Innovation in the Medical Home: How Mobile and Social Technologies Can Accelerate Health Behavior Changes

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The Big 6

60% of all spending on Chronic Disease

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

Individual's Health Status

Service Levels

- 36 – 65
- 66 – 80
- 80 & Up

- Well
- Chronic
- Acute
‘Shift Left’ of Healthcare through Technology

1) from Intel, and Center for Aging Services Technologies (CAST)
Improved Health Outcomes: Home Hemodialysis

- 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

Hanly et al: NEJM, 2001
Pierratos et al: JASN, 1998
Patient-Perceived Barriers to Home Hemodialysis

- Perceived burden on family members
- Fear of self-cannulation
- Fear of a catastrophic event in the absence of nursing support
- Low self-efficacy
Patient-Provider Feedback Loop

- Gathering data
- Interpreting information
- Communicating back to patient
- Acting on results
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 physicians, as needed.
Forces Affecting the Diffusion of Health Technologies

- Political Will
- Magnitude Of Effect
- Ease of Use And Safety
- Affordability
- Industry
- Public/Societal
- End-Users/Hospital profile/Domino effect

Evidence of Effectiveness/Cost-effectiveness
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 HbA1c, blood pressure, and low-density lipoprotein (LDL) cholesterol levels.

Results: In the intervention group (n = 844), mean HbA1c improved over one year from 7.35% to 6.97% and from 8.35% to 7.42% in the subgroup with baseline HbA1c ≥7% (n = 353). In the usual care group (n = 821) mean HbA1c improved over one year from 7.43% to 7.37%. Adjusted net reductions (comparator minus baseline mean values in each group) were statistically significant for intervention (p = 0.034) and usual care (p = 0.047) groups.
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.
Why Remote Patient Monitoring Is Overhyped

Telemonitoring of patients with chronic conditions is a hot concept in the tech world. Companies like Intel, General Electric, Philips, and numerous upstarts are pursuing various gadgets that aim to provide seamless communication between patients and their doctors. The premise is that people with chronic diseases like heart failure and diabetes will do better and avoid complications if there are better means to communicate daily fluctuations in symptoms with their health providers. But two big new studies show, shockingly, that better communication may not be enough. Yale cardiologist Dr. K. Howard has led the charge of the cardiac disease community to advocate for remote monitoring, but two recent studies suggest that remote monitoring may not be the answer. The first study, published in the Journal of the American Heart Association, examined 20,000 patients with heart failure and found that remote monitoring did not improve outcomes. The second study, published in the Journal of the American College of Cardiology, examined 6,000 patients with diabetes and found that remote monitoring did not improve glycemic control.
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

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Cost of intervention: $3,425 US per patient
Spyglass Study of 100 Care Organizations

“A few barriers have to 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”
Congestive Heart Failure Client
Symptoms

Have you fainted?

1. No
2. Yes
3. Cancel
Symptoms
Has your breathing at night worsened?

1. No
2. Yes
3. Cancel
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
Details Needed

110 / 80
Pulse: 74 /min

Taken Today 10:00 AM

Was this?
1. First thing in the morning
2. During the day
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

Diabetic Hypertension  RCT
Blood Pressure automatically transmitted to BlackBerry
Blood Sugar readings automatically sent to BlackBerry
Results can be graphed to show progress and trends.
Pilot Results
Diabetic Hypertension

Intervention group (55 patients)

- systolic: -9.1 mmHg
- diastolic: -3.2 mmHg

Control group (55 patients)

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
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
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
Mobile apps are a natural, ubiquitous means for the potential delivery of health services to young diabetes patients.
Diabetes apps already flooding the market from both hobbyists and diabetes product providers.
These apps are poorly differentiated and more or less simply electronic versions of their paper counterpart: the paper log
For clinicians, the routine, passive logging of blood sugar, whether paper-based or electronic, is often ineffective in aiding young patients with self-care and glycemic control.
a diabetes app
for the ePatient
The next generation diabetes app is ...

- mobile
- encourages active self monitoring
- provides “teachable moments”
- allows communication with parents and providers
- creates engagement and adherence through a social community
- promotes positive health behaviors through *rewards*
Version 1
LeighannMMM  DD was 76 before her 45 min hip hop class. Gave 2 snacks – hope it's enough to get her through.  
#diabetes #bgnow

about 7 hours ago from TweetDeck

diabetesalic #bgnow 86

about 7 hours ago from web

cdalexander had a BG reading of 89 mg/dL at 02:36PM (Afternoon) #bgnow #diabetes

about 7 hours ago from Twitter4R

rainbow_goddess #bgnow 3.2 mmol/l No wonder I feel like going to sleep here at my desk.

about 8 hours ago from web

babscampbell 198 #bgnow

about 8 hours ago from TweetDeck
Partnered with Google and Microsoft
Shares data securely with Google Health and Microsoft HealthVault

Social Networking via diabetes community on Twitter
Available in ten languages

Nî hâo

Néih hóu

Zdravstvuite

Hello

Buenos días

Annyong ashimnikka

Bonjour

Guten Tag
Downloads:

>42000

more than 8000 active daily users
<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>United States</td>
<td>34.4%</td>
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<tr>
<td>Korea</td>
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<tr>
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<tr>
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<tr>
<td>China</td>
<td>4.8%</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.6%</td>
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<tr>
<td>France</td>
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<td>2.9%</td>
</tr>
<tr>
<td>Spain</td>
<td>2.8%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2.3%</td>
</tr>
</tbody>
</table>
Clinical Pilot
Pilot

20 adolescents aged 12-16 years with an uncontrolled HbA1c between 8-10%

Duration of the pilot was 3 months
Pilot

20 adolescents aged 12-16 years with an uncontrolled HbA1c between 8-10%

Duration of the pilot was 3 months

Supplied with the bant application running on an iPhone 4 and a LifeScan OneTouch UltraMini glucometer with a Bluetooth adapter

The outcome measure was the average daily frequency of blood glucose measurement during the pilot compared to the period three months prior
Version 2
User-centered design phase
THEME:
Data collector vs. decision-maker
THEME: Fast, discrete transactions:
THEME:
Overcoming inertia
THEME:
Ad hoc information sharing
<table>
<thead>
<tr>
<th>Meal</th>
<th>Value</th>
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<tbody>
<tr>
<td>Breakfast</td>
<td>5.1 mmol/l</td>
</tr>
<tr>
<td>Lunch</td>
<td>5.6 mmol/l</td>
</tr>
<tr>
<td>Snack</td>
<td>5.0 mmol/l</td>
</tr>
</tbody>
</table>
Snack: 5.0 mmol/l
Dinner: 5.0–5.2 mmol/l
Bedtime: 5.2–5.6 mmol/l

1 day ago
bantapptester11
6.9 mmol/l
Oh damn! A little late with my tests tonight as I tried to work through dinner. This is where timing of insulin and food come in

bantapptester3
Timestamps in Rewards feed don't update.

bantapptester12
3h
#bgnow 6.4 mmol/l

bantapptester7
3h
11.0 mmol/l Was the Second of 2 rdgs ... First one missing
OneTouch Ultra Mini integration
both wired and wireless
OneTouch Ultra integration

Bluetooth Adapter
<table>
<thead>
<tr>
<th>Meal</th>
<th>Reading Count</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overnight</td>
<td>1 reading</td>
<td>14.0 mmol/l</td>
</tr>
<tr>
<td>Breakfast</td>
<td>1 reading</td>
<td>11.4 mmol/l</td>
</tr>
<tr>
<td>Lunch</td>
<td>1 reading</td>
<td>4.0 mmol/l</td>
</tr>
<tr>
<td>Dinner</td>
<td>1 reading</td>
<td>3.2 mmol/l</td>
</tr>
</tbody>
</table>
Opps! This trend is still going. Please review your selections.

6 Low Lunch Readings
Oct 3 - Oct 7

What will you do to stop this Low trend from continuing?

- Adjust basal
- Adjust bolus
- Change ratio
- Improve carb counting
- Other
Lunch
6 readings
11.6 mmol/l average

3 High Lunch readings

Cause: Food
Fix: Adjust basal
Readings Graph

Labels, Colors & Reminders

Day starts at 6:00 AM

Sharing

Connects with TELUS health space

Email

About

Feedback
Community

received: Enjoy "Night Vision Picture and Video Spy Toolbox - Pro"! Tap link to redeem: http://bit.ly/iITEYU

I hope we could keep the iPhone/ipod touch :(

To y'all r lucky you get iPhones I got a iPod but o well it's still sick

have u been to camp huronda

I might go

what thing and when

Sorry meant: is anyone going :P

Hey.. I'd anyone going to the diabetes day thing?

hola welcome to the knew improve future lol I'm joking how
Criteria:
- Regular Glucose Measurements
- Participation in Communities
- Therapy Control
*bant* encourages positive health behaviours through rewards.
**Experience Points**  
+100 XP for 4 readings. Sticking to it!

**bant Reward**

**bant Reward**
Enjoy "Night Vision Picture and Video Spy Toolbox - Pro"! Tap link to redeem: http://bit.ly/iiTEYU

**Experience Points**
+70 XP for 4 readings. Sticking to it!
+100 XP for 4 readings. Sticking to it!

bant Reward


bant Reward

Enjoy "Night Vision Picture and Video Spy Toolbox - Pro"! Tap link to redeem: http://bit.ly/iiTEYU

Experience Points

+70 XP for 4 readings. Sticking to it!
Results

49.6% Daily average frequency of blood glucose measurement (from 2.38 to 3.56, p=0.006)
Results

Satisfaction was high, with 87.5% (14 of 16 subjects) stating that they would continue to use the system.
“... thought about trends and what to do when the alert popped up”

“... I tested more often at lunch”

“... rewards motivated me to test more”

“... she initiated more conversations about her blood sugars”
to the Dr. who cures
Diabetes'
trouble out
DEAR DR. BANTING,

I WISH YOU COULD COME TO SEE ME. I AM A FAT BOY NOW AND I FEEL FINE. I CAN CLIMB A TREE. MARGARET WOULD
Conclusion

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“active” monitoring is required

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