Secure Messaging and Personal Health Records: Designing Customer-Facing Processes

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CHEPS Seminar, September 18, 2017
Agenda

- **Study 1: Secure Messaging Implementation at the VHA**
  - Collaborators and co-authors:
    - VHA: Susan Wood, Stephanie Shimada, Beth Ann Petrakis, James Rothendler, Maryan Zirkle, Shibeizhao, Hua Feng, Gemmae Fix, Tracy Martin, Howard Gordon, Steven Simon
    - WPI: Bengisu Tulu
    - University of Colorado: Mustafa Ozkaynak (Post-doc)
- **Study 2: Patient Portal Use**
  - Collaborators and co-authors:
    - WPI: Diane Strong, Bengisu Tulu, Zhou Fang (MS Student), Farhan Mushtaq (PhD Student)
    - University of Wisconsin-Milwaukee: Wonchan Choi (Post-doc)
    - Reliant Medical Group: Lawrence Garber, John Trudel
- **Conclusions: Process Design**
Patient-Facing Technologies

• Interaction of the patient (consumer) with the health system through IT

• Categories of use (Ahern et al., 2011)
  – Information and transactions
e.g., request/view appointments, refill medications, request health information, financial
  – Expert care
e.g., secure messaging, electronic/access to patient/health data, remote monitoring and telehealth
  – Self-care and community
e.g., peer online support, self-management

• Benefits: quality of care, value, access
Study 1: Secure Messaging
Study 1: Secure Messaging

- Examine clinical workflow associated with the use of Secure Messaging (SM) at the VA
- Online secure communication between patients and providers about non-urgent issues.
  - “Did you want me to get lab work done before I see you?”
  - “I’m sending a list of vitamins and supplements that I take. Please have the doctor make sure that they are OK to take, and don’t counteract what I take for my Parkinsons”
  - “Thanks for sending me the test results. I still have a question for the doctor about the numbers that you gave me.”
- What is the ‘most appropriate’ workflow?
SM Rollout at the VA

- VA provides health care to 6 million veterans; 18 regions, approximately 150 VA Medical Centers and 1400 community-based outpatient clinics
- My HealtheVet (MHV)
  - Roll-out began 2008
  - Secure messaging since 2011
  - Separate system from the EHR
- By September 2016, about 1.9 patients opted in
SM Use

• Positively associated with:
  – Health outcomes (Zhou et al. 2010; Wade-Vuturo et al. 2013; Harris et al. 2013)
  – Patient satisfaction (Lin C-T et al. 2005; Wade-Vuturo et al. 2013)
  – Perceived improved patient knowledge and self-care (Woods et al. 2013)
  – Adherence (Muller et al. 2009)
  – Efficiency (Liederman and Morefield 2003)
  – Cost of care (Reid 2009; Zhou et al. 2010)

• Challenges remain:
  – Adoption rates (Shimada et al., 2013)
  – Usability (e.g., Heyworth et al. 2013)
  – Integration with workflow (e.g., Wakefield et al., 2010)
Process Analysis

Context & Process Management

Process: network of activities and buffers

Resources

Inputs
Flow units: secure messages

Outputs
Resolved messages

Information structure

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SM Workflow Studies

• Secure message analysis (flow unit)
  – Content/types of messages (Rohrer et al., 2013; Roter et al., 2008; White et al., 2004)
  – Length and readability (Mirsky et al., 2016)
  – Response timeliness and fulfillment (Sittig et al., 2003)

• Resources
  – Patient/consumer perceptions
    ▪ Improves satisfaction (Hoonakker et al., 2017, Haun et al., 2013)
    ▪ Perceived to add value & improve quality of care (Hoonakker et al., 2017)
    ▪ Worried about appropriate use (Seick et al., 2017)
  – Provider and staff perceptions
    ▪ Concern about workload among clinicians; staff more satisfied (Hoonakker et al., 2017)
    ▪ Concern about message content/clarity (Seick et al., 2017)
    ▪ Perceived to add value & improve quality of care (Hoonakker et al., 2017)
SM Study at VA

Inputs
Flow units: secure messages

Process: network of activities and buffers

Outputs
Resolved messages

Resources

SM Thread Analysis: message types, flow

Site Visits: flow, fit with care teams and processes
Message Thread Analysis
(Shimada et al., 2017)

• Sampled message threads from 10 patient care teams, from two regional areas (urban medical center and affiliated community clinics)
  – Direct use of SM by the primary care provider
  – Volume of incoming messages
  – Rate of message ‘escalation’

• Thread: string of related messages

• 1000 threads, 25 from each team between January 1, 2013 and April 15, 2013

Observations
- Content type:
  - 78.3% have transactional content (medication renewal, scheduling, referral, administrative)
  - 36.2% have clinical content (medication issue, health issue, test result, test issue)
  - 20% have other content
- Sites differ in type of content:
  - Site 1: scheduling, referrals, other
  - Site 2: health and medication issues
Thread Analysis: Workflow

- Who sends/responds to messages

![Pie chart showing distribution of messages by role: Registered Nurse (340, 28%), Nurse Practitioner (PCP) (324, 27%), Other (285, 24%), Medical Assistant/Health Tech (165, 14%), Pharmacist (33, 2%), Licensed Practical Nurse (18, 1%), Other Provider (10, 1%), and Nurse Practitioner (PCP) (26, 2%)].
Thread Analysis: Workflow, cont...

- **Message length and resolution**
  - 62% completed in 2 messages or less; 94.5% in 4 or less
  - Resolution varies by type:
    - Across types, 10-30% have no resolution within thread
    - High resolution rates:
      - Test results/issues
      - Transactional
    - Lower rates:
      - Health/medication issues
      - FYI, self-reporting, appreciation
      - Other (life issues, complaints)

- **Responsiveness**
  - 87% resolved within 3 business days
  - Time to first response/completion depends on type

Observation: workflow and organization unclear, variation
SM Site Visits

• 8 sites (4 in each regional area; subset of 20)
• 2-4 interviewees per site: 29 Interviews
• Semi-structured interview protocol
  – Interviewee’s role on the healthcare team,
  – How SM was used,
  – The integration of SM with daily practice
  – Team members’ attitudes towards and experiences with SM
## Methods: Sample

<table>
<thead>
<tr>
<th>Team No</th>
<th>Location</th>
<th>Incoming Message Volume in 6 Months</th>
<th>Provider Completion Rate*</th>
<th>Roles of the Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New England</td>
<td>303</td>
<td>0%</td>
<td>Physician, licensed practical nurse (LPN), registered nurse (RN), Pharmacist**</td>
</tr>
<tr>
<td>2</td>
<td>New England</td>
<td>197</td>
<td>0%</td>
<td>Physician, LPN, Pharmacist**</td>
</tr>
<tr>
<td>3</td>
<td>New England</td>
<td>283</td>
<td>20%</td>
<td>Nurse Practitioner, LPN, RN</td>
</tr>
<tr>
<td>4</td>
<td>New England</td>
<td>329</td>
<td>58%</td>
<td>Physician, LPN, RN, Pharmacist</td>
</tr>
<tr>
<td>5</td>
<td>Northwest</td>
<td>385</td>
<td>0%</td>
<td>Physician, LPN, RN, Pharmacist</td>
</tr>
<tr>
<td>6</td>
<td>Northwest</td>
<td>491</td>
<td>0%</td>
<td>Physician, RN, Medical assistant</td>
</tr>
<tr>
<td>7</td>
<td>Northwest</td>
<td>503</td>
<td>73%</td>
<td>Physician, LPN, RN, Social worker</td>
</tr>
<tr>
<td>8</td>
<td>Northwest</td>
<td>539</td>
<td>32%</td>
<td>Physician, LPN, RN, Medical Assistant</td>
</tr>
</tbody>
</table>

* Provider completion rate is the percentage of the secure messages completed by provider (physician or nurse practitioner) by clicking the “Complete” button in the SM system.
Methods: Data Analysis

- All interviews for a team were read by two researchers, and each created a summary on a semi-structured template
  - Interviewees: tenure - VA/on team, roles and responsibilities
  - Types of messages
  - Process steps (receipt, triage, response, documentation, completion)
  - Outcome/value
  - Organization
  - Technology
- A third researcher synthesized the other two researchers’ notes to create an overall site summary
- Site summaries and thread data are being combined to support analysis.
Results: SM Workflow

- Message Received
  - Decide to open
  - Message Opened
    - Who receives it?
    - When? (morning, t/o day)
  - Triage
    - Handle message
    - Assign through SM
      - Message content
      - Whether sent directly to person
  - Information Gathering
  - Take action
    - Reassign
      - via CPRS
      - other systems
      - other team
      - members
      - patient
      - providers external to team
    - Assign through CPRS
      - Hard copy, print message
      - Send outside team
  - Respond to Patient
  - Complete
  - Document in CPRS
  - Action Outside SM

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Results: Flow Patterns

Examined variations in flow patterns across sites; who initially handled and who completed them

<table>
<thead>
<tr>
<th></th>
<th>Staff Completes SM Messages – Verbal/Printing with Provider</th>
<th>Staff Completes SM Messages – CPRS with Provider</th>
<th>Staff and Providers handle/complete messages in SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Person Opens SM</td>
<td>1, 2</td>
<td></td>
<td>8 (occasionally provider)</td>
</tr>
<tr>
<td>Multiple Staff Open SM</td>
<td></td>
<td>5, 6</td>
<td>3</td>
</tr>
<tr>
<td>Staff and Providers Open SM</td>
<td></td>
<td></td>
<td>4, 7</td>
</tr>
</tbody>
</table>
## Results: Technology Fit

<table>
<thead>
<tr>
<th>Level</th>
<th>Description of the Level from Karsh et al.</th>
<th>Workflow Issues Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>User-technology fit</td>
<td>“Fit between technology and user characteristics (e.g., values, attitudes, abilities)”</td>
<td>1. Use among team members varies due to their abilities, attitudes and values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Inappropriate use of messaging by patients</td>
</tr>
<tr>
<td>Task-technology fit</td>
<td>“Fit between technology and health care task characteristics (e.g., complexity, time constraints)”</td>
<td>3. SM was tethered, but not integrated, into the electronic record</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Technology-related issues (e.g., frequent log offs, time required to log onto second system)</td>
</tr>
<tr>
<td>Organization-technology fit</td>
<td>“Fit between technology and organizational characteristics (e.g., policies, practices, social climate, resources)”</td>
<td>5. Need for additional policies (e.g., access by family members, identification of surrogates)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Additional workload</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Despite the significant impact on workload, there was no workload credit for SM.</td>
</tr>
<tr>
<td>Environment-technology fit</td>
<td>“Fit between technology and the external (e.g. politics, culture) or internal (e.g., lighting, layout, noise) environment”</td>
<td>8. Patient expectations of early response</td>
</tr>
</tbody>
</table>

Study 2: Patient Portal Implementation
Study Setting and Data

- Multi-specialty group medical practice (250 physicians, 25 clinics, 200,000 patients, and over one million patient visits annually)

- Data:
  - Method: invited 10K portal users (randomly selected from 40K) to participate; 632 signed consent to participate
  - For each participant, collected 3 types of data:
    - ‘Clickstream’ data on their portal use (343K clicks) (Jan 2011 – Dec 2012, 2 years of data)
    - Encounters (56K records)
    - Patient survey (110 items, 13 subsections)
      - Demographic information
      - Self-reported health status
      - Empowerment (PES), activation (PAM)
      - Computer use
      - Attitudes toward portal (Perceived Ease of Use, Perceived Usefulness)
Portal Use and Health Status

- Portal usage is proportional to clinical encounters
- Patients with poorer health use the portal more

Office Visits: ‘Good’ Health Status

Office Visits: ‘Poor’ Health Status
Portal Use and Health Management

- Technology acceptance model:
  Perceived ease of use (PEOU) and perceived usefulness (PU) of a patient portal will have significant effects on users’ health management (HM)

- Explore PES and PAM as mediators; demographic data as moderators
Results: Structural Equation Modeling

- 2-factor model of health management:
  - Improvement
  - Action

- PEOU, PU have a significant effect on perceived health management

- Patient empowerment played a significant role as a mediator

- Education had some moderating effects; income and health status did not

- PAM had no direct effect on HM practice

* 467 responses used; excluded indicators with low factor loading
Conclusions: Process Design
Process Design Guidelines

• What can be learned about how to design processes for patient-facing technologies?
• What are goals? (design for engagement)
• Need an understanding of the ‘system’
  — Quantitative data sources may not provide enough insight about dynamics and environmental variables (mixed methods)
  — More than tasks/activities
  — Patient is part of the system
• Process design
  — Understand operational variations and design standard solutions
  — Responsive to preferences
• Implementation strategies should be responsive to lack of fit between technology and workflow at multiple levels
Acknowledgments

• Study 1 was funded by the Veterans Health Administration (QUERI RRP 11-409, PI: Woods), with additional support from the New England Veterans Engineering Resource Center.

• Study 2 was funded in part by the National Science Foundation, “AOC: Health Information Technology as an Agent of Change for Improving Health Care Delivery Processes”, Award Number: 0826842
Thank you!

Questions
References

### Message Threads – NE

<table>
<thead>
<tr>
<th>Message Number in Thread</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td># Messages</td>
<td>100</td>
<td>91</td>
<td>48</td>
<td>31</td>
<td>14</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Avg. Length</td>
<td>52.3</td>
<td>27.1</td>
<td>30.2</td>
<td>42.5</td>
<td>22.4</td>
<td>30.3</td>
<td>29.3</td>
<td>11.5</td>
<td>7</td>
</tr>
<tr>
<td>Patient</td>
<td>81</td>
<td>14</td>
<td>32</td>
<td>9</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Caregiver</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA/Health Tech</td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPN</td>
<td>6</td>
<td>44</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td></td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD-PCP</td>
<td>7</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>NP-PCP</td>
<td>1</td>
<td>4</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacist</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Provider</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 86% messages initiated by patients/caregivers
  (messages initiated by providers may be responses to messages initiated by patients in a different thread)
- Most messages have a response (91%)
- About ½ of message threads contain 3 messages or less
- LPNs/RNs respond to most messages
# Message Threads – Site 4 (NE)

- 1 message – 0 issues; 10 messages – 1 issue; 12 messages – 2 issues; 2 messages – 3 issues
- 72.5% (29/40) fully addressed, 5% partially, 17.5% none/don’t know, 5% NA
- Average length of thread: 3.6 messages
- MD generates 28% of messages (7/25); tests/referrals

<table>
<thead>
<tr>
<th>Issue</th>
<th># Messages</th>
<th>Message Flow</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Med Renewal</td>
<td>7</td>
<td>P/C-MD(-P/C) (3); P/C (2); P/C-RN (forward); P/C-MD-P/C-Other (forward)</td>
<td></td>
</tr>
<tr>
<td>Scheduling</td>
<td>6</td>
<td>P/C-MA-P/C-MA; P/C-RN-P/C-RN-P/C P/C-MD (2; 1 with another issue) P/C-RN-RN-P/C; P/C-RN-RN-RN-RN-P/C-RN (3 issues)</td>
<td></td>
</tr>
<tr>
<td>Referral</td>
<td>5</td>
<td>P/C-MD-P/C; P/C-MD-P/C-RN-MD-P/C-MD-P/C-MD-P/C-MD-P/C-MD-P/C-MD-P/C-MD-P/C-RN (3 (2 with test result)</td>
<td>Longest thread</td>
</tr>
<tr>
<td>Test Results</td>
<td>7</td>
<td>MD-P/C-MD(-P/C) (5) MD-P/C-RN-P/C</td>
<td>2 with test result; 2 with referral</td>
</tr>
<tr>
<td>Med Issues</td>
<td>2</td>
<td>P/C-MD-P/C; P/C-RN-RN-RN-RN-P/C-R</td>
<td></td>
</tr>
<tr>
<td>Test Issue</td>
<td>1</td>
<td>P/C-MA-P/C-MD</td>
<td>2 Admin.</td>
</tr>
</tbody>
</table>