Turning Digital "Fumes" into a Breath of Fresh Air

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Session: How are we to understanding the reducing clinical burden in a Northern European Context?

October 11, 2023

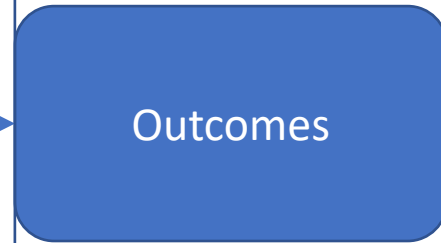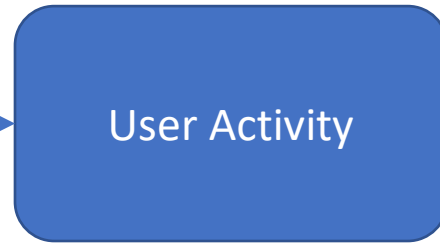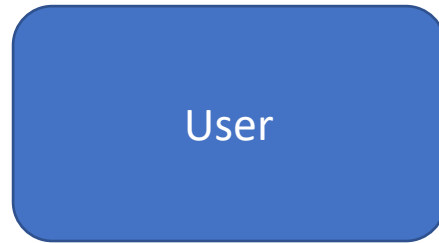# Framework for Measures and Relationships

Contextual Factors

Busyness

Team structure

EHR user interface

Fatigue

Gender

Inherent Traits

| User | → | User Activity | → | Outcomes |

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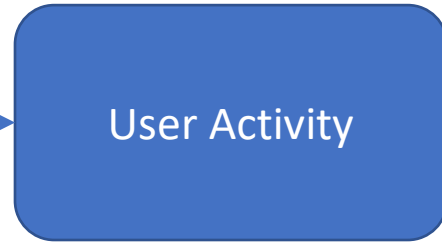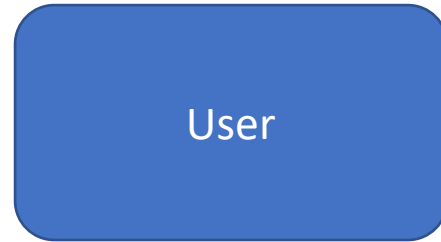
EHR ACTIVITY LOG DATA

Audit Logs

Example Audit Log

Record Review · Orders · Documentation

patients

time

05/12/2019 13:04:52 | PROV1 | 105837489 | View Problem List | MED1238
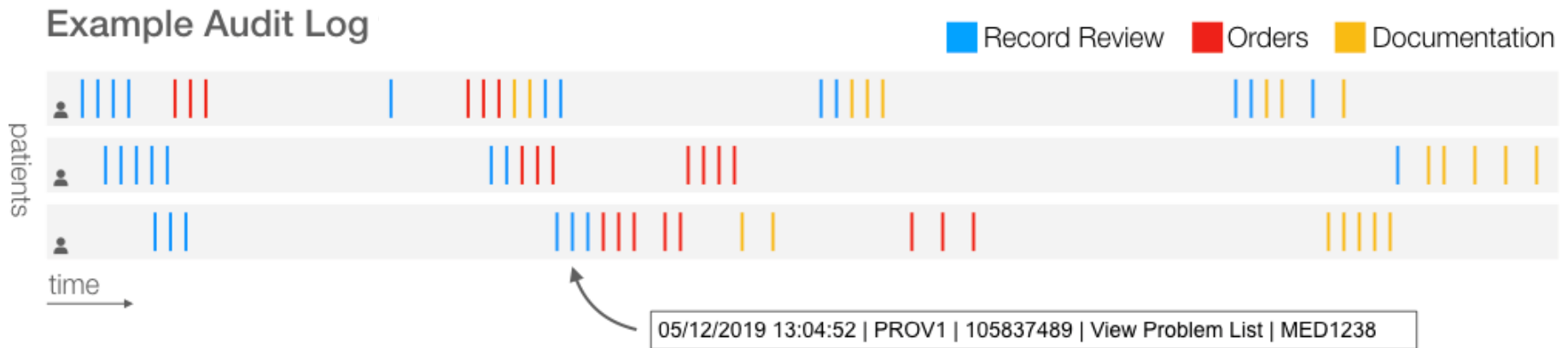
Log entries contain:
- Who accessed
- What patient
- When
- What action

Figure credit: Adam Rule

User Activity Logs

A. EHR Use | B. Event Handlers | C. EHR Use Metadata | D. Aggregation | E. Measures

User and System Actions → Record → Audit Log (Event Log)

→ Record → Other Event Log (Event Log)

→ Record and Aggregate → Duration of Use Log (Aggregate Log)

→ Record → Clinical Data and Metadata

Investigator-defined Aggregation → Investigator-derived Measures

Developer-defined Aggregation → Developer-derived Measures

Figure credit: Adam Rule

Activity Log Measures
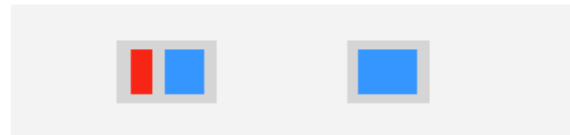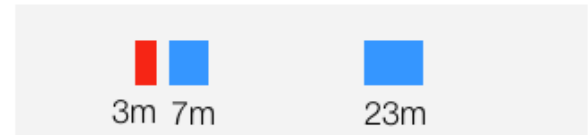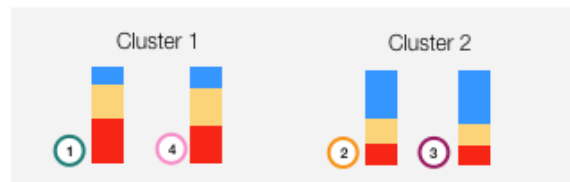
Rule A, Chiang MF, Hribar MR. Using Electronic Health Record Audit Logs to Study Clinical Activity: A Systematic Review of Aims, Measures, and Methods. JAMIA. To appear.

General Challenges

1) No capture of activities that occur outside the EHR

2) Up to each EHR developer which actions to record

3) Up to each EHR developer to assign "meaning" to actions

4) Not always a 1:1 relationship between front-end action and back-end capture; logging logic rarely fully described

5) Capturing accurate time-based measures particularly tricky

6) Many bases for adjustment/normalization of measures

Example: Team Performance and Diagnostic Outcomes

Context:

Prior work has tied team measures (e.g., size, structure, experience) to patient outcomes.

EHR audit log data allow more granular team measures, which could be particularly relevant to understand variation in outcomes in cases with clinical uncertainty

Research Question:

Do team-based measures predict variability in a key outcome – door-to-needle time – for acute ischemic stroke patients in the ED?

Team Measures:
2 final concepts & 6 measures

- Team Busyness
  - Average Movement
  - Average Number of other patients
  - Average number of chart switches

- Team Experience
  - Shortest time since last TPA case
  - Average mutual experience of TT with tPA
  - Average mutual experience of TT with any encounters

For each patient in cohort…
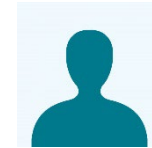
1) Identify treatment window

2) Identify treatment team

3) Identify actions of treatment team during treatment window

4) Compute measures

Multi-site Study – 24 hospitals across 3 health systems

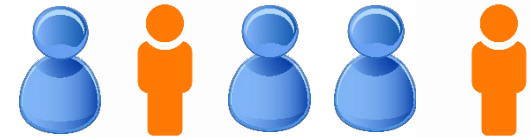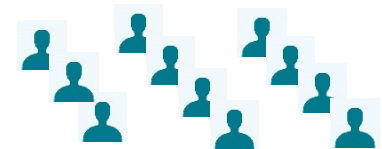| Measure	Definition	Site A		Site B		Site C	
	For all members of the patient's treatment team during the treatment window, mean number of:	Mean	SD	Mean	SD	Mean	SD
Busyness							
Movement	Unique workstations used	1.79	0.39	2.51	0.41	2.11	0.36
Charting	Non-index patient charts viewed	14.56	9.31	10.18	2.95	13.38	5.35
Switching	Chart switches	35.99	17.04	26.71	8.52	26.96	9.56
Experience							
Recency	Length of time in days since last tPA case	14.67	23.64	13.23	14.06	6.66	11.76
Teamwork: Any	Any shared encounters within the prior 6 months	0.81	0.93	0.51	0.29	0.73	0.39
Teamwork: tPA	Shared tPA encounters within the prior 6 months	0.20	0.19	0.12	0.10	0.17	0.12

Associations between Team Measures and Outcome (DNT)

	Site A	Site B	Site C
Outcome	*Mean* (SD)	*Mean (SD)*	*Mean (SD)*
DNT: Minutes between ED arrival time and tPA administration time	56 (+/- 39)	57.5 (+/- 37)	45 (+/- 25)

	Site A		Site B		Site C	
Measure	*Coefficient*	*P-Value*	*Coefficient*	*P-Value*	*Coefficient*	*P-Value*
Busyness						
Movement	-3.67	0.58	2.37	0.69	-5.37	0.11
Charting	-0.51	0.06	-0.66	0.41	-0.24	0.31
Switching	-0.22	0.14	-0.24	0.40	-0.18	0.17
Experience						
Recency	-0.01	0.92	0.27	0.11	**0.32**	**0.002**
Teamwork: Any	-1.93	0.49	**-19.16**	**0.027**	**-11.02**	**<0.001**
Teamwork: tPA	**-37.01**	**0.005**	**-80.93**	**0.001**	**-42.93**	**<0.001**

Rose et al. JAMIA 2022

WHAT WE LEARNED…

Despite significant variation in underlying data generation processes, the activity log measures were remarkably consistent across sites

Where we found variability in activity log data (e.g., in names of events or relative frequencies), unclear what drives differences across sites – actual differences in care vs. audit log/EHR configuration

WHAT WE LEARNED cont…

- Audit log measures are most feasible for more "global" measures of context. For example:
  - how many chart review activities occurred for clinician XYZ on XYZ date
  - how many unique individuals took an action in patient XYZ's chart on XYZ date

- Measures got complicated, hard to standardize across sites, and difficult to know "right" definition when needing to simultaneously define:
  - *which patients, which providers (i.e., who is the clinical team?), which action(s), and over what timeframe*
  - Difficult to ensure 'face validity' of the metrics

Where else can we apply activity-log derived measures: Current projects

Levels of Documentation & Consumption of EHR Data

- Social determinants of health data
- Advanced care planning navigator

Trainee Maturation

- Digital Growth Chart
- Patterns of progress note production
- Senior resident phenotypes

EHR-related Burnout

- Impact of billing for e-visits on messaging volume
- ML on raw audit log data to assign level of service for E&M coding
- Impact of CMS changes in E&M documentation requirements

Outcomes

- COVID-induced transition to telemedicine

If you are interested, join our national network…

National Research Network for EHR Audit Log Data

150+

MEMBERS FROM OVER 50 ORGANIZATIONS

The National Research Network for EHR Audit Log Data is focused on use of EHR Audit-log and Meta-data to support health services research. Kicking off on March 16, 2018, a group of researchers convened to share their experiences and ideas, learn from each other, and pursue collaborative projects.

The monthly NRN webinars are focused on these three topics:

- Research Topics and Funding (types of research questions well suited to audit log data, funding sources for audit log research)

- Research Methodologies and Skillsets (methodological/modeling approaches well suited to audit log data, skillsets of research team)

- Data Quality and Creating Meaningful Measures (accuracy, usefulness of data documentation, various levels of granularity, strategies for reducing noise/errors)

NRN Workgroups

Questions about the NRN for EHR Audit Log Data?

Contact Sarah Rosenthal | sarah.rosenthal@ucsf.edu

Local Projects

National Policy

National Research Network

https://cliir.ucsf.edu/portfolio/national-research-network-ehr-audit-log-data