# NCI Multilevel Geospatial and Contextual Webinar Series:

## Emerging Methods of Exploring the Team Microenvironment in Cancer Care

NIH NATIONAL CANCER INSTITUTE

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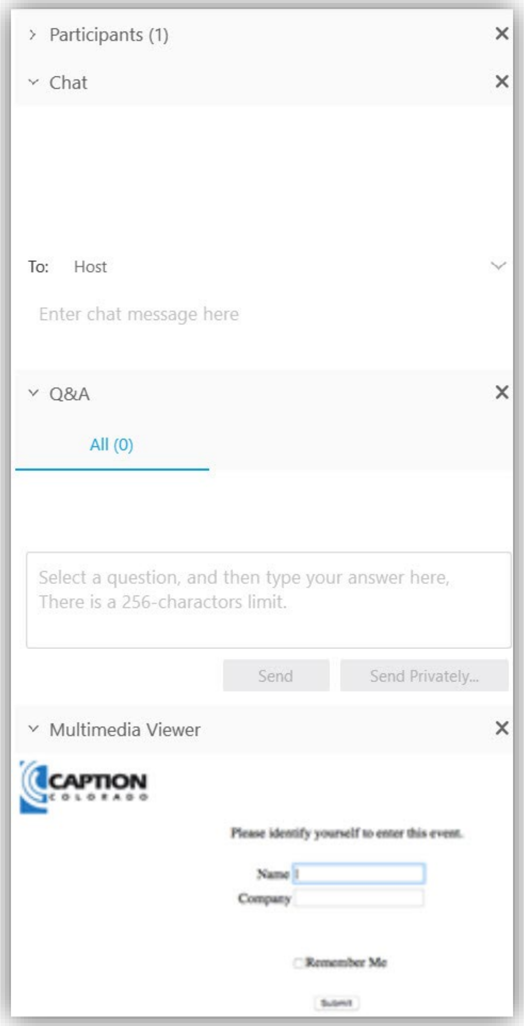


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# Webinar Overview

Emerging Methods of Exploring the
Team Microenvironment in Cancer Care

ARMSTRONG INSTITUTE
FOR PATIENT SAFETY AND QUALITY

JOHNS HOPKINS
MEDICINE

# Towards a Social Data Science for Safety and Quality

## Emerging Methods of Exploring the Team Microenvironment in Cancer Care

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Dept. of Anesthesiology and Critical Care Medicine, School of Medicine
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School of Nursing

October 9th, 2019

# Acknowledgements


## Collaborators

- Hopkins (short list)
  - Salar Khaleghzadegan, Adam Sapirstein, Eileen Kasda, Carey Priebe, Mary Catherine Beach
- Rice
  - Ed Salas, Julie Dinh, Jensine Paoletti, Fred Osawald

## Funders

GORDON AND BETTY MOORE FOUNDATION

DARPA

NASA

# Agenda

- Measuring the team microenvironment
  - Definitions of key concepts
  - Social Data Science Methods
- Representative projects
  - Individual and team workload, stress, and resilience
  - Shared decision making, respect and dignity
  - Coordination in Multi-Team Systems
  - Event-reporting, narrative dynamics, and local safety climate
- Future directions

# Measuring the Team Microenvironment

## Definitions, challenges, and methods

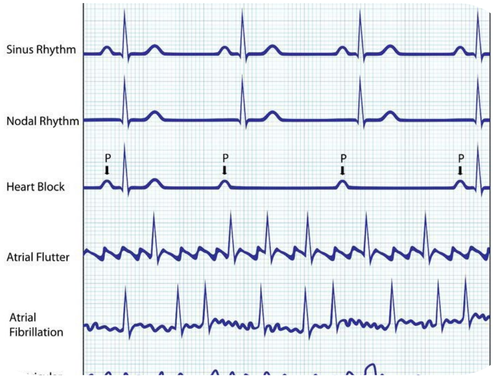
# Teams, health system delivery, and social data science (SDS)

- The quality of teamwork impacts overall safety and quality of healthcare delivery systems[1]
- The ***team microenvironment*** is… “the collection of factors that exert influence on the social interactions of people participating in care delivery.”[2]
- ***Social data science*** (or computational social science) blends approaches for generating insights from large structured and unstructured data sets with theories of human behavior and social interactions at multiple scales.

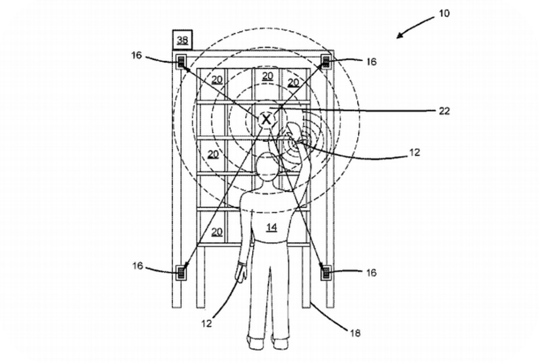
## **You can learn a lot about a team without asking members questions or directly observing them**: Four key unobtrusive measurement domains


Linguistic Communication

Paralinguistic Communication

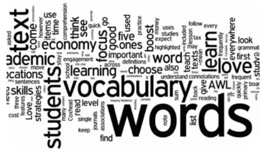



Physiological Dynamics




Activity Tracking

# **What team members say matters**: Representative findings for linguistic analysis in teams




Linguistic Communication

| **Measure type** | **Example metrics associated with team performance** |
| --- | --- |
| Domain specific content | • 50+ years of team and group communication research |
| Non-domain specific content | • The frequency of positive, assenting words vs dissenting words, the positive emotion words, use of first person plural, lower variability in word count across team members are positively associated with task performance outcomes[1,2] |
| Similarity in word use | • Task related linguistic alignment predicts team task outcomes[3]<br>• Linguistic style matching predicts affective and task outcomes[4]<br>• Overall semantic similarity predicts task outcomes[5] |
| Sequence in word use | • Closed-loop communication[6]<br>• Anticipation ratio[7] |

# What team members communicate without using words matters: Representative findings for paralinguistics in teams

Paralinguistic Communication

| Measure type | Example metrics associated with team performance |
| --- | --- |
| Communication flow | • Egalitarian turn taking predicts team task outcomes[1.2]<br>• Lower stability in turn taking sequence predicts team task outcomes[3]<br>• Speech duration predicts perceptions of emergent leadership [4] |
| Facial expression and gaze behavior | • Synchrony in facial expressions positively predicts team affective and task outcomes[5,6]<br>• Low synchrony in facial expressions predicts performance strategy shift[6]<br>• Synchrony in gaze behavior predicts team task outcomes[7] |
| Vocal features | • Large feature space models are predictive of individual affective states, personality, and perceptions of competence in persuasiveness[8] |
| Gesture and posture | • Synchrony in postural sway negatively predicts team affective outomes[9] |

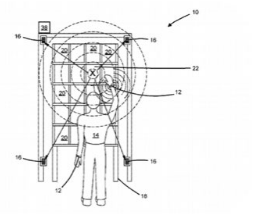
# The physiological dynamics of interacting team members matter:
## Representative findings for physiological dynamics in teams

Physiological Dynamics

| Phys. | Inputs | Mediators | Outputs |
|---|---|---|---|
| EEG/ fNIRS | **Mixed findings**: PS higher in competitive vs. cooperative tasks[7]; higher for expert (vs. novice) teams[20]. EEG shows PS increases with task demands[24,26,29] and task uncertainty[7,25] but fNIRS shows reduced PS with increased task demands[21]. | **Limited findings**: Non-linear 'flexibility' associated with more terse domain-specific communication[7]. | **No findings** |
| EMG | **Many factors**: Liner PS in smiling and frowning higher in competitive vs. cooperative tasks[9], with gender differences[11]. PA higher for lower expertise team members[26]. | **Mixed findings**: Linear PS in facial EMG not related to team affective states[17], but higher non-linear PS was associated with higher negative emotions in the team[23]. | **Limited findings**: Non-linear (but not linear) PS in postural sway positively predicts affective outcomes[15]. |
| Electro-dermal | **Many factors**: No effect of composition (gender[11], inclusion of synthetic agent[10]) on linear PS. Higher PA in cooperative vs. competitive tasks, with gender differences[28]. Trait anxiety and empathy impacts linear and non-linear PS[21]. | **Mixed findings**: Non-linear PS negatively associated with leadership behaviors[22], but positively associated with positive affective states[23]. | **Consistent findings**: Linear PS positively predicted team task[1,13] and affective[5] outcomes. |
| Cardio-vascular | **Many factors**: Linear PS is higher in competitive vs. cooperative tasks[5], varying with team composition (higher PS in males[11], lower with inclusion of synthetic agent[10], PA decreases with increasing expertise[26]). Linear PS increases with task difficulty[13]. | **Mixed findings**: Linear[4] PS was negatively associated with team process measures, while non-linear PS was both negatively[15] and positively[19] associated with team process. | **Mixed findings**: Across studies linear PS both positively[1,2,3,17] and negatively[4] predicted team task outcomes, while PA negatively predicted task outcomes[9]. Linear[5] and non-linear[15] PS negatively predicted affective outcomes. |

Kazi S, Khaleghzadegan S, Dinh JV, Shelhamer MJ, Sapirstein A, Goeddel LA, Chime NO, Salas E, Rosen MA. Team Physiological Dynamics: A Critical Review. Human factors. 2019 Sep 26:0018720819874160.

# Where team members are and what they are doing matter
# Examples of activity tracking



Activity Tracking

- Co-location networks for measures of team risks[1]
- Electronic health record access logs for measures of workload[2] and team coordination[3]
- Wearables for physical work process mapping[4]
- Administrative data for mapping patient paths through healthcare delivery system[5]

# How are these measures applied?

| Topic | Study | Linguistic | Paralinguistic | TPD | Activity Tracking |
|---|---|---|---|---|---|
| Individual and Team Workload, Stress and Resilience | Nursing workload in the ICU | - | Y | - | Y |
| | Internal Medicine Resident Work | - | - | - | Y |
| | Collective allostatic load in a PICU | - | Y | Y | Y |
| | Teamwork competency assessment | Y | Y | Y | Y |
| Shared decision making, respect and dignity | ECHO | Y | Y | - | - |
| Coordination and MTSs | Handoffs and teamwork across units in an acute care facility | - | - | - | Y |
| Climate and narrative dynamics | Event reporting and the language of blame | Y | - | - | - |

# Individual and Team Workload, Stress and Resilience

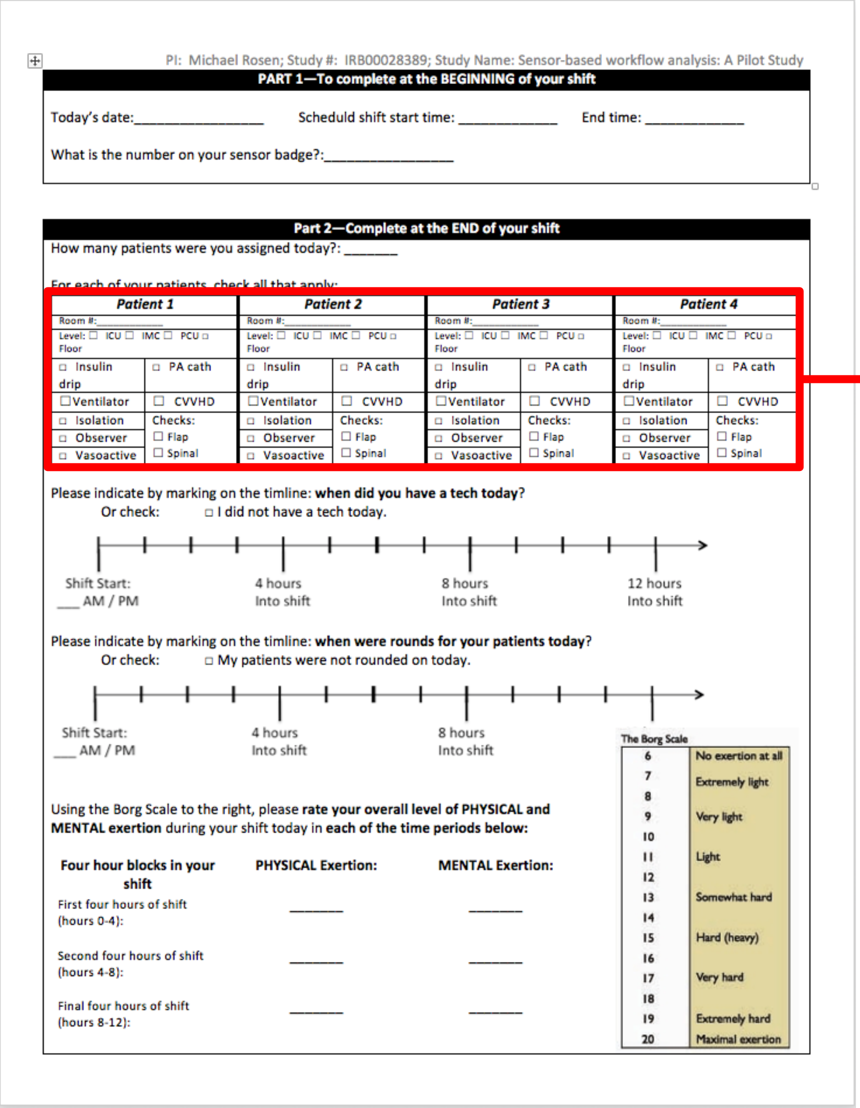
# Challenges with individual and team workload and it's measurement

- Workload is related to:
  - Patient outcomes
    - Patient experience
    - HAIs
    - Delays in treatment
    - Postop complications
  - Workforce and organizational outcomes
    - Burnout and job dissatisfaction
    - Turnover, disengagement from or exiting the professions
    - Efficiency and productivity

- Existing approaches to measuring workload rely on:
  - Staffing ratios (sometimes weighted by acuity systems)
  - Observation
  - Survey

For references, see: Rosen MA, Dietz AS, Lee N, Wang IJ, Markowitz J, Wyskiel RM, Yang T, Priebe CE, Sapirstein A, Gurses AP, Pronovost PJ. Sensor-based measurement of critical care nursing workload. PloS one. 2018 Oct 12;13(10):e0204819.

# Study 1: RN workload in an ICU



PI: Michael Rosen; Study #: IRB00028389; Study Name: Sensor-based workflow analysis: A Pilot Study

**PART 1—To complete at the BEGINNING of your shift**

Today's date:________________ Scheduld shift start time: ____________ End time: ____________

What is the number on your sensor badge?:________________

**Part 2—Complete at the END of your shift**

How many patients were you assigned today?: _______

For each of your patients, check all that apply:

| Patient 1 | | Patient 2 | | Patient 3 | | Patient 4 | |
|---|---|---|---|---|---|---|---|
| Room #:___________ | | Room #:___________ | | Room #:___________ | | Room #:___________ | |
| Level: ☐ ICU ☐ IMC ☐ PCU ☐ Floor | | Level: ☐ ICU ☐ IMC ☐ PCU ☐ Floor | | Level: ☐ ICU ☐ IMC ☐ PCU ☐ Floor | | Level: ☐ ICU ☐ IMC ☐ PCU ☐ Floor | |
| ☐ Insulin drip | ☐ PA cath | ☐ Insulin drip | ☐ PA cath | ☐ Insulin drip | ☐ PA cath | ☐ Insulin drip | ☐ PA cath |
| ☐ Ventilator | ☐ CVVHD | ☐ Ventilator | ☐ CVVHD | ☐ Ventilator | ☐ CVVHD | ☐ Ventilator | ☐ CVVHD |
| ☐ Isolation | Checks: | ☐ Isolation | Checks: | ☐ Isolation | Checks: | ☐ Isolation | Checks: |
| ☐ Observer | ☐ Flap | ☐ Observer | ☐ Flap | ☐ Observer | ☐ Flap | ☐ Observer | ☐ Flap |
| ☐ Vasoactive | ☐ Spinal | ☐ Vasoactive | ☐ Spinal | ☐ Vasoactive | ☐ Spinal | ☐ Vasoactive | ☐ Spinal |

Please indicate by marking on the timline: **when did you have a tech today?**

Or check: ☐ I did not have a tech today.

Shift Start: ___ AM / PM — 4 hours Into shift — 8 hours Into shift — 12 hours Into shift

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Using the Borg Scale to the right, please **rate your overall level of PHYSICAL and MENTAL exertion** during your shift today in **each of the time periods below:**

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The Borg Scale

| | |
|---|---|
| 6 | No exertion at all |
| 7 | Extremely light |
| 8 | |
| 9 | Very light |
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| 14 | |
| 15 | Hard (heavy) |
| 16 | |
| 17 | Very hard |
| 18 | |
| 19 | Extremely hard |
| 20 | Maximal exertion |

**Patient Factors:**

- Level of care
- Insulin drip
- Vent.
- Vasoactive
- PA cath
- CVVHD
- Flap or spine checks

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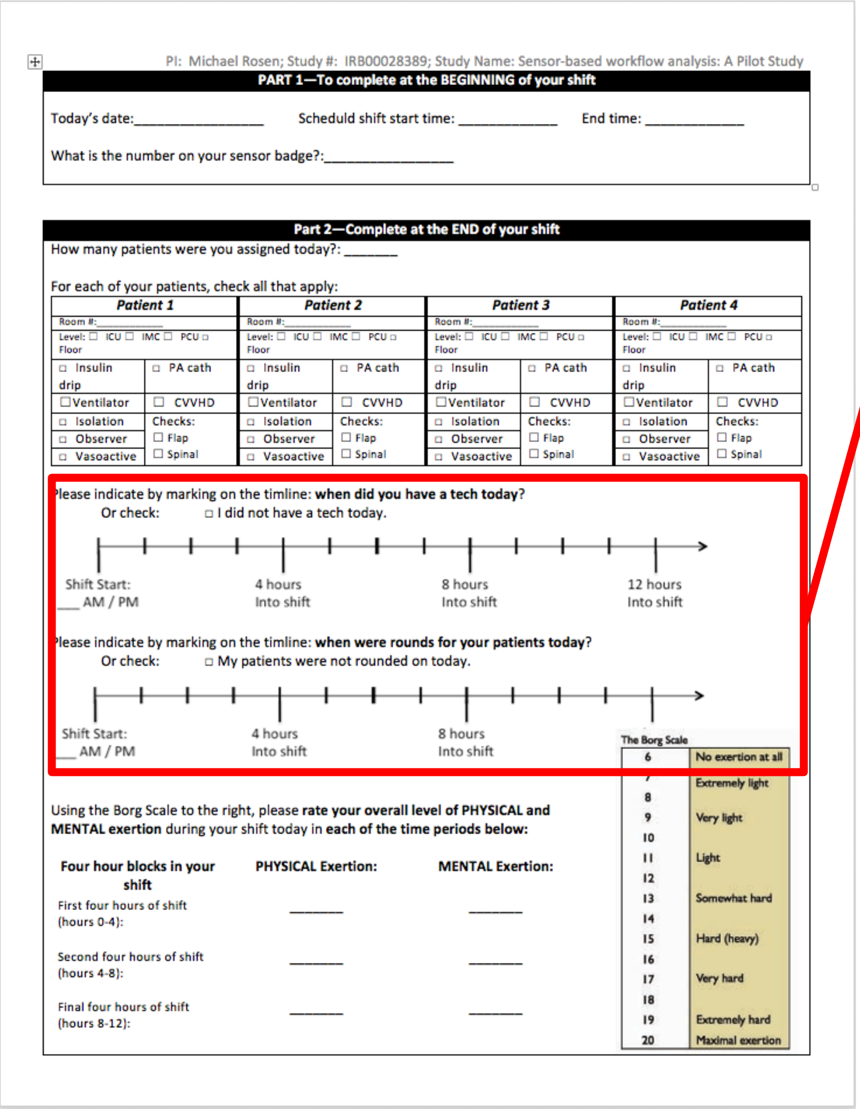

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| 14 | |
| 15 | Hard (heavy) |
| 16 | |
| 17 | Very hard |
| 18 | |
| 19 | Extremely hard |
| 20 | Maximal exertion |

**Shift factors:**

- # of patients
- Composite of # of patients by task factors
- CNA?
- When rounding occurred

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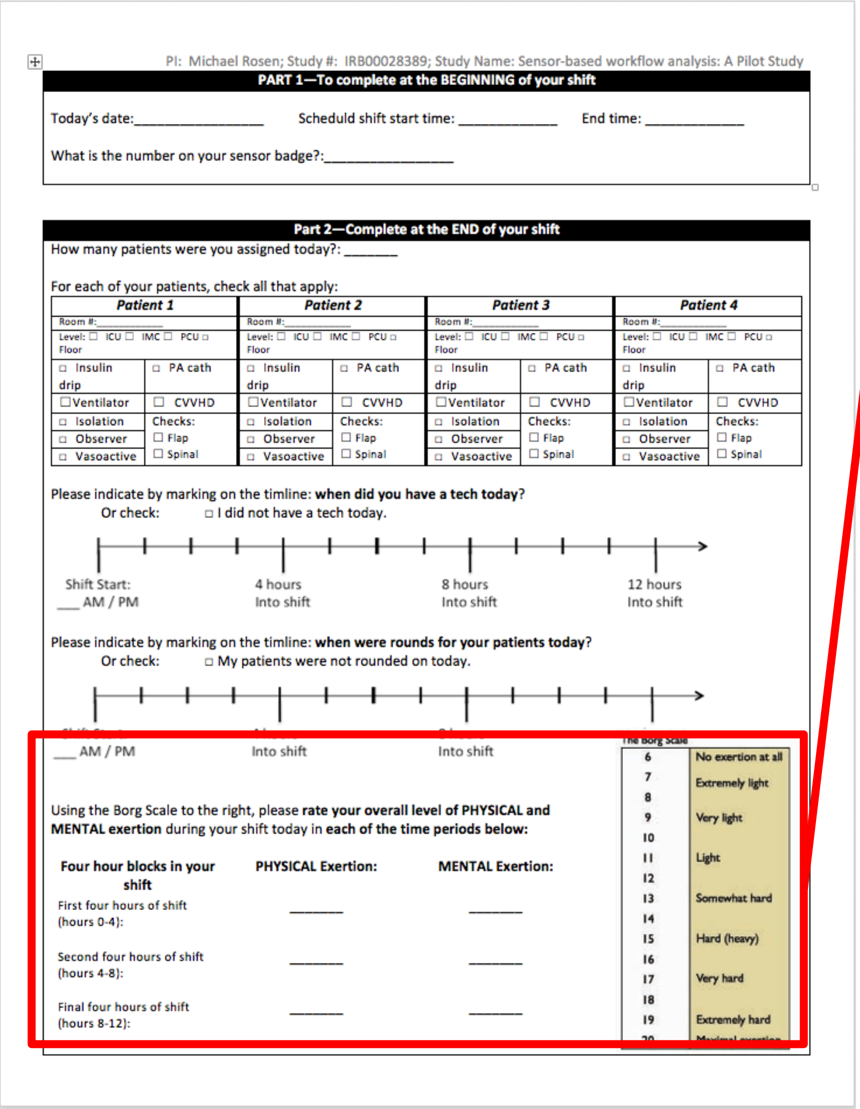
# Study 1: RN workload in an ICU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## Self-report exertion:

- Q 4 hr ratings of mental and physical exertion

# Example metric set for RN workflow

Time in location

Movement through space

- Transitions between areas (#)
- ‘**Burstiness**’ of transitions
- Shannon **Entropy** of locations over time

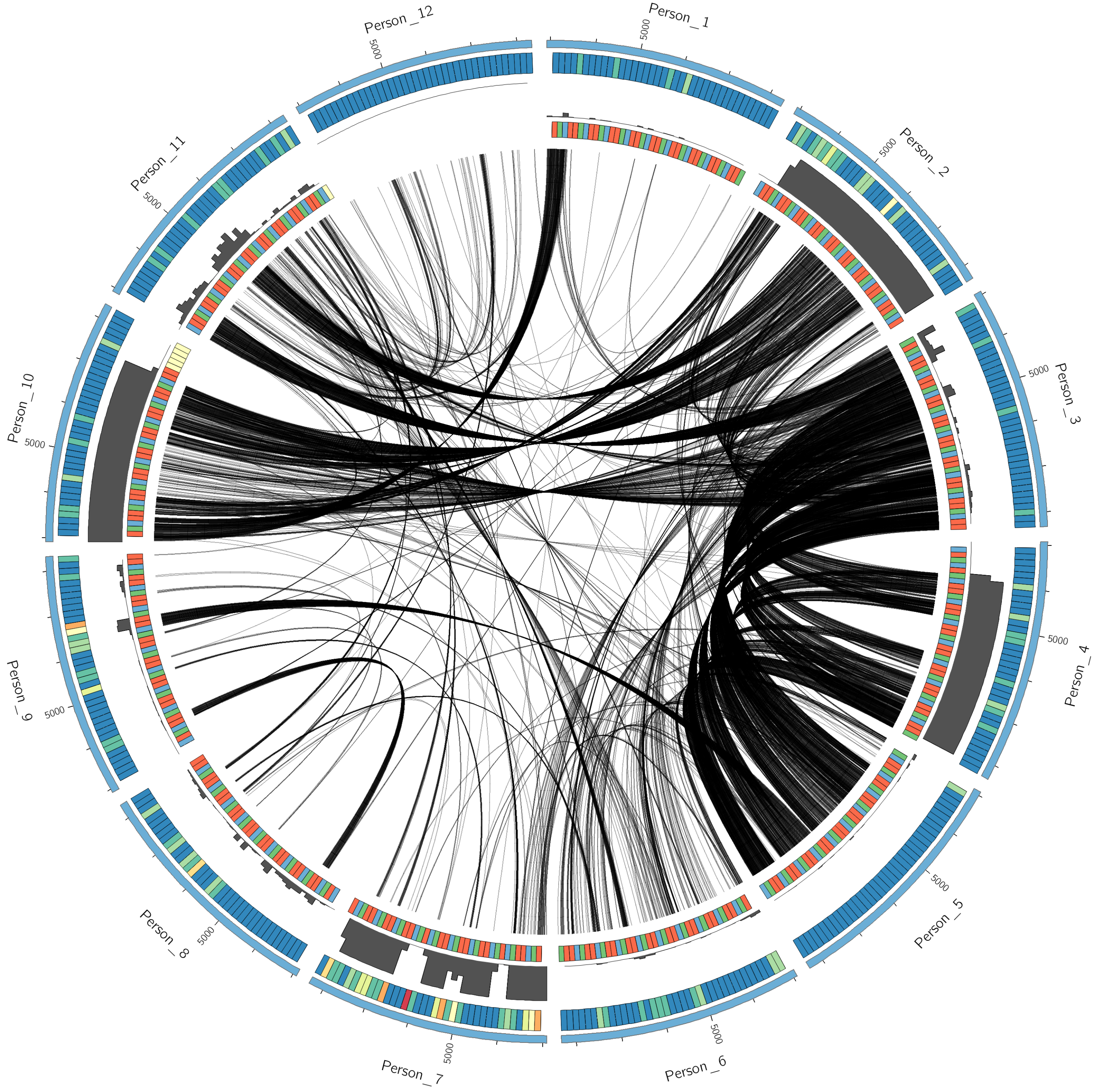
Audio

- Volume (mean, sd)
- Pitch (mean, sd)
- Time spent speaking
- ‘**Burstiness**’ of speaking

Accelerometer and gyroscope metrics

- Activity (energy) level
- Body movement
- Time standing / sitting
- Time walking
- ‘**Burstiness**’ of walking

Location x (Audio & Accel./gyro. Measures)



RN Workstation

- 3 stations ea.

Service Areas

- Med rm
- Supply rm
- Nutrition

Patient Rooms

- 2 sensor ea.
- 4 rms excluded

All else = “off the grid”

- Unaccounted for time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# Analysis process

- Dataset
  - 356 work hours from 89 4-hour blocks across 35 shifts
- Dimension reduction
  - Elastic net method applied to 72 sensor features (plus pairwise interactions) for each outcome
- Multi-level Modeling
  - Test grouping structure (shift)
  - Level 1 predictors (sensor features)
  - Level 2 predictors (task demands)
  - Random coefficients
  - Cross-level interactions

# Findings

**Mental Exertion**

- 63% c
- Final r
  - **5%**
  - **73**
- With:
  - 5 s
  - 1 T
  - 1 C
  drip x burstiness of speaking)

**Physical Exertion**

etween shifts

for:

iance

variance

patient load)

n (Avg pt load x Volume speaking at RN station)

- **Overall patterns of interaction that matter**
  - **Burstiness** of speaking
  - Time **speaking outside of main work areas** x **Time at nursing stations**
  - **Entropy of transitions x Burstiness of transitions**
- **Context specific interactions that matter**
  - Patient on an **insulin drip** X **Burstiness** of speaking
  - **Average patient load** x Volume while speaking at nursing stations

# Study 2: Does this scale to residents?

**Questions**

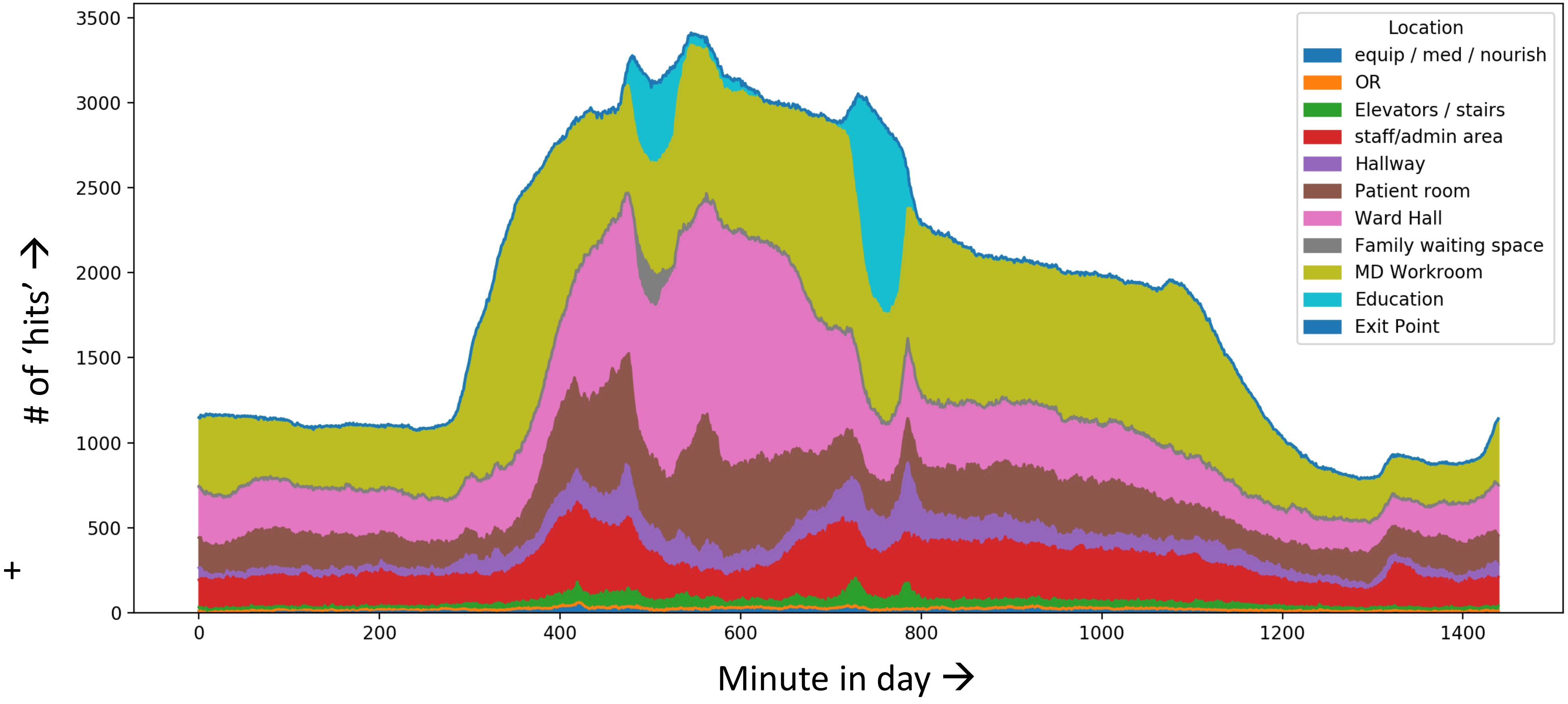
How are residents
spending their tim
do differences pre
educational or we
outcomes?

**Pilot overview**

43 Interns
July – Oct 2018
3,973 shifts
45,367.8 hrs

**Single sensor**

Location tracking system +
EHR metrics

# Study 3: Collective Allostatic Load in a PICU

1. Better understand the impact of **chronic** and **acute stressors** on **individual** and **team performance** in the PICU.
2. Explore **how team interactions exacerbate** or **ameliorate** these **stress effects**.

## Why do this?

- Better **workload measurement systems** which can drive unit resource allocation decisions in near real-time
- **Counter measures** for staff to **minimize**, **manage**, and **mend** from stress effects

# Measurement framework

| Stressors / work demands | Stress responses | Teamwork | Task and team |
|---|---|---|---|
| *Administrative data:* Measures characterizing patient cohort (census, churn, acuity scoring) and staffing levels (RN/pt ratio), and nursing activity (TISS-28, NAS) | *Self-reported workload*: NASA-TLX revised | *Self-reported teamwork quality:* Team process scale; Mayo High Perf. Teamwork Scale in codes | *Individual burnout*: Maslach short |
| *Self-reported stressors:* Custom survey capturing unique features of the work day that cause stress in the PICU | *Emotional state recognition*: Physiology (Cardiac and electro-dermal responses), and speech features (vocal stress) | *Team interaction patterns*: Movement and communication patterns (involving no recordings of actual speech) | *Team affect*: Mutual trust, team potency / efficacy |
| | | | *Objective task outcomes:* Call button response latencies; CPR quality scores in codes |

# Study devices, and why we are using them


Staff location badge

Movement and Physical Workload

Wrist worn physiology monitor

Workload and stress measurement

Smartphone

Surveys, emotional state detection, team interaction

# Data collection overview: A day in the life of the study

1. Focus is on PICU Leadership Team (Fellows and Charge Nurses).
2. We need a whole team to collect data!

## Start of Shift

1. Device Donning

~ 2 Minutes or less

## Morning (~11 AM)

1. Core Survey
- Workload
  - 12 items
- Team process
  - 10 items
- Stressors
  - 1 item
- Code team evaluation
  - only if code occurred
  - 16 items

~ 3-5 Minutes

## Afternoon (~ 3 PM)

1. Core Survey
- Same as Morning
- 22 items (+16 if a code occurred)

~ 3-5 Minutes

## End of Shift (~ 7 PM)

1. Core Survey
- Same as Morning and Afternoon
- 22 items (+16 if a code occurred)

2. End of Day Survey
- Team trust
  - 21 items
- Team efficacy
  - 18 items
- Burnout
  - 2 items

3. Device Doffing

~ 5-7 Minutes

# Study 4: Sociometric Team Selection Project

- Generate construct and criterion validity evidence for individual and team LDSE behavioral competencies.
- Develop unobtrusive and sociometric indices of individual and team LDSE behavioral competencies.
- Develop technology and guidelines for the use of sociometric measures in astronaut selection.

# Coordination and Multi-team Systems

# Example Handoff Improvement Research (resident to resident)

- Resident handoff-improvement program in 9 sites
  - **23% decrease** in **medical error rate**
  - **30% decrease** in **preventable adverse event rate**
  - No change in non-preventable adverse event rate
    - **Significant increase** in **inclusion of key handoff elements** (verbal and written)
    - **No significant change in handoff duration** (2.4 to 2.5 minutes per patient), or resident workflow, patient-family contact, or computer time.

*The* NEW ENGLAND JOURNAL *of* MEDICINE

SPECIAL ARTICLE

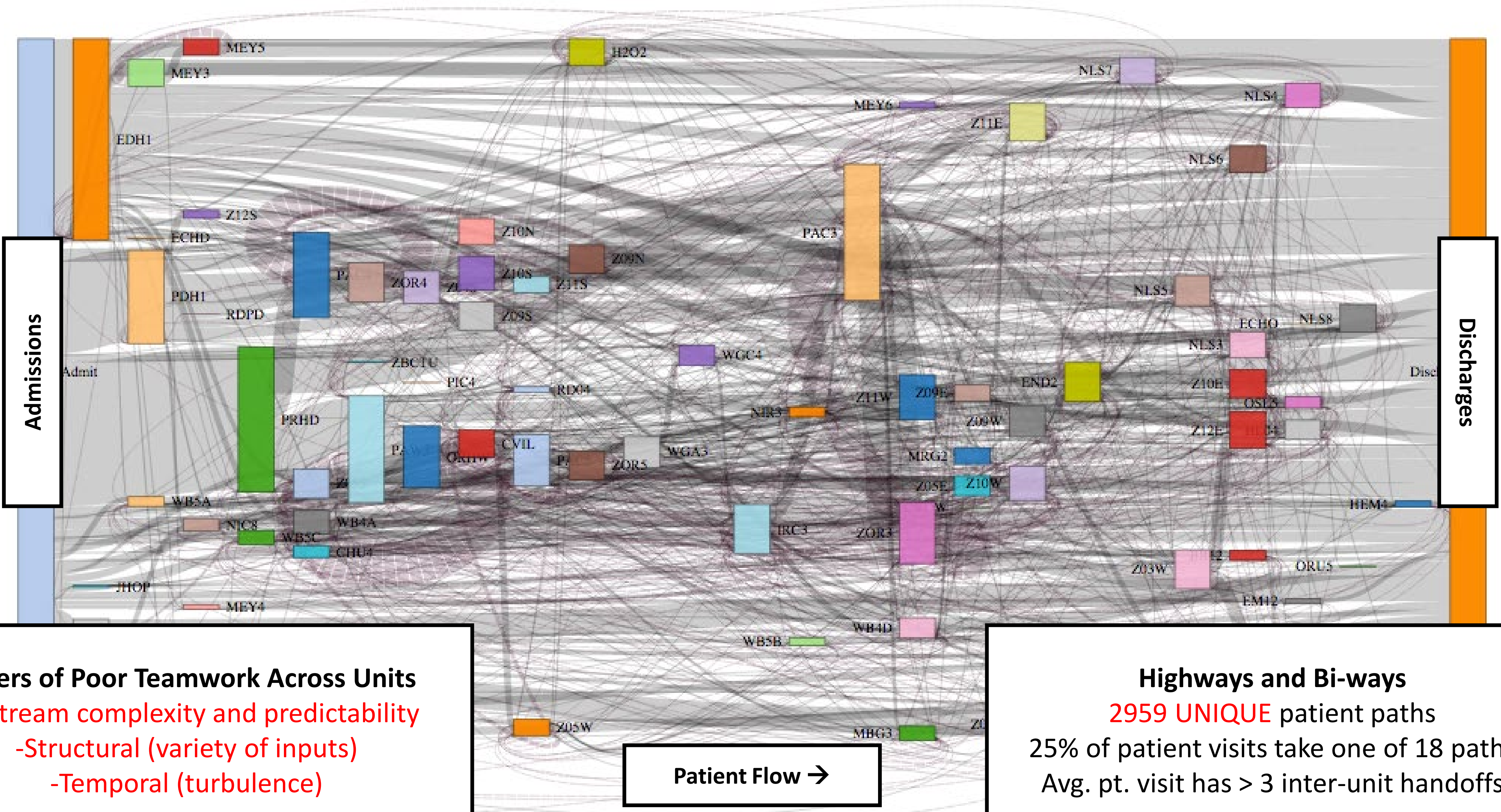
## Changes in Medical Errors after Implementation of a Handoff Program

A.J. Starmer, N.D. Spector, R. Srivastava, D.C. West, G. Rosenbluth, A.D. Allen, E.L. Noble, L.L. Tse, A.K. Dalal, C.A. Keohane, S.R. Lipsitz, J.M. Rothschild, M.F. Wien, C.S. Yoon, K.R. Zigmont, K.M. Wilson, J.K. O'Toole, L.G. Solan, M. Aylor, Z. Bismilla, M. Coffey, S. Mahant, R.L. Blankenburg, L.A. Destino, J.L. Everhart, S.J. Patel, J.F. Bale, Jr., J.B. Spackman, A.T. Stevenson, S. Calaman, F.S. Cole, D.F. Balmer, J.H. Hepps, J.O. Lopreiato, C.E. Yu, T.C. Sectish, and C.P. Landrigan, for the I-PASS Study Group*

Starmer, et al. "Changes in medical errors after implementation of a handoff program." *New England Journal of Medicine* 371, no. 19 (2014): 1803-1812.

# Study 5: Inter-unit patient transfers

1 FQ / ~12k pt admissions / ~ 1,000 bed hosp. / 108 units




**Divers of Poor Teamwork Across Units**

Upstream complexity and predictability

-Structural (variety of inputs)

-Temporal (turbulence)

**Highways and Bi-ways**

2959 UNIQUE patient paths

25% of patient visits take one of 18 paths

Avg. pt. visit has > 3 inter-unit handoffs

# Study 5: Data and Analysis

**Traditional unit metrics**

- Bed size, ‘churn’, LOS

**Temporal features of transitions**

- # in AM/PM, wkdy/wknd
- ‘Burstiness’ in AM/PM, wkdy/wknd

**Structural features of transitions**

- In/out degree, centrality, betweenness, density, transitivity

**Teamwork Across Hospital Units** (TAHU)

- Hospital units do not coordinate well with each other. [R]
- There is good cooperation among hospital units that need to work together.
- It is often unpleasant to work with staff from other hospital units. [R]
- Hospital units work well together to provide the best care for patients.

# Study 5: Findings (43 Units from one hospital)

| **Predictor** | **β (SE)** | **t (p)** |
|---|---|---|
| Betweenness Centrality (weighted) | 0.40 (0.13) | 3.0 (0.005) |
| Discharge Burstiness during Night Shift | 0.27 (0.14) | 2.0 (0.056) |
| Average Neighbor Degree | 0.24 (0.14) | 1.8 (0.086) |
| Adj $R^2$ = 0.23<br>F(3,39) = 5.08<br>p = 0.005 | | |

# Patient safety event reporting, unit climate, and narrative dynamics

# Challenges in patient safety event reporting

|   |   |
|---|---|
|   | ~1 event report per bed per month |
| x | ~ 1,000 utilized beds |
|   | ~ **1,000 reports per month** |

→

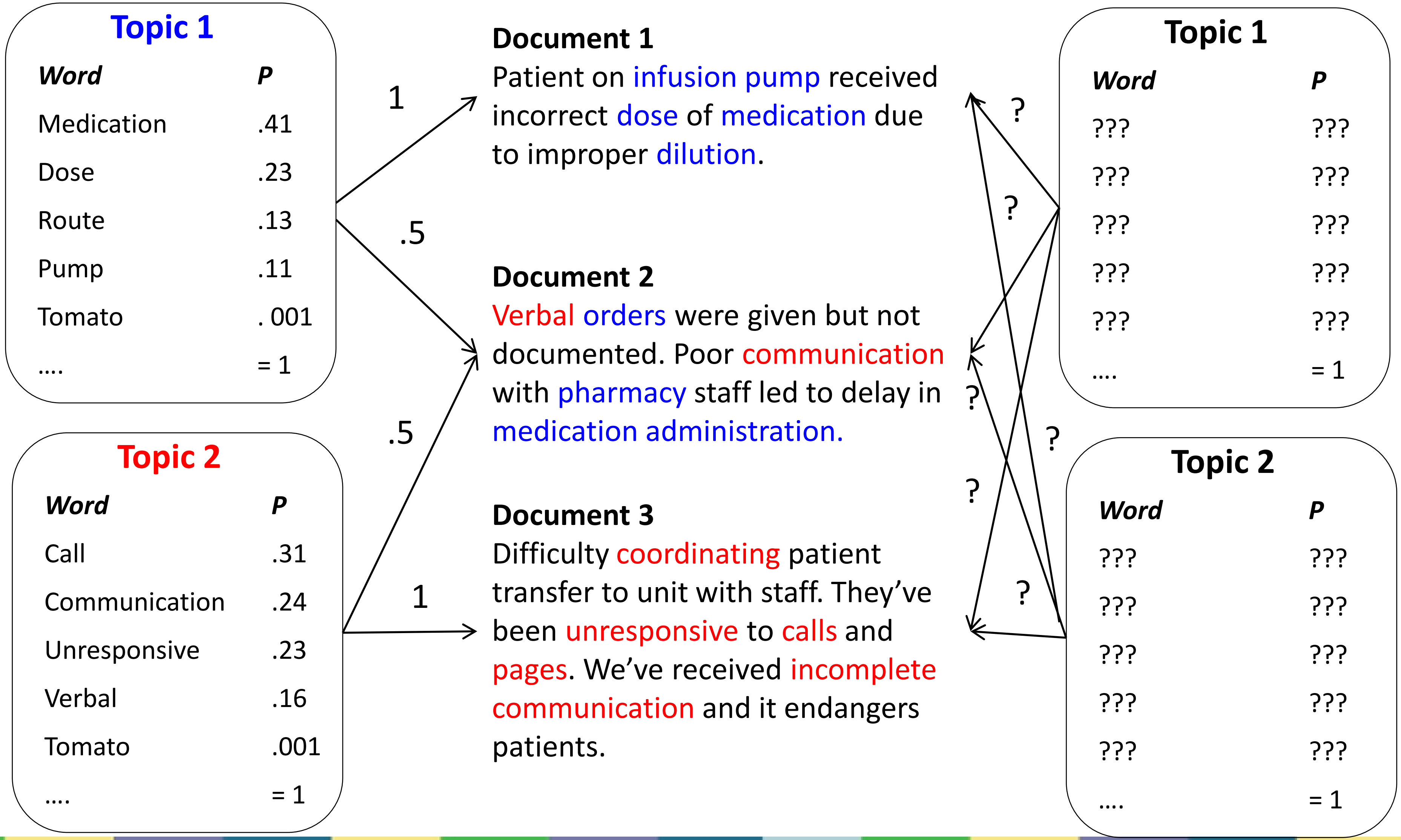
**Each requiring:**

- Further analysis
- Problem solving
- Solution generation
- Implementation
- Evaluation

# Study 6: Are there better ways?

- Apply topic modeling to safety event reports
- Explore content validity
  - Can we find coherent patterns? Of important safety trends?
  - How well are discovered patterns currently represented in event taxonomies?
- Explore predictive validity
  - Do topic scores account for variance in harm scores above and beyond existing event categories?

# Topic Modeling with LDA Example



# Study 6: Approach

- Topic modeling
  - 13,317 reports from over 15 months
  - 40 topic model was ‘best fitting’
- Topic labeling and rating
  - Review by 5 SMEs in 9 hours of focus groups
  - Ratings of coherence, importance, and current awareness / representation in event taxonomies
- Multi-level modeling of harm scores
  - Existing event categories used as grouping variable, and predict within and between group variance in harm scores

# Study 6: Example Topics

**Topic 1**
Blood
**Blood Products**
Request
Unit
Product
Bank
Sent
Transfus

**Topic 2**
Infus
Heparin
Rate
Drip
Weight
CPN
Start
**Heparin or High Risk Meds**

**Topic 3**
Bed
Floor
**Falls**
Fell
Bathroom
Sit
Head
Chair
Side

**Topic 4**
Pressur
Unable
Bleed
Continu
Would
Eval
Elev
**Pressure Ulcers or Wound Care**

**Topic 5**
Chang
Shift
Pain
**Errors at time of shift**
Day
Everi
High
Dilaudid

# Study 6: Results

**The majority of topics (72.5%) were rated as highly coherent, and only 5% were rated as having no discernable pattern**

| | | | |
|---|---|---|---|
| 1: Risky env. Conditions<br>patient, room, left, safety, enter | 2: Comm. / coord. Breakdowns<br>call, told, state, get, take | 3: Skin damage<br>site, arm, right, left, assess | 4: Retained foreign object<br>xray, needl, chest, count, case |
| 5: Patient ID<br>name, discharge, home, patient, mother | 6: PCA use error catches<br>chang, shift, pain, night, pca | 7: Blood product management<br>blood, red, cell, return, request | 8: Specimen management<br>lab, result, drawn, draw, test |
| 9: Interpersonal conflict<br>ask, said, put, know, want | 10: No pattern<br>back, one, came, still, come | 11: Line placement / mngmnt.<br>line, central, cathet, place, babi | 12: Equipment contamination<br>tray, set, clean, steril, instrument |
| 13: Code issues<br>bedsid, assess, immedi, vital, code | 14: Ambig. or incorrect orders<br>given, patient, review, chart, notifi | 15: Orders and patient ID<br>note, upon, document, may, follow | 16: Medication errors<br>medic, pharmacy, med, dose, administ |
| 17: Med labeling error<br>check, correct, label, doubl, wrong | 18: Pt transfer issues<br>patient, admit, transfer, floor, admiss | 19: Specimen labeling<br>specimen, contain, locat, receiv, must | 20: Patient aggression<br>staff, secur, member, family, leav |
| 21: No pattern<br>use, anoth, make, complet, sure | 22: Access to services<br>care, provid, contact, clinic, today | 23: Allergic reaction to contrast<br>mri, contrast, scan, inject, patient | 24: Med order/dosing errors<br>order, dose, poe, receiv, enter |
| 25: Falls<br>bed, floor, assist, fall, fell | 26: controlled substance waste<br>wast, found, fentanyl, drop, pyxi | 27: Blood sugar / insulin mngmt<br>pts, blood, insulin, glucose, check | 28: Distributed comm.<br>Page, pacu, resid, anesthesia, servic |
| 29: Missing wrist band<br>patient, caus, wristband, must, phlebotomist | 30: Patient consent<br>report, place, prior, without, consent | 31: Pt transfer w/o monitoring<br>arriv, unit, charg, transport, notifi | 32: Infusion pump & tubing<br>tube, pump, bag, fluid, run |
| 33: Com. & role clarity<br>team, communic, picu, attend, plan | 34: Dental and equip issues<br>procedur, remov, attempt, pull, area | 35: Pressure ulcers and BP<br>pressur, unabl, bleed, continu, wound | 36: Airway management<br>equip, machine, oxygen, intub, sedat |
| 37: Transitions of care<br>nurs, inform, made, receiv, awar | 38: Scheduling / coord. Issues<br>time, need, hour, due, avail | 39: Med infusion errors<br>infus, heparin, rate, drip, weight | 40: Med error – discrepancy<br>day, number, system, record, occur |

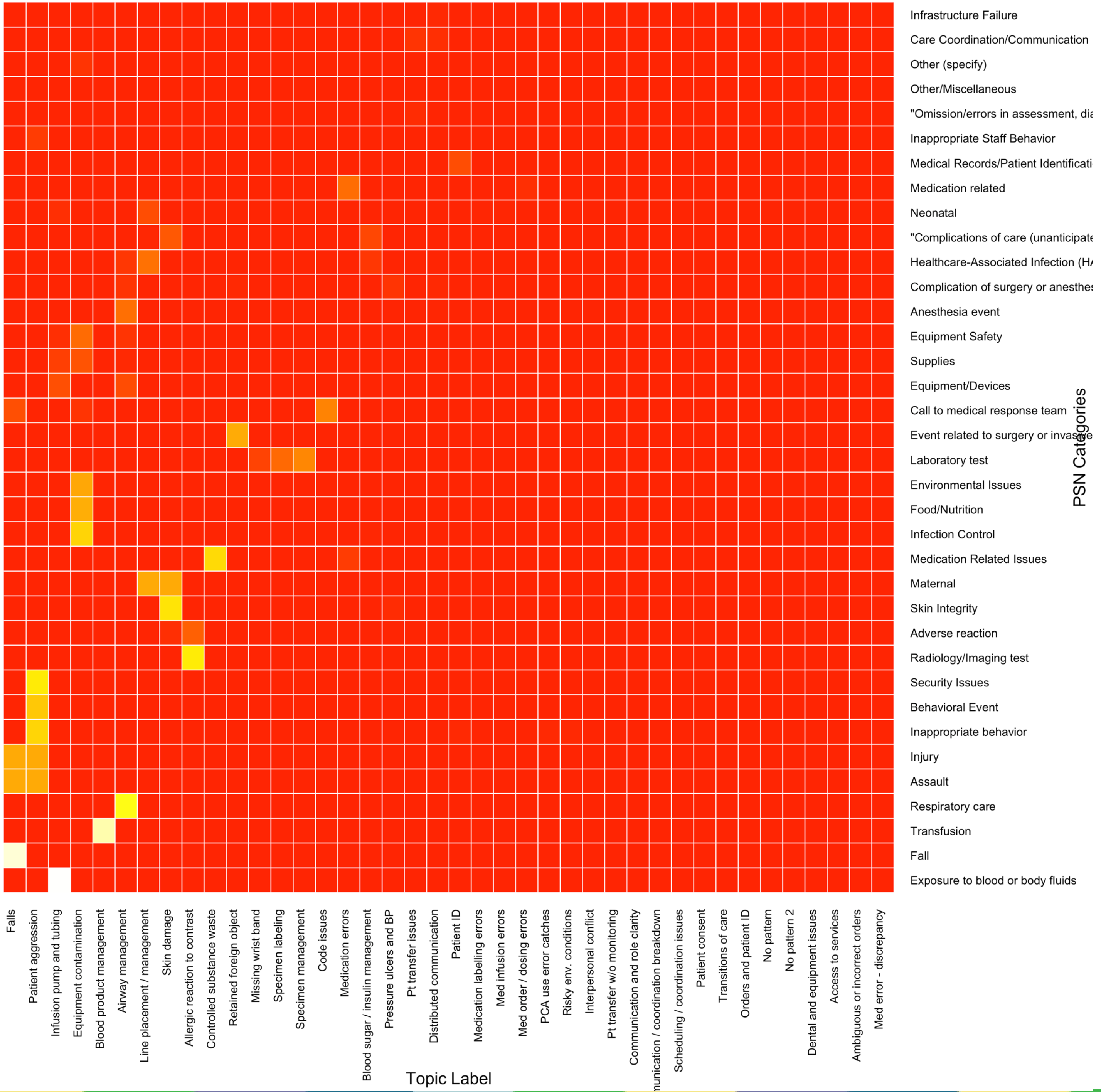
Table 2. Topic names and top 5 words for a 40 topic model of PSER data. Green = topics rated as highly coherent; Yellow = topics rates as somewhat coherent; Red = Topics rated as incoherent.

# Topic coherence and importance by awareness and representation (examples)

| | | **Current awareness and representation in event taxonomy** | |
|---|---|---|---|
| | | *High* | *Low* |
| **Topic coherence and importance** | *High* | 11 topics<br>• OR controlled substances waste management<br>• ID/safety bands not scan-able<br>• Blood wastage<br>• … | 14 topics<br>• Central lines<br>• Hypoglycemia events<br>• Pre-procedure issues<br>• Dose monitoring errors<br>• … |
| | *Low* | 0 topics | 15 topics<br>• Logistics and operational barriers<br>• Electronic ordering configuration<br>• Extubations<br>• Availability of resources<br>• … |

# Topics vs. PSN Event Types

- Heatmap – Proportion of events within PSN category classified into each topic
- One to one mapping (telling what we already know)
- Some join or split categories (new way to think about what we already know)
- Some have no clear correspondence (new pattern)



# Study 6: Takeaways

## Findings

- Existing event categories as a grouping variable
  - 51% of variance was between event categories
  - 49% of variance was within event categories
- Lexical features (sentiment analysis, LIWC)
  - 11% of between event variance
  - 3% of within event variance
- Topic scores
  - 27% of between event variance
  - 6% of within event variance

## Future directions

- Language of blame in event reporting data as a marker of local climate
  - Natural experiment around a just culture implementation
- Towards measures of narrative stability and change as makers of climate

# Summary of social data science (SDS) pilot studies: Describe, explain, predict, control

- SDS methods are useful for **description** and strong in **prediction**
  - The detail can be overwhelming, and requires engaging domain experts with complex data
  - Highly predictive, but poorly explanatory models are of limited interest
- SDS needs tighter coupling with social sciences to enable **explanation**
  - Ongoing process of applying, adapting, and building new theory
  - New methods enable more temporal theories of social interaction
- We've only scratch the surface of interventions for **control**
  - Better systems for selection, training and development, ongoing support, and operations management

# Future directions for Social Data Science

# SDS can enable translational organizational sciences.

**Better science**

- Reduced burden of data collection
- Increased scale of data collection
- Multi-method triangulation

**Better organizations**

- Selection systems
- Work redesign
- Risk monitoring
- Performance feedback

# Thoughts on the road ahead

- Need to mature integrative frameworks
  - Huge variety in theories and methods available
- Need to invest in fundamental measure validation
  - What is an appropriate approach to scaling measures up
- Need to build the technical infrastructure
  - Current investments focus on clinical data (correctly), but do not include key SDS data sources (e.g., EHR access logs)
- Need to invest in the human capital
  - Introducing into
  - Brining strong research teams together
  - Best configurations of SDS skill sets across team members

# Thanks for your time. Questions?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