A Systems Approach to Predicting Healthcare Failures

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Bottom Line Up Front

- Strong communications prevent medical errors
- Healthcare stakeholders and their interactions form the foundational communication system
  - IT “solutions” only effective in concert with strong interpersonal communications
- Capturing and characterizing the system is now possible via Geographic Information Systems and Social Network Analysis
- This approach is expected to reveal **system** conditions which lead to medical errors

- Breakdowns in communication are responsible for two-thirds of preventable medical errors
- Clinical and administrative responses have been incremental (i.e., not systematic)
- Electronic health records and other IT tools have helped, but…
- **Technology is most effective in concert with strong, systematic person-to-person communication at and among all levels**

Myriad of stakeholders, fragmented encounters

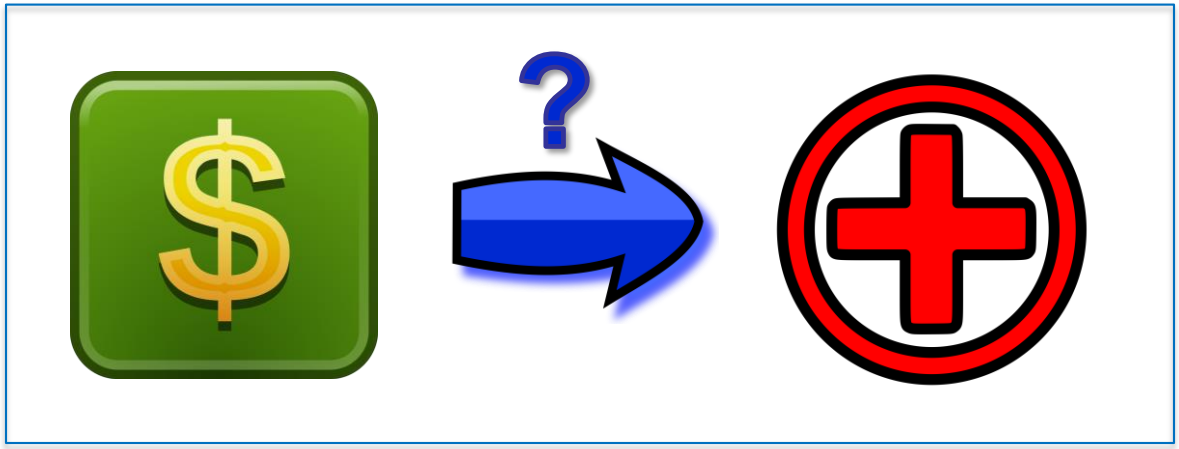
Today's care includes:

- Patients
- Clinicians
- Nurses
- Allied health staff
- Administrative staff
- Executive leadership
- Additional support staff

Why a systems approach?

The quality conundrum

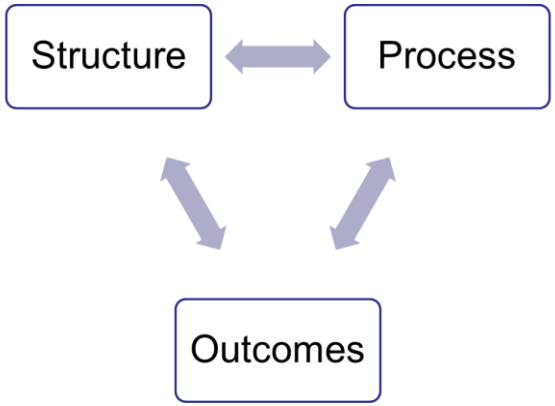
- Increases in healthcare spending do not lead to proportional increases in health
- Non-linearity suggests healthcare is a complex adaptive system



Non-linear perspectives

Donabedian (1966)

- Assess healthcare quality at multiple levels: structure, process, and outcome



Wood et al. (2013)

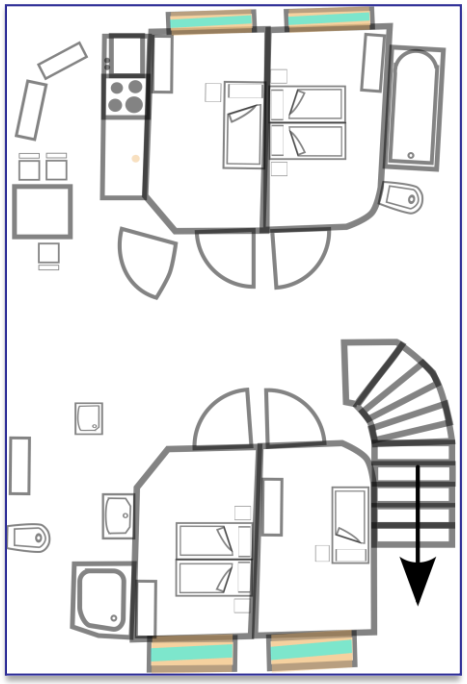
- Characterize stakeholders and their interrelations as a system

Proposed research approach

- Examine quality of care at the process level
- Focus on stakeholder interactions in context
- Employ a systems perspective
  - Stakeholders = Components
  - Interactions = Interfaces
- Capture the dynamic structure of the system
- Characterize system strengths and weaknesses
- Seek to identify disruptions in communication

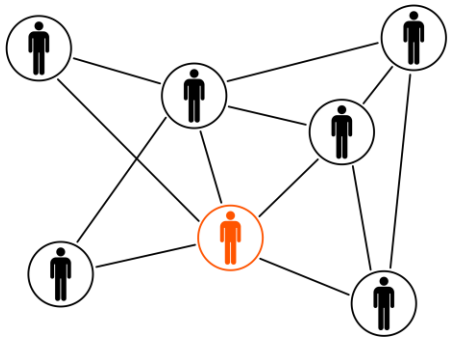
Role of Geographic Information Systems

- Evaluating interactions in a busy (sometimes chaotic) healthcare setting is challenging
- Surveys are common, but flawed
  - Interrupt active care
  - Challenging to scale
- Location-aware devices now capable of high sampling frequency and accuracy

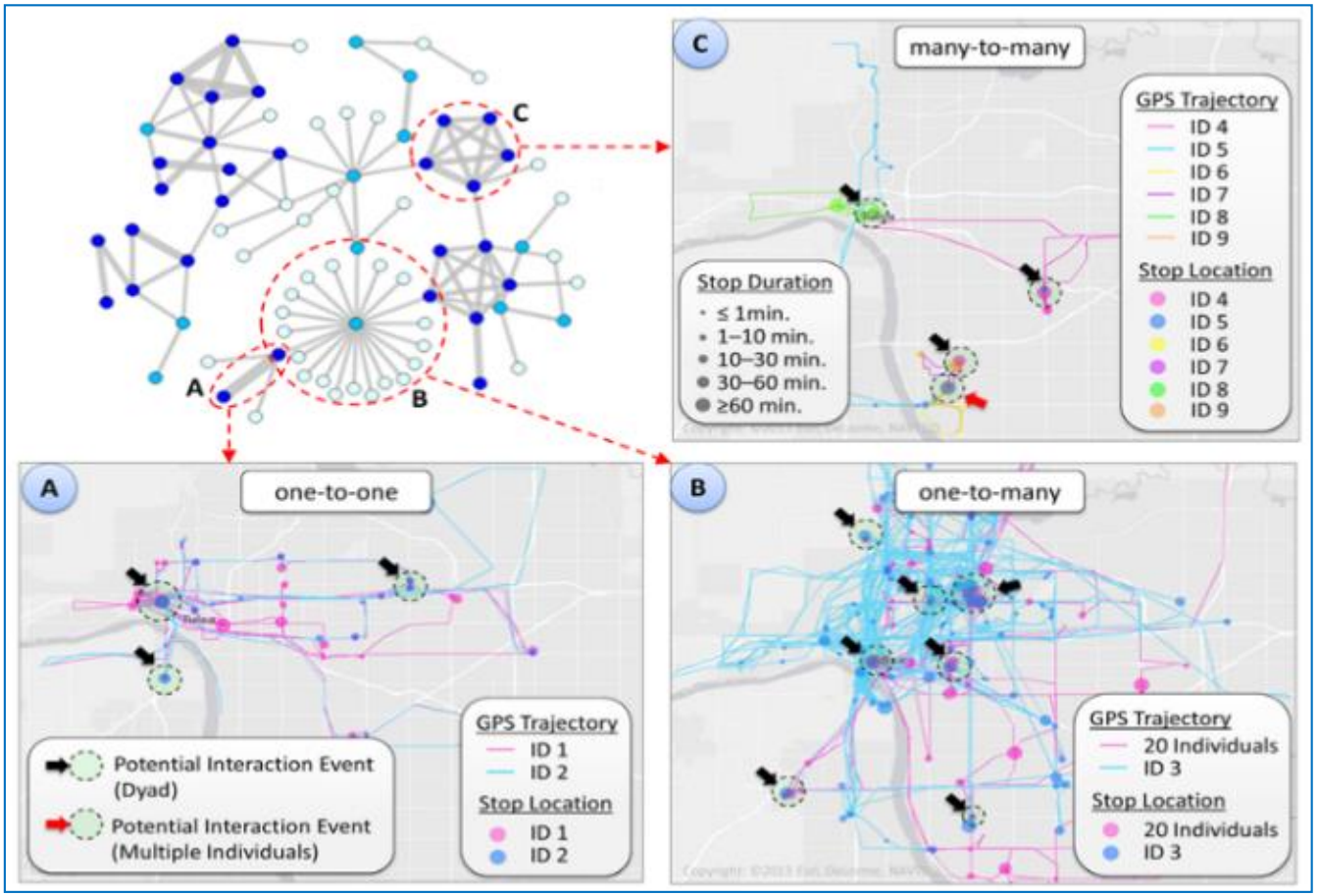


Role of Social Network Analysis

- Stakeholders are interconnected and maintain differing levels of interaction which may promote or inhibit communication
- Social Network Analysis provides quantitative measures, including:
  - Density
  - Centrality
  - Degree of connection
  - Reciprocity
  - Transitivity



Example output



Adapted from: Yuan, M., Nara, A., & Bothwell, J. (2014)

Research goals and benefits

- Ability to identify:
  - High-performing system characteristics
  - Low-performing system characteristics
  - Disruptions to system behavior
- Improve care via:
  - Informed care delivery design/re-design
  - Automated communication disruption alerts
  - Predictive qualities
  - Patient zero capacity

Time for Q&A…

Recap

- Strong communications prevent medical errors
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Thank you!

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Backup slides

Conceptual data capture framework

STRUCTURAL

Context
Hospital Characteristics and Existing (Social) Networks

Patterns of Change
Non-Complex: Disorganization, linear, equilibrium, periodic orbits

Complex: Cascading, tipping points, phase transitions, path dependence, emergent structures

PROCESS

Complexity
- *Diversity*: Actors in the healthcare delivery process
- *Connectedness*: Closeness of actors (location)
- *Interdependence*: Task, role, interactivity, how actors respond to each other
- *Learning*: Adaptation or new structure

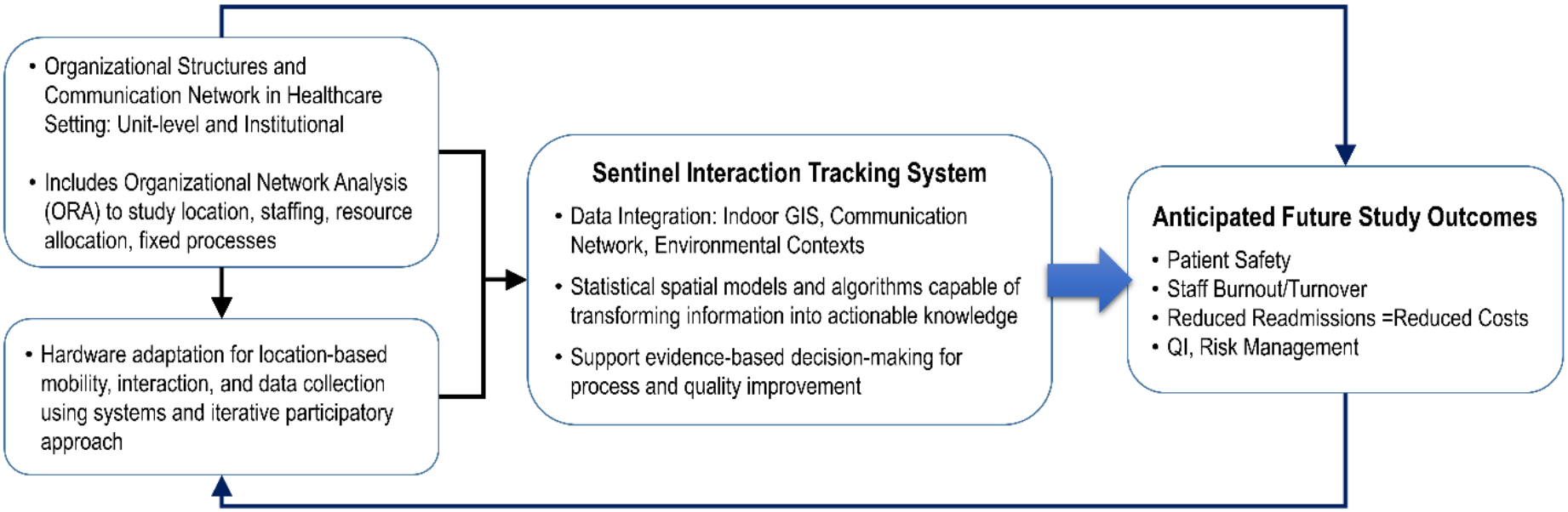
OUTCOME

Intended
- Health Services
- Network Flows
- Health Status

Unintended
- Distorted Service
- Incidents
- Unsustainability

External Environmental Factors
- Hospital Environment
- Actor Characteristics (Age, Gender, Seniority)

Interaction tracking system framework



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