Improving The Process of Cancer Care

Session 1 of a 5 part series

Process of Care Research Branch
Division of Cancer Control and Population Sciences/Behavioral Research Program

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Carly Parry PhD, Heather Edwards PhD, Miho Tanaka PhD, Bryan Leyva Vengoechea, BS, Toccara Chamberlain, MA
Series Purpose – for NCI

• Solicit opinions from three sectors of the community regarding problems in the quality of cancer care
  ◦ Providers, Researchers, Health Care Purchasers

• Identify potential research topics that might address those problems

• Focus the research agenda of PCRB upon major underlying factors affecting the processes of cancer care.
For Participants

• Understand the perspectives of three communities with respect to problems in cancer care delivery

• Learn conceptual, analytic, and practical approaches to understanding and addressing problems in cancer care delivery

• Contribute to the development of NCI’s research agenda
Ms F
Unmarried and Desirous of Children

Last MD Visit
PE/Pap at age 18

- Gets insurance.
- Decides needs PE

6 yrs pass as she does not have an MD

MD Visit PE/Pap

- Refer to Gynecologist
- Cervical Carcinoma In situ
- Need Cone Bx

Phone call for F/U

2 weeks

MD Visit

GYN Visit

One Month Delay

Oncology

2nd Opinions

Need Hysterectomy

Hysterectomy Performed June 14, 2001

Radiation

Chemotherapy October 2001
Is this case a problem of individual failures?

Groups, not individuals saw this woman.

How could we measure the functioning of those groups to evaluate whether they were creating the conditions for success?

Adapted from Taplin et al. 2009 (16)
Objectives

• Describe decision-based framework for designing team performance systems.
• Illustrate tradeoffs between components of this framework.
• Discuss applied and research-based examples of measuring team performance with observation and social sensors.
Understanding the tradeoffs

A FRAMEWORK FOR DEVELOPING MEASURES OF TEAMWORK
Decision Point Design Framework for Team Performance Measures

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<tbody>
<tr>
<td>Evaluation</td>
<td>Teamwork competencies</td>
<td>Observation</td>
<td>Learning environment</td>
<td>Frequency</td>
<td>Selecting, training, and supporting raters</td>
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<td>Feedback</td>
<td>Multi-level evaluation</td>
<td>Self-report</td>
<td>‘On the job’</td>
<td>Timing relative to interventions</td>
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<td>Research</td>
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<td>Scoring methodology</td>
<td>Hybrid approach</td>
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<td>Certification</td>
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<td>Needs analysis</td>
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Rosen, Scheibel, Salas, Wu, Silvestri, & King, 2013
## How do you measure?

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<thead>
<tr>
<th>Method</th>
<th>Strengths</th>
<th>Challenges</th>
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<tr>
<td><strong>Self-report</strong></td>
<td>Familiarity, Flexibility, Established validity</td>
<td>Temporal resolution, Respondent burden</td>
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<td>Surveys</td>
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<td><strong>Observation</strong></td>
<td>Objectivity, Established validity</td>
<td>Maintaining reliability, Cost / logistics</td>
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<td>Behavioral markers</td>
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<td><strong>Social sensors</strong></td>
<td>Continuous / dynamic, Low-cost</td>
<td>Privacy / trust, Complexity of data</td>
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<td>Automated collection of social interaction data</td>
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<td><strong>Activity traces</strong></td>
<td>‘Free data’ (sort of), Can characterize distributed interaction</td>
<td>Privacy / trust, Complexity of data</td>
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<td>Enduring data produced through task completion (email, ping, e-white boards, EMR use)</td>
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What do you measure?

**Inputs**
- Knowledge stock
  - Shared mental models
  - Transactive memory systems
- Task characteristics
  - Interdependence
- Org. context
  - Culture

**Mediators**
- Action processes
  - Communication
  - Leadership
  - Performance Monitoring
  - Back-up behavior
  - Adaptation & learning
- Transition processes
  - Planning
  - Goal specification
- Interpersonal processes
  - Conflict management

**Outputs**
- Effectiveness
  - Task Outcomes
  - Member Satisfaction
  - Viability
- Team Learning Outcomes
  - $\Delta$ Knowledge
  - $\Delta$ Skill
  - $\Delta$ Attitudes
What do you measure?

**Inputs**
- Team Cognition
  - SMM & Transactive Memory

**Mediators**
- Team Behavior
  - Action, Transition, Interpersonal

**Outputs**
- Team Effectiveness

1. $\rho = .38$
2. $\rho = .43$
3. $\rho_{\text{efficacy}} = .35$
4. $\rho_{\text{cohesion}} = .17 / .31$

References:
1. DeChurch & Mesmer-Magnus, 2010
2. Lepine et al., 2008
3. Gully et al., 2002
4. Beal et al., 2003
Abstraction Hierarchy for Behavioral Markers

Rosen, Scheibel, Salas, Wu, Silvestri, & King, 2013
Measurement Systems: From Markers to Metrics

Abstract / Generic Content

Behavioral Specificity of Content

Specific / Concrete Content

The Rater / Observer

Where is the knowledge burden?

The Tool / Protocol

Expectations for Performance
Example

SOCIAL SENSORS
Developing methods to measure healthcare team performance in acute and chronic care settings

Michael A. Rosen, PhD
Assistant Professor, Armstrong Institute for Patient Safety and Quality

November 6th, 2013
Capabilities

- IR and Bluetooth sensors
  - Proximity
  - Location
- Microphones
  - Speaking (yes/no) and conversational analysis
  - Pitch / volume
  - Actual audio
- Accelerometer
  - Activity
  - Posture
Emerging validity evidence

**Team inputs**
- Personality traits ($\sim r = .3$ to $.4$)$^{1,2}$

**Team Mediators**
- High reliability with observational measures in the ED ($r = .96$, $p < .001$)$^3$
- Classification of trauma team tasks (87.5% accuracy)$^4$

**Team mediators $\rightarrow$ outcomes**
- Face to face interaction time predicted LOS in PACU ($r = .53$, $p < .01$)$^1$

1. Olguin Olguin et al., 2009
3. Kannampallil et al., 2011
4. Vankipuram et al., 2011
Pilot work

• ‘Micro’ validity evidence generated
  – Sensor data covaries reasonably well with perceptions of interaction ($r = .59, p < .01$)

• Data visualization
  – We can’t analyze all of the complexity yet (more on this later), but we can see it.
  – Basis of the ‘interaction mirror’ intervention
Bluetooth detections
Each blue segment is a person.
Each line is a connection between people over time.
This data was collected at over 6 ½ hours.
Time speaking.
In addition to detections, we can extract a variety of information from the microphone data. Circos lets us visualize these metrics as histograms, heat maps, line graphs, etc.
Speech analysis.
For each badges, the raw microphone data is parsed and each second of speech categorized as: *speaking*, *listening* (badge is silent in the proximity of another badge speaking), *overlap* (two badges in proximity are speaking), and *silent* (all badges in proximity are not speaking). This can be broken down to a 60 second time scale (or lower if needed).

Total number of seconds speaking over 10 minute period.
Additional data streams. While the badges collect a number of other metrics, the most immediately useful are activity level captured through an accelerometer, and various forms of voice analysis (the badges provide a form of spectral analysis).
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Heat map of mean activity level per 10 minute interval (across people).

Heat map of mean volume level per 10 minute interval, standardized within person.
Needed research in this area

- **Technical**
  - improving sensor properties and performance
- **Analytic**
  - developing real-time predictive algorithms
- **Psychometric**
  - establishing validity and generalizability evidence
- **Socio-cultural**
  - building a culture of trust in sensor-based systems
- **Interventional**
  - feedback and alerting displays
Our next steps

• Iterative participatory design of feedback displays for different roles and levels: individual, team, and unit views for immediate feedback and analyzing trends over time.

• Validation of sensor-based measures against traditional gold standards for teamwork and workflow (self-report and observational methods).

• Development of predictive analytics for dynamic network data: advancing the methods of tensor decomposition of networked sensors.
Questions?

• Mike Rosen  
  – mrosen44@jhmi.edu
Continuing the Discussion

• We invite you to join us in the upcoming Cyber Discussions. Remember, your participation is essential to shaping this research agenda.

• **Save-the-dates:**

  **Wednesday, March 19, 2014, 2:00 PM - 3:00 PM EST**
  Cooperation, Competition and Team Performance: Towards a Contingency Report  
  *Dr. Stephen Humphrey*

  **July 9, 2014, 2:00 PM - 3:00 PM EST**
  Team Based Measures in Primary Care  
  *Dr. Richard Ricciardi*

  **November 5, 2014, 2:00 PM - 3:00 PM EST**
  Research Priorities in Cancer Care Teams Research  
  *Dr. Eduardo Salas*

  **July 1, 2015, 2:00 PM - 3:00 PM EST**
  Team Cognition: Understanding the Factors That Drive Process and Performance  
  *Dr. Steve Fiore*

• To register, go to: [http://dccps.nci.nih.gov/brp/pcrb/cyberseminars.html](http://dccps.nci.nih.gov/brp/pcrb/cyberseminars.html)
• If you have questions, contact Veronica Chollette (cholletv@mail.nih.gov)