



U.S. Department of Health and Human Services



Agency for Healthcare Research and Quality

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# 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

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# Agenda

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- 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.



# Presenters and Moderator Disclosures

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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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- Questions will be read aloud by the moderator.

The screenshot displays the WebEx interface with the Q&A panel open. At the top, there are tabs for 'Participants', 'Chat', and 'Q&A'. The 'Q&A' panel is expanded, showing a 'Speaking:' section with 'Panelists: 2' and 'Attendees:'. Below this, there is a 'Q&A' section with a dropdown menu set to 'All (0)'. A red arrow points to the 'Ask:' dropdown menu, which is currently set to 'All Panelists'. Below the dropdown, there is a text input field with the placeholder text 'Select a participant in the ask menu first and type your question here. There is a 256 character limit.' and a 'Send' button.



# Learning Objectives

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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.



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# Examining the Relationship Between Health IT and Ambulatory Care Workflow Redesign

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



# Acknowledgements

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- 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.)

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# Background

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- 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

# Background (cont.)

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- 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)

# Study Objective

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- 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

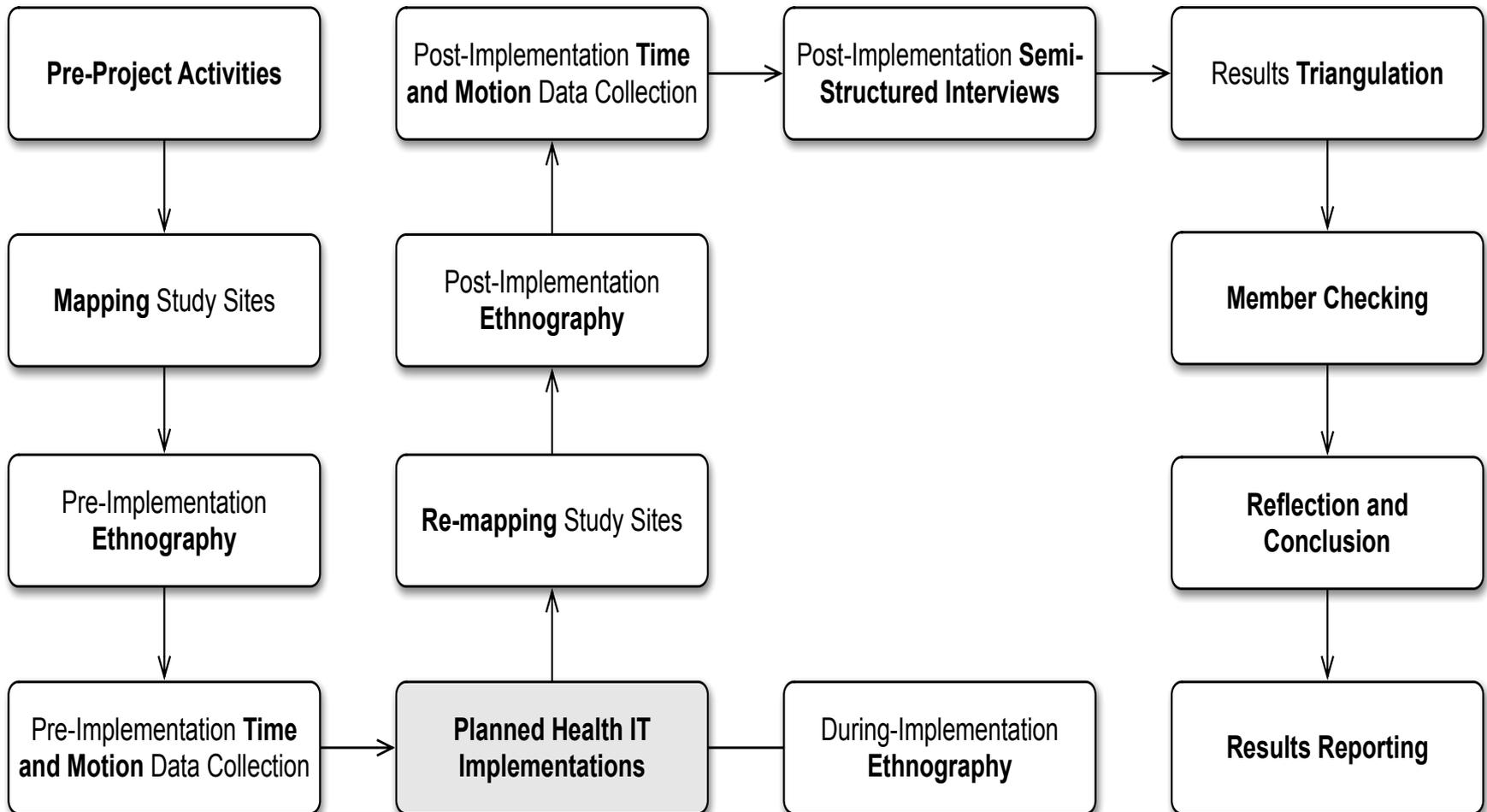
- Study sites:
  - ▶ Two health care organizations:
    1. Not-for-profit integrated hospital and multispecialty medical group practice in Western United States (Organization West)
    2. Not-for-profit, community-owned health system, providing ambulatory care to underserved communities in Eastern United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

- Study design:
  - ▶ Prospective observational
  - ▶ Mixed methods
  - ▶ Data collection before, during, and after planned health IT implementations:
    - Ethnographic observations
    - Time and motion observations
    - Log audit trail data
    - Semi-structured interviews
    - Member checking focus groups

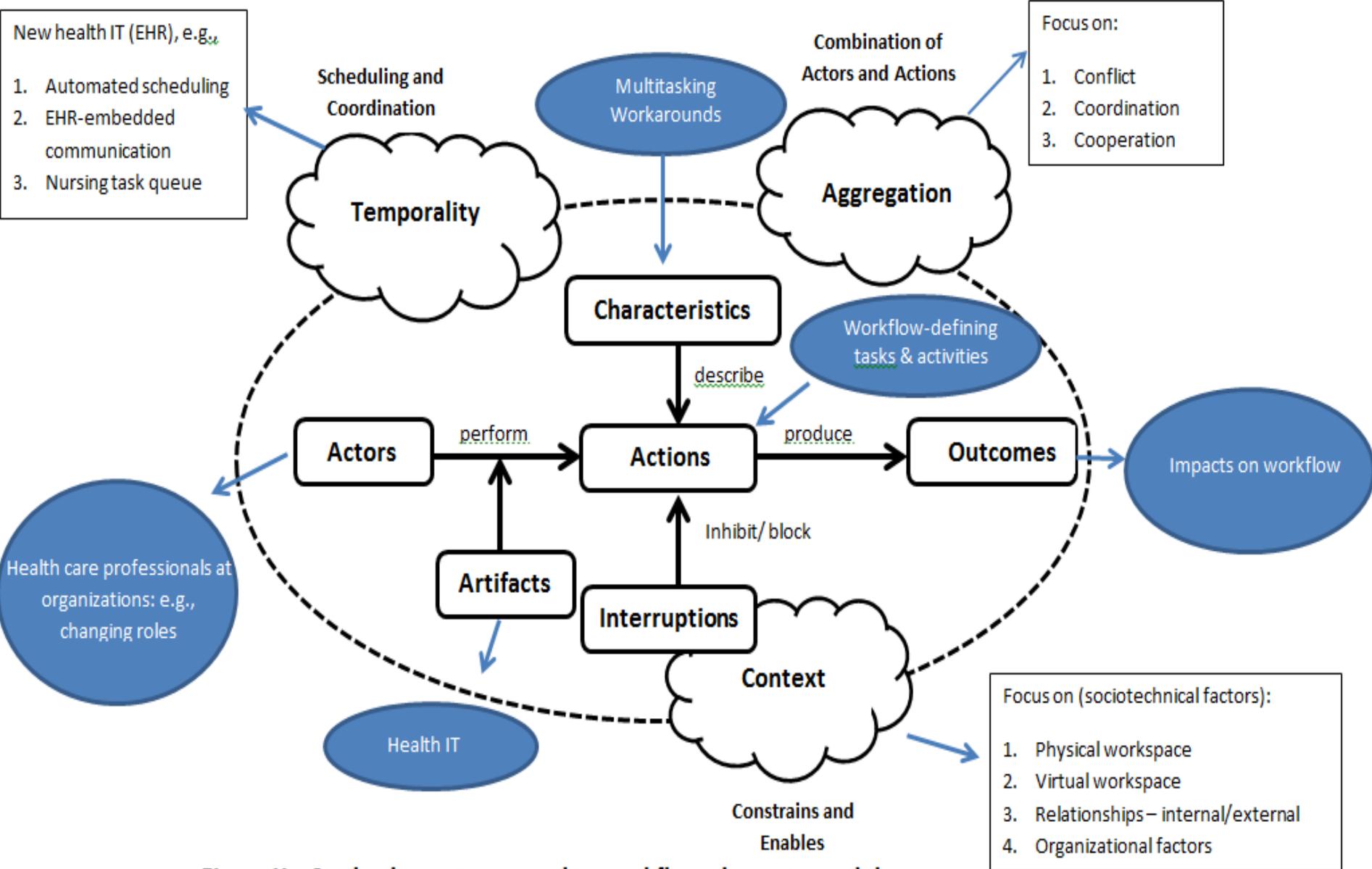
# Methods (cont.)



# Conceptual Models

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- 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

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- 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

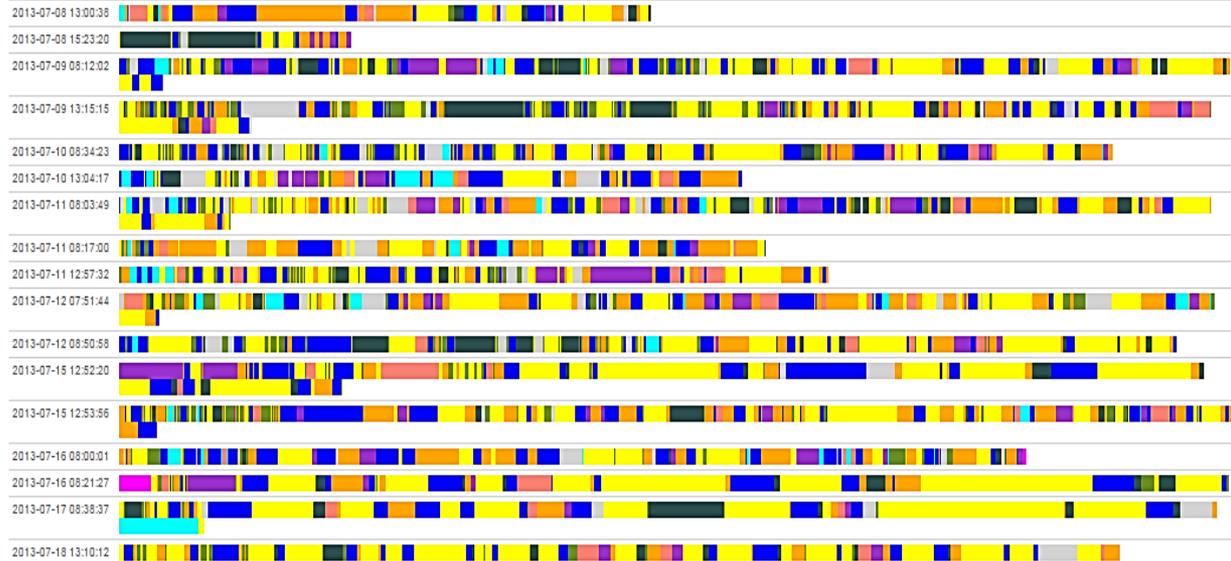
## Timebelt Visualization

PRE/POST Difference

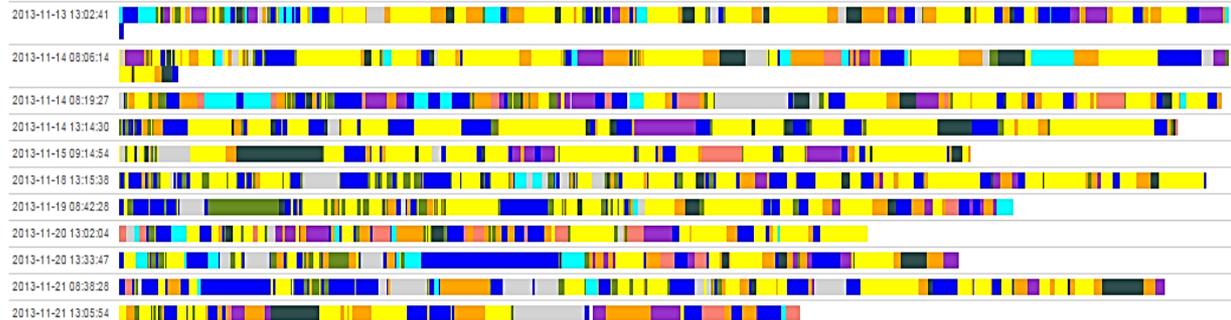
Frequent Patterns



## PRE



## POST





# Analyses: Heat Map Visualization

## PRE (%)

	A	B	C	D	E	F	G	H	I	J	K
A.Computer—Communicating (1000-1001)	--	0.014	0.342	0.137	0.099	0.171	0.122	0	0.027	0.068	0.005
B.Dictating (1100)	0.031	--	0.257	0.437	0.046	0.13	0.05	0	0.004	0.027	0
C.Computer—ELPR (1200-1220)	0.048	0.011	--	0.208	0.067	0.248	0.18	0.001	0.049	0.061	0.006
D.Paper (1300-1314)	0.018	0.018	0.234	--	0.045	0.226	0.284	0	0.059	0.04	0.003
E.Phone (1400-1402)	0.049	0.026	0.362	0.209	--	0.164	0.086	0.002	0.006	0.04	0.003
F.Talking (1500-1506)	0.016	0.005	0.269	0.176	0.037	--	0.288	0.001	0.094	0.039	0.002
G.Walking (1600-1602)	0.006	0.002	0.104	0.247	0.019	0.373	--	0.001	0.15	0.048	0.002
H.Meeting (1700)	0	0	0.129	0.129	0.032	0.226	0.161	--	0.032	0.258	0
I.Performing (1800-1811)	0.005	0.001	0.137	0.124	0.008	0.262	0.375	0	--	0.042	0.001
J.Personal (1900-1909)	0.041	0.011	0.219	0.139	0.054	0.173	0.243	0.004	0.063	--	0.003
K.Cell phone/iPad (2000)	0.034	0.056	0.371	0.079	0.079	0.124	0.112	0	0.045	0.067	--

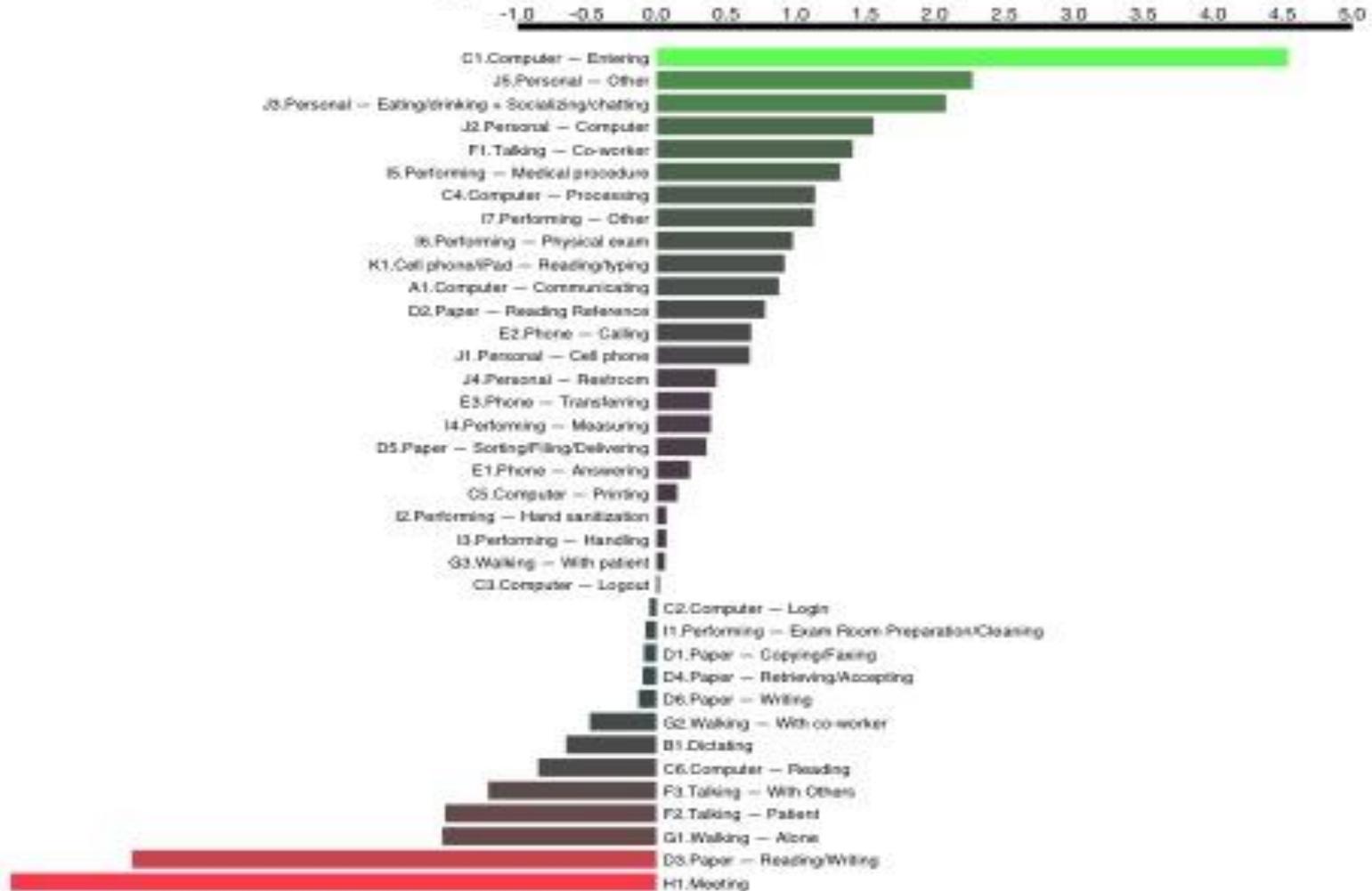
## POST (%)

	A	B	C	D	E	F	G	H	I	J	K
A.Computer—Communicating (1000-1001)	--	0.008	0.333	0.145	0.111	0.165	0.092	0	0.013	0.09	0.008
B.Dictating (1100)	0.013	--	0.273	0.368	0.039	0.121	0.104	0.004	0.009	0.022	0.009
C.Computer—ELPR (1200-1220)	0.046	0.017	--	0.162	0.079	0.287	0.164	0	0.057	0.051	0.01
D.Paper (1300-1314)	0.037	0.022	0.242	--	0.047	0.243	0.233	0	0.068	0.04	0.003
E.Phone (1400-1402)	0.051	0.015	0.305	0.181	--	0.244	0.096	0	0.003	0.051	0.004
F.Talking (1500-1506)	0.015	0.004	0.304	0.143	0.045	--	0.265	0	0.097	0.037	0.003
G.Walking (1600-1602)	0.008	0.004	0.129	0.183	0.017	0.43	--	0.001	0.126	0.051	0.003
H.Meeting (1700)	0	0	0.3	0.1	0	0.3	0.3	--	0	0	0
I.Performing (1800-1811)	0.003	0.002	0.151	0.094	0.005	0.332	0.308	0.001	--	0.053	0.001
J.Personal (1900-1909)	0.046	0.012	0.241	0.088	0.058	0.229	0.236	0	0.043	--	0.006
K.Cell phone/iPad (2000)	0.032	0.108	0.344	0.129	0.065	0.151	0.065	0	0.032	0.065	--



# Analyses: Visual Analytics of Pre-Post Comparison

DIFFERENCE BY Category





# Results: Study Sample

Data Collection Activity	Provider (MD/DO/ NP/PA)	Medical Asst.	Nurse	Staff	Other	TOTAL
Observation	41	29	19	26	7	122
Time and Motion	29	16	6	6	1	58
Interview	17	5	6	3	8	39
Focus Group	17	9	6	6	0	38
Unique	44	29	19	26	12	130



# Results: Data Volume

Data Collection Method	Data Volume	Hours of Observation
Ethnographic Observations	554 pages field notes	366 hours
Semi-structured Interviews	351 pages transcriptions	~39 hours
Focus Groups	~90 pages transcriptions	~6 hours
Time & Motion Observations	85,808 distinct records	1,173.4 hours
Audit Trail Logs	79,362 entries	NA



# Findings by Study Goals

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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

## **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

---

## **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.)

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- 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

Measure	Clinical Role	Organization West				Organization East	
		Primary Care sites		Specialty Care		Pre	Post
		Pre	Post	Pre	Post		
Frequency (number of occurrences per hour)	Provider	21.46	18.66	25.47	21.04	29.06	16.59*
	Medical Asst.	47.49	25.78*	6.24	6.87	24.84	10.87*
	Nurse	12.26	4.23	13.08	9.22	--	--
	Staff	48.12	23.59*	--	--	17.33	13.24
	<b>All Roles</b>	<b>25.62</b>	<b>18.32*</b>	19.97	16.46	<b>26.94</b>	<b>14.04*</b>
Average duration (seconds)	Provider	54.68	47.74	60.86	61.48	61.67	37.25*
	Medical Asst.	78.18	43.79*	30.02	27.06	54.63	24.89*
	Nurses	36.69	22.77	36.48	29.24	--	--
	Staff	61.16	49.72	--	--	49.83	35.48
	<b>All Roles</b>	<b>53.95</b>	<b>43.89*</b>	50.91	49.49	<b>58.36</b>	<b>32.23*</b>

\* p < 0.05

# Findings (cont.)

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

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# 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)

# Findings (cont.)

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- 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



## Findings (cont.)

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*“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.)

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- 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.”*

# Findings (cont.)

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

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- Impacts of health IT on efficiency
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# Findings (cont.)

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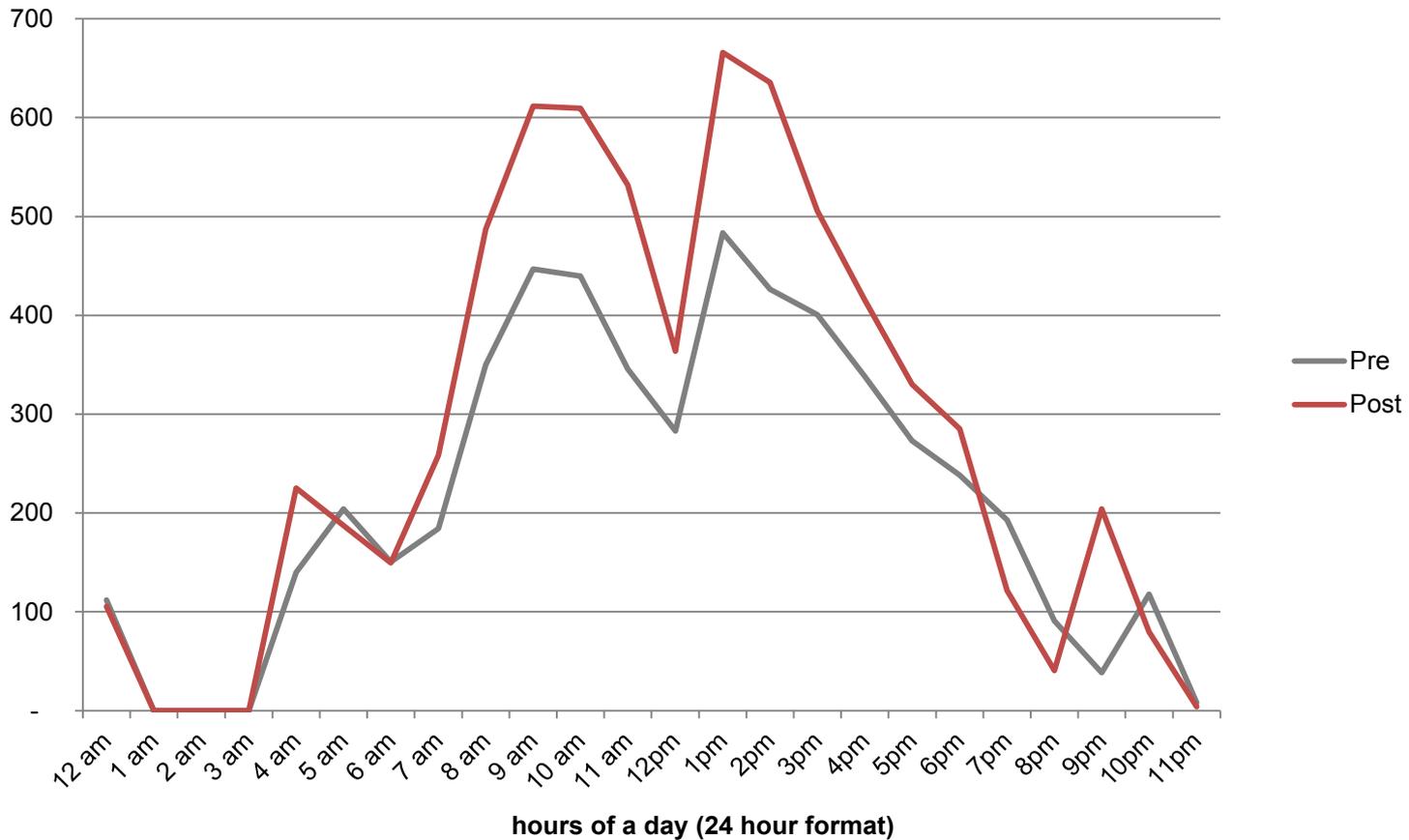
## **Goal 1: Causal relationship between health IT implementation and ambulatory care workflow redesign**

- 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



## Findings (cont.)

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- 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.”*

# Findings (cont.)

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## **Goal 2: Sociotechnical factors and the role they play in mitigating or augmenting health IT's impact on workflow**

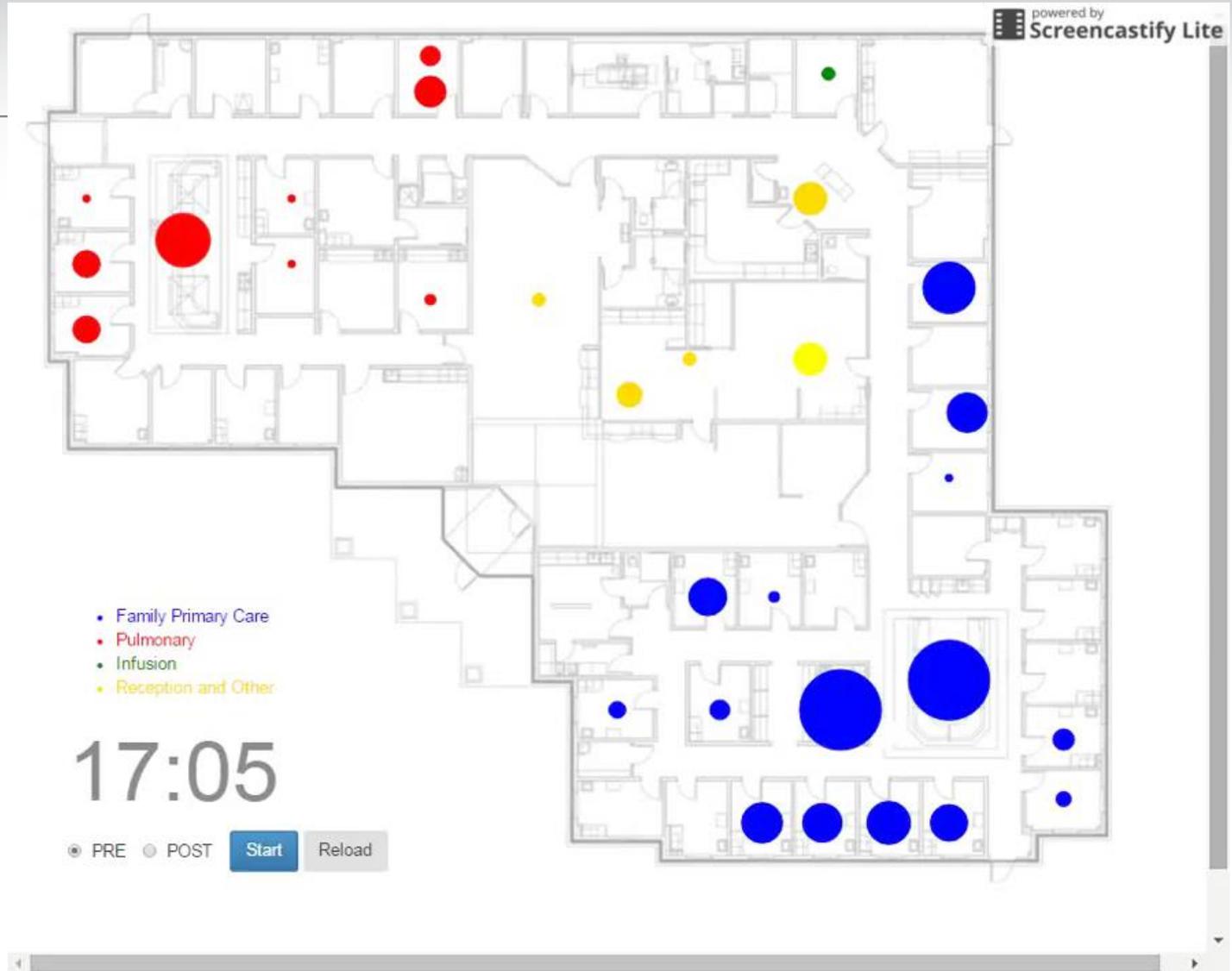
- Physical space
- Relationships and their interdependencies
- Power differentials

# Findings (cont.)

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- 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



## Findings (cont.)

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- 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.)

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- 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.”*

## Findings (cont.)

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**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

Clinical Role	Organization West						Organization East			
	All Primary Care sites		Primary Care 2		Specialty Care		All Primary Care sites		Primary Care 3	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<b>Provider</b>	<b>0.91</b>	<b>2.18*</b>	<b>0.95</b>	<b>3.25*</b>	1.12	1.33	0.90	0.92	0.39	1.05*
<b>Medical Asst.</b>	0.77	2.32	0.67	3.20*	1.03	0.28	0.66	1.32	0.29	1.16
<b>Nurse</b>	0.80	0.40*	0.69	0.40	0.73	0.69	--	--	--	--
<b>Staff</b>	0.46	--	0.65	--	--	--	--	0.72	--	0.72
<b>All roles</b>	<b>0.83</b>	<b>1.86*</b>	<b>0.80</b>	<b>2.24*</b>	1.06	1.19	0.79	1.04	<b>0.34</b>	<b>1.05*</b>

Number of interruptions per hour

\* p < 0.05

# Implications

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- Importance of staff engagement
- Consideration of clinic differences
- Expect the unexpected
- Employ minimum specifications
- Consideration of workload

# Lessons Learned

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- 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

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- 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**



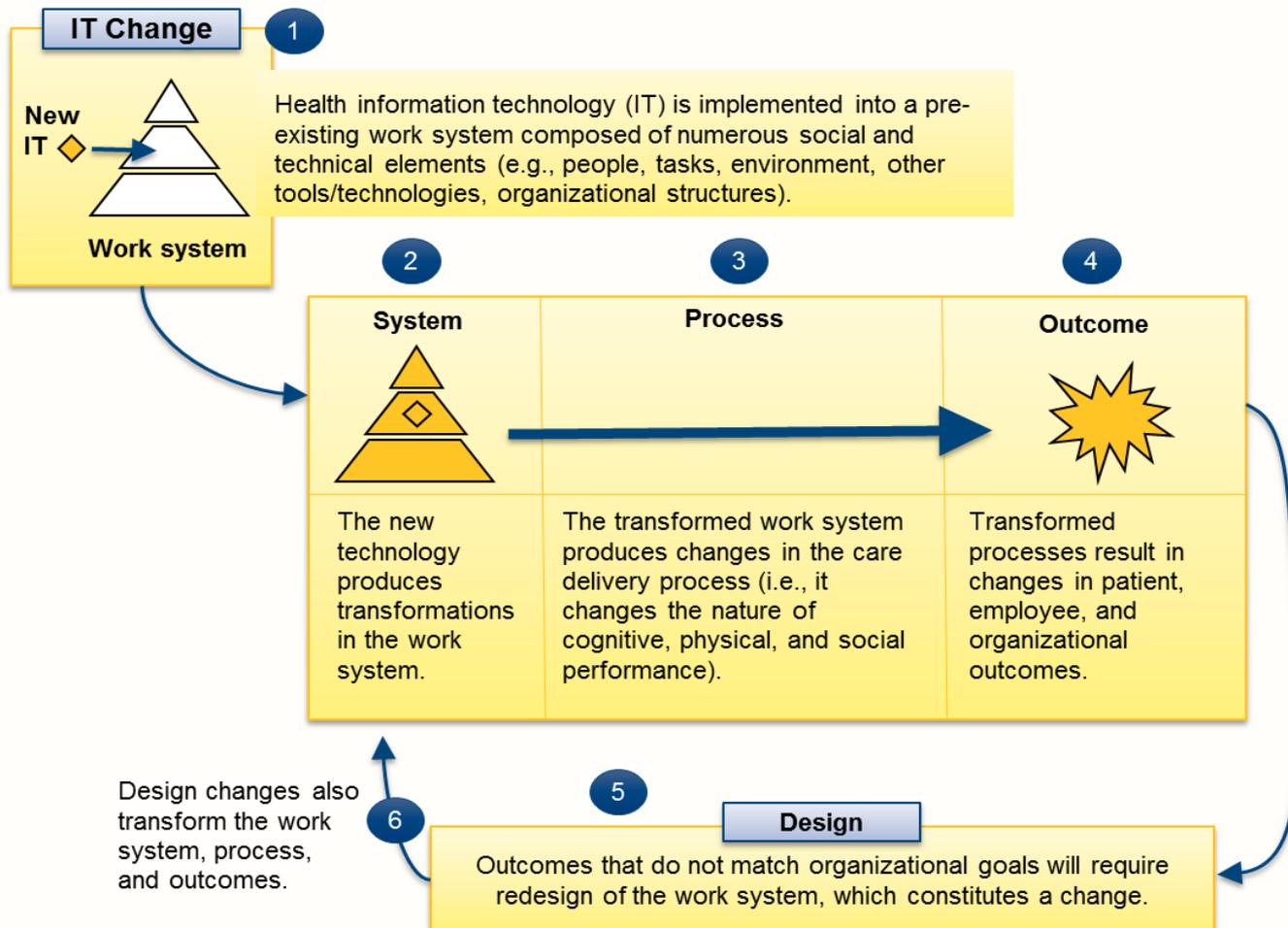
# Research Question

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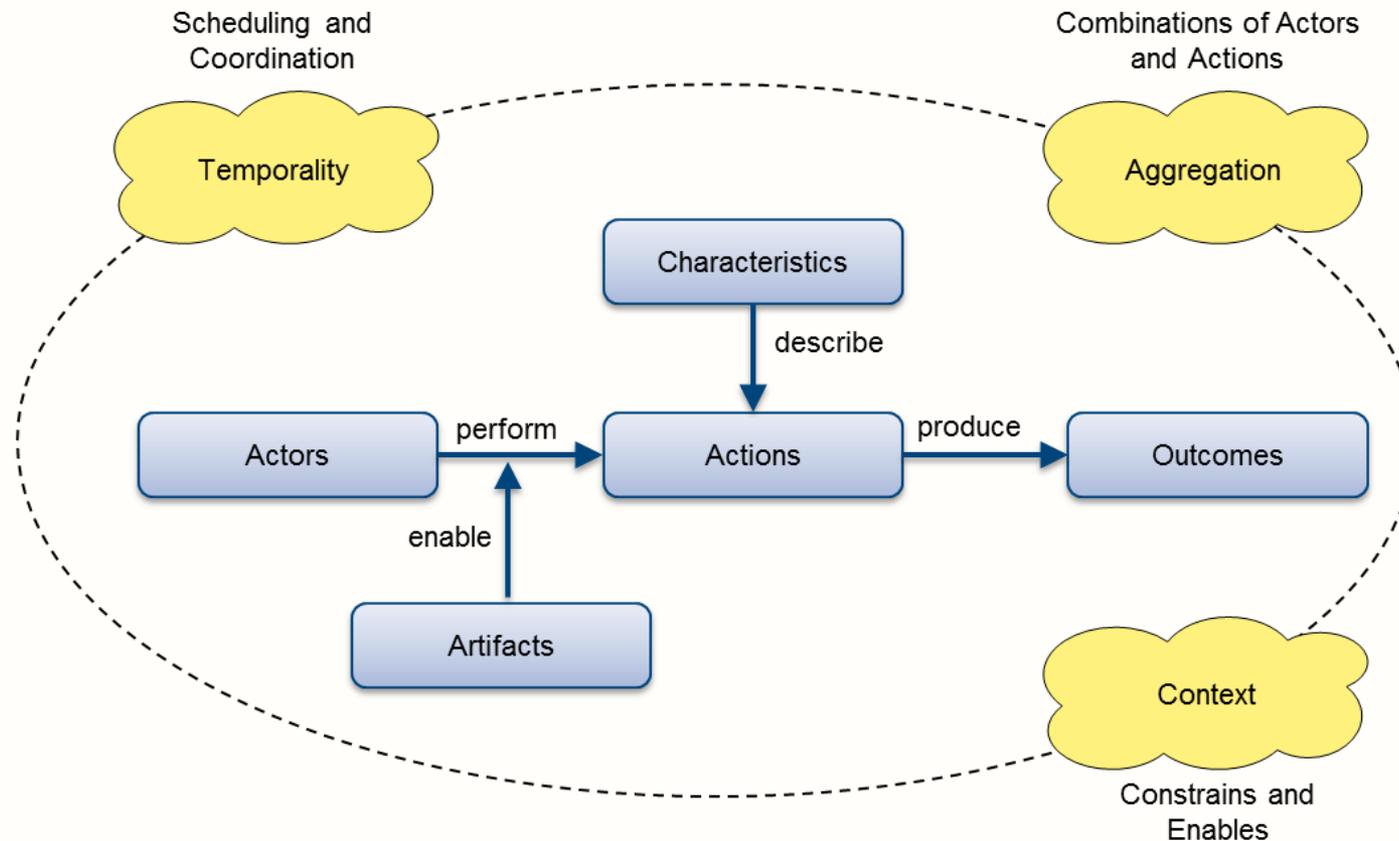
- What is the workflow impact of implementing health IT-enabled care coordination within six ambulatory primary care clinics?

# Theoretical Framework: SEIPS

## Systems Engineering Initiative for Patient Safety (SEIPS)



## Workflow Elements Model (WEM)





# My Health Team at Vanderbilt (MHTAV)

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- 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

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

CC: Care Coordinator; MA: Medical Assistant; MD: Medical Doctor; NP: Nurse Practitioner; PSR: Patient Service Rep 54



# Plan of Care (POC)

## 1) Hypertension

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

Surveillance  Active-engage

POC Status: [Active](#)

HTN Start Date

Approx. Cycle (Wks):

HTN Early Check Date

HTN-POC Exp Date

F/U by MA?

### 1) Short Term Target(s)

Record Date	Record By	Target Name	Target Value	Comment	<input style="float: right;" type="button" value="+"/>
2014/01/15		test			

### 2) Medication Goals Show History

Record Date	Record By	Event Type	Goal	Comment	<input style="float: right;" type="button" value="+"/>
2014/02/11		Change			

[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

Record Date	Record By	Goal	Comment	<input style="float: right;" type="button" value="+"/>
2014/02/11				

### 4) Monitoring Goals Show History

Record Date	Record By	Goal	Comment	<input style="float: right;" type="button" value="+"/>

[MHaV] 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

Record Date	Record By	Goal Name	Status	Comment	<input style="float: right;" type="button" value="+"/>

# Worklist

- Care coordinator and clinician activity are driven by a worklist.

Heart Failure	Diabetes	Hypertension	HomeBP	PCP	Next PCP Visit	Alerts	Actions
		1b (Surv)	■			HiBP:(02/24)	Actions
1a ■	3b ■	3b ■	■		2014/07/09 13:40	HiBP:(03/26); POC:(03/19, 03/19 *)	Actions
	2b ■	3a □	■			POC:(2013/06/10 *, 2013/06/24 *)	Actions
		1a ■	■			WestMedSurv:(06/12); WestPromote: (06/17)	Actions



# Protocol for Diabetes

Risk Stratification and Status	At Control	Assessment by MD	Frequency of Pt Self Monitoring	Freq of CC/MA Contact
<b>Initial Verification of Control:</b>  <b>1A/2A/3A</b>	<u>Patients &lt; 80 years old:</u> A1C <7.0  OR  <u>Patients &gt;80 years old:</u> A1C < 8.0  OR  MD Specification	At least once a year		<b>1A:</b> 6 months-yearly between scheduled appointments with provider <b>2A:</b> Every 6 months between scheduled appointments with provider <b>3A:</b> Every 6 months between scheduled appointments with provider
<b>Surveillance of Control:</b>  <b>1A/2A/3A</b>	<u>Patients &lt; 80 years old:</u> A1C <7.0  OR  <u>Patients &gt;80 years old:</u> A1C ≤ 8.0  OR  MD Specification	<b>1A:</b> Annual office encounter <b>2A:</b> Every 6 months <b>3A:</b> Every 6 months	<b>1A:</b> A1C reading every 6 months with PCP approval <b>2A/3A:</b> A1C every 3 months	Every 6 months between scheduled appointments with provider



# Protocol for Diabetes (cont.)

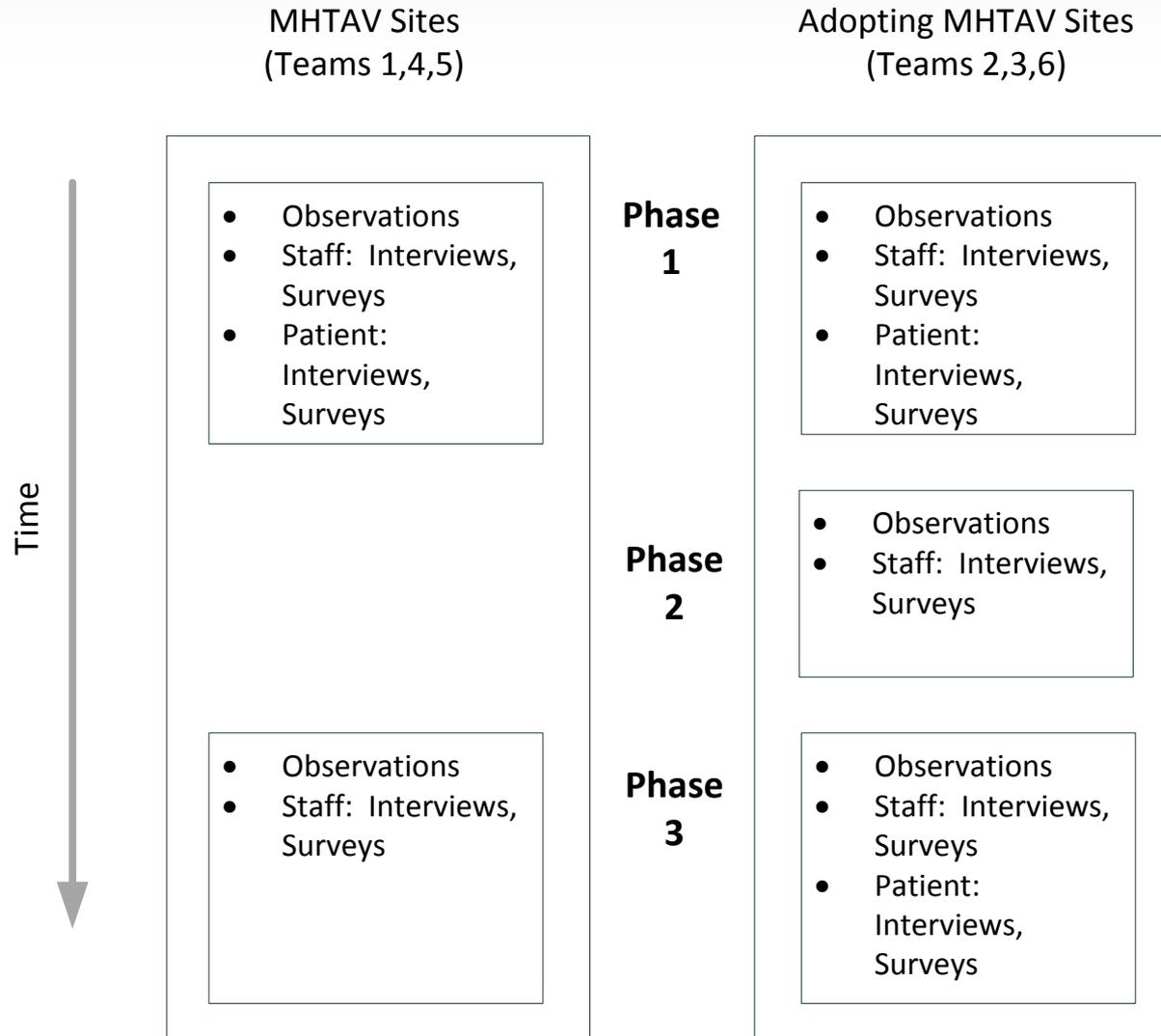
Risk Stratification and Status	At Control	Assessment by MD	Frequency of Pt Self Monitoring	Freq of CC/MA Contact
<b>Titration:</b> <b>1B/2B/3B</b>	<u>Patients &lt; 80 years old:</u> A1C $\geq$ 7.0  OR <u>Patients &gt; 80 years old:</u> A1C $\geq$ 8.0  OR MD Specification	Every 3 months	<i>When adding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

# Study Design

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- 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.)





# Study Sites

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

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. 61



# Data Collected

Data Collection Activity	Source of Data	Data Description
Direct observations of care coordination	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.	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
Staff interviews	Practice staff participating in direct observations	Responses to interview guide questions
Patient interviews	Patients with diabetes contacted through direct observation or introduced by their physician	Responses to interview guide questions
Staff surveys	Practice staff	Responses to modified Technology Acceptance Model (TAM) survey
Patient surveys	Patients	Responses to Patient Activation Measure (PAM) 13-item instrument; and Summary of Diabetes Self-Care Activities (SDSCA) 10-item instrument

# Data Analysis

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- 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

Analysis Activity	Source of Data	Product
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. 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
    - Home data collection
    - Medication side effects f/u
    - Understanding external factors

# 1. Establishing Formal and Informal Relationships with Patients (cont.)



Relevant IT Resources or Attributes	Workflow: Establishing and Maintaining Relationships with Patients	
	Activity: Enrollment/ Auto-Enrollment	Activity: Building Rapport with Patients
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. <b>Good alignment</b> <input type="checkbox"/>	Reminders to call/message patients or connect with them in clinic. Opportunity for CC to build rapport via face-to-face communication. <b>Good alignment</b> <input type="checkbox"/>
B. Auto-enrollment	Patients are automatically added to CC's panel based on collected data and stratified according to the protocol, minimizing CC work. <b>Good alignment</b> <input type="checkbox"/>	CCs reported face-to-face meetings with patients were important to rapport-building. <b>Poor alignment</b> <input type="checkbox"/>
C. Disease Control Form (DCF)	Displays information about patient, including the next appointment. <b>Good alignment</b> <input type="checkbox"/>	DCF shows status of patient and allows CC to update status based on information received from communications with patient. <b>Good alignment</b> <input type="checkbox"/>

# 1. Establishing Formal and Informal Relationships with Patients (cont.)



Relevant IT Resources or Attributes	Workflow: Establishing and Maintaining Relationships with Patients	
	Activity: Enrollment/ Auto-Enrollment	Activity: Building Rapport with Patients
D. POC Support tab	<p>Records activities involving initial patient contact, and assists in establishing the POC for the patient.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>	<p>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).</p> <p><b>Good alignment</b> <input type="checkbox"/></p> <p>“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.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>

## 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.)



Relevant IT Resources or Attributes	Workflow: Establishing and Maintaining a Plan of Care (POC)	
	Activity: Establishing a POC	Activity: Maintaining/Changing a POC
Alerts and reminders populate the CC worklist	<p>POC establishment driven by patient readings (from clinic) and collaboration between the CC and provider.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>	<p>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.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>
Disease Control Form (DCF) tab (MHT dashboard)	<p>Displays information about patient, including the next appointment and relevant readings.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>	<p>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.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>

## 2. Establishing and Maintaining a Plan of Care (cont.)



Relevant IT Resources or Attributes	Workflow: Establishing and Maintaining a Plan of Care (POC)	
	Activity: Establishing a POC	Activity: Maintaining/Changing a POC
POC Support tab (MHT dashboard)	<p>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.</p> <p><b>Good</b> alignment <input type="checkbox"/></p>	<p>“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.</p> <p><b>Poor</b> alignment <input type="checkbox"/></p>

## 2. Establishing and Maintaining a Plan of Care (cont.)



Relevant IT Resources or Attributes	Workflow: Establishing and Maintaining a Plan of Care (POC)	
	Activity: Establishing a POC	Activity: Maintaining/Changing a POC
Journaling tab (MHT dashboard)	<p>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.</p> <p><b>Good</b> alignment <input type="checkbox"/></p>	<p>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).</p> <p><b>Good</b> alignment <input type="checkbox"/></p>
Utilization Data tab	<p>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.</p> <p><b>Moderate</b> alignment <input type="checkbox"/></p>	<p>Allows CCs to see when patient is scheduled to visit the clinic, and can support face-to-face encounters.</p> <p><b>Good</b> alignment <input type="checkbox"/></p>

# 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.)



Relevant IT Resources or Attributes	Workflow: Collecting and Analyzing Home Monitoring Data		
	Activity: Setting Up Home Monitoring Devices	Activity: Collecting and Compiling Data	Activity: Identifying Actionable Readings and Following Up
Worklist alerts and reminders	Reminders are used to connect with patients during clinic appointments. <b>Good alignment</b> <input type="checkbox"/>	Reminders for both CC and MA to check patient submission of readings. <b>Good alignment</b> <input type="checkbox"/>	
Patient Portal Messaging		Enables multiple pathways—messaging or online journaling—in addition to paper, to acquire glucometer data. <b>Good alignment</b> <input type="checkbox"/>	
BP Journal feature			MA documents readings, CC reviews. BP journal does not have a field for pulse rate, which is captured on the paper form. <b>Moderate alignment</b> <input type="checkbox"/>
Disease Control Form (DCF)			CC creates form to facilitate physician decisionmaking re: medication changes and other therapies. <b>Good alignment</b> <input type="checkbox"/>

## 4. Educating and Coaching Patients

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- 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.)



Relevant IT Resources or Attributes	Workflow: Educating and Coaching Patients		
	Activity: Creating Educational Materials/ Tools for Patients	Activity: Contacting Patients (In Person or by Phone)	Activity: Training and/or Counseling Patients
Shared/standardized education folder/module on database	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). <b>Good alignment</b>		
My Health Team (MHT) alerts and reminders	▬	MHT worklist, alerts, and/or schedule help CCs determine if/when (or schedule an appointment with) a patient is coming in and if there is an opportunity for patient training. <b>Good alignment</b> ▬	After receiving an alert or reminder, CC talks to patient and/or checks documentation to determine and address information needs of the patient and then takes the opportunity to inform/teach and/or coach/counsel them accordingly. <b>Moderate alignment</b> ▬

# 4. Educating and Coaching Patients (cont.)



Workflow: Educating and Coaching Patients			
Relevant IT Resources or Attributes	Activity: Creating Educational Materials/ Tools for Patients	Activity: Contacting Patients (In Person or by Phone)	Activity: Training and/or Counseling Patients
Internet materials (PDFs of educational modules)	<p>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.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>		<p>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.</p> <p><b>Moderate alignment</b> <input type="checkbox"/></p>
Server based educational materials, lists of resources (e.g., local courses or services), needs, ideas and/or inquiries	<p>None currently exist on local server, database, or software/tools.</p> <p><b>Poor alignment</b> <input type="checkbox"/></p>		

## 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



# 5. Coordinating with Other Clinicians and Patients



Workflow: Coordinating with Other Clinicians (Nurses & PCPs)			
Relevant IT Resources or Attributes	Activity: Messaging	Activity: Medication Changes and Refills	Activity: Prompts to CCs and Patients
MHT worklist alerts and reminders		Notify CCs (or IVR system) to follow-up with patients about new or changed medications on a certain date <b>Good alignment</b> <input type="checkbox"/>	Reminders are used to notify patients to come in for a lab/test a few days before their doctor's appointment <b>Good alignment</b> <input type="checkbox"/>  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. <b>Good alignment</b> <input type="checkbox"/>
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). <b>Good alignment</b> <input type="checkbox"/>  Clinicians having a large number of messages sent by the CCs can feel overwhelmed and wish the technology helped to alleviate this <b>Poor alignment</b> <input type="checkbox"/>  Messages sent/received to coordinate the best time for the CC to see the patient are often not received in time. <b>Poor alignment</b> <input type="checkbox"/>	Prescription requests and/or information and questions about medications can be e-mailed among CCs and the clinicians. <b>Good alignment</b> <input type="checkbox"/>	Electronic messaging (MHAV and/or e-mail) has helped CCs when scheduling appointments with patients. <b>Good alignment</b> <input type="checkbox"/>

# 5. Coordinating with Other Clinicians and Patients (cont.)



Relevant IT Resources or Attributes	Workflow: Coordinating with Other Clinicians (Nurses & PCPs)		
	Activity: Messaging	Activity: Medication Changes and Refills	Activity: Prompts to CCs and Patients
Clinic schedule for viewing by CCs			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 <b>Poor alignment</b> <input type="checkbox"/>
Interactive voice response (IVR) system asks patients about new or changed medications (if patient has consented)		IVR system only asks generic and broad questions that often lack specific and contextual information. <b>Poor alignment</b> <input type="checkbox"/>	Since the IVR system is not always reliable, the CC doesn't get sufficient or reliable information and must call the Pt to ask about their new/changed med. <b>Poor alignment</b> <input type="checkbox"/>
CCs schedule or availability status is not accessible remotely/electronically			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. <b>Poor alignment</b> <input type="checkbox"/>

## 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.)



Workflow: Search for Information to Support Decisionmaking and Action		
Relevant IT Resources or Attributes	Activity: Seeking Information	Activity: Making Sense of Information for Documentation and Action
<p><b>Data sources internal to the organization:</b></p> <ul style="list-style-type: none"> <li>Clinic notes</li> <li>Hospital provider notes</li> <li>Hospital discharge notes</li> <li>Medication lists</li> <li>Prescription information</li> <li>Appointment information</li> <li>Messages from clinicians</li> </ul> <p>*Schedule information</p>	<p>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.</p> <p>* 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.</p> <p><b>Moderate alignment</b> <span style="float: right;">▬</span></p>	<p>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.</p> <p><b>Good alignment</b> <span style="float: right;">▬</span></p> <p>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.</p> <p><b>Moderate alignment</b> <span style="float: right;">▬</span></p>
<p><b>Data sources internal to the organization</b></p>		<p>The box/area for inserting documentation of “Actions” was small, requiring the CC to gather information, make sense of it, then distill it into a very short (2-line) paragraph.</p> <p><b>Poor alignment</b> <span style="float: right;">▬</span></p>

# 6. Searching for Information to Support Decisionmaking and Action (cont.)



Relevant IT Resources or Attributes	Activity: Seeking Information	Activity: Making Sense of Information for Documentation and Action
Data from partner organization accessible electronically via the Internet: discharge summaries and some test results	Certain data were available electronically from a close regional partner hospital. <b>Good alignment</b> <input type="text" value=""/>	
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)	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. <b>Moderate alignment</b> <input type="text" value=""/>	
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	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. <b>Good alignment</b> <input type="text" value=""/>	

# 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
    - Generated in any clinic within medical center
  - ▶ Admission alerts
    - Generated with hospital admission or ED visit
  - ▶ Scheduled alerts
    - Set by CC or MA, such as when a home reading is expected

# 7. Prioritizing Tasks and Planning Work (cont.)

Relevant IT Resources or Attributes	Workflow: Prioritizing Tasks and Planning Work		
	Activity: Identifying Opportunities to Engage Patients Face to Face in the Clinic	Activity: Identifying High Priority Alerts	Activity: Setting Alerts
MHT worklist	<p>List can be sorted by “Next Clinic Visit,” enabling CC to see patients with visits in the coming days.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>	<p>Alert column displays type of alert, can “show details” to get more information, e.g., specific BP value that triggered alert.</p> <p><b>Good alignment</b> <input type="checkbox"/></p>	
Online whiteboard	<p>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.</p> <p><b>Moderate alignment</b> <input type="checkbox"/></p>		

# 7. Prioritizing Tasks and Planning Work (cont.)

Relevant IT Resources or Attributes	Activity: Identifying Opportunities to Engage Patients Face to Face in the Clinic	Activity: Identifying High Priority Alerts	Activity: Setting Alerts
External calendar (wall, cell phone)			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. <b>Good alignment</b> <input type="text" value=""/>
MHT “next clinic visit”			Events around which follow-up alerts are scheduled. Does not appear to be updated in real-time. <b>Moderate alignment</b> <input type="text" value=""/>
Outlook calendar			Used to set follow-up alerts for nonurgent issues. Requires opening a window on a separate computer or screen. <b>Moderate alignment</b> <input type="text" value=""/>



# Technology Acceptance Model Survey (Staff)

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- 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

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- 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

Role	Page Views: Count	Page Views: %
Care Coordinator (CC)	480,159	76
Medical Assistant (MA)	81,463	12
MHT Development Team Lead	45,801	7
Other*	22,847	3
Total	630,270	100

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

- 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)

# Discussion (cont.)

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- 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
    - “Actions” box in POC too small

# Discussion (cont.)

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- 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.)

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- 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

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- 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.)

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- 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.)

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- 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

- ▶ Holden RJ, Brown RL, Alper SJ, et al. That's nice, but what does IT do? Evaluating the impact of bar coded medication administration by measuring changes in the process of care. *Int J Ind Ergon*. 2011 Jul 1;41(4):370-9. PMID: 21686318.

- WEM

- ▶ Unertl KM, Novak LL, Johnson KB, et al. Traversing the many paths of workflow research: developing a conceptual framework of workflow terminology through a systematic literature review. *J Am Med Inform Assoc*. 2010 May-Jun;17(3):265-73. PMID: 20442143.



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# Obtaining CME/CE Credits

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If you would like to receive continuing education credit for this activity, please visit:

<http://hitwebinar.cds.pesgce.com/eindex.php>



# 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.

The screenshot displays the WebEx interface for a Q&A session. At the top, there are tabs for 'Participants', 'Chat', and 'Q&A'. The 'Participants' tab is active, showing a list of participants under 'Speaking:'. Below this, there are sections for 'Panelists: 2' and 'Attendees:'. The 'Q&A' tab is also active, showing a dropdown menu for 'Ask:' set to 'All (0)'. At the bottom, there is a text input field with a 'Send' button. A red arrow points to the 'Send' button.

# Appendix



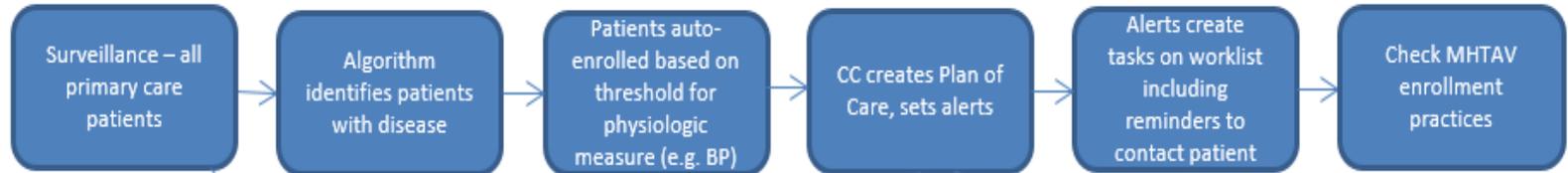
# 1. Establishing Formal and Informal Relationships with Patients

## Pre-MHTAV



## Post-MHTAV

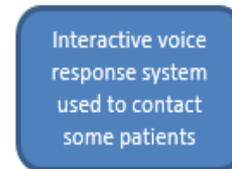
### Technology-driven



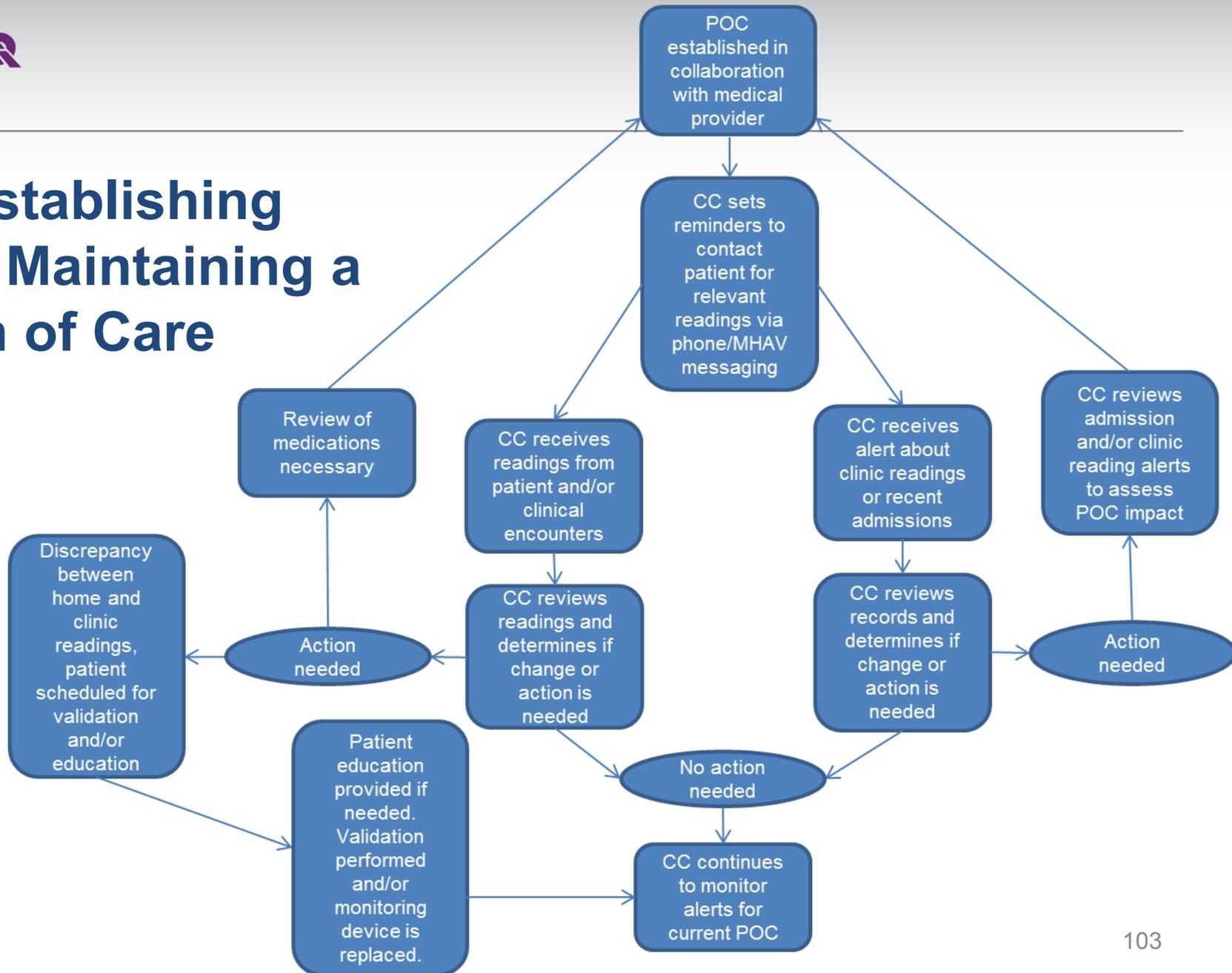
### Role-driven



## Later MHTAV

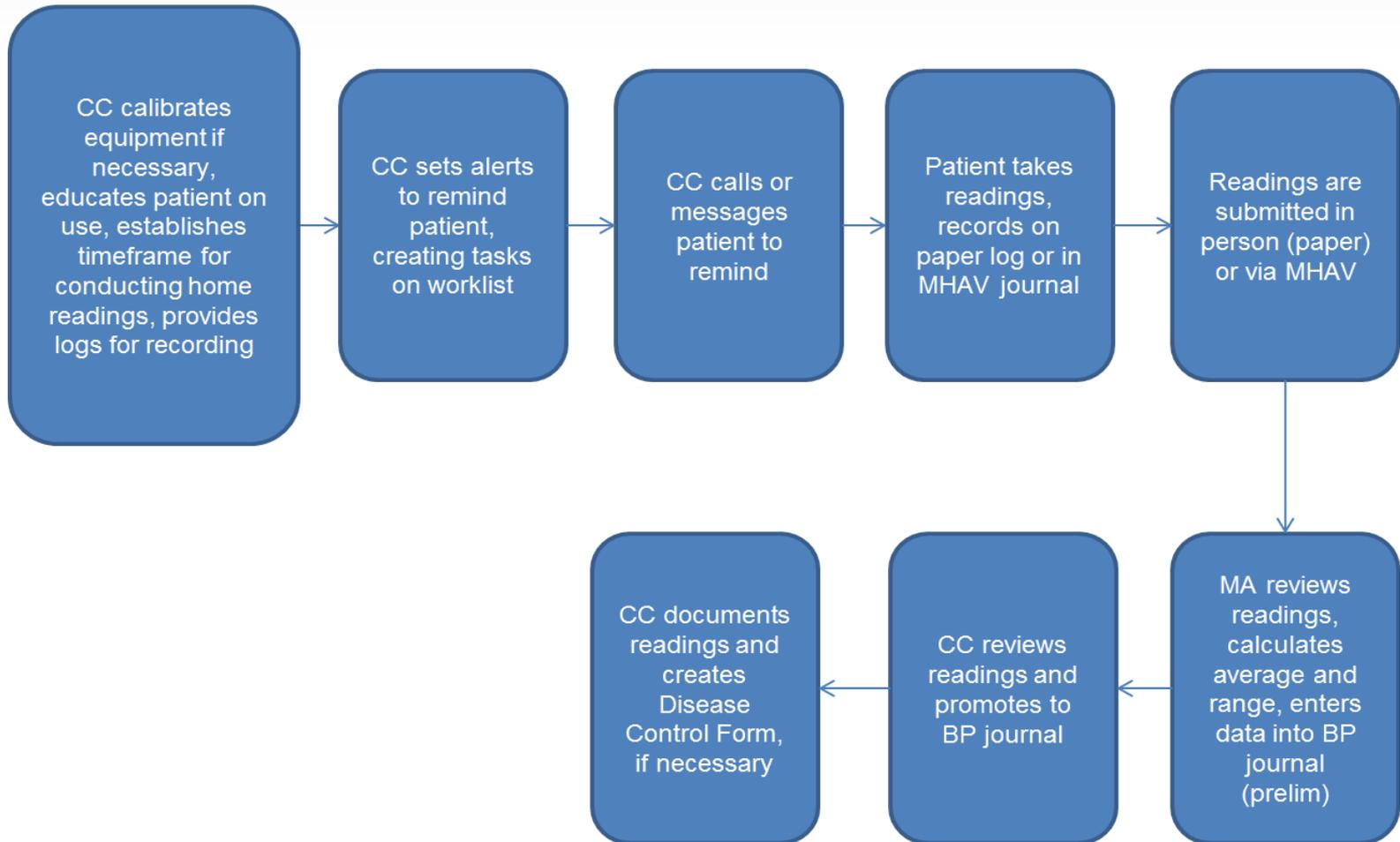


## 2. Establishing and Maintaining a Plan of Care

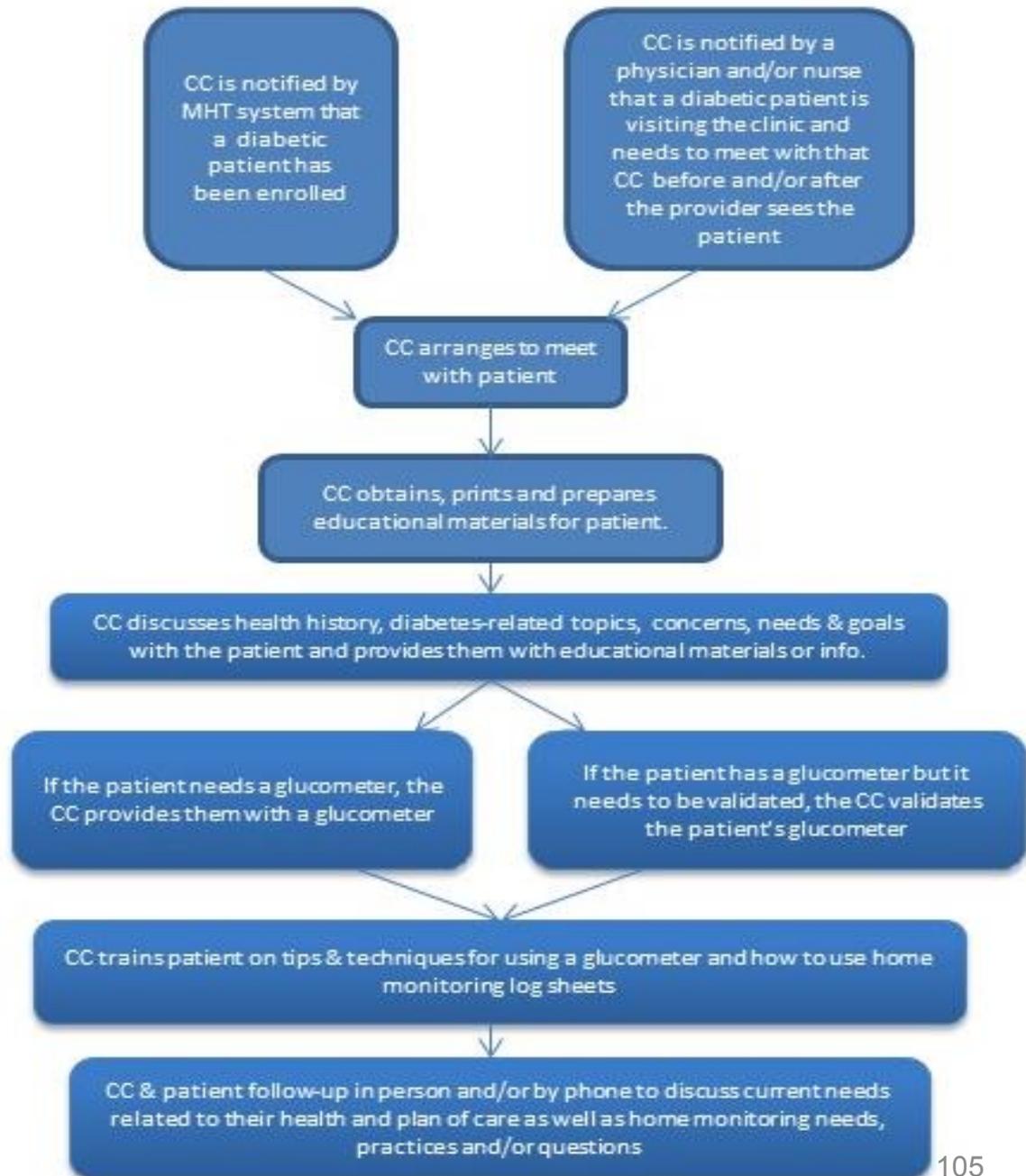




# 3. Collecting and Analyzing Home Monitoring Data



## 4. Educating and Coaching Patients

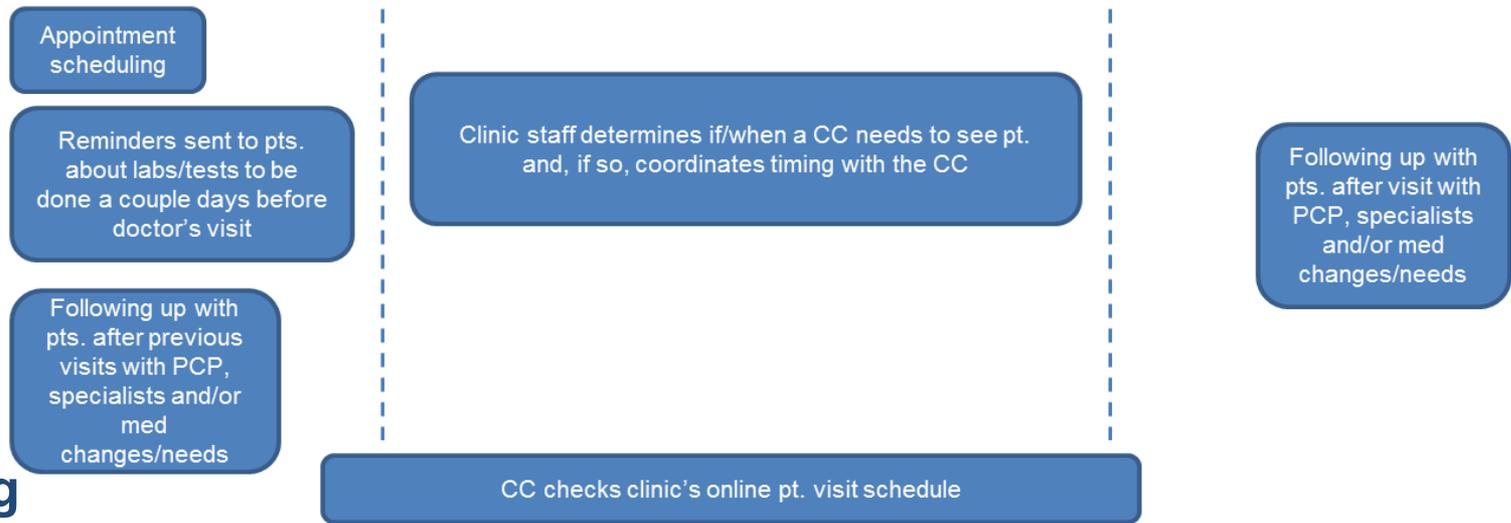
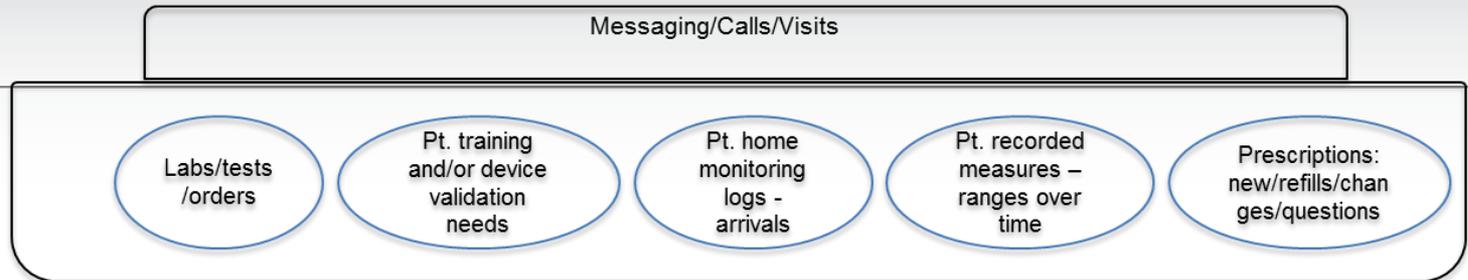




Pre Clinic Visit

During Clinic Visit

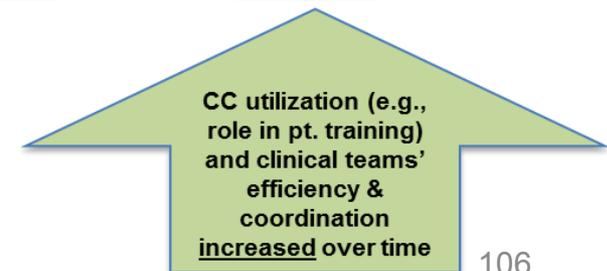
After Clinic Visit



Early Stages

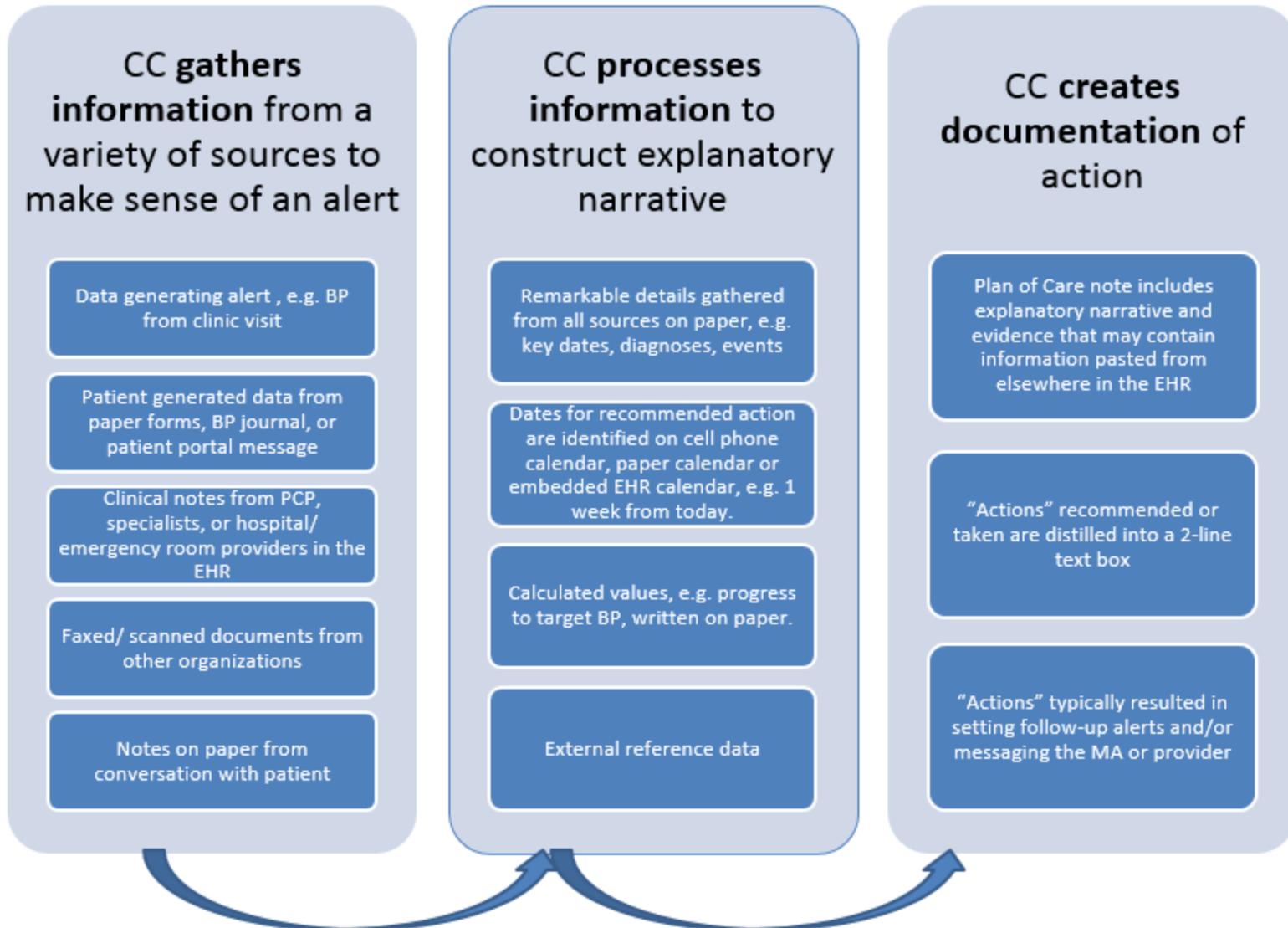
MHT System Implementation in Teams/Sites

Later Stages



## 5. Coordinating with Other Clinicians and Patients

# 6. Searching for Information to Support Decisionmaking and Action



# 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 reviews alerts for any very high readings, e.g. blood pressure at level that requires a call to patient to check for symptoms of a stroke

CC opens window to display clinic Whiteboard for near-real-time info on when patient arrives

CC deals with urgent or highly time-sensitive messages

Juggling all of these tasks

### 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

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