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Medical Informatics

Medical Device Informatics

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Human Factors

the hospital @ home

In the home

The Empowered Patient and Self-management

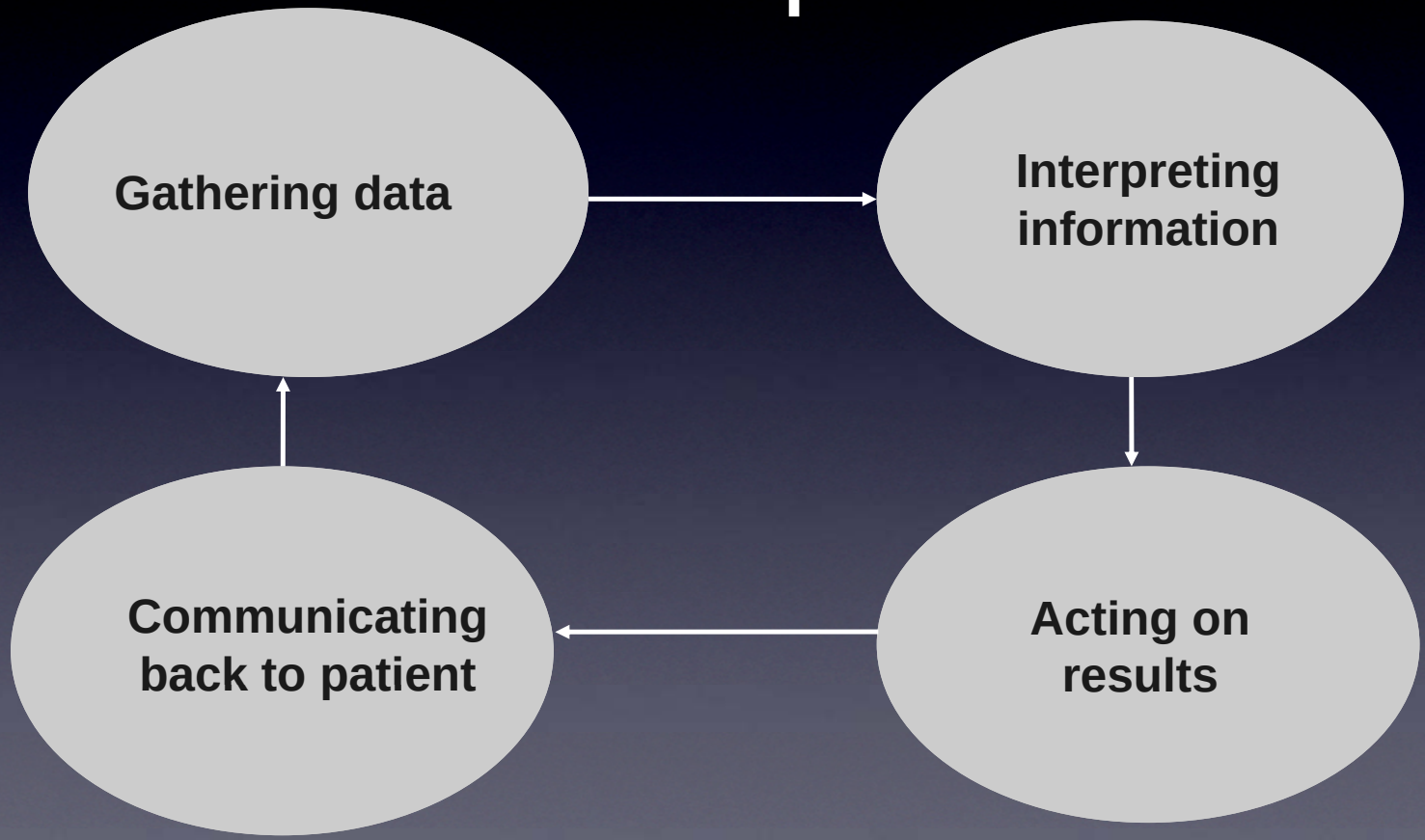
Project 1 of 4

Mobile Phone based Remote Patient Monitoring of Heart Failure

The Scope of Chronic Disease

- Six chronic diseases account for **60**% of healthcare spending in Canada:
  - Diabetes
  - High Blood Pressure
  - Kidney Disease
  - Heart Failure
  - Lung Disease
  - Mental Health

Patient-Provider Feedback Loop

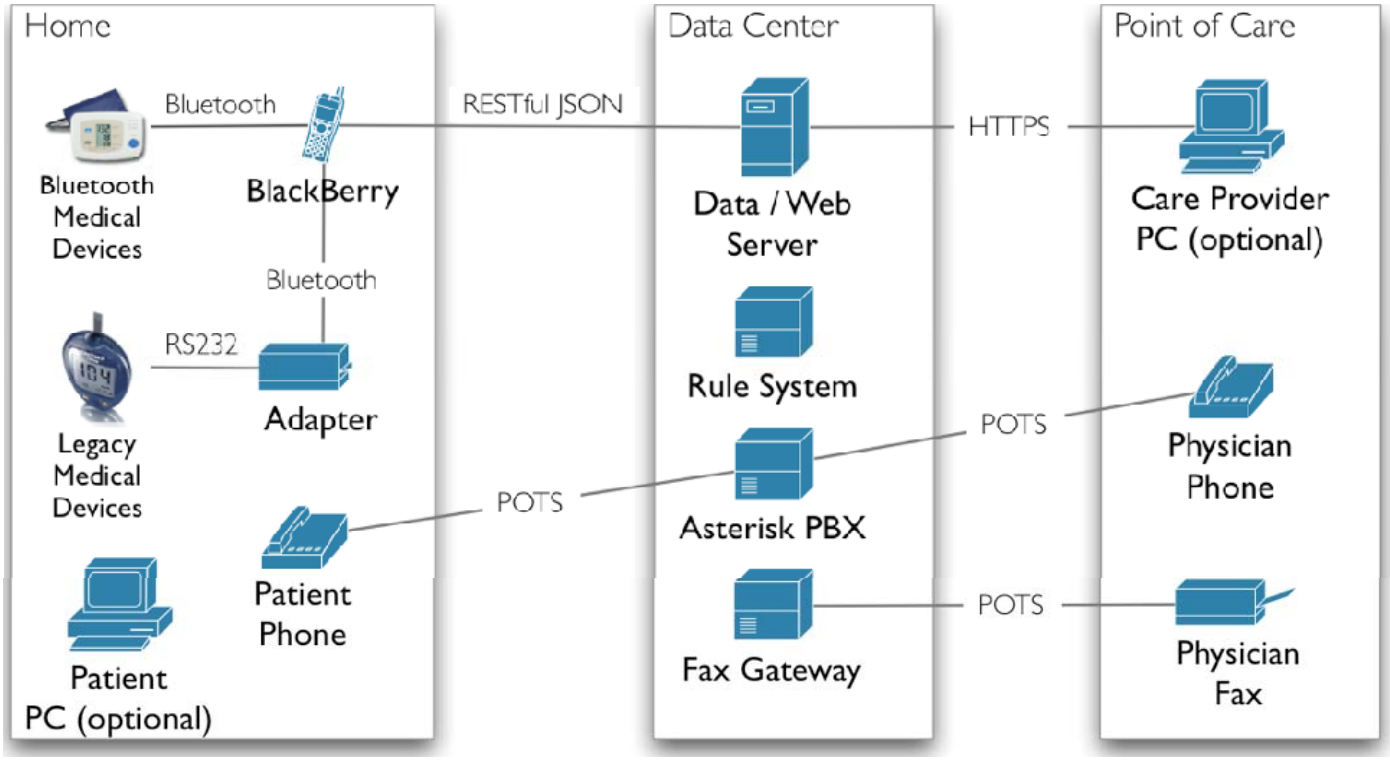


Joseph Hayduk, 86, is heart failure and uses a device that transmits his vital signs to a RN at Meridian Health.
The RN calls all 18 patients in program daily. The New York Times Feb 13, 2009

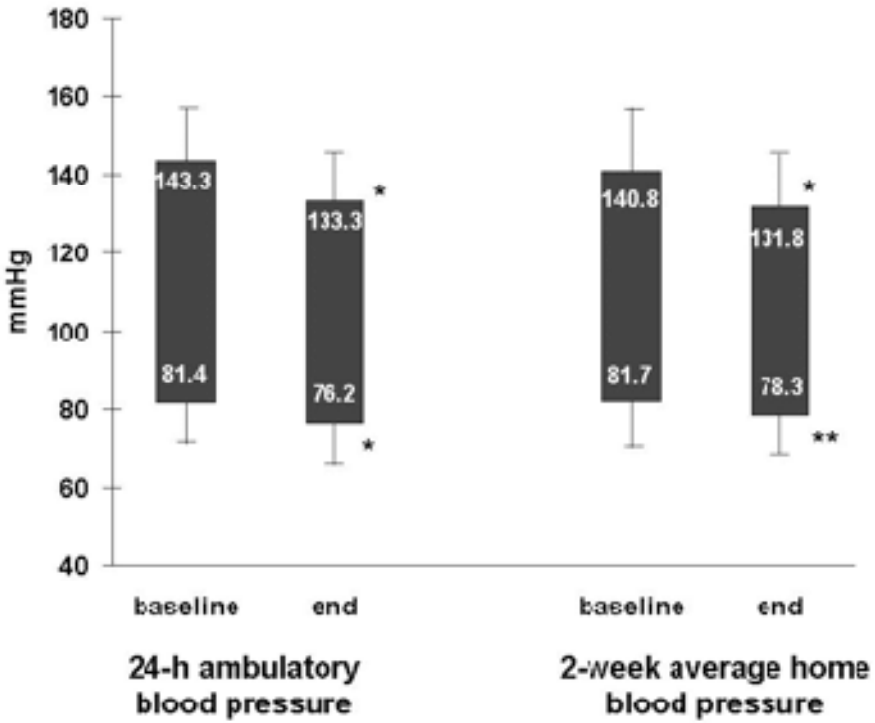
Diabetes self-management system

RPM in Heart Failure

- Emily Seto, PhD candidate
  - user-centered design
  - development of a rules engine
  - evaluation of intervention (100 patients)
- Collaborator: Heather Ross, Cardiology, UHN/UofT


Home
Bluetooth
Bluetooth Medical Devices
BlackBerry
Bluetooth
RS232
Adapter
Legacy Medical Devices
Patient Phone
Patient PC (optional)
RESTful JSON
POTS
Data Center
Data / Web Server
Rule System
Asterisk PBX
Fax Gateway
HTTPS
POTS
POTS
Point of Care
Care Provider PC (optional)
Physician Phone
Physician Fax

Trial Results



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CARD GUARD
The Telemedicine Company
PMP
Self Check ECG

Congestive Heart Failure Client

Project 2 of 4

Medical Body Area Network (MBAN) Platform for Ambulatory Monitoring (AM)

Partnered Research Project

Investigators

Joseph Cafazzo, UHN and U of T
Ramesh Abhari, McGill University

Collaborators

Paul Ritvo, UHN
Jeff Daskalakis, CAMH and U of T

Research In Motion

Christopher Labrador
Shirook Ali
James Warden
Adele Newton

Michigan Tech

application to mental health

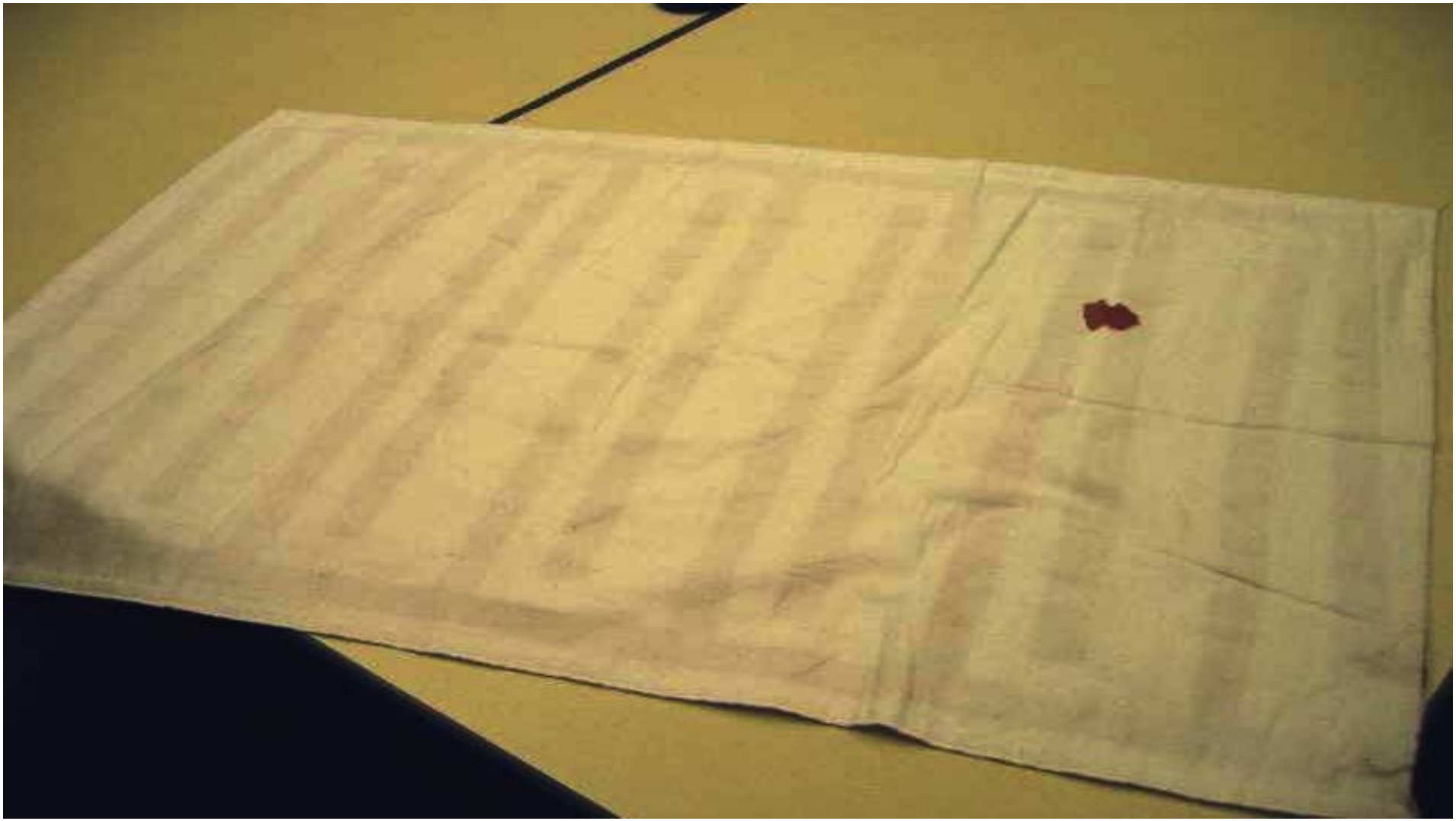
- 20% of population
- almost no technological interventions
- promising developments for detection

Enobio

design challenge

Nocturnal Home Hemodialysis

96
95



Respiration Sensor

- Measure *capacitive coupling* above a substrate-metallic pad:
  - Electrical permittivity of air << body tissue
  - Inspiration: ↑ air, ↓capacitive coupling
  - Expiration: ↓ air, ↑capacitive coupling

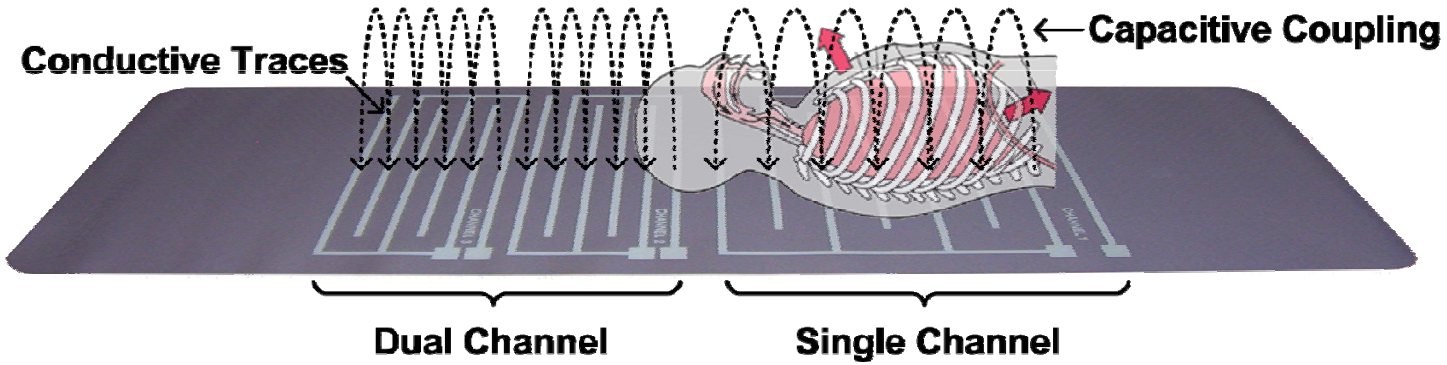
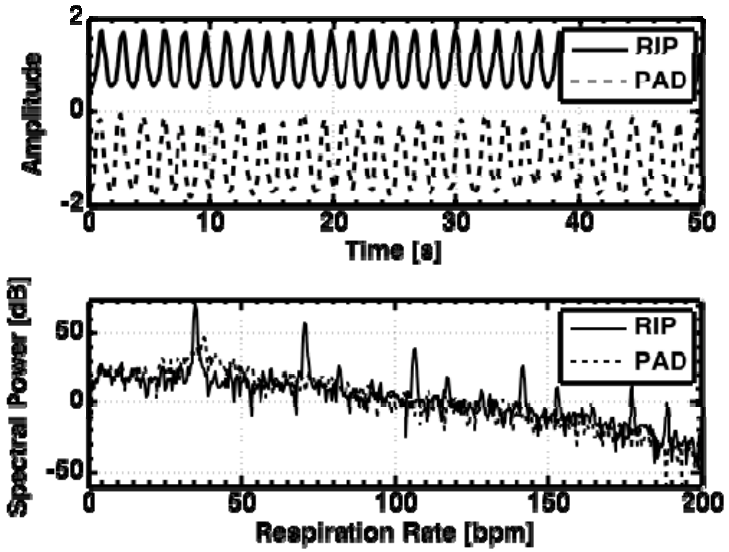


Photo: Philips

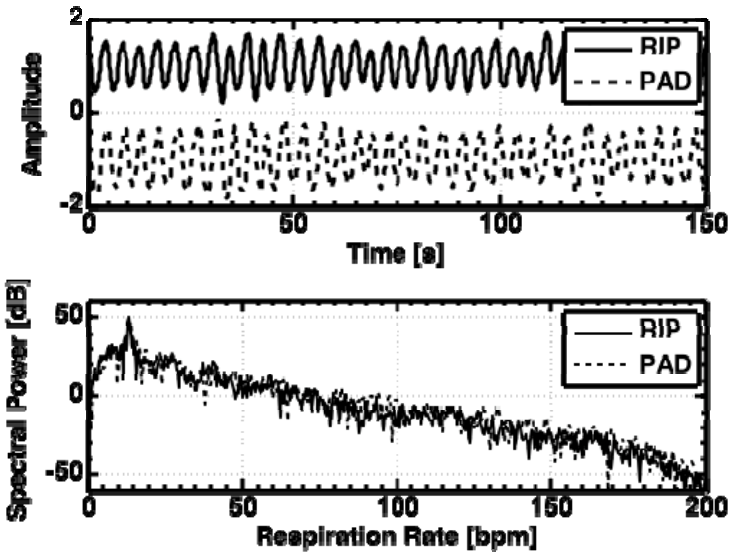
Validation

- Comparison of proposed contact-free sensor (PAD) with the gold standard Respiratory Inductance Plethysmography (RIP).
- Testing performed on ***SimMan*** mannequin and a ***healthy volunteer***.
- Measurements taken at 5, 15, 25, 35, 45, 55 breaths per minute (bpm).
- Analysis in both the *time* and *frequency* domain.

SimMan Robotic Mannequin



Healthy Volunteer



In the hospital

Safety and efficiency

Project 3 of 4

Advanced Information Access and Communication in the Modern Hospital

Partnered Research Project

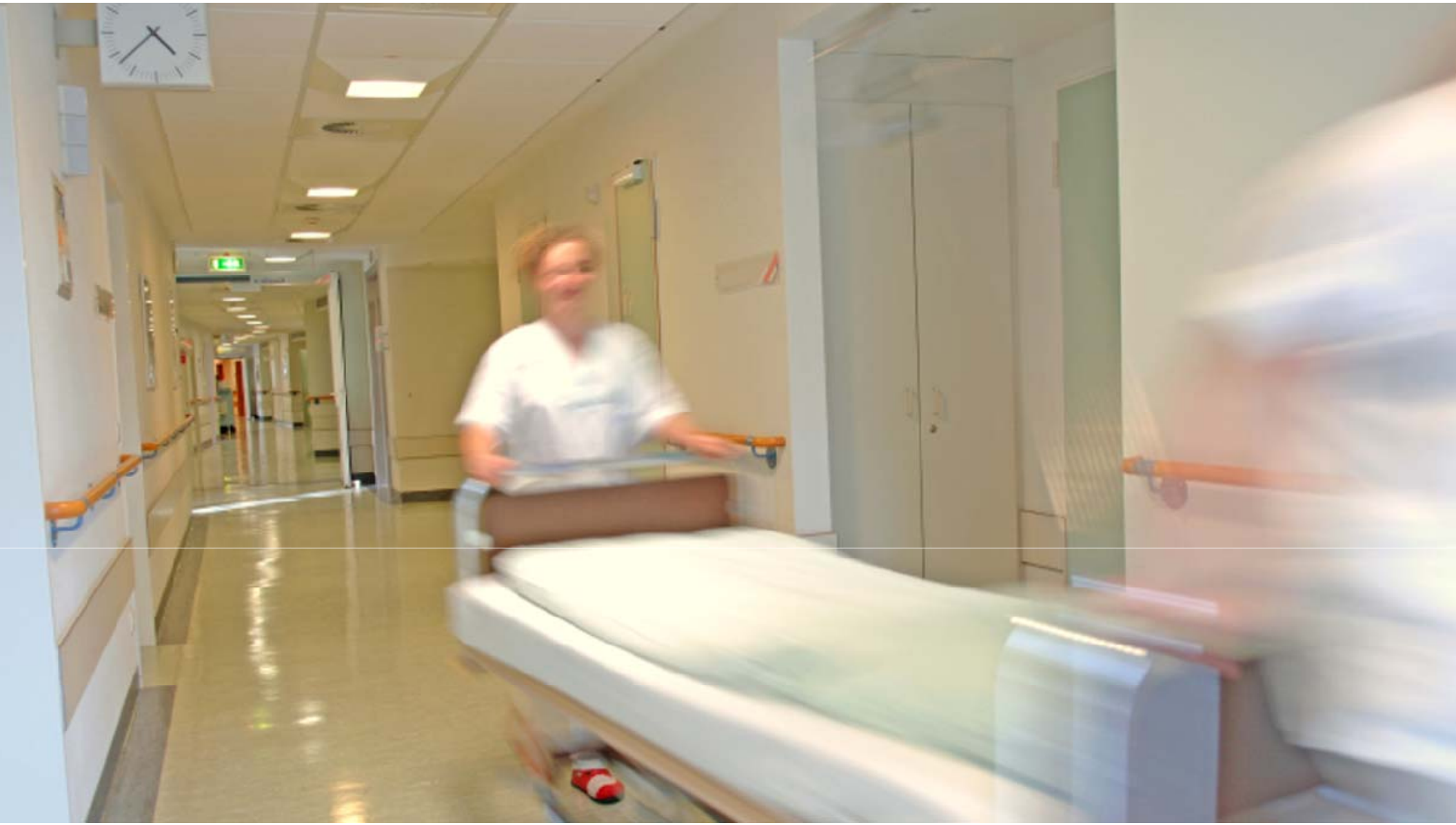
Joseph Cafazzo, PhD PEng

Diane Doran, PhD RN

Proposed collaborators:

Dr. Stephen Lapinsky, **Mount Sinai Hospital**
Drs. Dante Morra and Robert Wu, **University Health Network**
Drs. Ed Etchells, **Sunnybrook Health Sciences Centre**

Suzanne Rochford, Director - User Centered Design, **TELUS Health Solutions**
Deborah Durrell, **TELUS Health Solutions**



“handovers”

- Auckland study
  - average patient saw 17.8 health professionals (6 physicians, 10.7 nurses, and 1.0 allied health)
  - surgical patients saw 26.6 health professionals

The questions

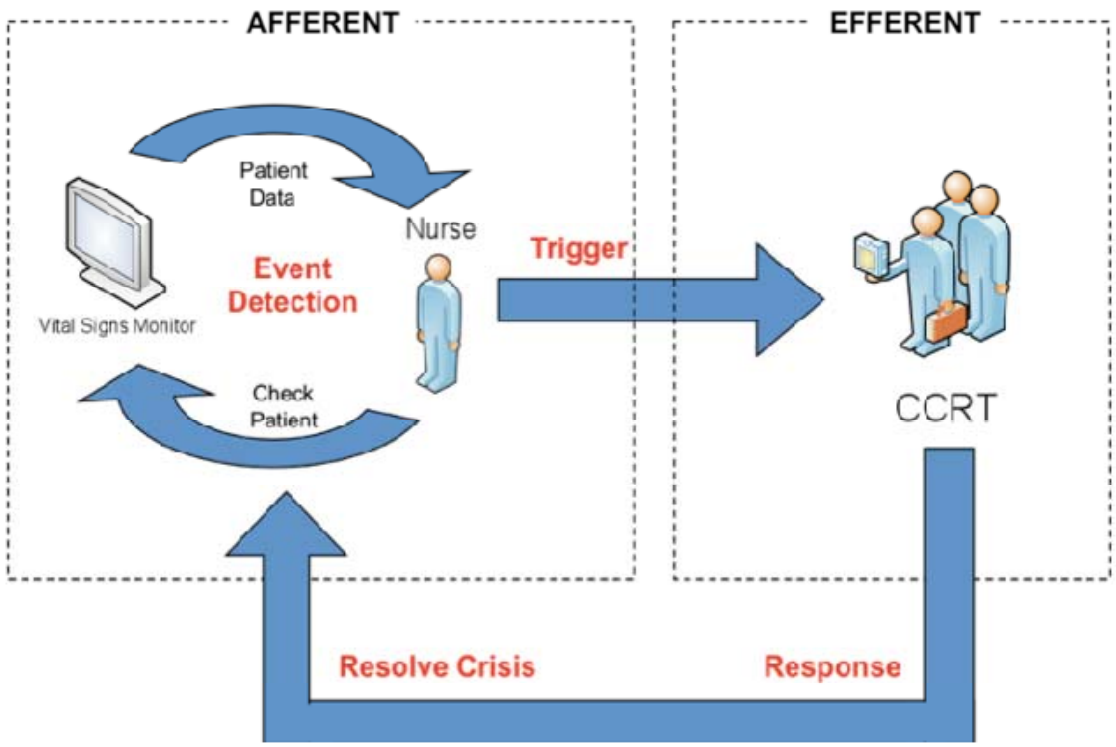
- What information from EHRs is needed to facilitate communication between clinicians, particularly during the critical time of handovers?
  - What subset of information from EHRs would be best provided on a mobile device to enable effective communication?

The study

- Ilinca Popovici, MHSc candidate
  - multi-site, “patient-centered” ethnography
  - workflow modeling
  - design of intervention

Project 4 of 4

“Failure-to-Rescue”


AFFERENT
EFFERENT
Patient
Data
Nurse
Trigger
Event
Detection
Vital Signs Monitor
Check
Patient
CCRT
Resolve Crisis
Response

CONSIDER CALLING CRITICAL CARE OUTREACH/RESPONSE TEAM (CCOT/CCRT) ANYTIME FOR VITAL SIGNS OF CONCE

eep your patients Out of the Blue TGH: 416 790-9999 TWH: 416 [redacted]226 PMH: 416 [redacted]3-CALL (MT. SINAI ACCESS TEAM).

DATE

TIME

PAIN SCORE Rest / Activity

TEMPERATURE

BLACK • = TEMP

O= oral

A= axilla

R= rectal

PULSE

BLACK • = PULSE

R= radial pulse

A= apical pulse

P= pedal pulse

IF HR >130 OR < 40 ENTER NUMERIC VALUE AND CONSIDER CALLING CCOT/CCRT.

RESPIRATION RATE (RR)

BLACK • = RR

IF RR >30 OR <8 ENTER NUMERIC VALUE IN BOX AND CONSIDER CALLING CCOT/ CCRT.

BLOOD PRESSURE

v = systole supine

^ = diastole supine

X = systole standing/sitting

X = diastole standing/sitting

IF SYSTOLIC BP >200 OR <90 ENTER NUMERIC VALUE AND CONSIDER CALLING CCOT/ CCRT.

O_2 SATURATION

AMOUNT OF O_2

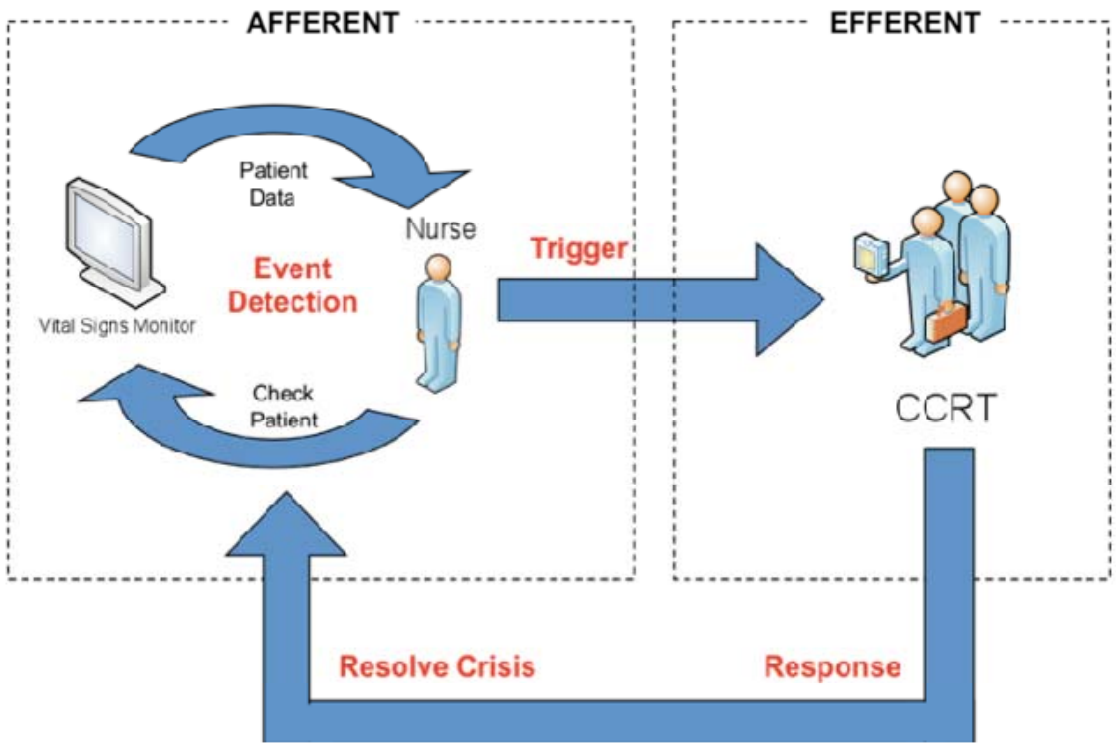
O_2 DELIVERY METHOD

WEIGHT (kg)

CLINICIAN INITIALS

Form B-3191 Print (R/EN/2008)

Figure 29. Usability Testing of Three Methods: (left to right)
Apple iPod Touch application, Motorola MC55 application, and UHN Vital Signs Record form


AFFERENT
EFFERENT
Patient
Data
Nurse
Trigger
Event
Detection
Vital Signs Monitor
Check
Patient
CCRT
Resolve Crisis
Response

The study

- Archana Gopal, MHSc candidate
  - design of end-to-end system
  - Early Warning Score (EWS) system
  - clinical pilot

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