Telemedicine in Prevention and Chronic Disease Management

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Background

- Untreated CVD Risk Factors
- ↑ Utilization Due to Obesity and Aging
- Medical Cost Rapidly Increasing
- More Efficient Medical Delivery Will Not Solve the Problem
- Need a Shift from **Acute Care Model** to a **Prevention Model**
- Information Technology Needs to be Part of the Answer
Background

- Heart Failure - NIH
- CVD Risk Reduction - PA
- Gestational Diabetes - NIH
- COPD - PA
- Gastroparesis - NIH
- Obesity – PA
- HTN - AHRQ
Background

Shopping - 1989 vs. 2009

<table>
<thead>
<tr>
<th>1989</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oder Catalog</td>
<td>Shop On-line</td>
</tr>
<tr>
<td>Review Catalog, Discuss item with Sales Person</td>
<td>See details and read reviews</td>
</tr>
<tr>
<td>Sales Person obtains mailing and billing information, places order</td>
<td>Enter mailing and billing information, place order</td>
</tr>
<tr>
<td>Sometime later item arrives</td>
<td>Receive noticed that item has been ordered and shipped</td>
</tr>
<tr>
<td></td>
<td>Notified about status of shipment</td>
</tr>
<tr>
<td></td>
<td>Know when item will arrive</td>
</tr>
</tbody>
</table>
# Background

Starting a new Prescription – 1989 vs. 2009

<table>
<thead>
<tr>
<th>1989</th>
<th>2009</th>
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<tbody>
<tr>
<td>Call patient</td>
<td>Call Patient</td>
</tr>
<tr>
<td>If no answer. Leave detailed message on answering machine</td>
<td>If no answer, leave vague message to call office (HIPAA).</td>
</tr>
<tr>
<td>Call Pharmacist with new prescription</td>
<td>Call Pharmacist with new prescription</td>
</tr>
<tr>
<td>Enter transactions in medical record</td>
<td></td>
</tr>
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</table>
What is Telemedicine?

- Telemedicine’s role is to strengthen the patient-provider relationship by using Today’s technology (cell phone, computers, internet, artificial intelligence, measuring devices), thereby improving chronic disease management and prevention in a cost effective manner. ➔ PHR ➔ Nurse Management
Prevention & Chronic Disease Management

- Nothing Like a Nurse!!
- Costs, Costs, Costs!
Design Philosophy

• Costs
  Hardware
  Asynchronous Communication

• Strengthen Patient-Provider Relationship
  Self-Monitoring
  Education
  Communication / Feedback with PCP

• Access
  Easy / Flexibility / Cost
## Cost

### Hardware ➔ Device directly Connected to Internet

<table>
<thead>
<tr>
<th>Authors</th>
<th>Device</th>
<th># Pts</th>
<th>Duration</th>
<th>Age</th>
<th>Asyn</th>
<th>Who Δ meds</th>
<th>BP Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artinian 2007</td>
<td>Yes</td>
<td>387</td>
<td>1 Yr</td>
<td>60</td>
<td>No</td>
<td>Doctor</td>
<td>↓ 13.0/6.3 mmHg</td>
</tr>
<tr>
<td>Logan 2007</td>
<td>Yes</td>
<td>33</td>
<td>4 mo</td>
<td>48.1</td>
<td>Automatic</td>
<td>Doctor</td>
<td>↓ 10.0/4.0 mmHg</td>
</tr>
<tr>
<td>Bobrie 2007</td>
<td>Yes</td>
<td>111</td>
<td>8 wks</td>
<td>59</td>
<td>No</td>
<td>Patient</td>
<td>↓ 9.0/6.0 mmHg</td>
</tr>
<tr>
<td>Green 2008</td>
<td>No</td>
<td>778</td>
<td>1 year</td>
<td>59.1</td>
<td>Yes</td>
<td>Pharmacist</td>
<td>↓ 13.2/4.6 mmHg</td>
</tr>
<tr>
<td>Rogers 2001</td>
<td>Yes</td>
<td>121</td>
<td>8 wks</td>
<td>61.5</td>
<td>No</td>
<td>Doctor</td>
<td>↓ 4.9/2.0 mmHg</td>
</tr>
<tr>
<td>Santamore</td>
<td>No</td>
<td>465</td>
<td>1 Yr</td>
<td>60.7</td>
<td>No</td>
<td>Doctor</td>
<td>↓ 18.1/7.1 mmHg</td>
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**BP Telemedicine Studies**
BP Accuracy Study Design

CVD Risk Reduction Study

- Hypothesis – Telemedicine Subjects will accurately transmit their BP values
- 465 Pts with moderate risk of CVD.
- Randomized to Standard Care or Telemedicine, given BP meters with memory
- Followed for 1 year
- Primary Outcome – BP values; Meter vs. Telemedicine
BP Accuracy Study

Tele BP 133.4±11.1 vs. Meter BP 136.4±11.9 mmHg
BP Accuracy Study

Tele BP 77.5±6.8 vs. Meter BP 79.7±7.5 mmHg
BP Accuracy Study

Mean Systolic BP versus Difference

Percent Error = -0.02±0.04%
BP Accuracy Study

Mean Diastolic BP vs. BP Difference

Percent Error = -0.032±0.04%
Cost

Is Hardware Needed?

- Device that directly transmits BP is more accurate than patient entering BP values
- But, only small patient errors
- Clinical studies show comparable Outcomes
- For large populations, hardware costs are excessive
## Cost

### Nurse’s Time - Asynchronous

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Heart Failure Study Design

- Hypothesis – A Telemedicine System ↓hospitalization
- 48 Pts with Class II, III or IV HF & Hospitalization within 6 months, computer with Internet access.
- Randomized to Standard Care or Telemedicine
- Followed for 1 year
- Primary Outcome - Hospital Days
## Communication

### Internet Messages – Telephone Calls

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>#/week</th>
<th>Ave/pt/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient messages</strong></td>
<td>1887</td>
<td>36</td>
<td>1.5</td>
</tr>
<tr>
<td>Text + data</td>
<td>721</td>
<td>14</td>
<td>0.6</td>
</tr>
<tr>
<td>Dataonly</td>
<td>1166</td>
<td>22</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Provider messages</strong></td>
<td>1887</td>
<td>36</td>
<td>1.5</td>
</tr>
<tr>
<td>Generic message</td>
<td>1250</td>
<td>24</td>
<td>1.0</td>
</tr>
<tr>
<td>Tailored message</td>
<td>637</td>
<td>12</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Telephone Calls:** Controls 8 calls/year/pt; Tele – 6 calls/yr/pt
## 1-Year Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Control (n=24)</th>
<th>Telemedicine (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED visits</td>
<td>12</td>
<td>5*</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>40</td>
<td>24*</td>
</tr>
<tr>
<td>Hospital Days</td>
<td>226</td>
<td>84*</td>
</tr>
</tbody>
</table>

* P < 0.025
Cost
Nurse’s Time - Asynchronous

- Asynchronous Communication is more Efficient
- BP Outcomes are Similar
- HF Outcomes Improved
- Who Pays for Nurse to Respond to Patient
- Automated Systems Show Promise
CVD Risk Reduction Study; 465 Pts with moderate risk of CVD; Randomized to Standard Care or Telemedicine, given BP meters with memory
Followed for 1 year

Telemedicine
Non-Monitors ➞ Monitors
Self-Monitoring Documented
Self-Monitoring
Blood Pressure over Time

- Rapid Decrease in BP
- Home BP values lower than office
Education
Telemedicine Screens

- Patient
- Input Data (messages)
- Medications
- Lab Data
- Review
- **Education**

Doctor
- Pt Review
- Medications
- Lab Data
- Scheduler
- User Log
Education
Telemedicine Screens

- Out of 196 Patients, only 2% access Educational Screens

- Take Home Message ➔ Push Education
“Your patient has been provided with a copy.”

**Framingham CVD Risk Score: 12%**

<table>
<thead>
<tr>
<th>Blood Pressure (mmHg) 167/86*</th>
<th>Weight (lbs) 137</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse (beats/min) 102*</td>
<td>Body Mass Index 25.1</td>
</tr>
<tr>
<td>SpO2 (%) 98</td>
<td>6 minute walk test (ft) 936</td>
</tr>
<tr>
<td></td>
<td>Cigarettes per Day 0</td>
</tr>
<tr>
<td>Fasting Blood glucose (mg/dl) 324*</td>
<td>Total Cholesterol (mg/dl) 267*</td>
</tr>
<tr>
<td></td>
<td>HDL (mg/dl) 40*</td>
</tr>
<tr>
<td>Hbg A1c (%) 12.9*</td>
<td>LDL (mg/dl) 130*</td>
</tr>
<tr>
<td></td>
<td>Triglycerides (mg/dl) 486*</td>
</tr>
<tr>
<td>Urine microalbumin (mg/L) 30.1*</td>
<td></td>
</tr>
<tr>
<td>Urine microalbumin/creatinine ratio (mg/g) 80*</td>
<td></td>
</tr>
</tbody>
</table>
MONTHLY REPORT ON HYPERTENSION-TELEMEDICINE STUDY

Date

Name__________
Physician__________

Your blood pressure readings are shown on the graph below. Note that readings should be within or below the blue bands to be considered normal.

[This graph will be timed for the 6 months study and will “grow” to the right as new measures are added FB]

TRENDS

Your current medications are: ... ...
Your blood pressure is at goal, continue your medications as prescribed. [message 1]
If your blood pressure is not at goal, based on your clinical status, we would recommend addition of ... ... or ... to bring your blood pressure down to normal values. [message 2]
Feedback to Practice

- From CVD Risk Reduction Study, Reports faxed to the PCP
  52% of Pts took the report to their office visit
  75% Discussed their values with their PCP

- From current HTN Study, Reports faxed to PCP
  One institution misplaced 14 reports

- Faxing works!

- But direct transfer to EMRs would be better
Feedback to Practice

Medication Adherence

<table>
<thead>
<tr>
<th></th>
<th>30-Day</th>
<th>90-Day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cholesterol</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lovastatin 20mg tab</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>Pravastatin 40mg tab</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amiloride-HCTZ 5mg-50mg</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>Enalapril-HCTZ 5mg-12.5mg</td>
<td>30</td>
<td>90</td>
</tr>
</tbody>
</table>
Access
Ease / Flexibility / Cost

52% have incomes <$25,000/Yr

- Averaging Over 2 Transmission / Week
- 61% Using Telephone Access
- Flexibility ➔ Needed, But Hard to Address in a Research Study
Design Philosophy

• **Costs**
  Hardware?
  ✓ Asynchronous Communication – Automated Messages!

• **Strengthen Patient-Provider Relationship**
  ✓ Self-Monitoring – Effective, Documented
  Education? - Push Educational Messages

✓ Communication / Feedback with PCP – Fax?, EMR!

• **Access**
  Easy / Flexibility / Cost? – Needed and Hard!
Always Behind Technology Curve

- Facebook
- 400 million members
- 61 PubMed References

- Text Messaging
- ???? People Texting
- 147 PubMed References
Planned Updates

- Secure, Asynchronous Communication
- TTRC
- Patient Secure Asyn Comm
- Tailored Smart System
- Guidelines
- Automated Reminders to Patients
- Automated Review of Data
- Built-in Intelligence
- Tailored Messages to Patient
Tailored Messages

- Automated Tailored Messages to Patient
  - Know gender, age, medical condition, insurance coverage, etc.
  - Monitoring status – at goal, not at goal, not monitoring
  - Behavioral Mining (Click Stream Mining)

- Dynamic Tailoring of Messages
Temple Telemedicine Research Center

Thank You

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