Ramesh Abhari, McGill University

Collaborators

Paul Ritvo, UHN
Jeff Daskalakis, CAMH and U of T

Research In Motion

Christopher Labrador
Shirook Ali
James Warden
Adele Newton
application to mental health

- 20% of population
- almost no technological interventions
- promising developments for detection

Objective: develop a practical biomarker for the detection of anxiety and depressions
Technical Challenges

- weak signals - uV range
- sensor treatment - dry or wet
- continuous signal - power management
Julien Penders,
Holst Centre, The Netherlands

Fig. 1. Wireless 8-channel EEG Sensor Platform

Fig. 2. Wireless EEG Headset
Fig. 7. Architecture of the complete eight-channel EEG acquisition ASIC.
design challenge
How do we detect emotions?

Valence hypothesis, states that there is differential hemispheric specialization for positive and negative emotions.
How do we detect emotions?

Emotional Valence - Stimulus

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Figure 1: Experimental Protocol

2 class classification: Positive/Neutral versus Negative

Kurtosis of maximum of Alpha power Left/Right ratio (F3/F4)

maximum of Alpha power Left/Right ratio (F3/F4)
future mHealth app?
Conclusion

mHealth and RPM needs rigorous, evidence-based design

passive monitoring doesn’t work

“active” monitoring is required

The future of mHealth is patient-focused, social, and consumer-initiated
The Teams

Healthcare Human Factors

Medical Device Informatics
Patient, heal thyself
The Role of mHealth in Self-Care

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