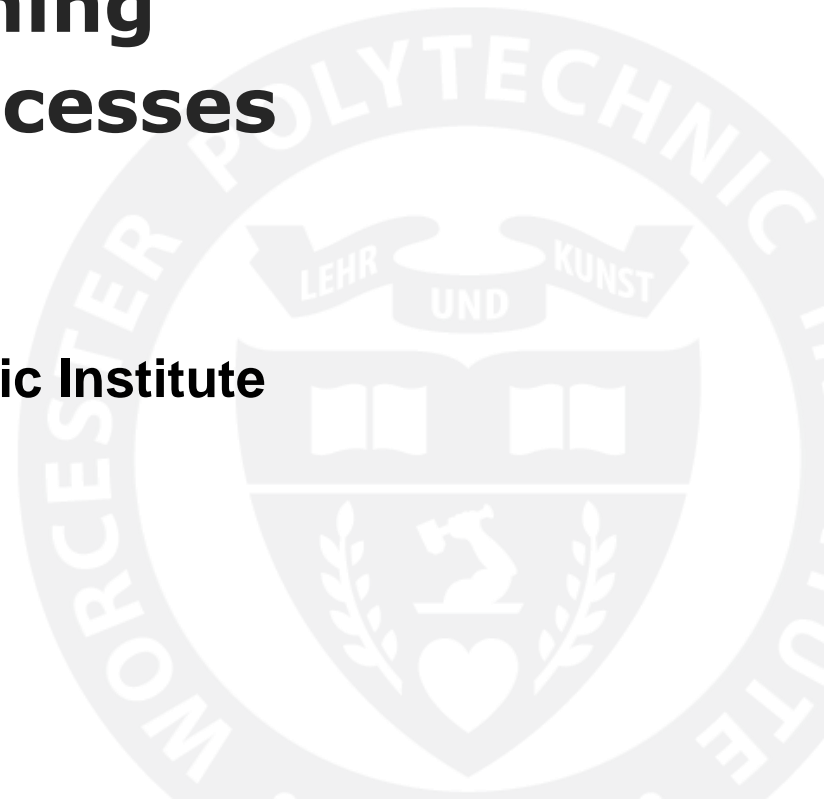# Secure Messaging and Personal Health Records: Designing Customer-Facing Processes

**Sharon Johnson, Worcester Polytechnic Institute**

**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, Shibei Zhao, 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

- <span style="color:red">Online secure communication</span> 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?
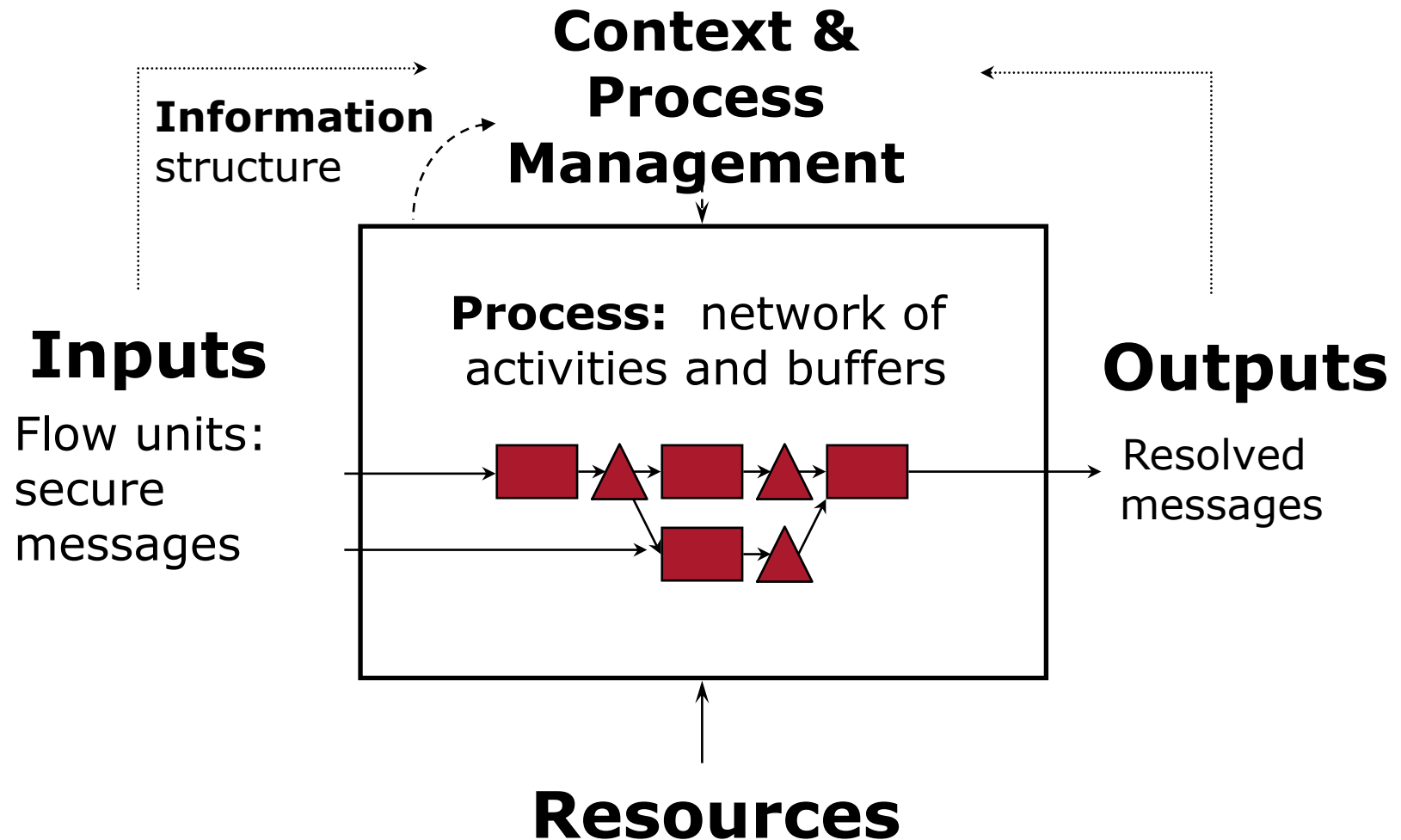
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# SM Rollout at the VA

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

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# 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)
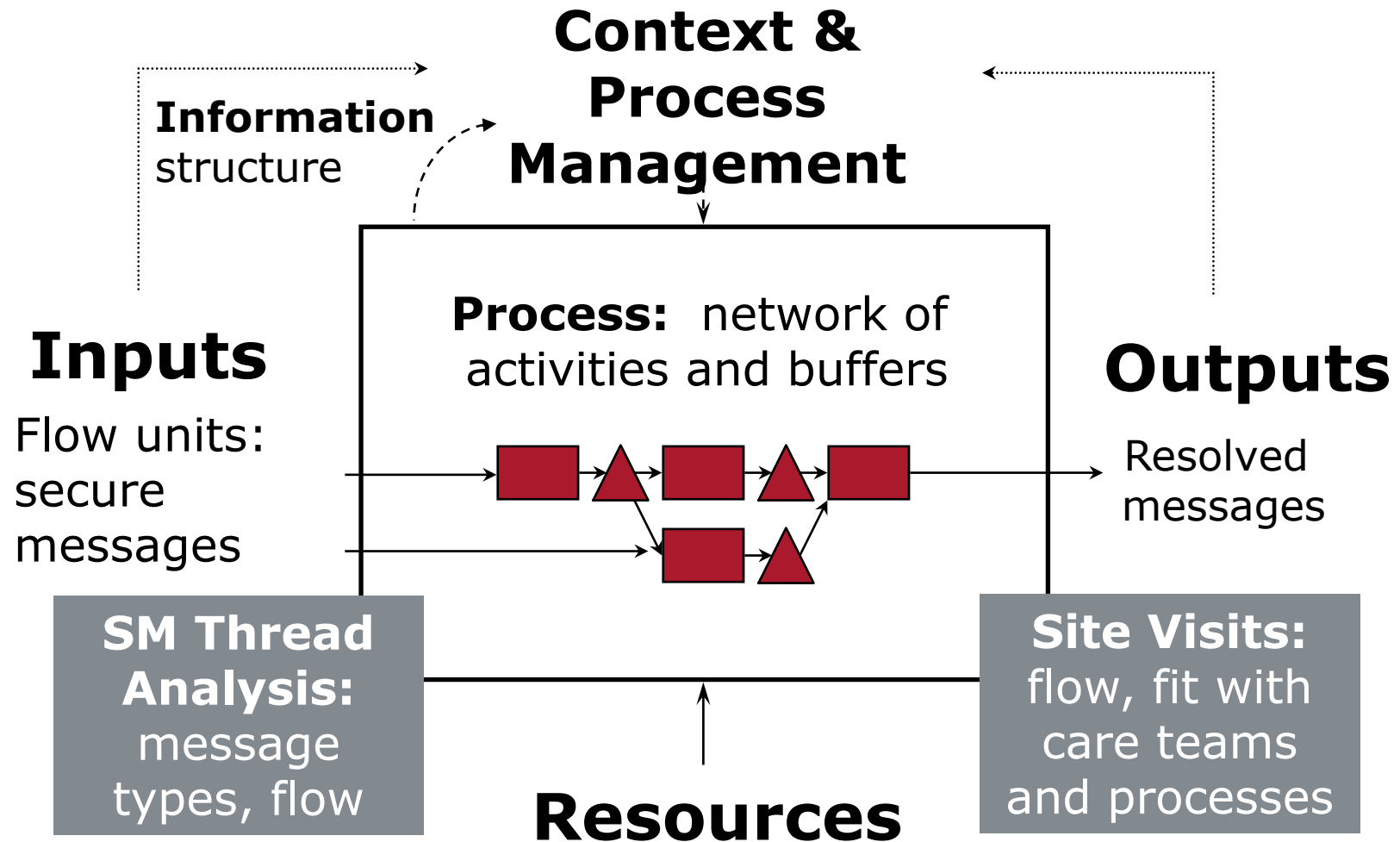  - Integration with workflow (e.g., Wakefield et al., 2010)

# Process Analysis



Context & Process Management

Information structure

Inputs

Flow units: secure messages

Process: network of activities and buffers

Outputs

Resolved messages

Resources

# 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)

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# SM Study at VA



**Context & Process Management**

**Information** structure

**Inputs**
Flow units: secure messages

**Process:** network of activities and buffers

**Outputs**
Resolved messages

**SM Thread Analysis:** message types, flow

**Resources**

**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

\* Shimada SL, Petrakis BA, Rothendler JA, Zirkle M, Zhao S, Feng H, Fix GM, Ozkaynak M, Martin T, Johnson SA, Tulu B. An analysis of patient-provider secure messaging at two Veterans Health Administration medical centers: message content and resolution through secure messaging. Journal of the American Medical Informatics Association. 2017 Mar 24:ocx021.

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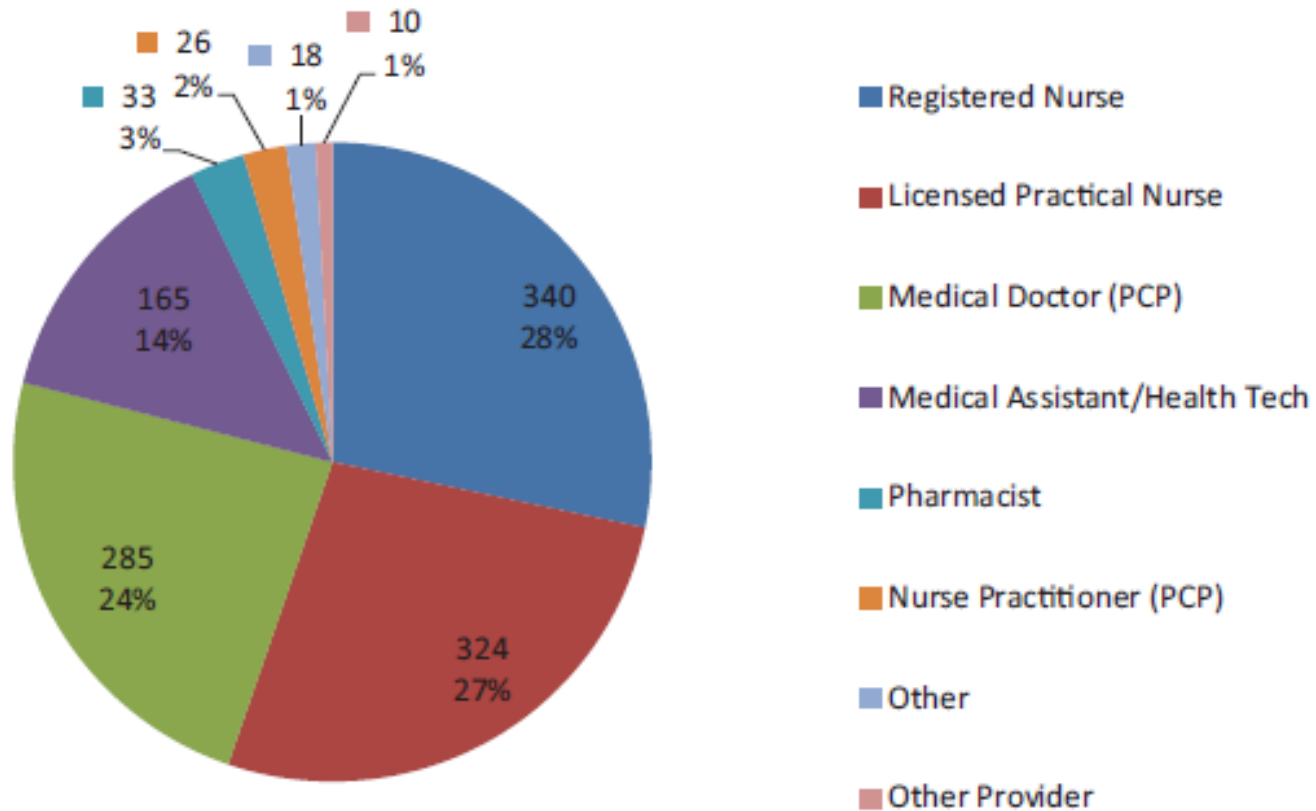
# Thread Analysis: Content

| Message content categories | Overall (N = 945) | | Site 1 (N = 461) | | Site 2 (N = 484) | |
|---|---|---|---|---|---|---|
| | N (%) of messages with content | Mean hours to first reply | N (%) of messages with content | Mean hours to first reply | N (%) of messages with content | Mean hours to first reply |
| Medication renewal or refill | 446 (47.2) | 28.0 | 221 (47.9) | 19.3 | 225 (46.5) | 37.1 |
| Scheduling | 166 (17.6) | 19.7 | 113 (24.5) | 15.7 | 53 (11.0) | 29.1 |
| Medication issue | 122 (12.9) | 38.5 | 49 (10.6) | 37.8 | 73 (15.1) | 38.9 |
| Health issue | 120 (12.7) | 28.9 | 33 (7.2) | 19.9 | 87 (18.0) | 33.2 |
| Referral | 66 (7.0) | 31.4 | 43 (9.3) | 25.5 | 23 (4.8) | 42.3 |
| Administrative | 61 (6.5) | 34.4 | | | | |
| Test result | 51 (5.4) | 28.0 | | | | |
| Test issue | 49 (5.2) | 36.9 | | | | |
| FYI informing | 46 (4.9) | 25.1 | | | | |
| My HealtheVet/ SM-related | 39 (4.1) | 27.1 | | | | |
| Appreciation | 37 (3.9) | 22.1 | | | | |
| Self-reporting | 26 (2.8) | 24.9 | | | | |
| Life issue | 14 (1.5) | 21.6 | | | | |
| Complaint | 14 (1.5) | 28.8 | | | | |
| Other | 14 (1.5) | 15.0 | | | | |

Observations
- Content type:
  - 78.3% have transactional content (med 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

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# Thread Analysis: Workflow

- Who sends/responds to messages

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# 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

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# 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

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

* 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
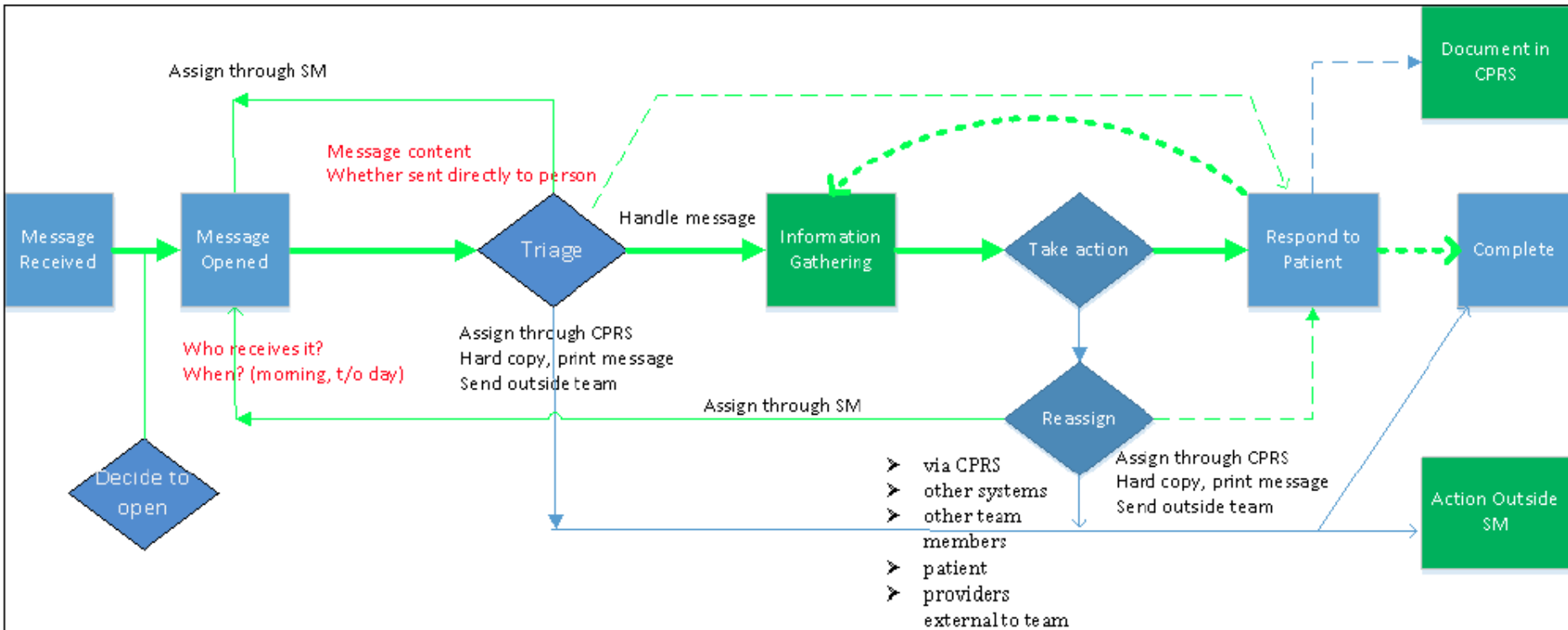
# Results: Flow Patterns

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

| | Staff Completes SM Messages – Verbal/Printing with Provider | Staff Completes SM Messages – CPRS with Provider | Staff and Providers handle/complete messages in SM |
|---|---|---|---|
| **Single Person Opens SM** | **1, 2** | | **8 (occasionally provider)** |
| **Multiple Staff Open SM** | | **5, 6** | **3** |
| **Staff and Providers Open SM** | | | **4, 7** |

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# Results: Technology Fit

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

- Karsh, B. T., Escoto, K. H., Beasley, J. W., & Holden, R. J. (2006). Toward a theoretical approach to medical error reporting system research and design. *Applied ergonomics*, *37*(3), 283-295.
- Ozkaynak, M., Johnson, S., Shimada, S., Petrakis, B.A., Tulu, B., Archambeault, C., Fix, G., Schwartz, E. and Woods, S., 2014. Examining the multi-level fit between work and technology in a secure messaging implementation. In *AMIA Annual Symposium Proceedings* (Vol. 2014, p. 954). AMIA.

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# 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
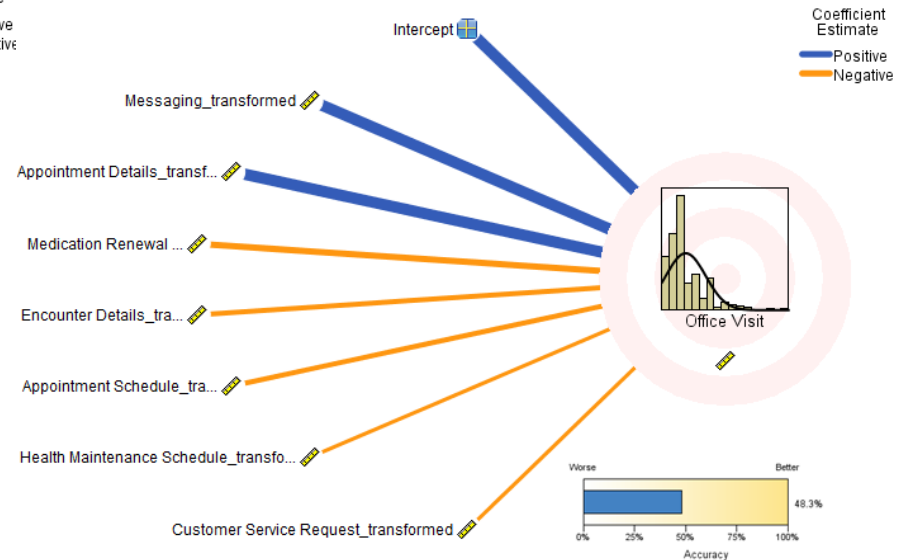- Patients with poorer health use the portal more

Office Visits: 'Good' Health Status
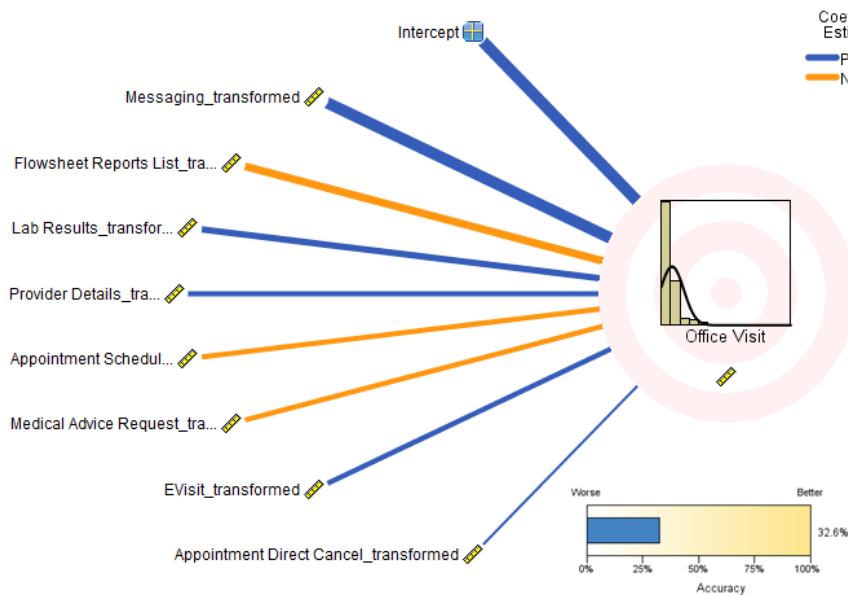
Office Visits: 'Poor' Health Status
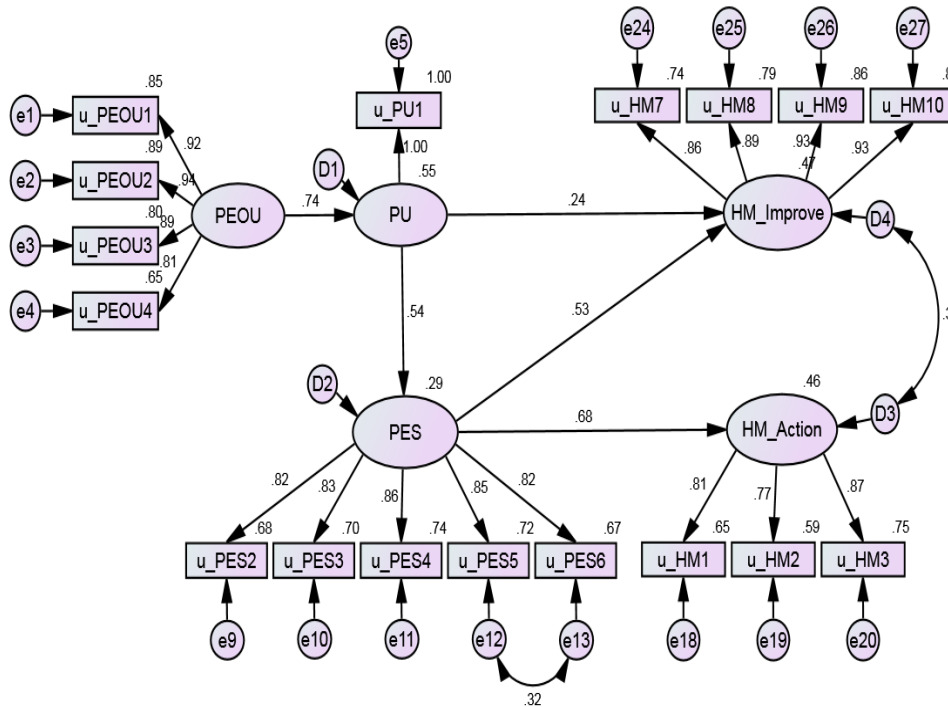
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# Portal Use and Health Management

- 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
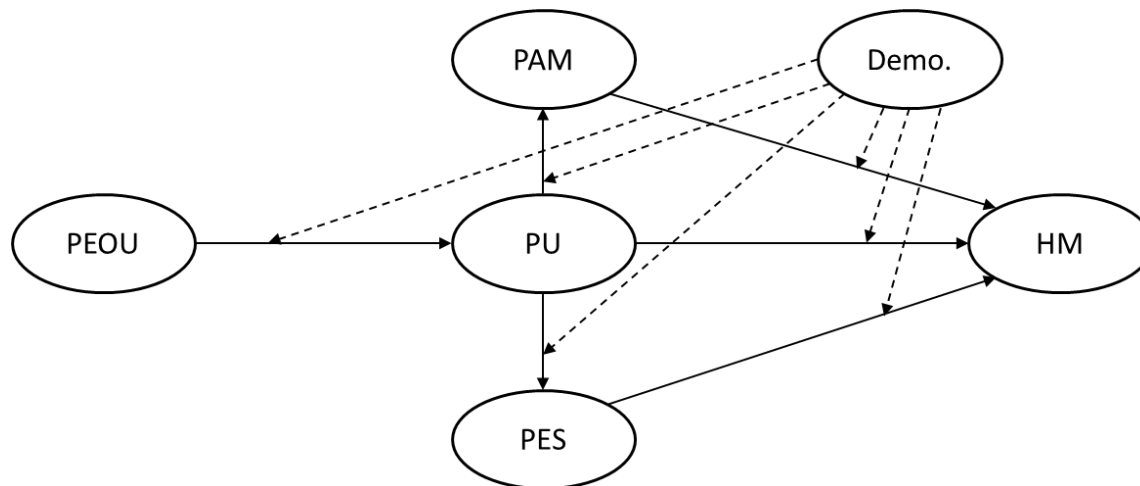
# Results: Structural Equation Modeling



- 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 preferencesb

- Implementation strategies should be responsive to lack of fit between technology and workflow at multiple levels

# Acknowledgments

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# References

- Ahern, D. K., Woods, S. S., Lightowler, M. C., Finley, S. W., & Houston, T. K. (2011). Promise of and potential for patient-facing technologies to enable meaningful use. *American journal of preventive medicine*, *40*(5), S162-S172.

# Message Threads – NE

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

- 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

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# 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

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

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