A National Web Conference on the Impact of Health IT on Workflow: Observations and Evidence from Multiple Settings

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Moderated By:
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Agency for Healthcare Research and Quality

June 25, 2015
Agenda

• Welcome and Introductions
• Presentations
• Q&A Session with Presenters
• Instructions for Obtaining CME Credits

Note: After today’s Webinar, a copy of the slides will be emailed to all participants.
The following presenters and moderator have no financial interest to disclose:

- Elizabeth Ciemins, Ph.D., M.P.H., M.A.
- Jonathan Wald, M.D., M.P.H., F.A.C.M.I.
- Teresa Zayas Cabán, Ph.D.

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How To Submit a Question

• At any time during the presentation, type your question into the “Q&A” section of your WebEx Q&A panel.
• Please address your questions to “All Panelists” in the dropdown menu.
• Select “Send” to submit your question to the moderator.
• Questions will be read aloud by the moderator.
Learning Objectives

At the conclusion of this activity, the participant will be able to:

1. Discuss the role that health IT implementation plays in ambulatory practice workflow processes through observations from two contrasting health care organizations.

2. Identify the specific facilitators and barriers associated with the adoption of a health IT-enabled care coordination program in primary care clinics.
Examining the Relationship Between Health IT and Ambulatory Care Workflow Redesign

Elizabeth Ciemins, Ph.D., M.P.H., M.A.
Billings Clinic
Acknowledgements

• Kai Zheng, Ph.D., Co-Principal Investigator
• Holly J. Lanham, Ph.D., M.B.A., Co-Investigator
• Curt Lindberg, D.Man., M.H.A., Co-Investigator

Technical Expert Panel:
• Charles P. Friedman, Ph.D. (Chair)
• Patricia Brennan, Ph.D., R.N., FAAN
• Pascale Carayon, Ph.D.
• Thomas Payne, M.D.
• Ben-Tzion Karsh, Ph.D.
Acknowledgements (cont.)

Research Analysts:
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• Nikolas Smart, MS
• Dustin Dickerson, MS

Site Coordinator:
• Amber Crist, MS

Clinicians and staff at all participating organizations and sites.

Research Assistants:
• April Barnes
• Holly Garcia
• Barbara Holloway, RN, BSN, CDE
• Jamiela Isaiah
• Betty Mullette, RN, MSN, CDE
• Connie Koch
• Will Liu
• Emily Peyton
• Julie Watkins
Background

• Health IT hope:
  ► Facilitate access to patient data
  ► Improve guideline adherence through decision support
  ► Engender beneficial workflow and process redesign

• Health IT reality:
  ► Implementation delays and budget overruns
  ► End-user resistance
  ► Failure to produce anticipated results
  ► Associated with unintended adverse consequences

(Buntin, 2011; Mekhjian, 2001; Kaplan, 2009; Jones, 2010; Linder, 2007; Romano, 2011; Campbell, 2006; Ash, 2007)
Negative impacts on workflow due to:

- Deficiencies in health IT design
- Problematic implementation process
- Misaligned end-user incentives
- Other behavioral, organizational, and societal factors (e.g., culture and professional autonomy)

(Buntin, 2011; Campbell, 2006; Ash, 2007; Niazkhani, 2009; NRC, 2009)
Study Objective

• To understand how health IT impacts clinical work processes and workflow, specifically:
  ► The causal relationship between health IT implementation and ambulatory care workflow redesign
  ► Sociotechnical factors and the role they play in mitigating or augmenting health IT’s impact on workflow
  ► The workflow impacts of health IT magnified through frequently occurring disruptive events, such as interruptions and exceptions
Methods

• Study sites:
  ► Two health care organizations:
    1. Not-for-profit integrated hospital and multispecialty medical group practice in Western United States (Organization West)
    2. Not-for-profit, community-owned health system, providing ambulatory care to underserved communities in Eastern United States (Organization East)
  ► Six ambulatory clinics:
    o Five primary care practices (~3,700 to 19,200 patients/year)
    o One specialty clinic (9,475 patients/year)
Health IT Implementations:

- **Organization West**
  - EHR updates/improvements:
    - Electronic homepage
    - Medical and social history prior to visit
    - Standardized EHR-based message center
    - Computerized provider order entry

- **Organization East**
  - New vendor-supplied EHR system:
    - Automated patient telephone reminders
    - Medical and social history prior to visit
    - Enhanced clinic team communication
    - Referral orders tracking and reminder system
    - Monitoring/reporting gaps in care
    - Templated notes
Methods (cont.)

• Study design:
  ► Prospective observational
  ► Mixed methods
  ► Data collection before, during, and after planned health IT implementations:
    o Ethnographic observations
    o Time and motion observations
    o Log audit trail data
    o Semi-structured interviews
    o Member checking focus groups
Methods (cont.)

- Pre-Project Activities
- Planned Health IT Implementations
- Post-Implementation Time and Motion Data Collection
- Post-Implementation Semi-Structured Interviews
- Results Triangulation
- Member Checking
- Reflection and Conclusion
- Results Reporting

- Mapping Study Sites
- Post-Implementation Ethnography
- Re-mapping Study Sites

- Pre-Implementation Time and Motion Data Collection
- Pre-Implementation Ethnography
Conceptual Models

• **Workflow Elements Model (Unertl, 2010)**
  ► Actors (people performing actions)
  ► Artifacts (physical or virtual tools)
  ► Actions (characteristics of actions)
  ► Outcomes (end products of the actions)

• **Sociotechnical Systems Theory (Trist and Emery, 1951)**
  ► Considers sociotechnical factors – human, social, organizational, technical – and their interplay in the environment, where technology (health IT) is employed

• **Complexity Science (Plsek, 1997)**
  ► Study of systems composed of multiple interacting, interdependent, and heterogeneous agents
  ► Extends these dominant models
Figure X. Study elements mapped to workflow elements model
Analyses

• Qualitative:
  ► Constant comparison approach to identify themes
  ► Data reduction methods to sharpen focus on objectives

• Quantitative:
  ► Time allocation analysis
  ► Workflow fragmentation analysis
  ► Pattern recognition
  ► Multitasking event analysis

• Integrative:
  ► Triangulation of findings from different sources
Analyses: Time Belt Visualization
## Analyses: Heat Map Visualization

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<th>C</th>
<th>D</th>
<th>E</th>
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<th>H</th>
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<td>0.032</td>
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Analyses: Visual Analytics of Pre-Post Comparison
## Results: Study Sample

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<th>Data Collection Activity</th>
<th>Provider (MD/DO/NP/PA)</th>
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<th>Nurse</th>
<th>Staff</th>
<th>Other</th>
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<td>29</td>
<td>19</td>
<td>26</td>
<td>7</td>
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<td>Interview</td>
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<td>5</td>
<td>6</td>
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<td>6</td>
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<td>19</td>
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## Results: Data Volume

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<th>Data Collection Method</th>
<th>Data Volume</th>
<th>Hours of Observation</th>
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<td>Ethnographic Observations</td>
<td>554 pages field notes</td>
<td>366 hours</td>
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<tr>
<td>Semi-structured Interviews</td>
<td>351 pages transcriptions</td>
<td>~39 hours</td>
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<tr>
<td>Focus Groups</td>
<td>~90 pages transcriptions</td>
<td>~6 hours</td>
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<tr>
<td>Time &amp; Motion Observations</td>
<td>85,808 distinct records</td>
<td>1,173.4 hours</td>
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<tr>
<td>Audit Trail Logs</td>
<td>79,362 entries</td>
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Findings by Study Goals

1. The causal relationship between health IT implementation and ambulatory care workflow redesign

2. Sociotechnical factors and the role they play in mitigating or augmenting health IT’s impact on workflow

3. The workflow impacts of health IT magnified through frequently occurring disruptive events, such as interruptions and exceptions
Findings

Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

- Shifting time allocation across tasks
- Multitasking
- Workflow workarounds
- Impacts of health IT on efficiency
- Changes in computer work hours (during and off-hours)
Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

- Shifting time allocation across tasks
- Multitasking
- Workflow workarounds
- Impacts of health IT on efficiency
- Changes in computer work hours (during and off-hours)
• Shifting time allocation across tasks
  ► Increased computer use (up to 47% increase)
    “[It is] irritating to me that I have to spend more and more time on the computer and less time with the patient … but I guess it’s the way of the future, but I don’t like it.” [provider]
  ► Decreased use of paper (~30% decrease)

• Multitasking (reductions)
## Multitasking Results

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<tr>
<th>Measure</th>
<th>Clinical Role</th>
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<th>Organization East</th>
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<td></td>
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<td>Pre</td>
<td>Post</td>
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<td>Post</td>
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* p < 0.05
Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

- Shifting time allocation across tasks
- Multitasking
- Workflow workarounds
- Impacts of health IT on efficiency
- Changes in computer work hours (during and off-hours)
Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

- Shifting time allocation across tasks
- Multitasking
- Workflow workarounds
- Impacts of health IT on efficiency
- Changes in computer work hours (during and off-hours)
Findings (cont.)

• Workflow workarounds due to:
  ► Fear of information being “lost in the system”
  ► Inadequate design or new systems’ setup (e.g., to address exceptions)
  ► Inefficient workflow

• Impacts on efficiency: Positive
  ► Collection of patient data in advance of visit
  ► Increased detail on radiology orders
  ► Short-term follow-up visit scheduling
  ► EHR-embedded email for provider-nurse communication, non-time sensitive
“The collection of patient data in advance of a patient’s visit, making it available to the provider, to myself, at the time of the visit has been enormously impactful in a positive way, allowing me to spend more time reviewing the data and discussing the information with a patient than actually collecting the data during their visit.”

“I think I’m probably more effective at conveying non-time sensitive information to my nurse, which then can be passed on to a patient, so I actually enroll my nurse in more activities where they have contact with the patient directly after a visit or before a surgery and it’s actually more effective.”
Findings (cont.)

• Impacts on efficiency: Negative
  ► More time on computer, less patient time
  ► Increased documentation requirements, more structure
  ► Workarounds

“Why are over the counter medications entered and viewed in a separate location? It would make more sense to be able to view all medications in one area.”
Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

• Shifting time allocation across tasks
• Multitasking
• Workflow workarounds
• Impacts of health IT on efficiency
• Changes in computer work hours (during and off-hours)
Findings (cont.)

Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign

- Shifting time allocation across tasks
- Multitasking
- Workflow workarounds
- Impacts of health IT on efficiency
- Changes in computer work hours (during and off-hours)
Computer Use by Time of Day

# system logs

hours of a day (24 hour format)
Findings (cont.)

• Changes in computer work hours (during and off-hours)

“The continuous dictation I think, for me, I used to try and dictate in between patients, and at the end of the day now is when I do all my dictation. I try and do it, but there’s just no time, so I end up dictating at 5 o’clock continuously for 2 hours.”
Goal 2: Sociotechnical factors and the role they play in mitigating or augmenting health IT’s impact on workflow

- Physical space
- Relationships and their interdependencies
- Power differentials
• **Physical Space**
  
  ► Adaptation of physical movements to new workflow patterns
  
  ► Different use of space to improve efficiency and integrate new health IT
Findings: Physical Space

https://youtu.be/f_9tDP9Dvfl
• Relationships and their interdependencies

“… each team is going to have a little different personality, and everybody has different strengths and weaknesses, and, like I told her, it’s a dance, and we’re learning the dance for the first few weeks, and we learn how each other moves and what we can help each other with.”

“… like when a nurse would go to a different team, there were things specifically about [HIT implementation] that they had learned and that they shared with the other teams, so I think it was good for them to move around and move information from team to team.”
Findings (cont.)

• Power differentials

“We even have in our physical space providers with nurses, and we’re all together, we’re a team, and so for us to have such a profound disruption, it’s not surprising to me that we would work together as a team, so that’s not really unique and that doesn’t mean much to me, it’s almost expected.”
Goal 3: The workflow impacts of health IT magnified through frequently occurring disruptive events, such as interruptions and exceptions

- Increased level of interruptions

“Phone interruptions during provider order entry could create new medication entry errors.” [nurse]
# Interruptions Results

<table>
<thead>
<tr>
<th>Clinical Role</th>
<th>Organization West</th>
<th>Organization East</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Primary Care sites</td>
<td>Primary Care 2</td>
</tr>
<tr>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Provider</td>
<td>0.91</td>
<td>2.18*</td>
</tr>
<tr>
<td>Medical Asst.</td>
<td>0.77</td>
<td>2.32</td>
</tr>
<tr>
<td>Nurse</td>
<td>0.80</td>
<td>0.40*</td>
</tr>
<tr>
<td>Staff</td>
<td>0.46</td>
<td>--</td>
</tr>
<tr>
<td>All roles</td>
<td>0.83</td>
<td>1.86*</td>
</tr>
</tbody>
</table>

Number of interruptions per hour

* p < 0.05
Implications

• Importance of staff engagement
• Consideration of clinic differences
• Expect the unexpected
• Employ minimum specifications
• Consideration of workload
Lessons Learned

- Challenges in quantifying workflow
- Challenges to studying small, rural clinics
- Flexibility may lead to learning opportunities
- Two-way value of member checking
- Value of mixed methods approach
Conclusions

• Multifaceted impacts of health IT on clinical work processes and workflow
• Effects are beneficial and detrimental
• Ambulatory practices are unique; different impacts due to different environments, strategies, and culture
Contact Information

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Health IT-Enabled Care Coordination and Redesign in Tennessee

Jonathan S. Wald, M.D., M.P.H., F.A.C.M.I.
RTI International
Research Question

- What is the workflow impact of implementing health IT-enabled care coordination within six ambulatory primary care clinics?
Theoretical Framework: SEIPS

Systems Engineering Initiative for Patient Safety (SEIPS)

Source: Holden, et al., 2011. Used under a Creative Commons license
Theoretical Framework: WEM

Workflow Elements Model (WEM)

Source: Unertl, et al., 2010. Used with the author's permission
My Health Team at Vanderbilt (MHTAV)

• Developed by Vanderbilt University
  ► To support communication among members of the care team

• Three conditions
  ► Diabetes, hypertension, and congestive heart failure

• Program approach
  ► Intensified patient engagement
  ► Dedicated care coordinators (CCs)
  ► Health IT tools
## CC Program IT Components

<table>
<thead>
<tr>
<th>IT Category</th>
<th>Component</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Health IT: MHT system (or MHT tools)</strong></td>
<td>Diabetes, hypertension, and congestive heart failure dashboards</td>
<td>CC, MA</td>
</tr>
<tr>
<td></td>
<td>Worklists</td>
<td>CC</td>
</tr>
<tr>
<td></td>
<td>Plan of Care (POC)</td>
<td>CC, MA, MD, NP</td>
</tr>
<tr>
<td></td>
<td>Disease Control Form (DCF)</td>
<td>CC, MD, NP</td>
</tr>
<tr>
<td></td>
<td>Alerts and reminders</td>
<td>CC, MA</td>
</tr>
<tr>
<td></td>
<td>Journaling tab from MHAV</td>
<td>CC, MA</td>
</tr>
<tr>
<td></td>
<td>Interactive voice response (IVR) system</td>
<td>CC, MA, patients</td>
</tr>
<tr>
<td><strong>Health IT</strong></td>
<td>Vanderbilt EHR (StarPanel)</td>
<td>CC, MA, MD, NP, clinic nurses</td>
</tr>
<tr>
<td></td>
<td>Patient portal secure messaging (My Health at Vanderbilt)</td>
<td>CC, MA, MD, NP, clinic nurses, patients</td>
</tr>
<tr>
<td></td>
<td>Online patient education materials</td>
<td>CC, MA, patients</td>
</tr>
<tr>
<td></td>
<td>Message basket*</td>
<td>CC, MA, MD, NP, clinic nurses</td>
</tr>
<tr>
<td><strong>General IT</strong></td>
<td>Online Whiteboard</td>
<td>CC, MA, MD, NP, clinic nurses</td>
</tr>
<tr>
<td></td>
<td>Clinic scheduling system</td>
<td>PSR</td>
</tr>
</tbody>
</table>

CC: Care Coordinator; MA: Medical Assistant; MD: Medical Doctor; NP: Nurse Practitioner; PSR: Patient Service Rep
## Plan of Care (POC)

### 1) Hypertension
- **Current:** Active-engage [Stratification: 2a]  View Mode of Care Changing History (see window below)

<table>
<thead>
<tr>
<th>Surveillance</th>
<th>Active-engage</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC Status</td>
<td>Active</td>
</tr>
</tbody>
</table>

- **HTN Start Date:** 2014/02/
- **HTN Early Check Date:**
- **HTN POC Exp Date:**
- **F/U by MA?**

#### 1) Short Term Target(s)

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Record By</th>
<th>Target Name</th>
<th>Target Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014/01/15</td>
<td></td>
<td>test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2) Medication Goals
- **Show History**

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Record By</th>
<th>Event Type</th>
<th>Goal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014/02/11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[West] most recent Med Change Survey done date: 2014/06/09
Click here to manage the current 'Med Change Survey' request

#### 3) Testing/Eval Goals
- **Show History**

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Record By</th>
<th>Goal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014/02/11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 4) Monitoring Goals
- **Show History**

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Record By</th>
<th>Goal</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[MIaV] most recent home BP sent in date: 2014/06/11
[West] no home BP sent in yet
Click here to send a new 'Sending Home BP Reminder' request

#### 5) Other Goals

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Record By</th>
<th>Goal Name</th>
<th>Status</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Care coordinator and clinician activity are driven by a worklist.

<table>
<thead>
<tr>
<th>Heart Failure</th>
<th>Diabetes</th>
<th>Hypertension</th>
<th>HomeBP</th>
<th>PCP</th>
<th>Next PCP Visit</th>
<th>Alerts</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>1b (Surv)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HiBP: 02/24</td>
<td>Actions</td>
</tr>
<tr>
<td>3b</td>
<td>3b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HiBP: 03/24; POC: (03/19, 03/19 *)</td>
<td>Actions</td>
</tr>
<tr>
<td>2b</td>
<td>3a</td>
<td></td>
<td></td>
<td></td>
<td>2014/07/09 13:40</td>
<td>POC: (2013/06/10 *, 2013/06/24 *)</td>
<td>Actions</td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WestMedSurv: (06/12); WestPromote: (06/17)</td>
<td>Actions</td>
</tr>
</tbody>
</table>
**Protocol for Diabetes**

<table>
<thead>
<tr>
<th>Risk Stratification and Status</th>
<th>At Control</th>
<th>Assessment by MD</th>
<th>Frequency of Pt Self Monitoring</th>
<th>Freq of CC/MA Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Verification of Control:</strong></td>
<td>Patients &lt; 80 years old: A1C &lt; 7.0</td>
<td>At least once a year</td>
<td>1A: 6 months-yearly between scheduled appointments with provider</td>
<td></td>
</tr>
<tr>
<td>1A/2A/3A</td>
<td>OR</td>
<td></td>
<td>2A: Every 6 months between scheduled appointments with provider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patients &gt;80 years old: A1C &lt; 8.0</td>
<td></td>
<td>3A: Every 6 months between scheduled appointments with provider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MD Specification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surveillance of Control:</strong></td>
<td>Patients &lt; 80 years old: A1C &lt; 7.0</td>
<td>1A: Annual office encounter</td>
<td>1A: A1C reading every 6 months with PCP approval</td>
<td></td>
</tr>
<tr>
<td>1A/2A/3A</td>
<td>OR</td>
<td>2A: Every 6 months</td>
<td>2A/3A: A1C every 3 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patients &gt;80 years old: A1C ≤ 8.0</td>
<td>3A: Every 6 months</td>
<td>Every 6 months between scheduled appointments with provider</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Protocol for Diabetes (cont.)

<table>
<thead>
<tr>
<th>Risk Stratification and Status</th>
<th>At Control</th>
<th>Assessment by MD</th>
<th>Frequency of Pt Self Monitoring</th>
<th>Freq of CC/MA Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Titration:</strong> 1B/2B/3B</td>
<td>Patients &lt; 80 years old: A1C ≥ 7.0 OR Patients &gt; 80 years old: A1C ≥ 8.0 OR MD Specification</td>
<td>Every 3 months</td>
<td><em>When adding a medication, wait 1 week and report any lows &lt;70 or side effects.</em> Check 3-4 days of blood glucose measurements: A1C &gt; 9: premeal, postmeal and bed time A1C ≤ 8: 2x’s a day (some fasting, some after meals (different meals and different days) Send range and average blood glucose. <strong>3B:</strong> Per PCP or Specialist Directive-Frequency per day/wk, time of day Evaluate average, low and high range</td>
<td>Every 3-4 weeks or adjusted by provider</td>
</tr>
</tbody>
</table>
Study Design

• Formal mixed methods approach
  ► Direct observation
  ► Patient and staff interviews
  ► Surveys of staff and patients
  ► Artifact and spatial data
  ► Software use monitoring
  ► Impact on process outcomes

• Site teams at six Vanderbilt University Medical Center (VUMC) affiliated-clinics that were in different phases of introducing MHTAV

• Study protocols approved by OMB and IRBs at RTI and Vanderbilt
### Study Design (cont.)

<table>
<thead>
<tr>
<th>Time</th>
<th>MHTAV Sites (Teams 1, 4, 5)</th>
<th>Adopting MHTAV Sites (Teams 2, 3, 6)</th>
</tr>
</thead>
</table>
| Phase 1 | Observations | • Observations  
• Staff: Interviews, Surveys  
• Patient: Interviews, Surveys |
| Phase 2 | Observations | • Observations  
• Staff: Interviews, Surveys  
• Patient: Interviews, Surveys |
| Phase 3 | Observations | • Observations  
• Staff: Interviews, Surveys  
• Patient: Interviews, Surveys |
### Study Sites

<table>
<thead>
<tr>
<th>Site Team</th>
<th>Attending MDs</th>
<th>Resident MDs</th>
<th>NPs</th>
<th>Setting</th>
<th>MHTAV Adoption**</th>
<th>CC Proximity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>93</td>
<td>0</td>
<td>Urban</td>
<td>Apr 2010</td>
<td>Yes, in separate office, 5 days/week</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Rural</td>
<td>Mar 2014</td>
<td>Yes, on-site, 2 days/week</td>
</tr>
<tr>
<td>3*</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>Urban</td>
<td>Nov 2013</td>
<td>Yes, on-site, 5 days/week</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>Suburban</td>
<td>Oct 2012</td>
<td>Yes, in office on different floor, 5 days/week</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>13</td>
<td>0</td>
<td>Suburban</td>
<td>May 2013</td>
<td>Yes, in separate office, 5 days/week</td>
</tr>
<tr>
<td>6*</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>Urban</td>
<td>Nov 2013</td>
<td>Yes, on-site, 5 days/week</td>
</tr>
</tbody>
</table>

MD = physician; NP = nurse practitioner; MHTAV = My Health Team at Vanderbilt; CC = care coordinator. *Two different teams were observed at the same clinic. **MHTAV site teams were 1, 4, 5; MHTAV-adopting site teams were 2, 3, and 6.
## Data Collected

<table>
<thead>
<tr>
<th>Data Collection Activity</th>
<th>Source of Data</th>
<th>Data Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct observations of care coordination</td>
<td>Care coordinator (if identified); patients; other individuals in the practice responsible for care coordination key workflows including: (a) registering patients, (b) sharing care plan, (c) handling alerts and reminders, (d) compiling and interpreting data from at-home monitoring, and (e) communicating with patients between visits.</td>
<td>Field notes of workflow steps, information flow steps, and other information required to create workflow and information flow models; description of health IT components and capabilities relating to care coordination</td>
</tr>
<tr>
<td>Staff interviews</td>
<td>Practice staff participating in direct observations</td>
<td>Responses to interview guide questions</td>
</tr>
<tr>
<td>Patient interviews</td>
<td>Patients with diabetes contacted through direct observation or introduced by their physician</td>
<td>Responses to interview guide questions</td>
</tr>
<tr>
<td>Staff surveys</td>
<td>Practice staff</td>
<td>Responses to modified Technology Acceptance Model (TAM) survey</td>
</tr>
<tr>
<td>Patient surveys</td>
<td>Patients</td>
<td>Responses to Patient Activation Measure (PAM) 13-item instrument; and Summary of Diabetes Self-Care Activities (SDSCA) 10-item instrument</td>
</tr>
</tbody>
</table>
Data Analysis

- Qualitative data coded using Dedoose
  - Phase 1: Open Coding
  - Phase 1: Axial Coding
  - Phase 3: Workflow Modeling

- Quantitative (survey) data tabulated using Excel
## Data Synthesis Plan

<table>
<thead>
<tr>
<th>Analysis Activity</th>
<th>Source of Data</th>
<th>Product</th>
</tr>
</thead>
</table>
| **A. Workflow diagramming to identify and describe workflows** | Semistructured staff discussion  
Direct observations  
Staff interviews  
Patient interviews | Set of workflows and workflow elements |
| **B. Identification of health IT design elements used in support of care coordination activities** | Semistructured staff discussion  
Direct observations  
Staff interviews  
Patient interviews  
Staff surveys  
Usage data  
Diabetes outcome data | Set of health IT design elements |
| **C. Identification of interactions between workflow and health IT design elements** | Analysis activities A and B  
Underlying source data | Set of interactions, health IT barriers, and facilitators to care coordination workflows |
| **D. Analysis of interactions across implementation stage (MHTAV, MHTAV adopting) and time** | Analysis activities A, B, and C  
Underlying source data | Interaction results by implementation stage |
Findings: Care Coordination Work

1 Relationship

2 POC

3 Ed / Coach

4 Home Data

5 Coordination

6 Searching

7 Planning
1. Establishing Formal and Informal Relationships with Patients

• Initial Engagement
  ► Face-to-face meeting (during routine visit)
  ► Auto-enrollment (if threshold met [e.g., HbA1c>9])

• Ongoing Engagement
  ► CC/Pt interactions via phone, patient portal, F2F
  ► Facilitates plan adherence
    o Home data collection
    o Medication side effects f/u
    o Understanding external factors
1. Establishing Formal and Informal Relationships with Patients (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Establishing and Maintaining Relationships with Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity: Enrollment/Auto-Enrollment</td>
<td>Activity: Building Rapport with Patients</td>
</tr>
</tbody>
</table>
| A. Alerts and reminders populate the CC worklist | Reminders are used to connect with patients during clinic appointments. This can assist in educational goals, as well as supporting the patient by providing monitoring equipment, validation of monitoring equipment.  
*Good alignment* |
| B. Auto-enrollment | Patients are automatically added to CC’s panel based on collected data and stratified according to the protocol, minimizing CC work.  
*Good alignment* |
| C. Disease Control Form (DCF) | Displays information about patient, including the next appointment.  
*Good alignment* |
| | Reminders to call/message patients or connect with them in clinic. Opportunity for CC to build rapport via face-to-face communication.  
*Good alignment* |
| | CCs reported face-to-face meetings with patients were important to rapport-building.  
*Poor alignment* |
| | DCF shows status of patient and allows CC to update status based on information received from communications with patient.  
*Good alignment* |
1. Establishing Formal and Informal Relationships with Patients (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Establishing and Maintaining Relationships with Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity: Enrollment/Auto-Enrollment</strong></td>
<td>Records activities involving initial patient contact, and assists in establishing the POC for the patient. <strong>Good alignment</strong></td>
</tr>
<tr>
<td><strong>Activity: Building Rapport with Patients</strong></td>
<td>Enables ongoing communication with patient, as well as input of possible pertinent information about the patient home environment (“Red Flags”: Activity, Diet, Foot care, Emotion coping skills, Disease monitoring, Unable to reach patient, Physical activity, Medication adherence, Medication reconciliation, Tobacco cessation, and Other categories). <strong>Good alignment</strong></td>
</tr>
</tbody>
</table>

“CC Actions” are entered here, and a history is maintained in the “POC Support Hx.” CC Actions contain information about education/coaching given to patient, and also monitoring equipment status (that is, validation of existing equipment or providing one to patient). These serve as memory cues to establish and build rapport with patients. **Good alignment**
2. Establishing and Maintaining a Plan of Care (POC)

- POC established at patient enrollment.
  - Updated by CC over time
- Data capture into POC
  - From the patient portal
  - From interactive voice response system
  - “Promoted” into the POC by CCs
- POC is primary focus for CCs.
# 2. Establishing and Maintaining a Plan of Care (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Establishing and Maintaining a Plan of Care (POC)</th>
<th>Activity: Establishing a POC</th>
<th>Activity: Maintaining/Changing a POC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alerts and reminders populate the CC worklist</td>
<td>POC establishment driven by patient readings (from clinic) and collaboration between the CC and provider. <strong>Good alignment</strong></td>
<td>Reminders to call/message patients or connect with them in clinic regarding home readings. BP readings create alerts to CC when above threshold established in conjunction with physician. Facilitates collaboration between CC and provider. <strong>Good alignment</strong></td>
<td></td>
</tr>
<tr>
<td>Disease Control Form (DCF) tab (MHT dashboard)</td>
<td>Displays information about patient, including the next appointment and relevant readings. <strong>Good alignment</strong></td>
<td>DCF shows status of patient and allows CC to update status based on information received from communications with patient. Used to communicate with physician, prompting action to manage POC. <strong>Good alignment</strong></td>
<td></td>
</tr>
</tbody>
</table>
2. Establishing and Maintaining a Plan of Care (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Establishing and Maintaining a Plan of Care (POC)</th>
<th>Activity: Maintaining/Changing a POC</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC Support tab (MHT dashboard)</td>
<td>Activity: Establishing a POC</td>
<td>“Actions” entered into POC Support screen, populating a “POC Support History”. This records all interactions performed by CC to maintain or support POC. “Actions” text window is very small and requires concise composition on behalf of the CC to maintain clarity. Actions and other information entered in this tab do not populate other tabs in the MHT tool, making it time intensive for CCs. <strong>Poor alignment</strong></td>
</tr>
<tr>
<td></td>
<td>Used to establish a POC with the physician. Displays goals established by physician regarding medication, monitoring and/or education. Most CC work takes place in this tab in the MHT tool. <strong>Good alignment</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Partnership**

- **Best Practice**
  - Establishing and maintaining a plan of care (POC) with cross-functional teams.
  - Utilizing IT resources and attributes for efficient communication and coordination.

**Challenges**

- Alignment between IT resources and POC processes.
- Time-intensive tasks for CCs.
## 2. Establishing and Maintaining a Plan of Care (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Establishing and Maintaining a Plan of Care (POC)</th>
<th>Activity: Establishing a POC</th>
<th>Activity: Maintaining/Changing a POC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journaling tab (MHT dashboard)</td>
<td>Contains information about patient journaling via MHAV, and allows manual input of readings sent by the patient via postal mail to CC/MA. Also contains information for IVR phone system entered readings.</td>
<td>Good alignment</td>
<td>Information from this tab assists the CC in determining if the patient is following the POC by taking readings as suggested. This information may also assist the CC in determining if a patient may need educational intervention and/or need medical equipment or validation of existing medical equipment (BP cuffs, glucometers).</td>
</tr>
<tr>
<td>Utilization Data tab</td>
<td>Displays upcoming and past appointments for patients on the CC’s panel. Does not display specialist appointments, only PCP and hospital admissions. Assists CC in knowing when the patient is scheduled to visit the clinic.</td>
<td>Moderate alignment</td>
<td>Allows CCs to see when patient is scheduled to visit the clinic, and can support face-to-face encounters.</td>
</tr>
</tbody>
</table>
3. Collecting and Analyzing Home Monitoring Data

• Variety of CC activities
  ► Securing equipment
  ► Calibrating equipment
  ► Showing how to use equipment
  ► Showing how to log readings

• Reviewing home monitoring data
• Updating the POC
• Responding as indicated by the readings
3. Collecting and Analyzing Home Monitoring Data (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Collecting and Analyzing Home Monitoring Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activity: Setting Up Home Monitoring Devices</td>
</tr>
<tr>
<td>Worklist alerts and reminders</td>
<td>Reminders are used to connect with patients during clinic appointments. <strong>Good alignment</strong></td>
</tr>
<tr>
<td>Patient Portal Messaging</td>
<td>Enables multiple pathways—messaging or online journaling—in addition to paper, to acquire glucometer data. <strong>Good alignment</strong></td>
</tr>
<tr>
<td>BP Journal feature</td>
<td></td>
</tr>
<tr>
<td>Disease Control Form (DCF)</td>
<td></td>
</tr>
</tbody>
</table>
4. Educating and Coaching Patients

• Variety of topics
  ► Insulin, diet, and exercise
  ► Management and reconciliation of medications

• Helping identify resources
  ► Services (i.e., local courses regarding a patient’s health issues)
  ► Resources available to their patients

• Health IT role
  ► Educational resources are stored online for all CCs.
  ► Other resources (e.g., local classes or social services) are not available online.
### 4. Educating and Coaching Patients (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Educating and Coaching Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared/standardized education folder/module on database</td>
<td>Activity: Creating Educational Materials/Tools for Patients</td>
</tr>
<tr>
<td>Educational materials (e.g., Krames educational modules) for patients are accessed, via the My Health Team (MHT) software or an easily accessible database, and prepared ahead of time (e.g., preprinted packets). <strong>Good alignment</strong></td>
<td></td>
</tr>
<tr>
<td>My Health Team (MHT) alerts and reminders</td>
<td></td>
</tr>
</tbody>
</table>
## 4. Educating and Coaching Patients (cont.)

### Workflow: Educating and Coaching Patients

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Activity: Creating Educational Materials/Tools for Patients</th>
<th>Activity: Contacting Patients (In Person or by Phone)</th>
<th>Activity: Training and/or Counseling Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet materials (PDFs of educational modules)</td>
<td>Internet searches for certain conditions (for example, diabetes, CHF), medications, issues, and/or resources available (local courses or services offered, such as dental services or discounts) allow CCs to find information related to any of their patients’ needs or inquiries. <strong>Good alignment</strong></td>
<td></td>
<td>CC prints out and disseminates materials/information resulting from the searches to a patient (by phone, e-mail, and/or in person) and discusses the materials and issues with the patient and/or coaches/counsels them, if appropriate. <strong>Moderate alignment</strong></td>
</tr>
<tr>
<td>Server based educational materials, lists of resources (e.g., local courses or services), needs, ideas and/or inquiries</td>
<td>None currently exist on local server, database, or software/tools. <strong>Poor alignment</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Coordinating with Other Clinicians and Patients

- Time is needed to coordinate activities.
  - PCPs, Specialists, RNs, LPNs, MAs, Social Work, CCs

- Integration of the CC role was variable.

- Challenges to team integration:
  - CC not located in the same physical space
  - Online clinic schedule not up to date
  - Lack of full understanding of the CC role

- External (to Vanderbilt) clinicians and practices
  - Rural, and Suburban sites, especially
### Relevant IT Resources or Attributes

#### MHT worklist alerts and reminders

Notify CCs (or IVR system) to follow-up with patients about new or changed medications on a certain date. *Good alignment*

Reminders are used to notify patients to come in for a lab/test a few days before their doctor’s appointment. *Good alignment*

Alerts and reminders notify CCs when a patient’s status (readmitted to hospital) has changed, a medical appointment has or will soon occur, and/or CCs need to follow up with the patient to see how they are doing and/or how an appointment went. *Good alignment*

### Electronic communications: Message basket/MHAV messages

Convenient method for CCs to notify clinicians when they need to act (such as to review a patient’s BP or blood glucose data, or that a patient needs training or a monitoring device validated).  *Good alignment*

Clinicians having a large number of messages sent by the CCs can feel overwhelmed and wish the technology helped to alleviate this. *Poor alignment*

Messages sent/received to coordinate the best time for the CC to see the patient are often not received in time.  *Poor alignment*

Prescription requests and/or information and questions about medications can be e-mailed among CCs and the clinicians.  *Good alignment*

Electronic messaging (MHAV and/or e-mail) has helped CCs when scheduling appointments with patients.  *Good alignment*
### 5. Coordinating with Other Clinicians and Patients (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Coordinating with Other Clinicians (Nurses &amp; PCPs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity: Messaging</strong></td>
<td><strong>Activity: Medication Changes and Refills</strong></td>
</tr>
<tr>
<td>Clinic schedule for viewing by CCs</td>
<td>The online schedule is unreliable due to delays, early arrivals, cancellations, and/or no-shows. CCs often must schedule another appointment to see the Pt at a different time. <em>Poor alignment</em></td>
</tr>
<tr>
<td>Interactive voice response (IVR) system asks patients about new or changed medications (if patient has consented)</td>
<td>IVR system only asks generic and broad questions that often lack specific and contextual information. <em>Poor alignment</em></td>
</tr>
<tr>
<td>CCs schedule or availability status is not accessible remotely/electronically</td>
<td>Clinic staff are unable to easily and quickly coordinate a face-to-face encounter between a patient and the CC. Instead, staff go to the CC’s office or call her, if they have time. <em>Poor alignment</em></td>
</tr>
</tbody>
</table>
6. Searching for Information to Support Decisionmaking and Action

• Information needed to investigate alerts or high home readings
  ► Prompted by med changes, insurance questions, etc.
  ► Results, specialist notes, primary care notes, hospital admission records, and other information

• Constructing a narrative that made sense
  ► Before CC contacted patient or messaged provider

• Use of paper notes by all CCs
  ► To organize findings, including past conversations with patients.
6. Searching for Information to Support Decisionmaking and Action (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Search for Information to Support Decisionmaking and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity: Seeking Information</strong></td>
<td>In systems inside the organization, the CC and staff knew how to find the information they needed, and how to triangulate sources, e.g. comparing doctor's note with prescription information to determine if a medication had been prescribed. Lists of notes that summarized “clinical communications,” that is, discussions with patients, sometimes became voluminous, and contained important “buried” information such as dose changes. * In one case, a clinic nurse maintained her login credentials to the clinic scheduling system from a previous role, and used that system to help a patient get seen in another clinic. <strong>Moderate alignment</strong>.</td>
</tr>
<tr>
<td><strong>Activity: Making Sense of Information for Documentation and Action</strong></td>
<td><img src="image.png" alt="Image" />Data from systems inside the organization could be pasted for use in documentation. Example: one CC often copied the medication list from the previous clinic visit into her note, to provide support/evidence for the action she was carrying out. <strong>Good alignment</strong>. All of the documentation was available electronically (either in the EHR or scanned); that is, no paper files had to be pulled when the CC was documenting on a particular patient, and the only non-electronic source data were notes from phone calls made during the documentation session. However, the system did not facilitate multiple windows being open on different computer screens, e.g. the POC on one screen and the last clinic note on another screen so both could be viewed at the same time. This resulted in paper notes being used to assemble the information necessary for documentation and decisionmaking. <strong>Moderate alignment</strong>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data sources internal to the organization:</th>
<th>Data sources internal to the organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinic notes</strong></td>
<td><strong>Clinic notes</strong></td>
</tr>
<tr>
<td><strong>Hospital provider notes</strong></td>
<td><strong>Hospital provider notes</strong></td>
</tr>
<tr>
<td><strong>Hospital discharge notes</strong></td>
<td><strong>Hospital discharge notes</strong></td>
</tr>
<tr>
<td><strong>Medication lists</strong></td>
<td><strong>Medication lists</strong></td>
</tr>
<tr>
<td><strong>Prescription information</strong></td>
<td><strong>Prescription information</strong></td>
</tr>
<tr>
<td><strong>Appointment information</strong></td>
<td><strong>Appointment information</strong></td>
</tr>
<tr>
<td><strong>Messages from clinicians</strong></td>
<td><strong>Messages from clinicians</strong></td>
</tr>
<tr>
<td><strong>Schedule information</strong></td>
<td><strong>Schedule information</strong></td>
</tr>
<tr>
<td><strong>In systems inside the organization</strong></td>
<td><strong>Data from systems inside the organization could be pasted for use in documentation. Example: one CC often copied the medication list from the previous clinic visit into her note, to provide support/evidence for the action she was carrying out. <strong>Good alignment</strong>. All of the documentation was available electronically (either in the EHR or scanned); that is, no paper files had to be pulled when the CC was documenting on a particular patient, and the only non-electronic source data were notes from phone calls made during the documentation session. However, the system did not facilitate multiple windows being open on different computer screens, e.g. the POC on one screen and the last clinic note on another screen so both could be viewed at the same time. This resulted in paper notes being used to assemble the information necessary for documentation and decisionmaking. <strong>Moderate alignment</strong>.</strong></td>
</tr>
</tbody>
</table>
### 6. Searching for Information to Support Decisionmaking and Action (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Search for Information to Support Decisionmaking and Action</th>
<th>Activity: Making Sense of Information for Documentation and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data from partner organization accessible electronically via the Internet: discharge summaries and some test results</td>
<td>Certain data were available electronically from a close regional partner hospital. <em>Good alignment</em></td>
<td></td>
</tr>
<tr>
<td>Data from other health care organizations faxed and scanned into the EHR (e.g., hospital discharge paperwork, insurance care coordinator reports, or diabetes education reports)</td>
<td>Information was often faxed or mailed to the clinic and scanned into the record. Information from other providers has become more difficult to obtain given HIPAA regulations; currently a form is completed and faxed. Information is relatively easy to find once it is scanned in. Multiple participants reported that personal relationships facilitated access to better information, for example, physicians with relationships at other hospitals, clinic nurse identifying high school friend as the diabetes educator at a hospital in the next county. Scanned documents were sometimes hard to read. <em>Moderate alignment</em></td>
<td></td>
</tr>
<tr>
<td>Information from the patient: Face to face conversations Phone calls Messaging in the patient portal Patient entry of home monitoring data into an electronic log (BP Journal) Paper logs mailed or brought in by the patient</td>
<td>Information was typically recorded on paper during phone calls. Paper logs mailed or brought to the clinic were quickly entered into the BP journal by the MA. One CC was observed talking with a patient on the phone and typing home BP readings directly into the BP Journal. <em>Good alignment</em></td>
<td></td>
</tr>
</tbody>
</table>
7. Prioritizing Tasks and Planning Work

• Daily task management
  ► Primary function of the MHT system

• Tasks displayed as “alerts”
  ► Generated manually or by the system

• Alert examples
  ► High blood pressure, high blood glucose alerts
    o Generated in any clinic within medical center
  ► Admission alerts
    o Generated with hospital admission or ED visit
  ► Scheduled alerts
    o Set by CC or MA, such as when a home reading is expected
## 7. Prioritizing Tasks and Planning Work (cont.)

<table>
<thead>
<tr>
<th>Relevant IT Resources or Attributes</th>
<th>Workflow: Prioritizing Tasks and Planning Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activity: Identifying Opportunities to Engage Patients Face to Face in the Clinic</td>
</tr>
<tr>
<td>MHT worklist</td>
<td>List can be sorted by “Next Clinic Visit,” enabling CC to see patients with visits in the coming days. Good alignment</td>
</tr>
<tr>
<td>Online whiteboard</td>
<td>CC can see when patients are checked in for their visit, and potentially available for intervention/discussion, however the whiteboard did not always reflect real time status. Moderate alignment</td>
</tr>
</tbody>
</table>
### Relevant IT Resources or Attributes

<table>
<thead>
<tr>
<th>Activity: Identifying Opportunities to Engage Patients Face-to-Face in the Clinic</th>
<th>Activity: Identifying High Priority Alerts</th>
<th>Activity: Setting Alerts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External calendar (wall, cell phone)</strong></td>
<td></td>
<td>Used to identify dates relative to scheduled clinical events (e.g., 2 weeks before next visit), and time frames (e.g., next 2 weeks). Observed to be more useful than MHT built-in calendar. <em>Good alignment</em></td>
</tr>
<tr>
<td><strong>MHT “next clinic visit”</strong></td>
<td>Events around which follow-up alerts are scheduled. Does not appear to be updated in real-time. <em>Moderate alignment</em></td>
<td></td>
</tr>
<tr>
<td><strong>Outlook calendar</strong></td>
<td>Used to set follow-up alerts for nonurgent issues. Requires opening a window on a separate computer or screen. <em>Moderate alignment</em></td>
<td></td>
</tr>
</tbody>
</table>
Technology Acceptance Model Survey (Staff)

• Software tools helpful overall
  ► Helped staff to improve patient care and collaborate with others

• High satisfaction with software tool use
  ► In coordinating the care of patients with other providers
  ► Plan to use in the future

• Lower ratings in flexibility
  ► Using the EHR in new ways
  ► Finding ways to adapt the EHR beyond its original design
Patient Surveys

• **Summary of Diabetes Self Care Activities (SDSCA)**
  - Taking daily medicines for diabetes: >90%
  - Checking feet daily: >70%
  - Eating healthy: 69%
  - Exercising: 31%

• **Patient Activation Measure**
  - No meaningful differences seen
## POC Usage Data

<table>
<thead>
<tr>
<th>Role</th>
<th>Page Views: Count</th>
<th>Page Views: %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care Coordinator (CC)</td>
<td>480,159</td>
<td>76</td>
</tr>
<tr>
<td>Medical Assistant (MA)</td>
<td>81,463</td>
<td>12</td>
</tr>
<tr>
<td>MHT Development Team Lead</td>
<td>45,801</td>
<td>7</td>
</tr>
<tr>
<td>Other*</td>
<td>22,847</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>630,270</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Other includes IT staff, social workers, and users at non-study sites*
Discussion

• Lots of interaction
  ► Multiple work activities, roles, and technologies interacted
  ► Complex care coordination work

• Context matters
  ► Physical co-location between clinicians and CCs
  ► Specialists (non-Vanderbilt?)
  ► Strength of relationship with the patient
  ► Timing (when last event occurred, or when due for next event)
• Central role of the CC
  ► Reflects the “intention” of the MHTAV program
  ► Does not fully capture the “work” of care coordination

• Health IT / Workflow interaction matrix
  ► Shows +, neutral, - alignment
  ► Helps identify missing technology or tech limitations
    o “Actions” box in POC too small
POC

- Was limited use intended?
  - How would broader team use of POC impact Communication, information awareness, situational awareness, or informational timeliness?
  - How could tracking POC use help?

- What should change in the design of the POC?
  - How narrowly or broadly focused does the POC need to be?
  - How flexible, in terms of user needs and context, should the POC tools be?
Discussion (cont.)

• Alignment varied with…
  ► Different individuals, interviews, and observations
  ► Gaps in system design suggesting missing or incomplete features (i.e., limited IVR tailoring)
  ► Variations in CC communication activities (in-person versus remote asynchronous)
  ► Time and team experience
  ► Barriers to information sharing (limited use of POC)
Conclusions

• IT innovation was a primary driver of care coordination redesign
  ► Developed a protocol, a role, a vision for implementing

• How well did the MHT system support the workflow?
  ► 7 areas of work (5 primary, 2 supporting)
  ► Multiple providers, coordinators, patients, caregivers, and care team members
  ► Dozens of workflows, Multiple IT systems used alone and in combination
  ► Overall: Mixed
Conclusions (cont.)

• Reasons for poor alignment were quite varied:
  ► System design
  ► Missing features
  ► Work activity variation
  ► User interface limitations

• Reasons for strong alignment were varied:
  ► Well-defined workflows and well-designed tools
  ► Training, team communication
  ► Co-location of CCs with other care team members
  ► Creative problem-solving by CCs and other team members
Conclusions (cont.)

• Improvements require
  ► System design changes (including missing features)
  ► Addressing work activity variation
  ► Improving user interface to support the complex work
  ► Well-defined workflows and well-designed tools
  ► Training, team communication, and co-location of CCs with other care team members
  ► Creative problem-solving by CCs and other team members
  ► Tincture of time; Ongoing process!
• SEIPS

• WEM
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http://hitwebinar.cds.pesgce.com/eindex.php
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• Please address your questions to “All Panelists” in the dropdown menu.
• Select “Send” to submit your question to the moderator.
• Questions will be read aloud by the moderator.
Appendix
1. Establishing Formal and Informal Relationships with Patients

Pre-MHTAV
- Provider facilitated introduction of CC to patient
- CC reviews patients meeting threshold. Enrolls during clinic encounter.

Post-MHTAV
- Technology-driven
  - Surveillance—all primary care patients
  - Algorithm identifies patients with disease
  - Patients auto-enrolled based on threshold for physiologic measure (e.g., BP)
  - CC creates Plan of Care, sets alerts
  - Alerts create tasks on worklist including reminders to contact patient
  - Check MHTAV enrollment practices

- Role-driven
  - Provider identifies patients at risk who do not meet threshold
  - CC calls patient to establish relationship, occasionally enrolls in clinic
  - CC finds time to see patients in clinic when possible

Later MHTAV
- Interactive voice response system used to contact some patients
- CC keeps notes in MHTAV tool to establish and maintain rapport with patient
2. Establishing and Maintaining a Plan of Care

- Discrepancy between home and clinic readings, patient scheduled for validation and/or education
  - Action needed
  - Patient education provided if needed. Validation performed and/or monitoring device is replaced.
    - No action needed
    - CC continues to monitor alerts for current POC

- Review of medications necessary
  - Action needed

- CC receives readings from patient and/or clinical encounters
  - CC reviews readings and determines if change or action is needed
    - No action needed
    - CC continues to monitor alerts for current POC

- CC sets reminders to contact patient for relevant readings via phone/MHAV messaging
  - CC receives alert about clinic readings or recent admissions
    - No action needed
    - CC reviews records and determines if change or action is needed

- POC established in collaboration with medical provider
  - CC reviews admission and/or clinic reading alerts to assess POC impact
    - No action needed
3. Collecting and Analyzing Home Monitoring Data

CC calibrates equipment if necessary, educates patient on use, establishes timeframe for conducting home readings, provides logs for recording

CC sets alerts to remind patient, creating tasks on worklist

CC calls or messages patient to remind

Patient takes readings, records on paper log or in MHAV journal

Readings are submitted in person (paper) or via MHAV

CC documents readings and creates Disease Control Form, if necessary

CC reviews readings and promotes to BP journal

MA reviews readings, calculates average and range, enters data into BP journal (prelim)
4. Educating and Coaching Patients

CC is notified by MHT system that a diabetic patient has been enrolled.

CC is notified by a physician and/or nurse that a diabetic patient is visiting the clinic and needs to meet with that CC before and/or after the provider sees the patient.

CC arranges to meet with patient.

CC obtains, prints and prepares educational materials for patient.

CC discusses health history, diabetes-related topics, concerns, needs & goals with the patient and provides them with educational materials or info.

If the patient needs a glucometer, the CC provides them with a glucometer.

If the patient has a glucometer but it needs to be validated, the CC validates the patient's glucometer.

CC trains patient on tips & techniques for using a glucometer and how to use home monitoring log sheets.

CC & patient follow-up in person and/or by phone to discuss current needs related to their health and plan of care as well as home monitoring needs, practices and/or questions.
5. Coordinating with Other Clinicians and Patients

Pre Clinic Visit

- Labs/tests/orders
- Pt. training and/or device validation needs
- Pt. home monitoring logs - arrivals
- Pt. recorded measures - ranges over time
- Prescriptions: new/refills/changes/questions

During Clinic Visit

- Messaging/Calls/Visits
- Appointment scheduling
- Reminders sent to pts. about labs/tests to be done a couple days before doctor’s visit
- Clinic staff determines if/when a CC needs to see pt. and, if so, coordinates timing with the CC
- CC checks clinic’s online pt. visit schedule

After Clinic Visit

- Following up with pts. after visit with PCP, specialists and/or med changes/needs
- Following up with pts. after previous visits with PCP, specialists and/or med changes/needs
- Clinic utilization (e.g., role in pt. training) and clinical teams’ efficiency & coordination increased over time

Early Stages

- Providers’ message volume & workload increase in early stages of MHT system implementation

MHT System Implementation in Teams/Sites

- Later Stages
6. Searching for Information to Support Decisionmaking and Action

**CC gathers information from a variety of sources to make sense of an alert**
- Data generating alert, e.g. BP from clinic visit
- Patient generated data from paper forms, BP journal, or patient portal message
- Clinical notes from PCP, specialists, or hospital/emergency room providers in the EHR
- Faxed/scanned documents from other organizations
- Notes on paper from conversation with patient

**CC processes information to construct explanatory narrative**
- Remarkable details gathered from all sources on paper, e.g. key dates, diagnoses, events
- Dates for recommended action are identified on cell phone calendar, paper calendar or embedded EHR calendar, e.g. 1 week from today.
- Calculated values, e.g. progress to target BP, written on paper.
- External reference data

**CC creates documentation of action**
- Plan of Care note includes explanatory narrative and evidence that may contain information pasted from elsewhere in the EHR
- “Actions” recommended or taken are distilled into a 2-line text box
- “Actions” typically resulted in setting follow-up alerts and/or messaging the MA or provider
7. Prioritizing Tasks and Planning Work

**Morning criteria for prioritizing:**
- **Time:** catching patient in the clinic, if necessary, urgent or time-sensitive messages
- **Clinical:** responding to very high alerts

**Afternoon criteria for prioritizing:**
- **Time:** alerts/tasks due that day
- **Clinical:** patients that are actively engaged

**Morning**
- CC sorts worklist by “Next Clinic Visit” column to get today’s scheduled patients to the top of the list
- CC opens window to display clinic Whiteboard for near-real-time info on when patient arrives
- CC sorts worklist by “Next Clinic Visit” column to get today’s scheduled patients to the top of the list
- CC deals with urgent or highly time-sensitive messages

**Afternoon**
- CC addresses alerts that are less urgent, e.g., scheduled follow-ups or lower-priority clinical alerts
- CC opens window to display clinic Whiteboard for near-real-time info on when patient arrives
- Juggling all of these tasks
- CC sets follow-up alerts using multiple temporal cues:
  - Timed relative to another clinical event e.g., 2 weeks before next clinic appointment
  - Timed for a specific period, e.g., the next 2 weeks
  - Planning her own workload, e.g., setting follow-up alerts on a day that she expects to be “slow” in terms of clinic activity