



# Biomedical and Health Informatics Year in Review

Session: S22 November 18, 2019 8:30AM

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@ciminoj

#AMIA2020



# Disclosure

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I and my spouse have no relevant relationships with commercial interests to disclose.

# Learning Objectives

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After participating in this session you should be able to:

- have a sense of the full scope of informatics research
- think about which Working Groups match your interests
- be inspired to publish significant work

# Overview

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- Workgroups asked to nominate papers
- I pick “interesting” ones to present
- I requested audiovisual materials from authors
- This talk is a guided tour of the slides and papers
- Trying to make sense of it all
- Process
- Acknowledgements and bibliography

# Format: Working Group Name Here



First slide:

Title - Journal

First Author...Senior Author, Institution

Summary points

More Slides:

Interesting observations

Visual material provided by authors

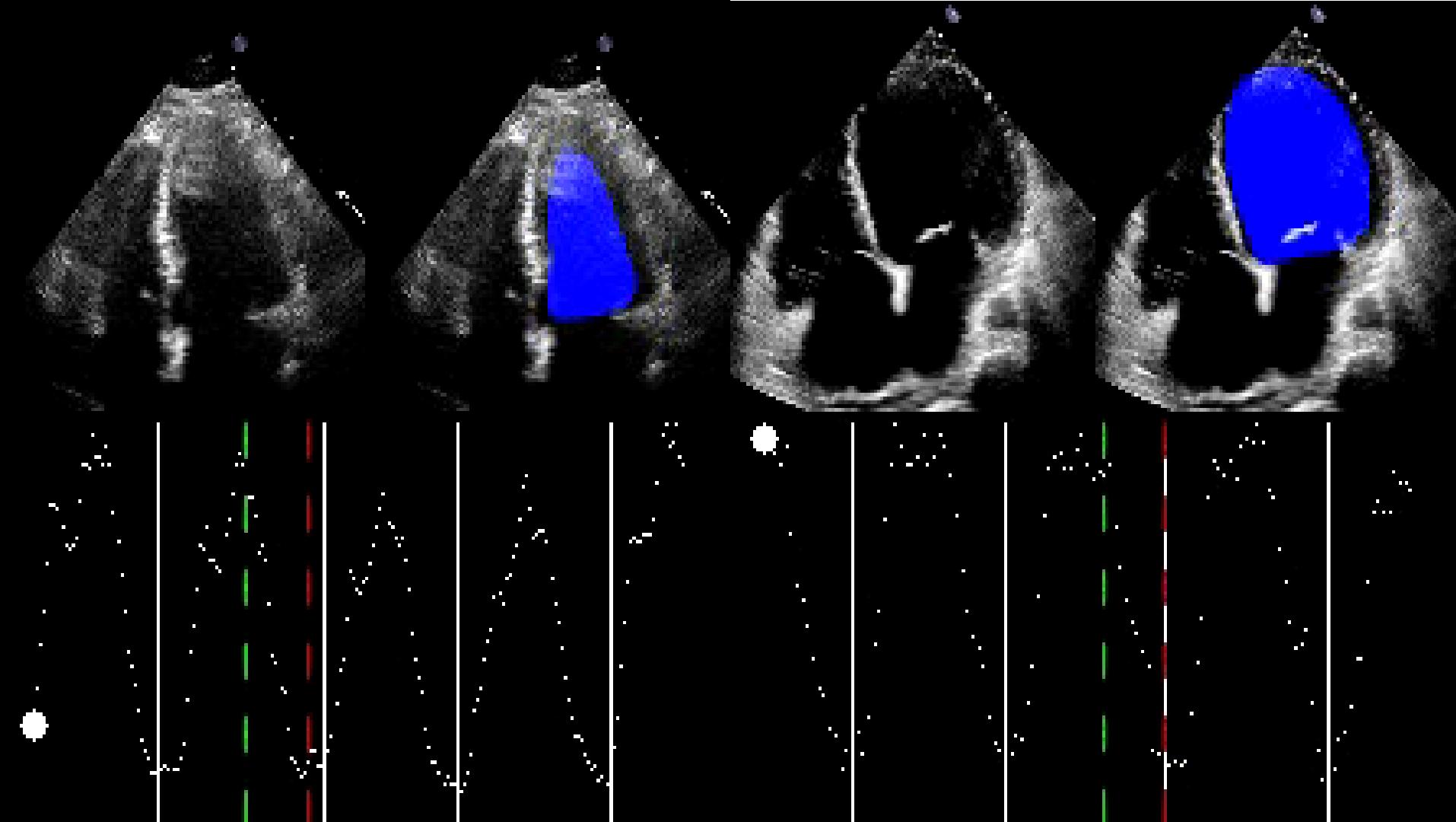
Brief summaries of honorable mention papers from the WG

# Biomedical Imaging Informatics



## *Video-based AI for beat-to-beat assessment of cardiac function - Nature*

- David Ouyang...James Zou – Stanford
- Echocardiogram videos estimate left heart ventricle function
- Human interpretation uses segmentation of a small number of heartbeats
- High inter-observer variability
- Spatial-temporal convolutional neural network
- Classified ejection fraction correctly 97% of the time
- Experts preferred system's classification over humans' in 17 of 20 videos



# Biomedical Imaging: Honorable Mention



*Deep Learning Reveals Cancer Metastasis and Therapeutic Antibody Targeting in the Entire Body - Cell*

- Chenchen Pan...Ali Ertürk – Helmholtz Zentrum München

*An augmented reality microscope with real-time artificial intelligence integration for cancer diagnosis – Nature Medicine*

- Po-Hsuan Chen...Martin Stumpe – Google Health

*Artificial Intelligence to Detect Papilledema from Ocular Fundus Photographs – N Engl J Med*

- Dan Milea...Valérie Biousse – Singapore National Eye Center (was CDS)

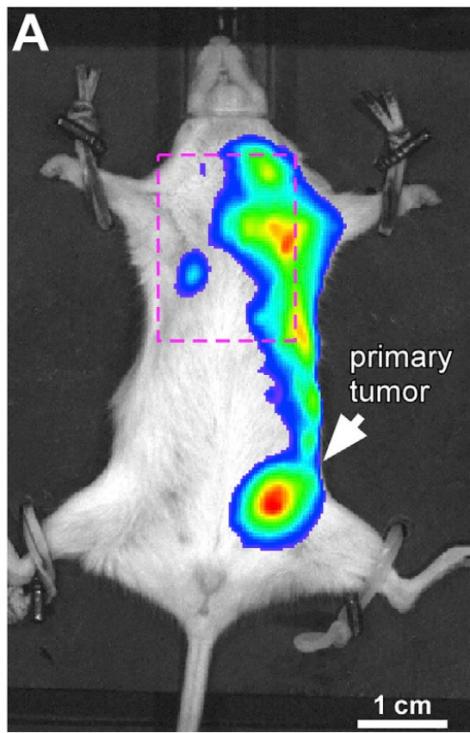
*Point-of-care oral cytology tool for the screening and assessment of potentially malignant oral lesions – Cancer Cytopathology*

- Michael McRae...John McDevitt – NYU (was Dental)
- Deep and unsupervised statistical learning

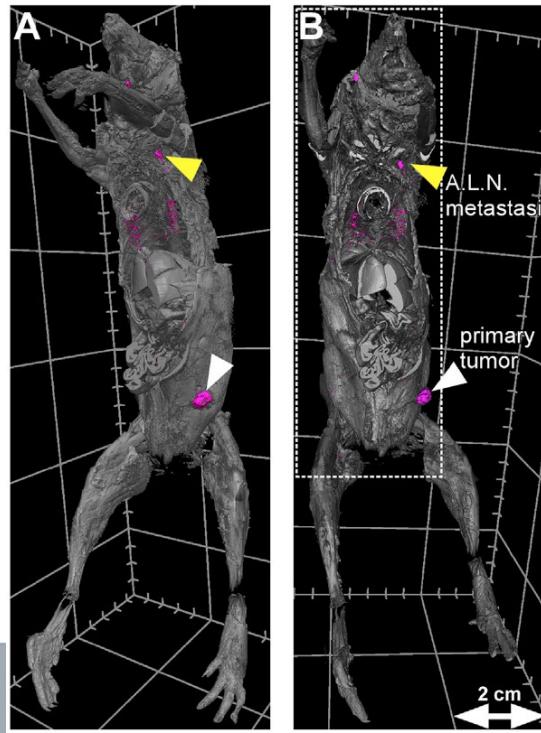
# Pan et al.: Metastasis Detection

- Cell-level quantification of micrometastases and therapeutic antibody targeting
- Implanted tumors expressing fluorescent proteins (mCherry and luciferinase)

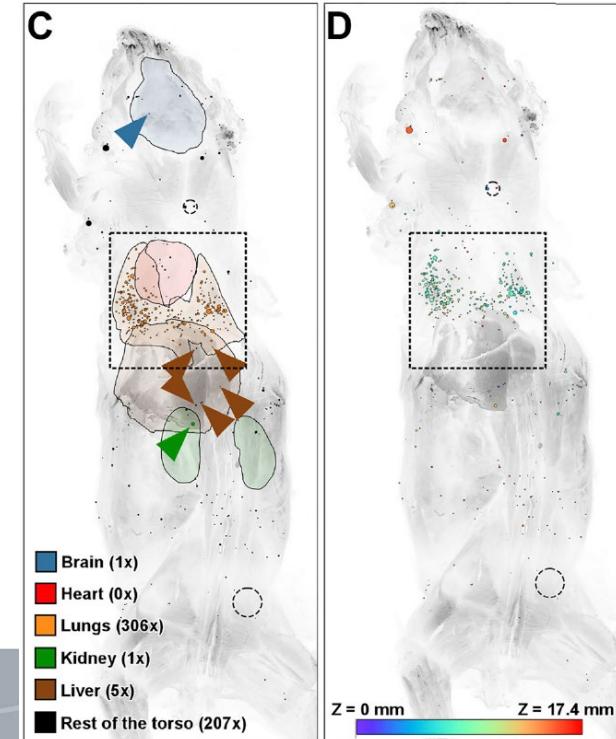
2D bioluminescence



3D light-sheet (rendered)

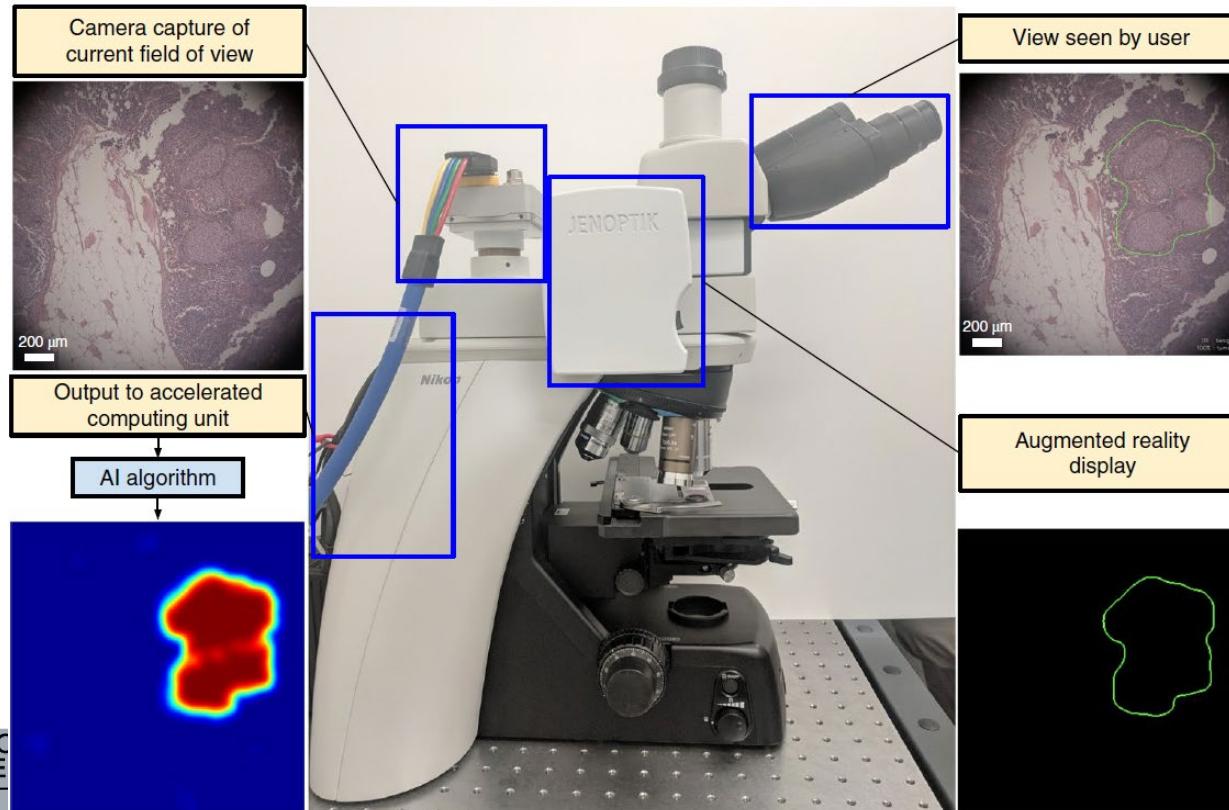


3D deep learning reconstruction



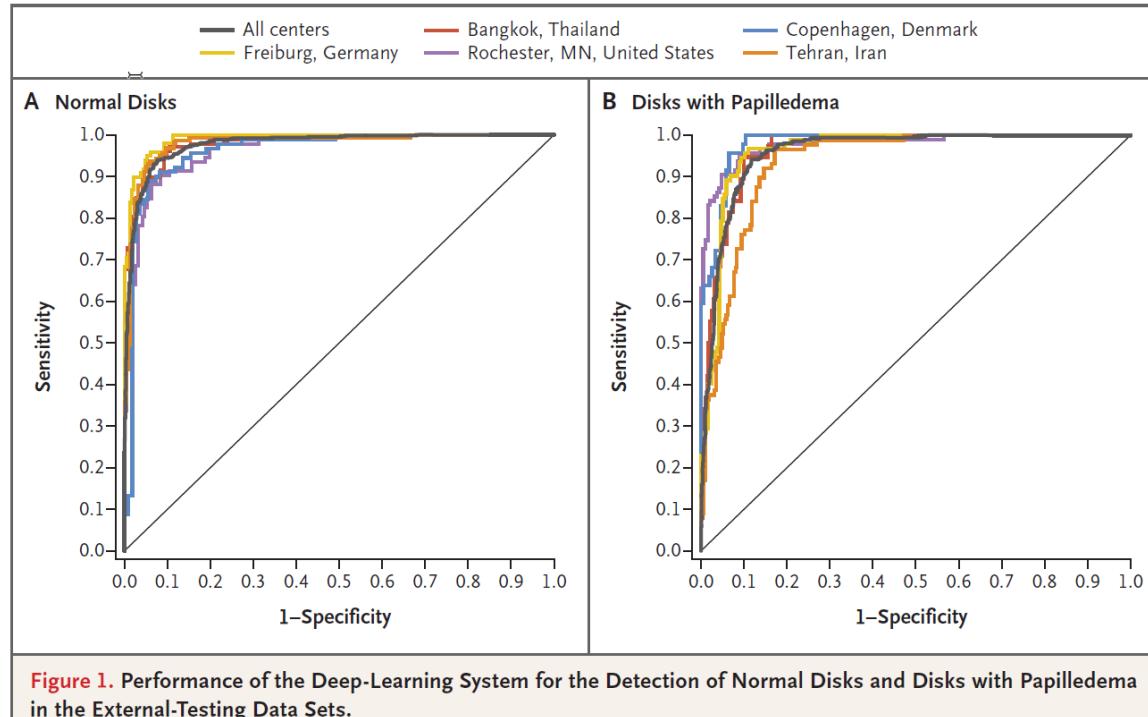
# Chen et al.: Human + Computer > Human

- Augmented reality microscope overlays AI information in real time



# Milea et al.: “Fundi Benign”

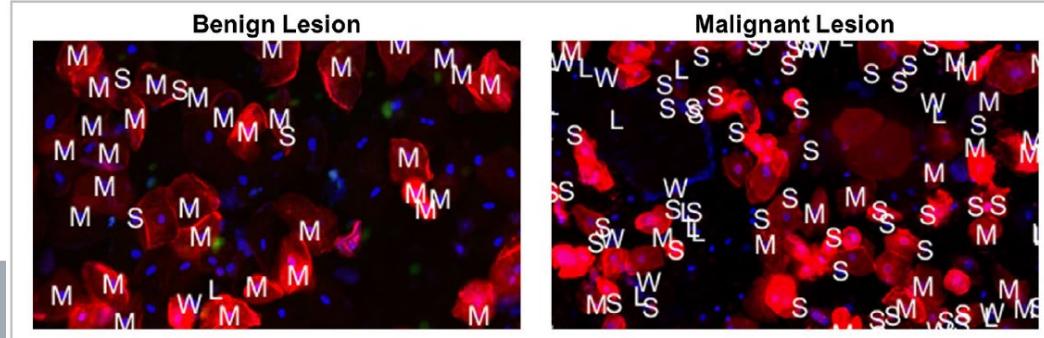
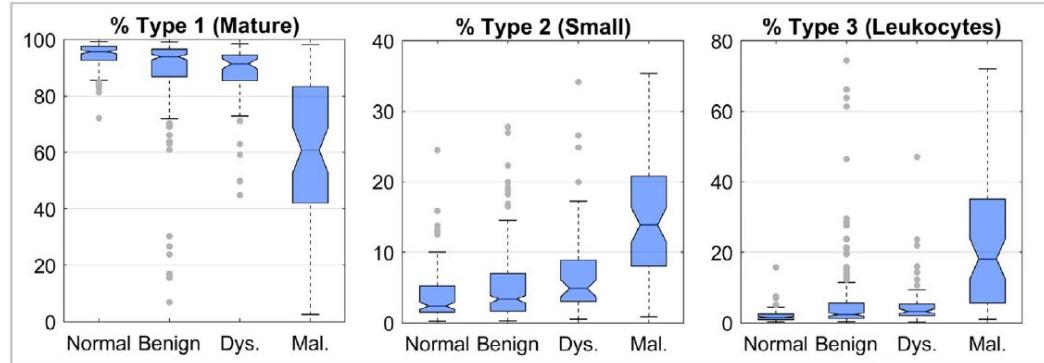
- Optic fundus exam is critical for detecting increased intracranial pressure



- In 10 of 177 misclassifications, experts agreed with the system
- Not quite ready to replace the intern:
  - Need to dilate the iris
  - Need to obtain a photograph

# McRae et al.: Screening Suspicious Lesions

- Desktop point-of-care oral cytology – brush cytology, single-use cartridge
- Malignant lesions show increased proportion of small cells and leukocytes



# Clinical Decision Support



*Structured override reasons for drug-drug interaction alerts in electronic health records - JAMIA*

- Adam Wright...Dean Sittig – various (also Primary Care Informatics WG)
- Drug-drug interaction (DDI) alerts from 10 EHRs (including UAB)
- 12 categories of overrides, including those not related to DDIs
- 3 categories accounted for 78% of override reasons:
  - Will take precautions
  - Not clinically significant
  - Benefit outweighs risk
- 3% were “not ordering drug” (chart review, historical med, patient expired)
- A useful classification system for focusing reduction of false positives

# CDS: Honorable Mention



*An experimental investigation of the impact of alert frequency and relevance on alert dwell time - IJMI*

- Melissa Baysari...Johanna Westbrook – Macquarie University, Sydney
- Students shown alerts during prescribing training
- Decreasing frequency increased attention, regardless of relevance

# CDS: Honorable Mention



*Reducing Alert Burden in Electronic Health Records: State of the Art Recommendations from Four Health Systems – Appl Clin Inform*

- John McGreevey 3<sup>rd</sup>...Richard Schreiber – U Penn
- Governance and management of alerts are not for the faint of heart



# McGreevey III et al.: “So you want alerts...”



Alert justification criteria	Questions to determine appropriateness
Considerations prior to build	
Problem identification	What problem will the alert solve?
Beneficial	Is there a clearly defined return on investment (e.g., increased screening referrals)? Will alert reduce potential adverse events?
Appropriateness	Is the alert consistent with clinician workflow?
No better alternative	Is there an existing clinical decision support that accomplishes the same thing? Is there a less intrusive mechanism that may succeed?
Not so complex as to inhibit system performance	Does testing reveal system malfunction or slowing?
Metrics defined	How will alert success be measured?
Scheduled review of alert	When are the first and subsequent dates of review?
Consistent with organizational strategy and principles	Is the alert compatible with institutional policy, financial goals, and clinician workflows?

Considerations for alert build	
CREATOR: 7 new rules for ideal alerts:	
<u>Consistent with organizational strategy and principles</u>	Addresses high priority goals, adheres to established alert guidelines
<u>Relevant and timely</u>	Appropriate for clinical workflow impacted
<u>Evaluable</u>	Predefined metrics
<u>Actionable</u>	Allow delete or modify of triggering orders from within alert
<u>Transparent</u>	Rationale of alert is clear, highlighting patient-specific data which triggered the alert
<u>Overridable</u>	Clinical workflows may not be predictable by alert designers; clinician may be presented with a scenario which exceeds the alert designers' foresight
<u>Referenced</u>	Citing literature as appropriate, supporting intent of alert

# CDS: Negative Studies



*Acute kidney injury risk-based screening in pediatric inpatients: a pragmatic randomized trial – Ped Res*

- Sara Van Driest...Gordon Bernard - Vanderbilt

*Integrated Management Program Advancing Community Treatment of Atrial Fibrillation (IMPACT-AF): A cluster randomized trial of a computerized clinical decision support tool – Am Heart J*

- Jafna Cox...Lehana Thabane – various (Canada)

*Impact of Clinical Decision Support on Antibiotic Prescribing for Acute Respiratory Infections: a Cluster Randomized Implementation Trial – J Gen Intern Med*

- Devin Mann...David Feldstein – NYU, U Utah, Hofstra, BU, UW-Madison

*Effective Antimicrobial Stewardship StrategIES (ARIES): Cluster Randomized Trial of Computerized Decision Support System and Prospective Review and Feedback – Open Forum Infectious Diseases*

- Shi Thong Heng...Tat Ming Ng – Tan Tock Seng Hospital, Singapore

*Computerized Advisory Decision Support for Cardiovascular Diseases in Primary Care: A Cluster Randomized Trial – Am J Med*

- Paul McKie...Rajeev Chaudhry – Mayo Clinic

AKI, efficacy, safety, antibiotics, mortality, reinfection, readmission, a-fib, hyperlipidemia

# Clinical Information Systems: Workflow



*Association of Electronic Health Record Use With Physician Fatigue and Efficiency – JAMA Network Open*

- Saif Khairat...Shannon Carson – UNC-Chapel Hill

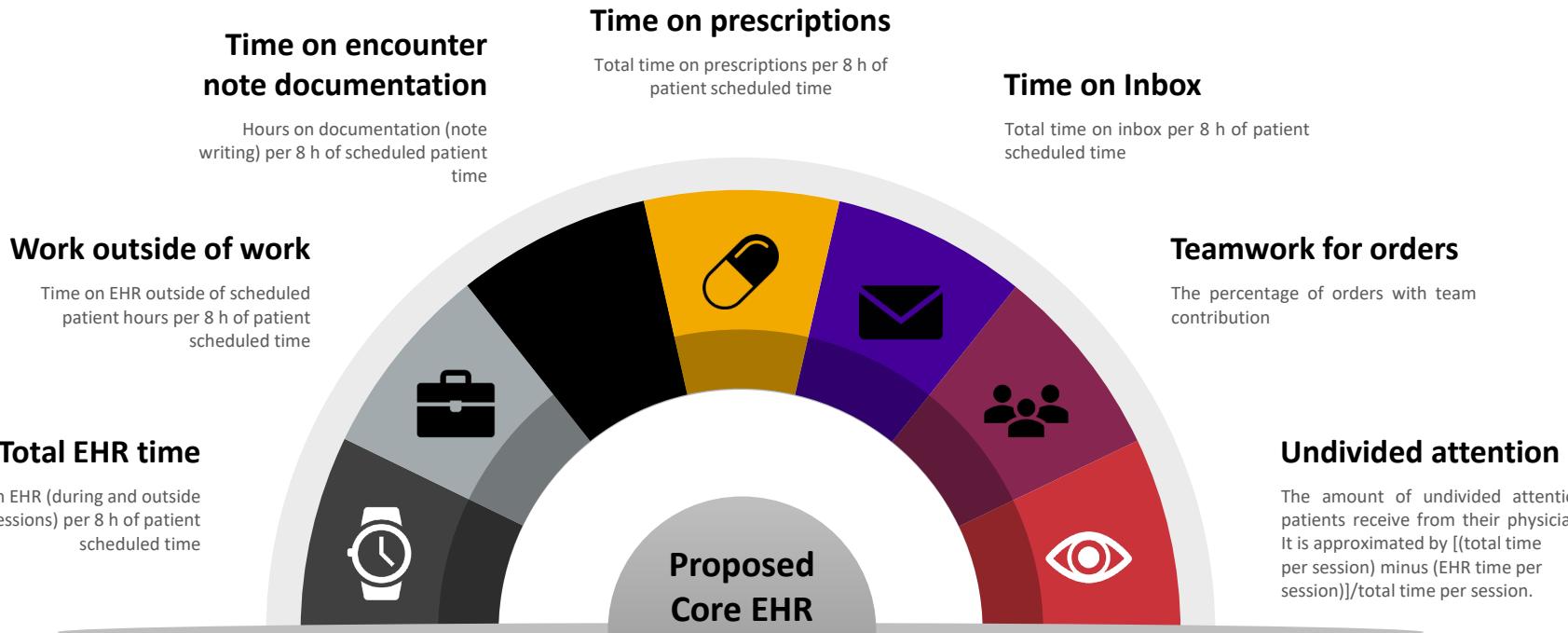
*Variation in electronic test results management and its implications for patient safety: A multisite investigation – JAMIA*

- Judith Thomas...Andrew Georgiou – Macquarie University, Australia

*Metrics for assessing physician activity using electronic health record log data - JAMIA*

- Christine Sinsky...Michelle Hribar – AMA, OHSU
- Formal studies of workflow (thematic analysis, pupilometry)
- Recommendations for metrics: efficiency (clicks), time (total, documentation, prescription, inbox), extramural work, teamwork, result tracking

# Sinsky et al.: Metrics for EHR Use



# CIS: Honorable Mention



*Reconsidering hospital EHR adoption at the dawn of HITECH: implications of the reported 9% adoption of a "basic" EHR – JAMIA*

- Jordan Everson, Joshua Rubin, Charles Friedman – Vanderbilt, U Michigan
- 2009: 9% electronic health record (EHR) adoption rate is widely cited
- Real number might have been 30%

# Clinical Research Informatics



## *Waiting for data: Barriers to executing data use agreements – Science*

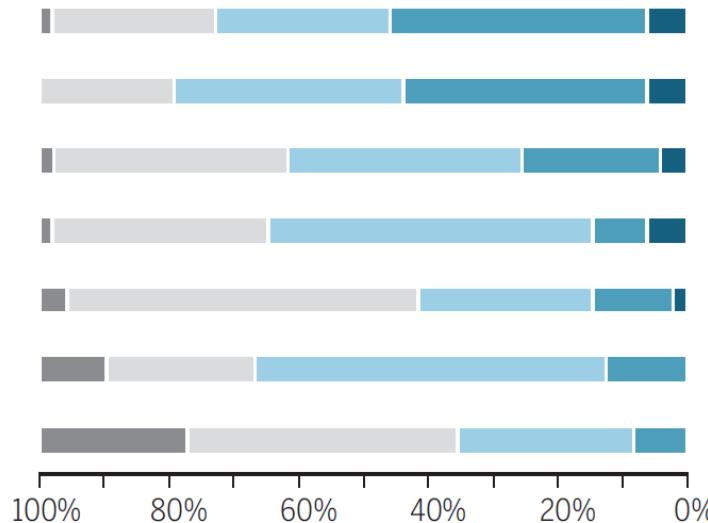
- Michelle Mello...David Studdert – Stanford
- Researchers want to share data
- Institutions need to sign off on data use agreements
- National repositories may not have defined research questions (COVID-19)

# Mello et al.: Data Use Agreements

- Troublesome contract provisions

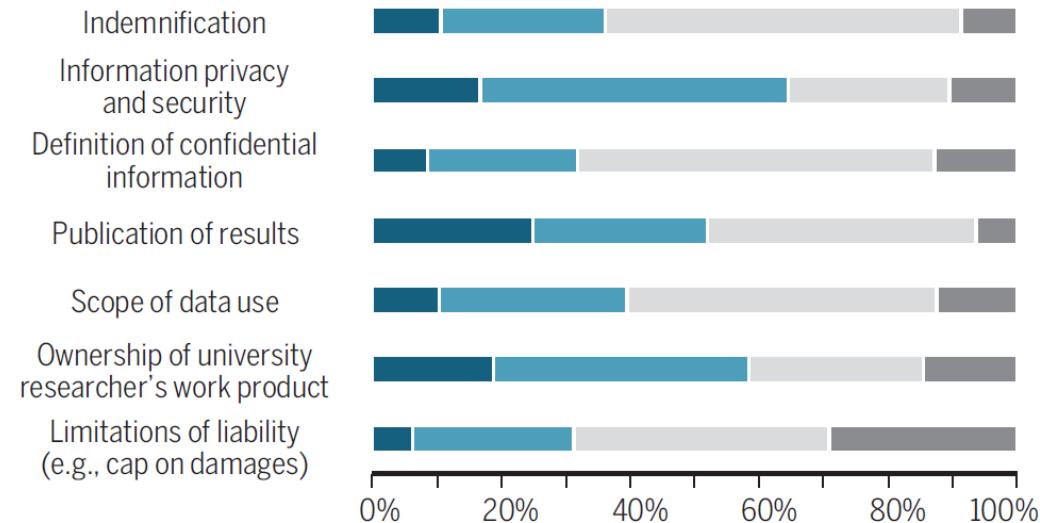
**Frequency with which provision surfaces as a contested issue**

● Never ● Rarely ● Sometimes ● Often ● Always



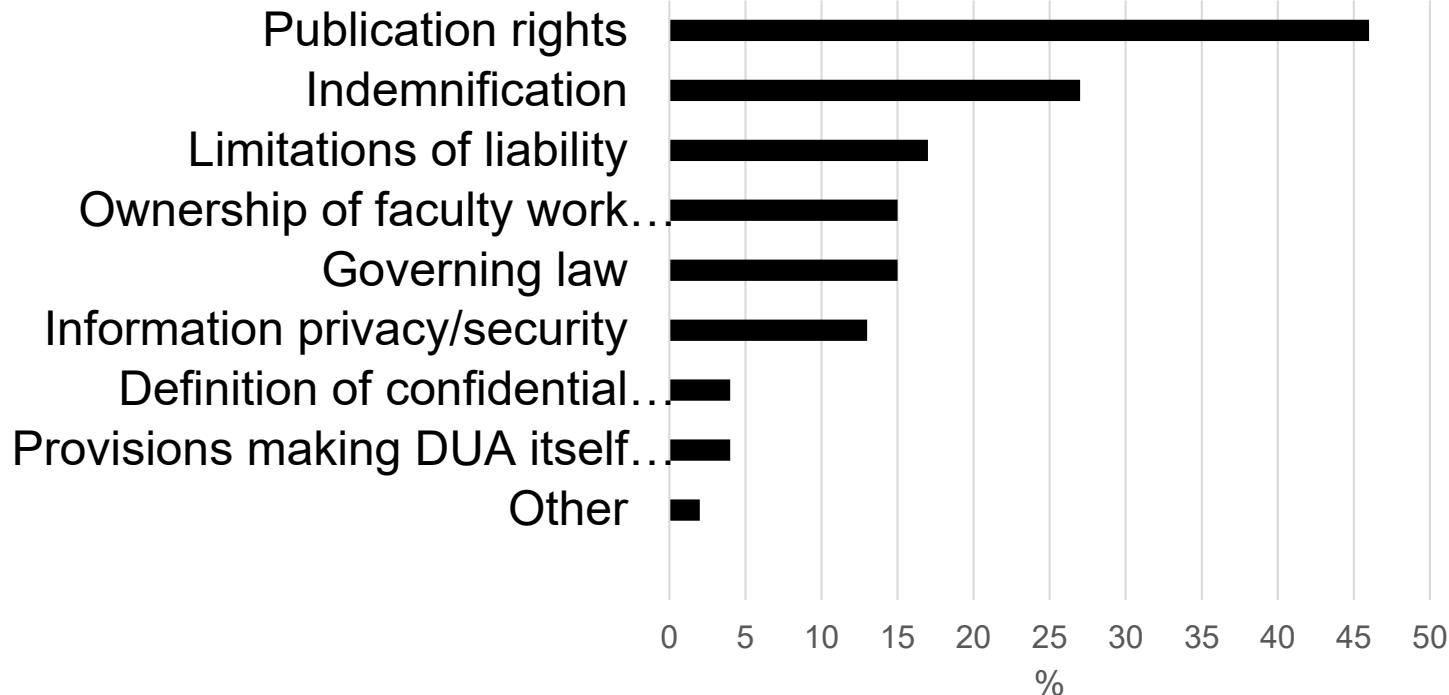
**Seriousness of the problem when it does arise**

● Serious problem ● Moderate problem ● Minor problem ● Not at all a problem



# Mello et al.: Data Use Agreements

- Deal breakers



# Mello et al.: Data Use Agreements

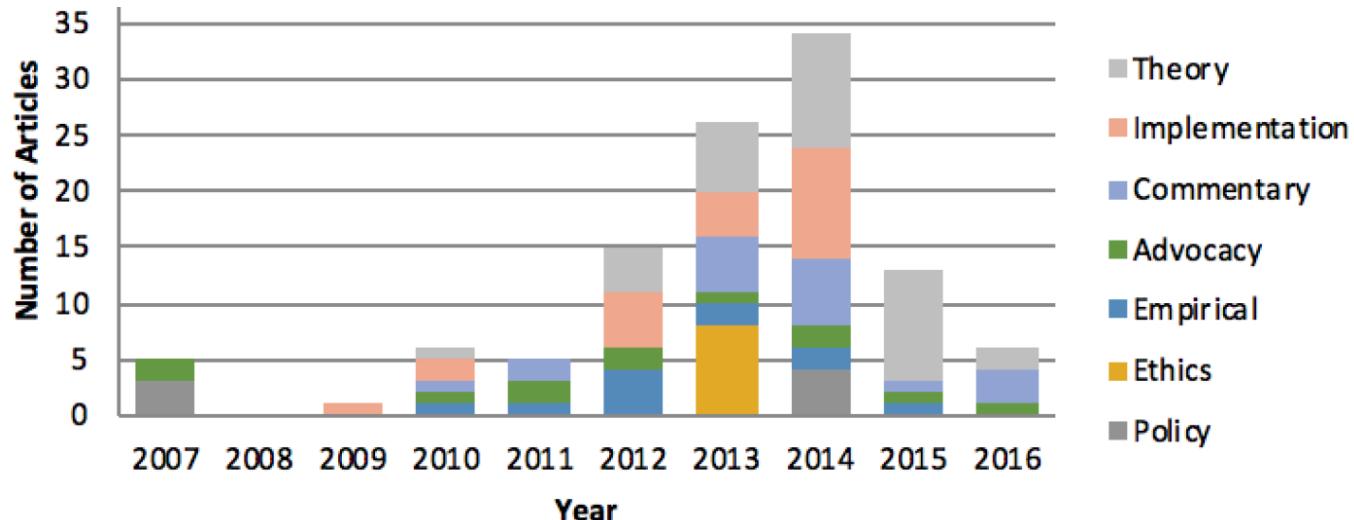


- Recommendations
  - Improve the intake process
  - Improve coordination across reviewing offices within the institution
  - Increase staffing
  - Pursue a universal Data Use Agreement template
  - Educate faculty about complexity and importance of DUAs

# CRI: Honorable Mention

## *An Analysis of the Learning Health System in Its First Decade in Practice: Scoping Review – Journal of Medical Internet Research*

- Jodyn Platt...Matthias Weinroth – U Michigan, Newcastle University
- LHS: Generate and apply the best evidence for healthcare choices
- Themes: Culture, Innovations, Data Infrastructure , Ethics



## *Learning endometriosis phenotypes from patient-generated data – Nature Digital Medicine*

- Iñigo Urteaga, Mollie McKillop, Noémie Elhadad – Columbia University
- Tissue similar to uterine lining growing in other places (abdomen, skin, etc.)
- Menstrual bleeding outside the uterus causes a variety of symptoms
- Collecting symptom information in real time can help characterize phenotypes
- Endometriosis phenotype (Phendo) tracker

# Urteaga et al.: Phendo



AT&T 11:16 AM 70%

Review Track This Day

Wed, Feb 8

3 Tracked Moments

Lb Cr Mo 7am 2

Left Lower Back Cramping Moderate Aleve

How was your day? ✓

What did you do to self manage? ✓

Do you have your period?

What did you eat?

Which activities were hard to do?

Which activities were hard to do? (Pictur...)

Did you exercise?

Profile Review Track Insights Citizen

AT&T 9:06 PM 65%

T-Mobile Wi-Fi 9:06 PM

Back Track this moment

Tue Mar 14 8 05 AM  
Wed Mar 15 9 06 PM  
Thu Mar 16 10 07 PM

Are you in pain now?

Any GI/Urine issues?

Experiencing something else?

How is your mood?

Are you bleeding?

Take any medication?

Profile Review Track Insights Citizen

AT&T 11:47 AM 65%

11:47 AM

Cancel

What's happening in your gastrointestinal/urinary system?

Cp Up Pb Uf

Can't Urinate Painful Urination Painful Bowel Movement Frequent Urination

Mi Mo Se

Mild Moderate Severe

Done

AT&T 11:38 AM 66%

11:38 AM

Cancel

What medication did you take?

To edit tracked information, go to your profile.

Wellbutrin 0

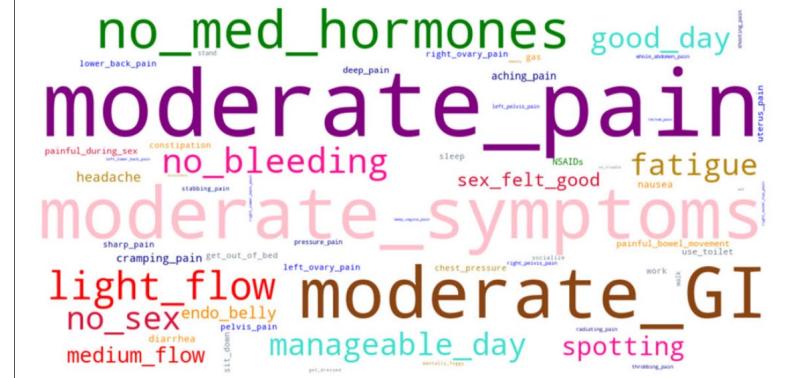
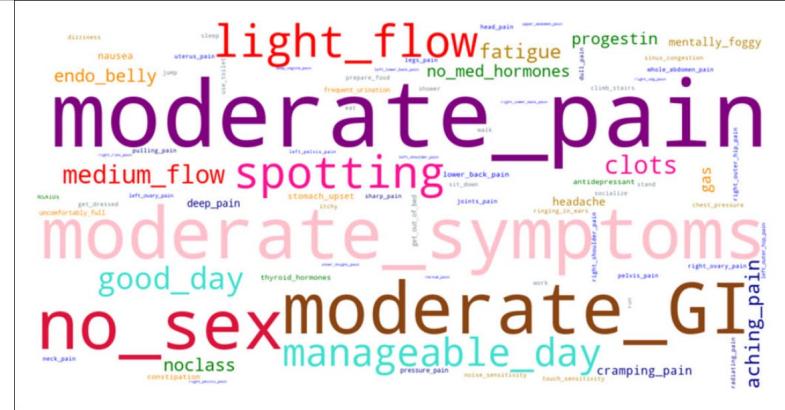
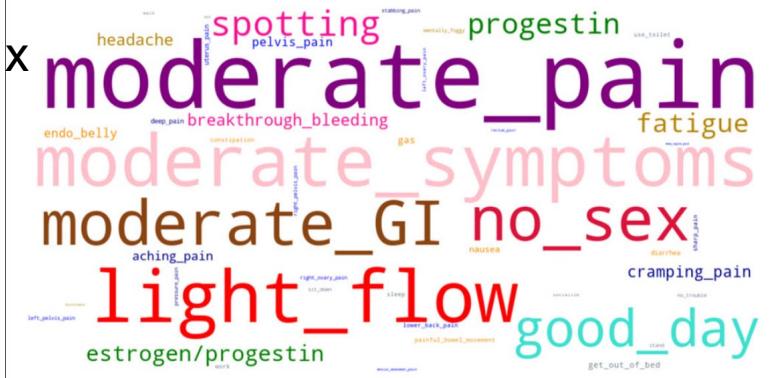
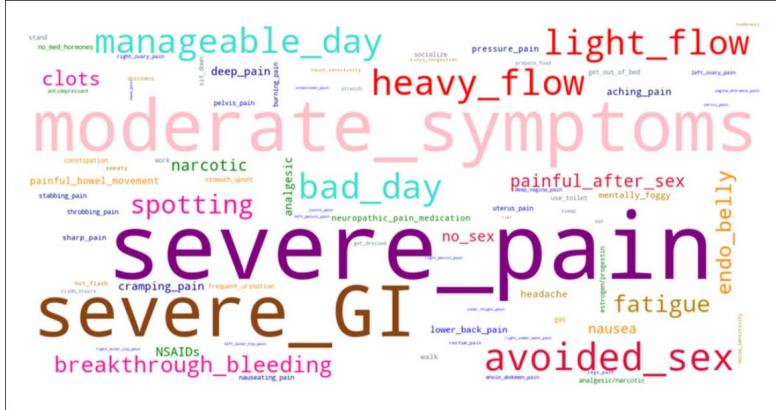
Tums 0

Tramadol 1

Aleve 0

Done

Urteaga et al.: Phendo

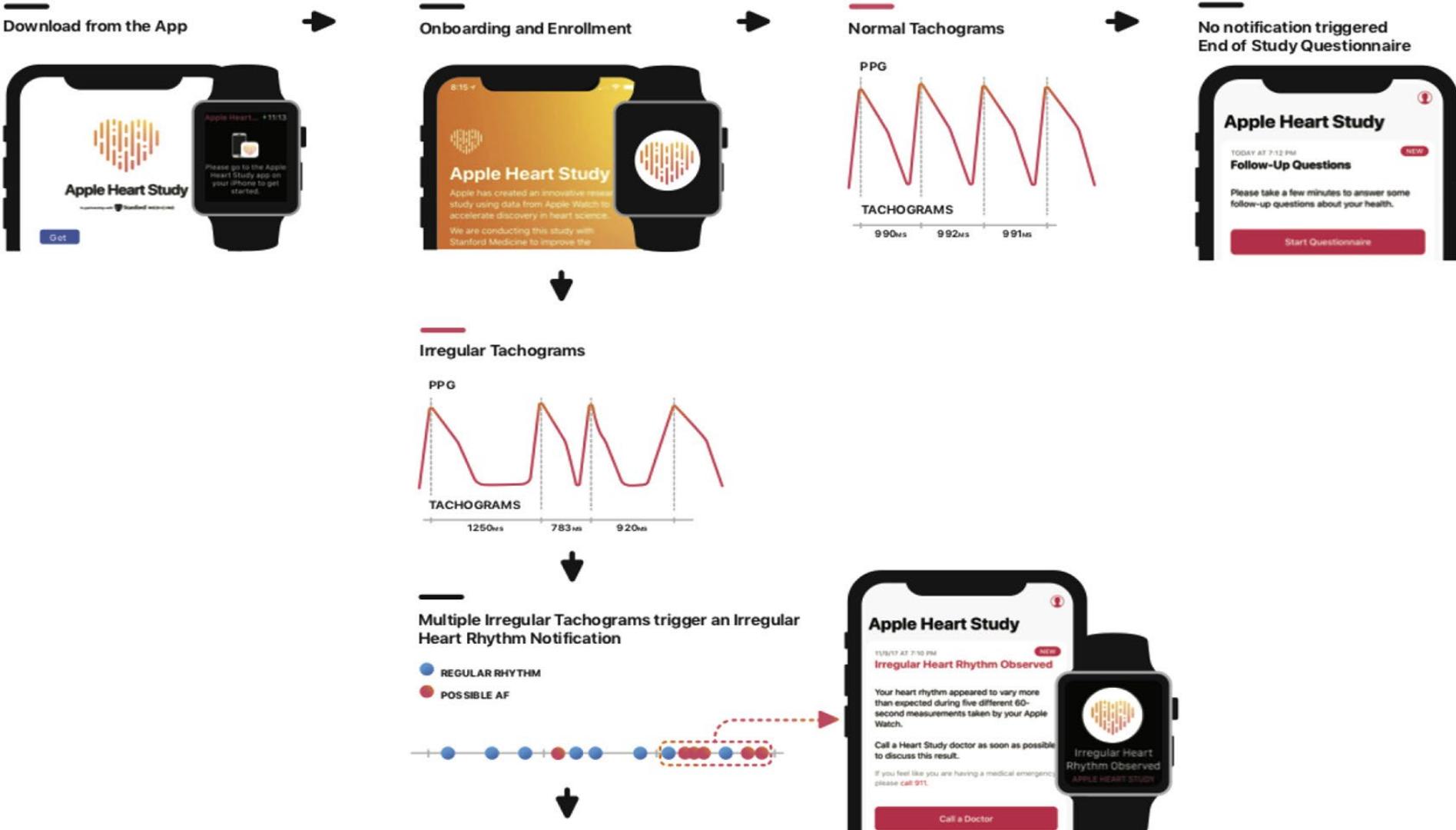


# Consumer & Pervasive Health Informatics



2019: *Rationale and Design of a Large-Scale, App-Based Study to Identify Cardiac Arrhythmias Using a Smartwatch: The Apple Heart Study - American Heart Journal*

- Mintu P. Turakhia...Marco V. Perez, Stanford University
- 419,093 smart watch users enrolled
- Measuring proportion of users with irregular pulse
- Secondary monitoring with continuous ECG device
- Goal is to provide evidence for validity of smartwatch algorithm



First video visit with Study Doctor



Eligible for ePatch



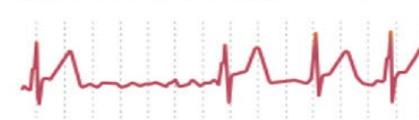
No AF/other arrhythmia on ePatch report



Second video visit with Study Doctor



AF/other arrhythmia on ePatch report



Recommend participant to proceed with usual care

90-Day Questionnaire and End of Study Questionnaire

Recommend participant to contact their healthcare provider

# Consumer & Pervasive Health Informatics



## *Large-Scale Assessment of a Smartwatch to Identify Atrial Fibrillation – N Engl J Med*

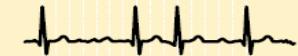
- Marco Perez...Mintu Turakhia – Stanford



Study w/ Novel Virtual Design  
419,297 in 8 months



Proportion Notified low  
Overall: 0.52% (0.49-0.54)



ECG patch 13 days after  
34% had Afib



Positive predictive value  
Tachogram: 0.71 (0.69-0.74)  
Notification: 0.84 (0.76-0.92)



57% Notified (surveyed)  
Contacted Non-Study Provider



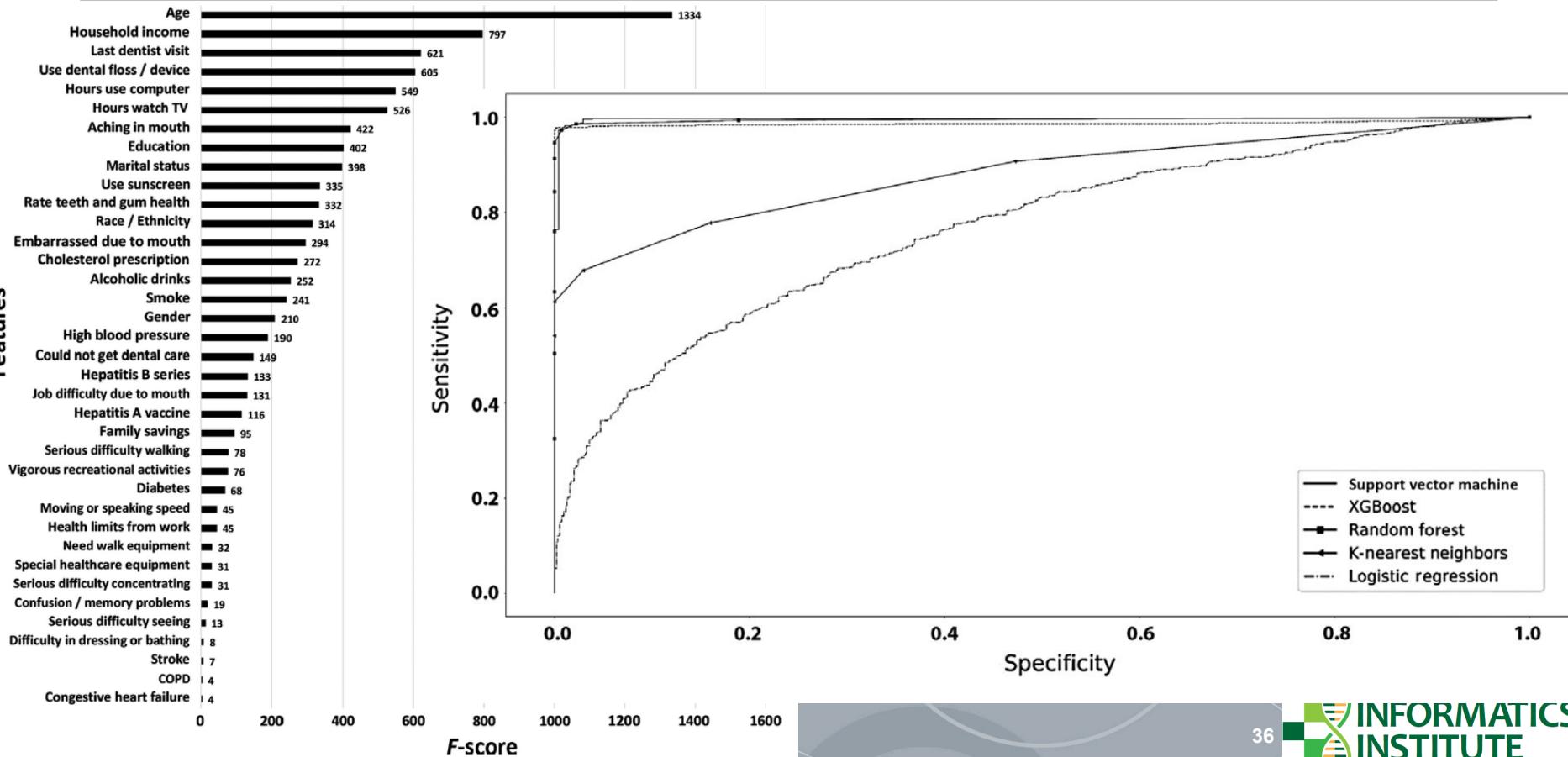
Exposure to the  
app was safe

- Relied on self-assessment of enrollment criteria and outcomes
- Fewer ECG patches than planned (decreased precision)
- Single-arm study

## *Application of machine learning for diagnostic prediction of root caries – Gerodontontology*

- Man Hung...Frank Licari – University of Minnesota
- Can dental caries be predicted with machine learning on patient database
- National Health and Nutrition Examination Survey (NHANES) used
- After excluding incomplete records, 5,135 cases and 357 variables remained

# Hung et al.: Prediction Caries in NHANES



# (Informatics) Education: 2019



*Domains, tasks, and knowledge for **clinical informatics subspecialty practice**: results of a practice analysis - J Am Med Inform Assoc*

- Howard D. Silverman...Douglas B. Fridsma, AMIA Position Paper

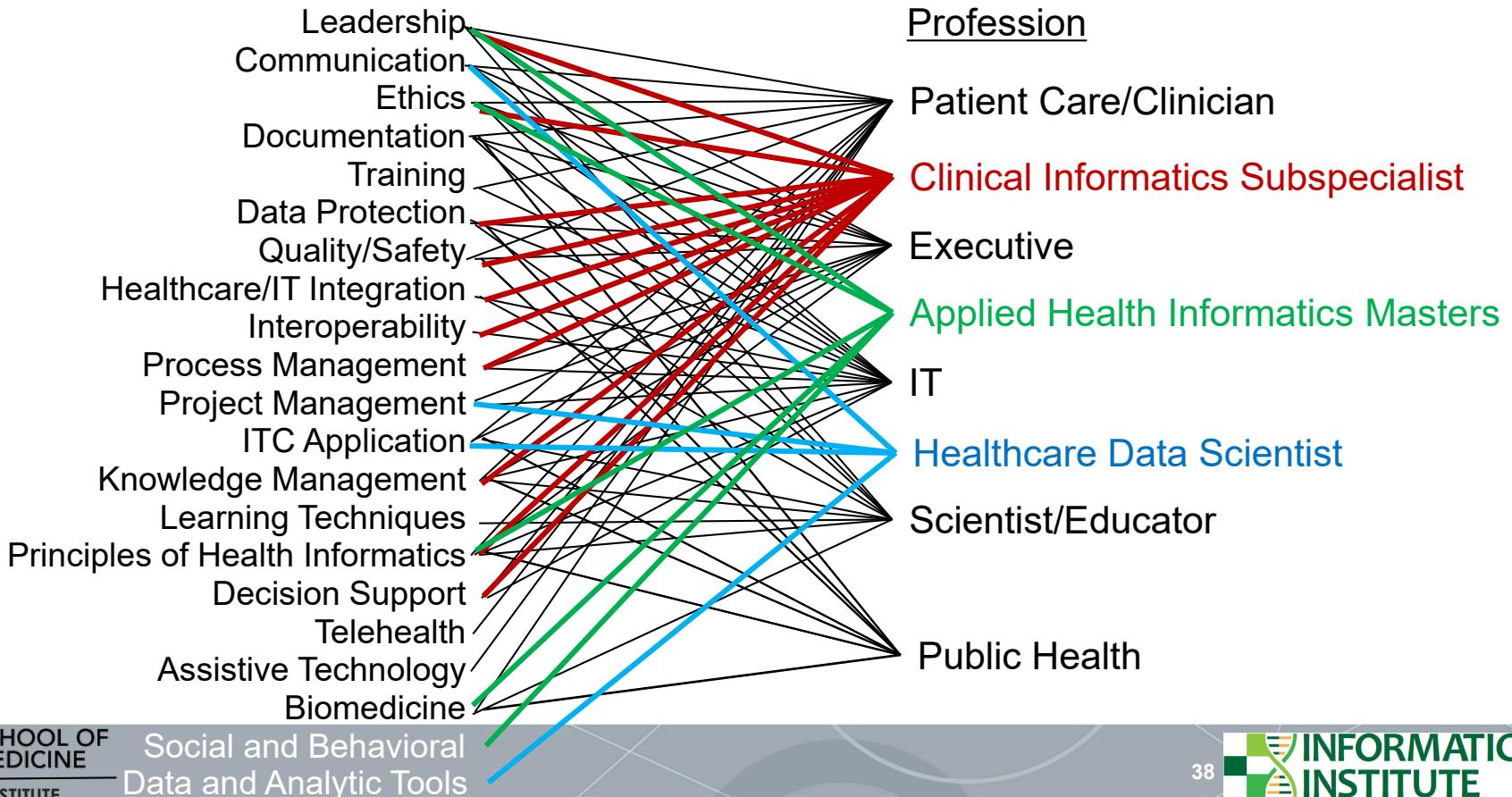
***Healthcare data scientist** qualifications, skills, and job focus: a content analysis of job postings - J Am Med Inform Assoc*

- Melanie A. Meyer, University of Massachusetts - Lowell

*AMIA Board White Paper: AMIA 2017 core competencies for **applied health informatics** education at the **master's degree** level - J Am Med Inform Assoc*

- Annette L. Valenta...Stephen B. Johnson, AMIA Position Paper

# (Informatics) Education: 2019



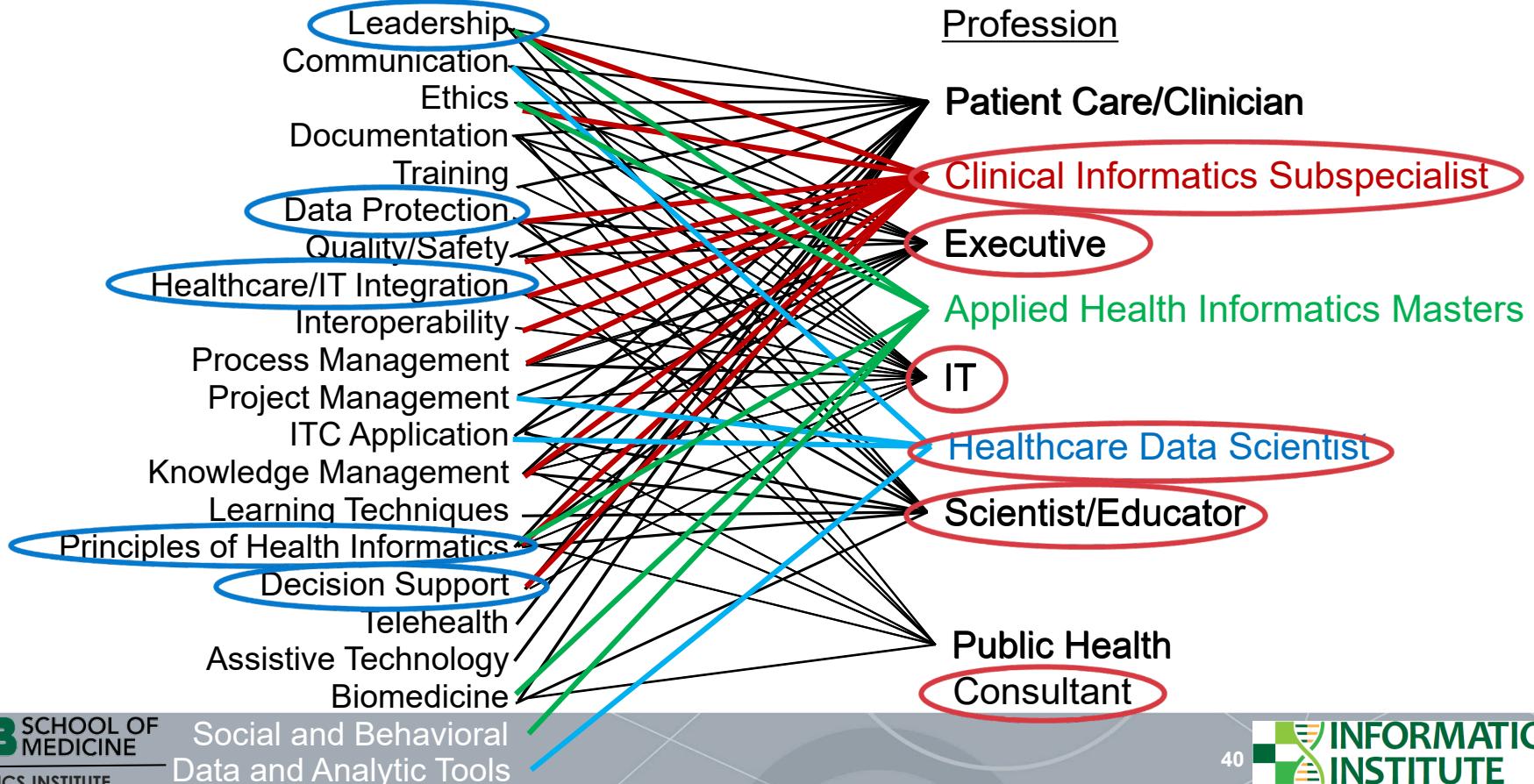
# (Informatics) Education



*Domains, tasks, and knowledge for health informatics practice: results of a practice analysis – JAMIA*

- Cynthia Gadd...Douglas Fridsma – AMIA Position Paper
- Survey of delineation of practice developed by 6 experts (authors)
- Validated through survey of 1011 health informatics practitioners
- 5 Domains
- 74 tasks
- 144 knowledge statements

# Gadd et al.: Domains of Practice



# Gadd et al.: Delineation of HI Practice



## Domain 1: Foundational Knowledge

**Health Informatics** - K002 Fundamental informatics concepts, models, and theories

**The Health System** - K027 The flow of data, information, and knowledge within the health system

## Domain 2: Enhancing Health Decision-making, Processes, and Outcomes Tasks

**Tasks** - 2.01 Develop, implement, monitor, evaluate, and maintain decision support systems to promote health care quality and enhance public health surveillance effectiveness.

**Knowledge/Skills** - K032. Clinical decision support principles and practices

## Domain 3: Health Information Systems (HIS)

**Tasks** – 23.03 Perform vendor evaluations and select product(s).

**Knowledge/Skills** - K053. System development lifecycle

## Domain 4: Data Governance, Management, and Analytics

**Tasks** – 4.07 Develop, enhance, and/or leverage scalable data architecture to store, query, retrieve, and record data from large data sets.

**Knowledge/Skills** - K090. Stewardship of data

## Domain 5: Leadership, Professionalism, Strategy, and Transformation Tasks

**Tasks** – 5.03 Develop privacy and confidentiality policies, data-use agreements and data sharing agreements.

**Knowledge/Skills** - K118. Institutional governance of health information systems

- Provides a data-driven description of HI practice to inform:
  - Education
  - Certification
  - Accreditation
  - Job description
  - Performance analysis
  - Career Choices

# (Informatics) Education



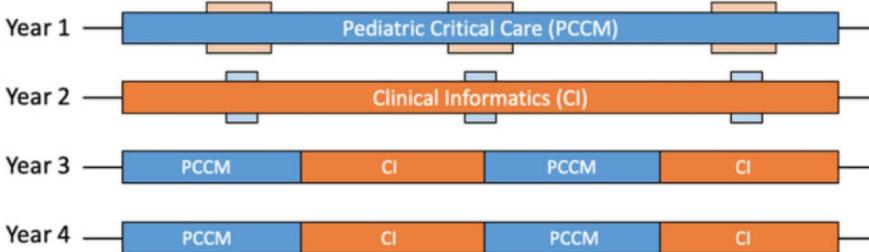
## *Early experiences with combined fellowship training in clinical informatics – JAMIA*

- Jonathan Palma...Anthony Luberti – Stanford, Boston Children's, CHOP
- Clinical informatics subspecialty requires board-certified specialty training
- Usual path is:
  - MD
  - Internship/residency
  - Board certification
  - Informatics fellowship (clinical or research/clinical)
  - Subspecialty certification
- Combined medical specialty/clinical informatics subspecialty training

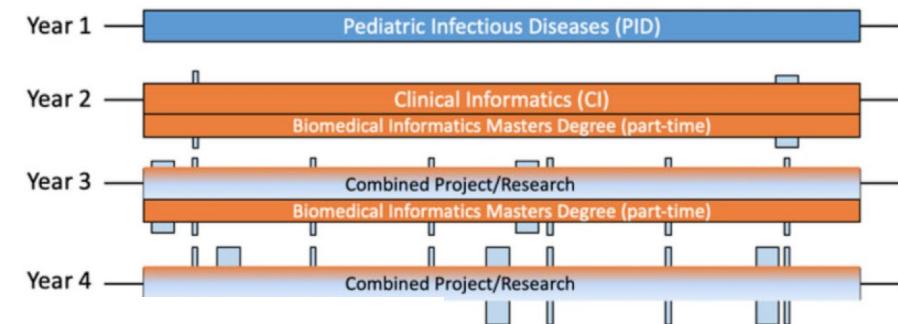
# Palma et al.: Combined Informatics Training



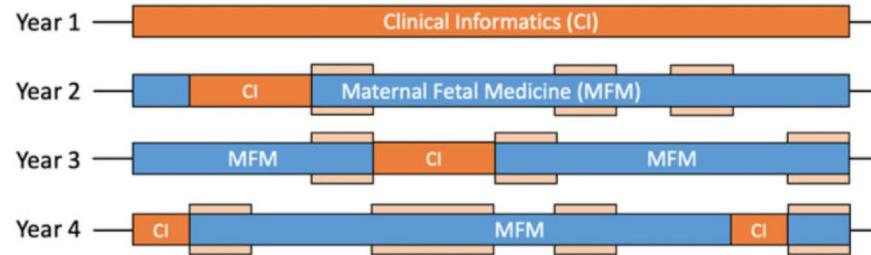
(a) Children's Hospital of Philadelphia



(b) Boston Children's Hospital



(c) Stanford University

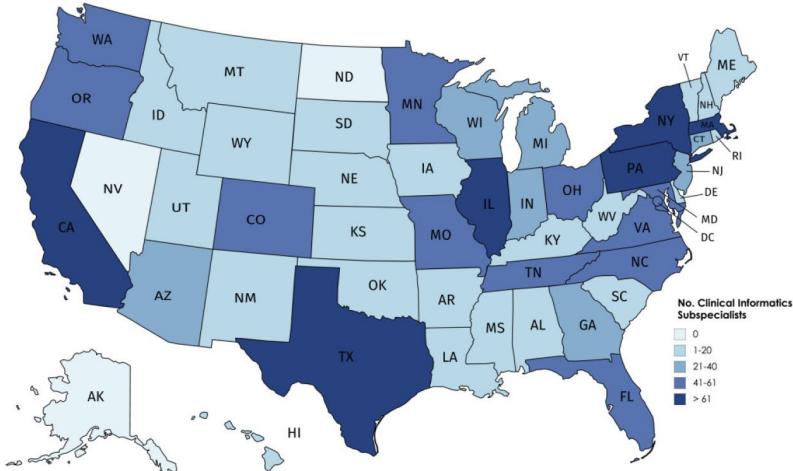


# (Informatics) Education



## Clinical informatics subspecialists: characterizing a novel evolving workforce – JAMIA

- Sheena Desai...Vinod Nambudri – Brigham



Created with mapchart.net ©

Figure 1. Geographic distribution of current clinical informatics subspecialists by US state, 2018 (N = 1730).

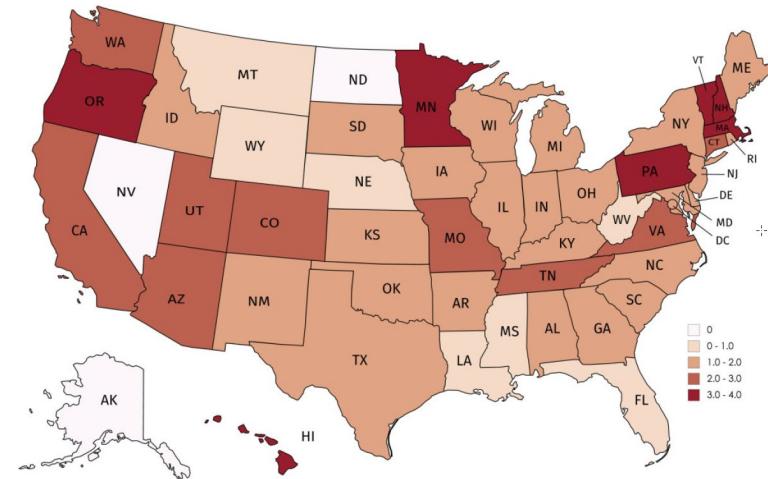


Figure 2. Number of clinical informatics subspecialists per 1000 active physicians in each US state, 2018.

# (Informatics) Education



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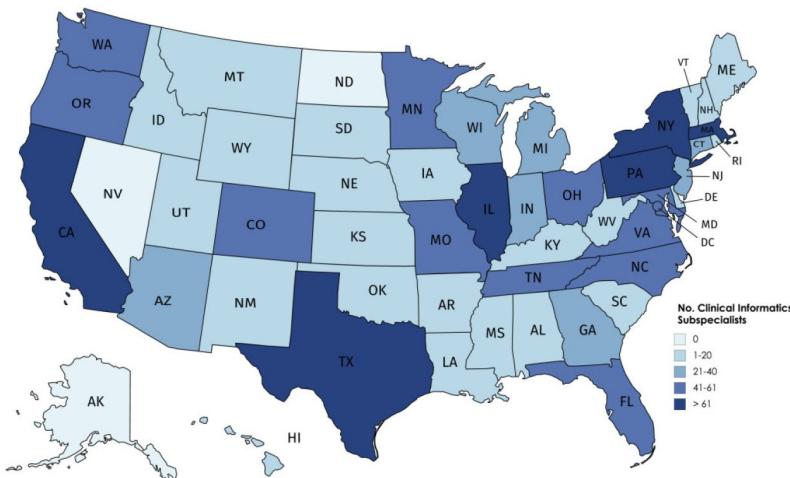


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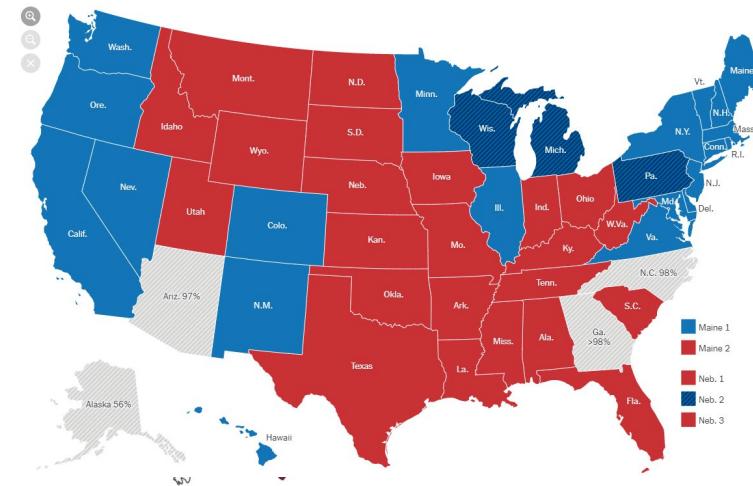


Figure 2. Number of clinical informatics subspecialists per 1000 active physicians in each US state, 2018.

# Education (Informatics)



*Lessons learned implementing a complex and innovative patient safety learning laboratory project in a large academic medical center – JAMIA*

- Alexandra Businger...Patricia Dykes – Brigham, Harvard, Northeastern, Columbia
- Develop a suite of patient- and provider-facing tools to:
  - Raise patients' awareness of safety issues and prevention strategies
  - Encourage patients to give input into their care
  - Support clinicians' monitoring of patient safety risks in real time

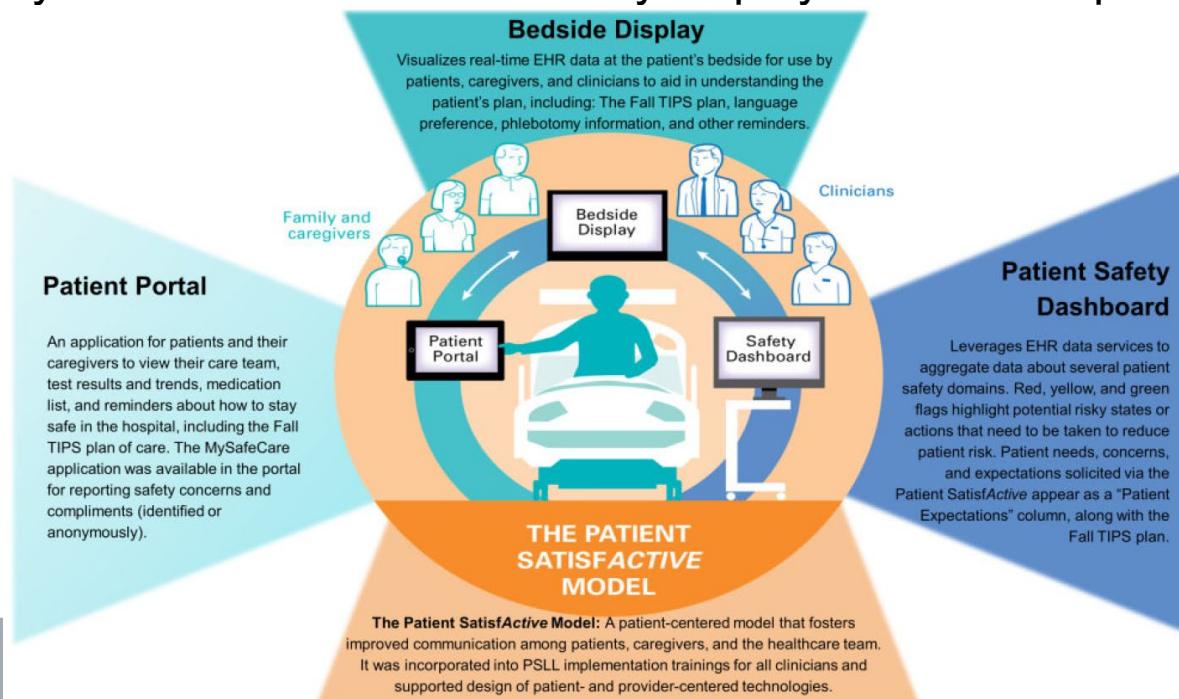
# Businger et al.: Patient Safety Learning Lab



Tailoring Interventions for Patient Safety – evidence based fall prevention protocol

MySafeCare: patient-facing tool for reporting safety concerns

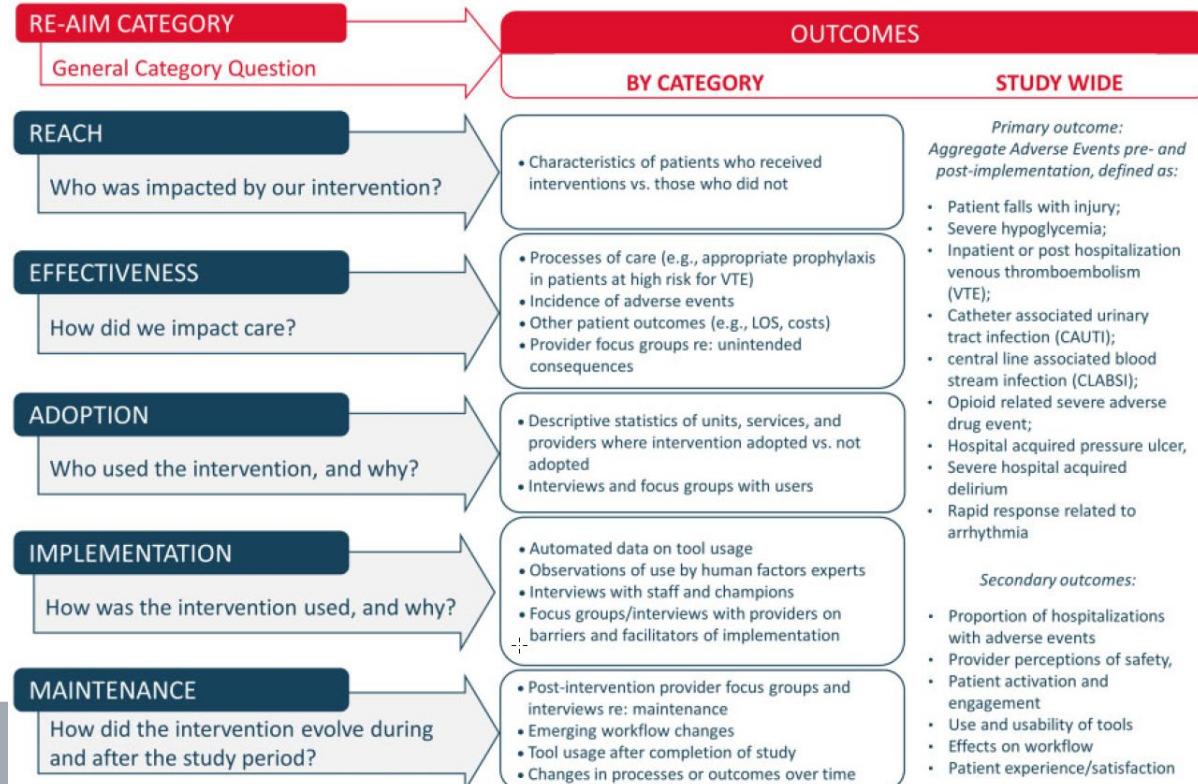
Patient Safety Dashboard: real-time safety display for interdisciplinary care team



# Businger et al.: Patient Safety Learning Lab



Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework: addressing the barriers to translation of research into practice



# Ethical, Legal and Social Issues

## *Ethics of Using and Sharing Clinical Imaging Data for Artificial Intelligence: A Proposed Framework – Radiology*

- David Larson...Curtis Langlotz - Stanford
- From Biomedical Imaging Informatics WG
- Premises:
  - Everyone is a data steward
  - Data are de-identified and aggregated
  - Patient privacy can be safeguarded
  - Patients are made aware of how (in general) their data will be used
  - Mechanisms to ensure ethical use of the data are possible

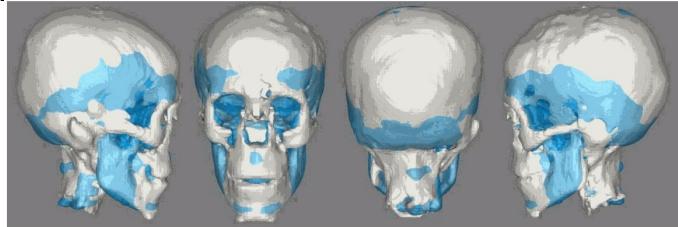


Fig.17 Model skull (blue) after this stage overlapped with mummy skull (white)

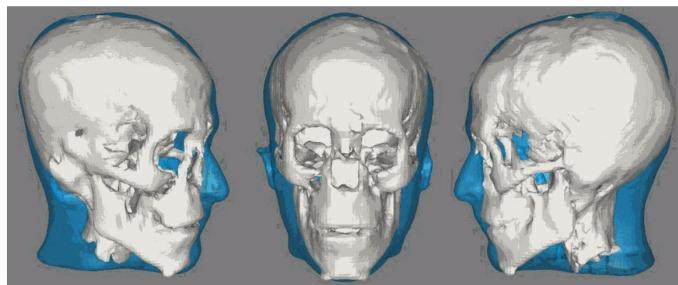


Fig.18 Model skin (blue) and mummy skull (white)

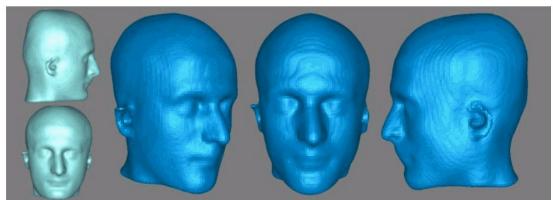


Fig.19 Face generated

# Larson et al.: Ethics of Data Sharing

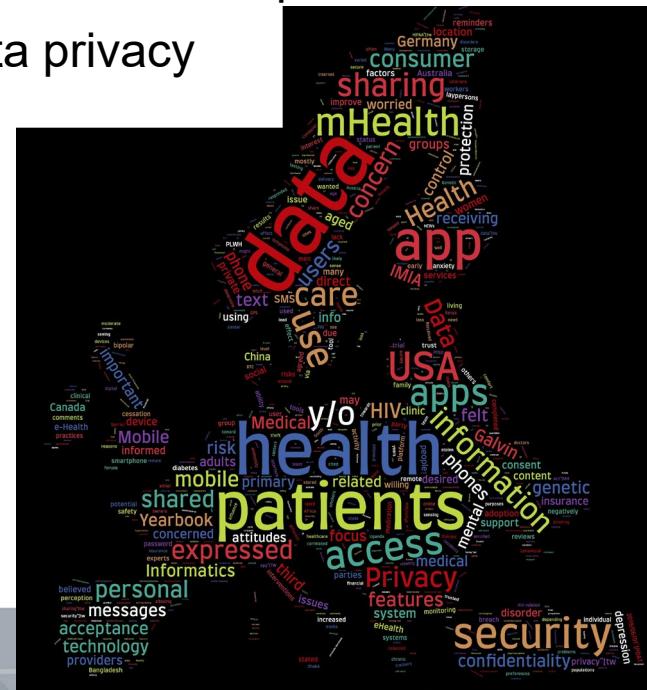
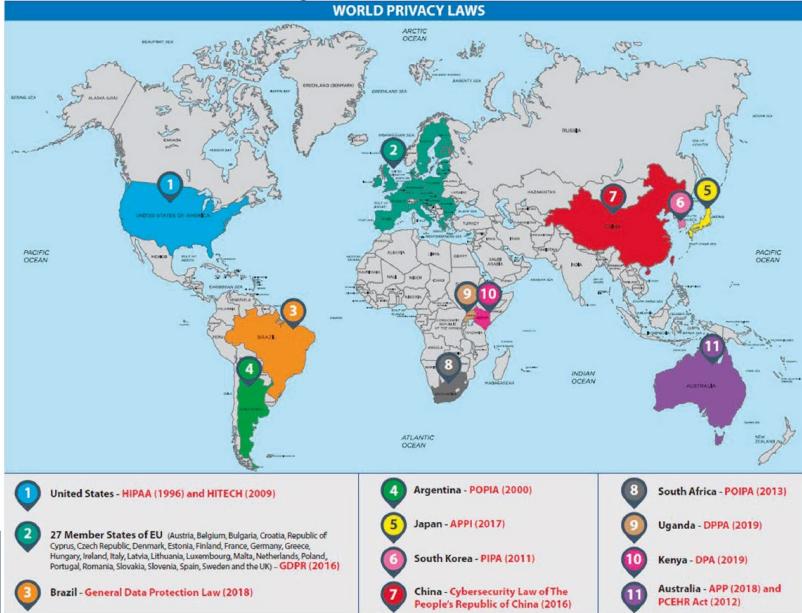


Is it ethical for providers to use data for AI?	Yes
Is patient consent required for retrospective use?	No
Should patients be able to opt out?	No
Is it appropriate for data to be widely shared?	Yes
Is it ethical for providers to sell data?	No (especially exclusively)
Is it ethical for corporations to profit from AI?	Yes (from activities, not data)
Is it ethical for providers to share data with industry?	Yes (if funding supports research, not data access)

# Ethical, Legal and Social Issues

## *Developments in Privacy and Data Ownership in Mobile Health Technologies, 2016-2019 - Yearbook of Medical Informatics*

- Hannah Galvin and Paul DeMuro – Tufts, Royal Palm Companies
- Survey of international frameworks for personal data privacy



# Evaluation

*The tradeoffs between safety and alert fatigue: Data from a national evaluation of hospital medication-related clinical decision support - JAMIA*

- Zoe Co...David Bates – Brigham and Women's Hospital
- Hospitals tested with the Computerized Physician Order Entry Tool
  - Test patients added to the EHR
  - Orders for each patient entered by prescribers
  - Orders classified as “fatal” (alert) and “nuisance” (don’t alert)
- Full demonstration of the national safety standard requires:
  - 85% of orders must be entered
  - Must alert correctly on 60% of the orders
  - Must not alert on “deception orders”

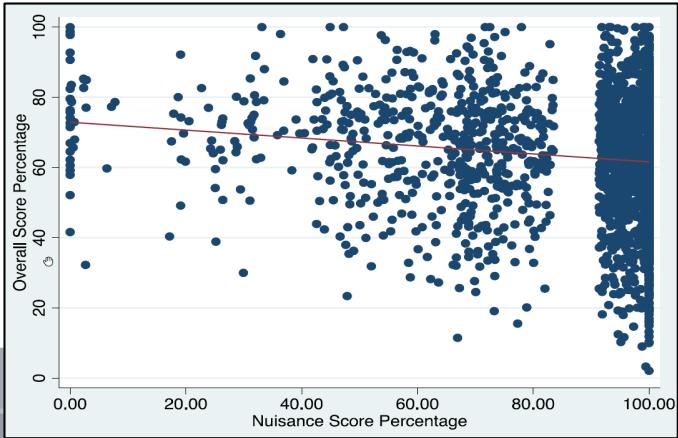
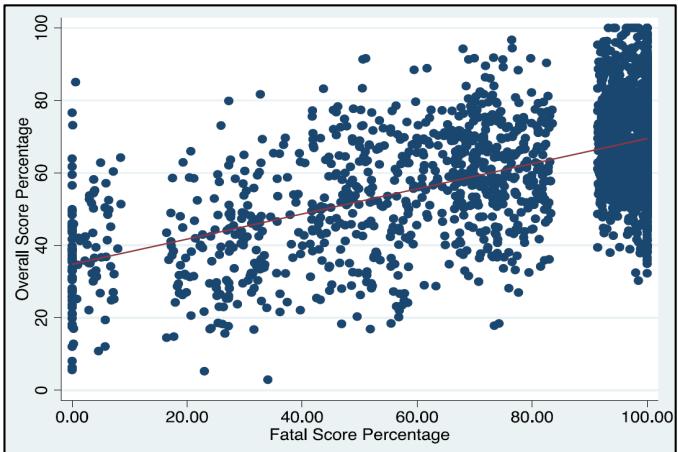
## Basic Decision Support

Order Category	Description
Drug Allergy	Medication is one for which a patient allergy has been documented
Drug Dose (Single)	Specified dose of medication exceeds the safe range for a single dose
Therapeutic Duplication	Medication combinations overlap therapeutically (same agent or class)
Drug-Drug Interaction	Medication order pairs that result in a known harmful interaction when used in combination
Drug Route	Specified route of administration is inappropriate or potentially harmful

## Advanced Decision Support

Order Category	Description
Drug Dose (Daily)	Cumulative dose of medication exceeds the safe range for daily dose
Drug Age	Medication dose inappropriate/contraindicated based on patient's age
Drug Laboratory	Medication dose inappropriate/contraindicated based on documented laboratory test results (includes renal status)
Drug Monitoring	Medication for which the standard of care includes subsequent monitoring of drug level or lab value to avoid harm
Drug Diagnosis	Medication dose inappropriate/contraindicated based on documented diagnosis

# Co et al.: Order entry Evaluation



# Evaluation: Honorable Mention

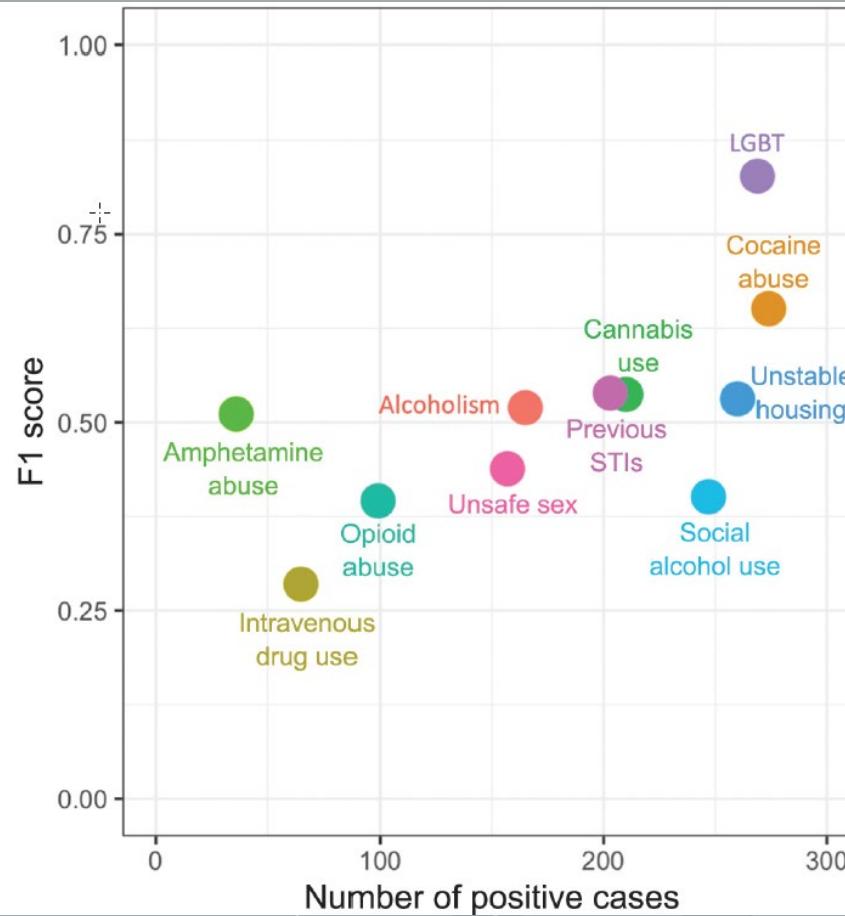


*Detecting Social and Behavioral Determinants of Health with Structured and Free-Text Clinical Data - Applied Clinical Informatics*

- Daniel Feller...Noémie Elhadad – Columbia University
- Social and behavioral determinants of health (sexual history, alcohol use, substance use, housing status) are poorly documented
- Little coded, structured data available; NLP inadequate
- F1 scores improved slightly with addition of structured data

# Feller et al.: Prevalence-Performance Relationship

AMIA  
INFORMATICS PROFESSIONALS. LEADING THE WAY.



## Telomere-to-telomere assembly of a complete human X chromosome - Nature

- Karton Miga...Adam Phillippy – UC Santa Cruz and NHGRI
- Did you think we had sequenced the entire genome? I did.
- Missing:
  - Pericentromeric satellite arrays – non-coding repeated DNA sequences
  - Exome regions with extensive segmental duplications

# Geno

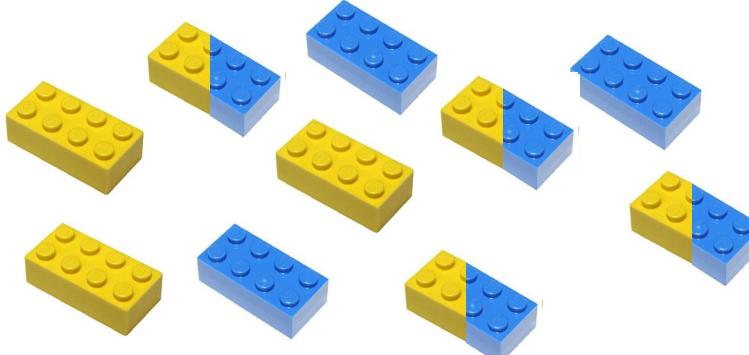


# Translational Bioinformatics AMIA INFORMATICS PROFESSIONALS. LEADING THE WAY.

## Telomeres

- Kan
  - Did yo
  - Missin
  - Per
  - Exc
- Assembly of a complete human X chromosome - Nature  
Phillippy – UC Santa Cruz and NHGRI  
sequenced the entire genome? I did.

site arrays – non-coding repeated DNA sequences  
extensive segmental duplications



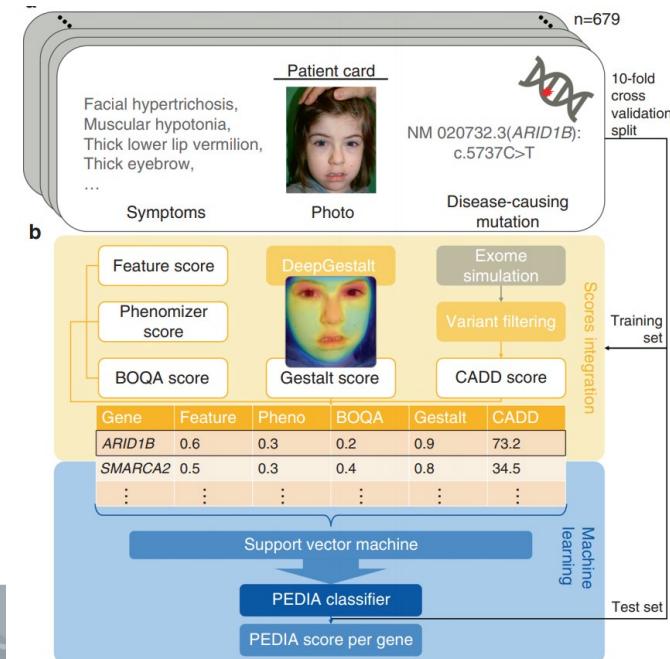


## Telomere-to-telomere assembly of a complete human X chromosome - Nature

- Karton Miga...Adam Phillippy – UC Santa Cruz and NHGRI
- Did you think we had sequenced the entire genome? I did.
- Missing:
  - Pericentromeric satellite arrays – non-coding repeated DNA sequences
  - Exome regions with extensive segmental duplications
- Method: high-coverage, ultra-long-read nanopore sequencing
- Results:
  - Reconstructed the X-chromosome centromeric satellite DNA array (3.1Mb)
  - Closed 29 gaps in the reference sequence
  - Mapped methylation patterns across complex tandem repeats and arrays

## PEDIA: prioritization of exome data by image analysis - Genetic Medicine

- Tzung-Chien Hsieh...Peter Krawitz – University of Bonn
- Phenotype information is needed for interpretation of genomic variants
- Coding by expert dysmorphologists
- What about a convolutional neural network?
- Top-1 accuracy improved 20-89%
- Top-10 accuracy improved by 5-99%



## *Artificial intelligence and the future of global health - Lancet*

- Nina Schwalbe and Brian Wahl – Columbia
- AI-driven interventions:
  - Diagnosis
  - Patient morbidity
  - Disease outbreak prediction and surveillance
  - Health policy and planning

# Global Health Informatics: EHRs and Gaps



INFORMATICS PROFESSIONALS. LEADING THE WAY.

*Understanding the challenges associated with the use of data from routine health information systems in low- and middle-income countries: A systematic review - Health Information Management*

- Klesta Hoxha...Karen Grépin – U of Waterloo (Canada), U of Hong Kong
- Most common barriers are organizational and environmental (infrastructure)

*Closing the gap in implementation of HIV clinical guidelines in a low resource setting using electronic medical records – BMC Health Services Research*

- Adrien Allorant...Nancy Puttkammer – University of Washington
- EHR data able to show deficiencies (as high as 100%) in adoption of guidelines

# Intensive Care



## *Graphical Presentations of Clinical Data in a Learning Electronic Medical Record – Applied Clinical Informatics*

- Luca Calzoni...Harry Hochheiser – University of Pittsburgh
- Model ICU physician data access patterns to predict data needs
- Literature review, observations and interviews to identify UI design themes:
  - Convey information effectively – highlighting, reference map, data panel
  - Highlight clinical outcome trends – arrows and triangles
  - Support analytic reasoning – grouping and linking



Previous

Next



Patient: John Doe

170 cm

65 kg

BMI: 22.5

Labs/Meds 152

Progress Notes 15

Radiology Reports 2

Time selector

30 Jan

31 Jan

1 Feb

2 Feb

3 Feb

4 Feb

5 Feb

All Patient Data

1 Feb | 2 Feb | 3 Feb | 4 Feb

1 Feb | 2 Feb | 3 Feb | 4 Feb

## Vitals

Systolic BP 145

CVP 13.0

Diastolic BP 95

FiO2 40.0

Mean BP 112

O2 Sat 100.0

HR 116.0

Temperature 36.6

## CBC

Hematocrit 37.2

Hgb 10.1

MCH 32.0

MCHC 34.8

MCV 92.1

MPV 11.1

RBC 3.16

Platelets 119

RDW 16.5

WBC 19.8

## Clinical Notes

UPMC Presbyterian Shadyside  
Critical Care Medicine

Date: February 4, 2017

Time: 12:40:00 PM

Patient: John Doe

MRN: 12776569

Physician: Anne M. Ray, M.D.

I am seeing this man in follow up for hypertension, atrial fibrillation, hyperglycemia, volume overload. I have examined the patient and reviewed his laboratory data. He denies complaints other than incisional pain.

Physical examination reveals a white male in no acute distress. Respiratory rate is 14, blood pressure is 145/85, heart rate 70.

Supplementary Fig. A2.1 Preliminary paper prototype 1 highlight in place. The prototype illustrates how the LEMR system could highlight highvalue patient information directly in place, in the main EMR panel. For each parameter, the green color is used in the graphs to identify in-range values, while red and blue indicate values above or below the normal range, respectively. LEMR, Learning Electronic Medical Record.



Previous

Next



Patient: John Doe

170 cm

65 kg

BMI: 22.5

Labs/Meds 152

Progress Notes 15

Radiology Reports 2

Time selector

30 Jan 31 Jan 1 Feb 2 Feb 3 Feb 4 Feb 5 Feb

## ▼ Reference Map



## Cardiovascular System !

Systolic BP 145.0 Total Cholest. 247  
Diastolic BP 95.0 LDL Cholest. 175  
Hematocrit 37.2 HDL Cholest. 39  
Sodium 146 Triglycerides 144  
Potassium 4.6

Show in-range labs



## Respiratory System ✓

All labs are in range

Show in-range labs



## Renal System !

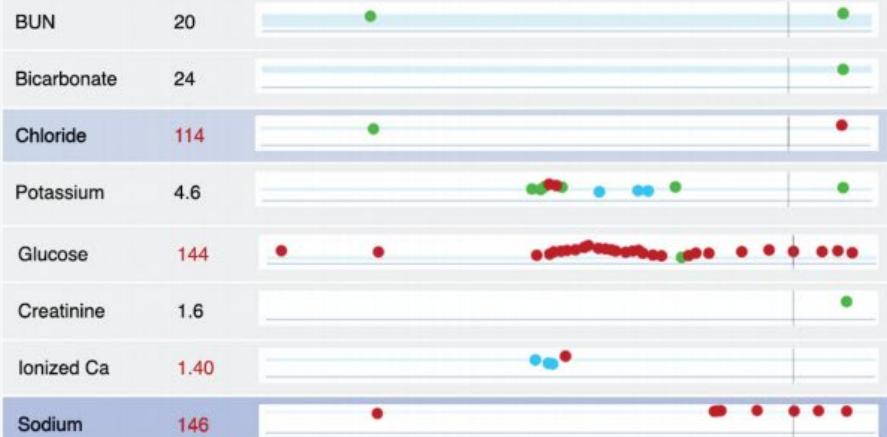
BUN 20 Glucose 144  
Bicarbonate 24 Creatinine 1.6  
Chloride 114 Ionized Ca 1.40

Show in-range labs

## All Patient Data

1 Feb 2 Feb 3 Feb 4 Feb

## Basic Chemistry



## Clinical Notes

UPMC Presbyterian Shadyside Critical Care Medicine

Date: February 4, 2017  
Time: 12:40:00 PM

Patient: John Doe  
MRN: 12776569  
Physician: Anne M. Ray, M.D.

I am seeing this man in follow up for hypertension, atrial fibrillation, hyperglycemia, volume overload. I have examined the patient and reviewed his laboratory data. He denies complaints other than incisional pain. Physical examination reveals a white male in no acute distress.

Supplementary Fig. A2.2 Preliminary paper prototype 2: reference map. The prototype illustrates how the LEMR system could highlight highvalue patient information using a reference map pointing to data items predicted to be of interest. In a panel on the left, links to high-value data items are organized by organ system. In-range labs are not displayed by default, to avoid information overload. All patient lab results will be displayed in the main panel. The reference map highlights the most important lab results for the physician to quickly assess patient status.

Labs/Meds 152

Progress Notes 15

Radiology Reports 2

Time selector

30 Jan

31 Jan

1 Feb

2 Feb

3 Feb

4 Feb

5 Feb

**Highlighted Data**

1 Feb | 2 Feb | 3 Feb | 4 Feb

1 Feb | 2 Feb | 3 Feb | 4 Feb

Systolic BP 145.0



Warfarin



Diastolic BP 95.0



Azithromycin



Hematocrit 37.2



INR 1.40



Sodium 146



Potassium 4.6



Ionized Ca 1.40



Creatinine 1.6



Accupril



Total Cholesterol 247



LDL Cholesterol 175



HDL Cholesterol 39

**Clinical Notes**UPMC Presbyterian Shadyside  
Critical Care MedicineDate: February 4, 2017  
Time: 12:40:00 PMPatient: John Doe  
MRN: 12776569  
Physician: Anne M. Ray, M.D.

I am seeing this man in follow up for hypertension, atrial fibrillation, hyperglycemia, volume overload. I have examined the patient and reviewed his laboratory data. He denies complaints other than incisional pain.

Physical examination reveals a white male in no acute distress.

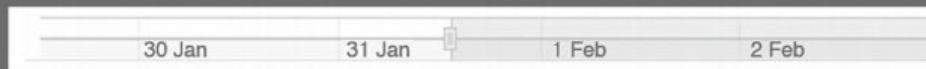
Supplementary Fig. A2.3 Preliminary paper prototype 3 highlight area. The prototype illustrates how the LEMR system could utilize a “highlighted data” dedicated panel for the display of high-value information. Arrows and triangles next to select lab test results (cholesterol, in this figure) are used to indicate the presence of uptrends and downtrends in the data. For each parameter, the green color is used in the graphs to identify in-range values, while red and blue indicate values above or below the normal range, respectively. In the “highlighted data” panel, related lab tests, vital signs, and medication data (e.g., systolic blood pressure and accupril, an angiotensin converting

Labs/Meds 152

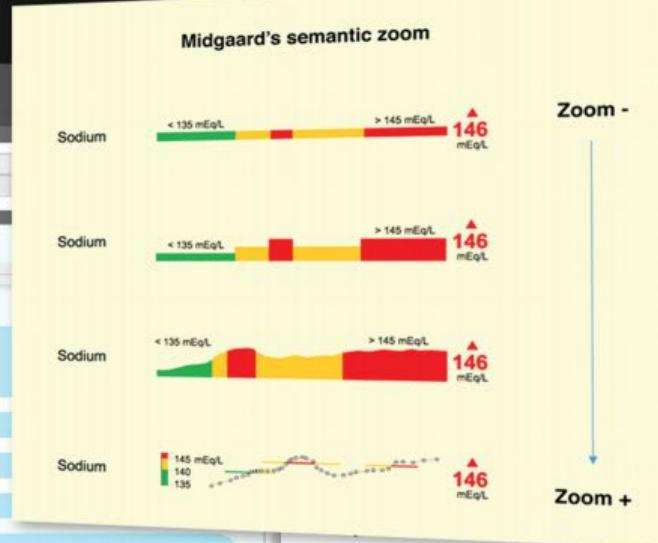
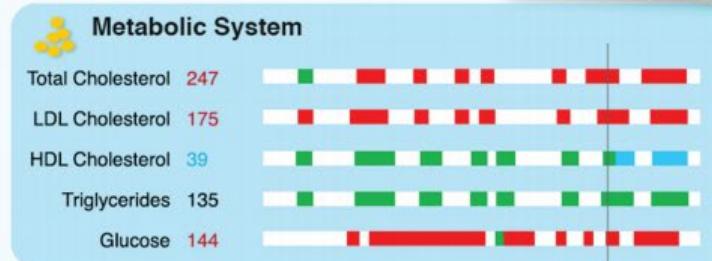
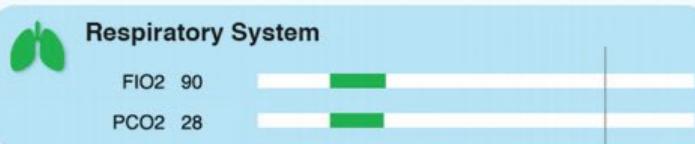
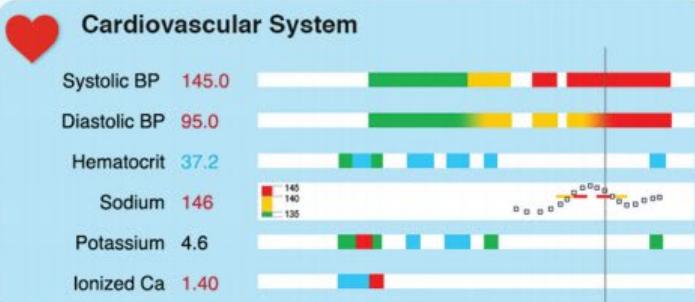
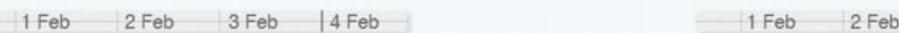
Progress Notes 15

Radiology Reports 2

Time selector



## ▼ Highlighted Data



I am seeing this man in follow up for hypertension, atrial fibrillation, hyperglycemia, volume overload. I have examined the patient and reviewed his laboratory data.

He denies complaints other than incisional pain.

Physical examination reveals a white male in no acute distress.

Respiratory rate is 14, blood

Supplementary Fig. A2.4 Preliminary paper prototype 4: semantic zoom. The prototype illustrates how the LEMR system could use Midgaard's semantic zoom<sup>27</sup> (a method that allows the visualization of variables at different levels of detail by changing the zoom level) to summarize clinical information. As displayed in the yellow box on the right (which was superimposed on the prototype for illustrative purposes, and does not represent an actual component of the LEMR user interface), Midgaard's semantic zoom technique allows to visualize variables at levels of detail that

*Effect of a Machine Learning-Derived Early Warning System for Intraoperative Hypotension vs Standard Care on Depth and Duration of Intraoperative Hypotension During Elective Noncardiac Surgery: The HYPE Randomized Clinical Trial - JAMA*

- Marije Wijnberge...Denise Veelo – Amsterdam University Medical Center
- Early warning system – machine learning on 23 arterial waveform variables
- Patients undergoing elective non-cardiac surgery randomized to receive warnings

Patient undergoing elective noncardiac surgery under general anesthesia

Hypotension Prediction Index (HPI) 50%-85%

Advice ▶ Diagnose cause

HPI > 85% or mean arterial pressure < 65 mm Hg

Advice ▶ Start treatment within 2 min

Presence of ≥2 criteria below

- Dynamic arterial elastance decrease
- Systemic vascular resistance decrease
- Stroke volume variation increase

Yes

Interpretation

Most likely cause:  
**vasoplegia<sup>a</sup>**

Start treatment

Evaluate treatment

- Dynamic arterial elastance
- Systemic vascular resistance
- Stroke volume variation
- Stroke volume
- Delta pressure over delta time
- HPI
- Mean arterial pressure

Presence of ≥2 criteria below

- Dynamic arterial elastance increase
- Stroke volume variation increase
- Stroke volume decrease

Yes

Interpretation

Most likely cause:  
**hypovolemia**

Presence of 3 criteria below

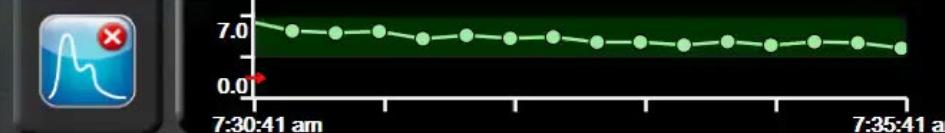
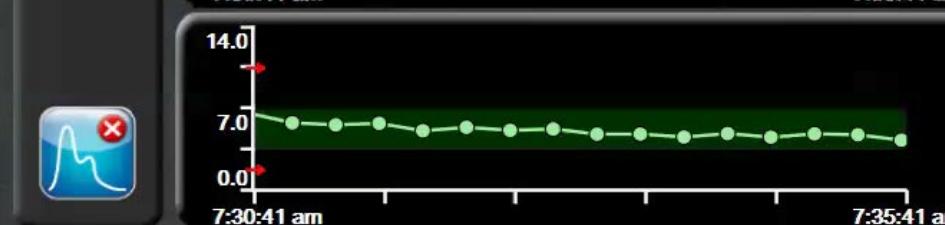
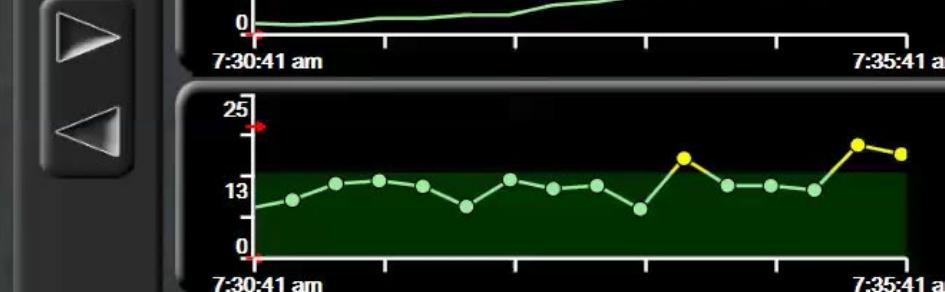
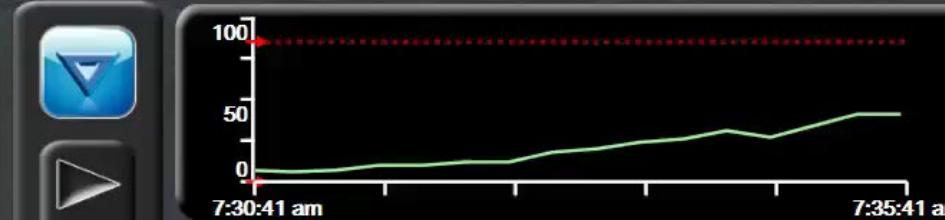
- Systemic vascular resistance equal or increase
- Stroke volume variation equal
- Stroke volume decrease

Yes

Interpretation

Most likely cause:  
**impaired contractility<sup>b</sup>**

Treat hypotension without advice



7:35:43 am | 08/07/2017 | FloTrac | 20 | BT: 36.4°C | 🔒

Alarm DIA is below low limit

*Effect of a Machine Learning-Derived Early Warning System for Intraoperative Hypotension vs Standard Care on Depth and Duration of Intraoperative Hypotension During Elective Noncardiac Surgery: The HYPE Randomized Clinical Trial - JAMA*

- Marije Wijnberge...Denise Veelo – Amsterdam University Medical Center
- Early warning system – machine learning on 23 arterial waveform variables
- Patients undergoing elective non-cardiac surgery randomized to receive warnings
- Median minutes in hypotension: 8.0 intervention, 32.7 control
- Adverse events resulting in death: 0 intervention, 2 (7%!) control

# Knowledge Discovery and Data Mining

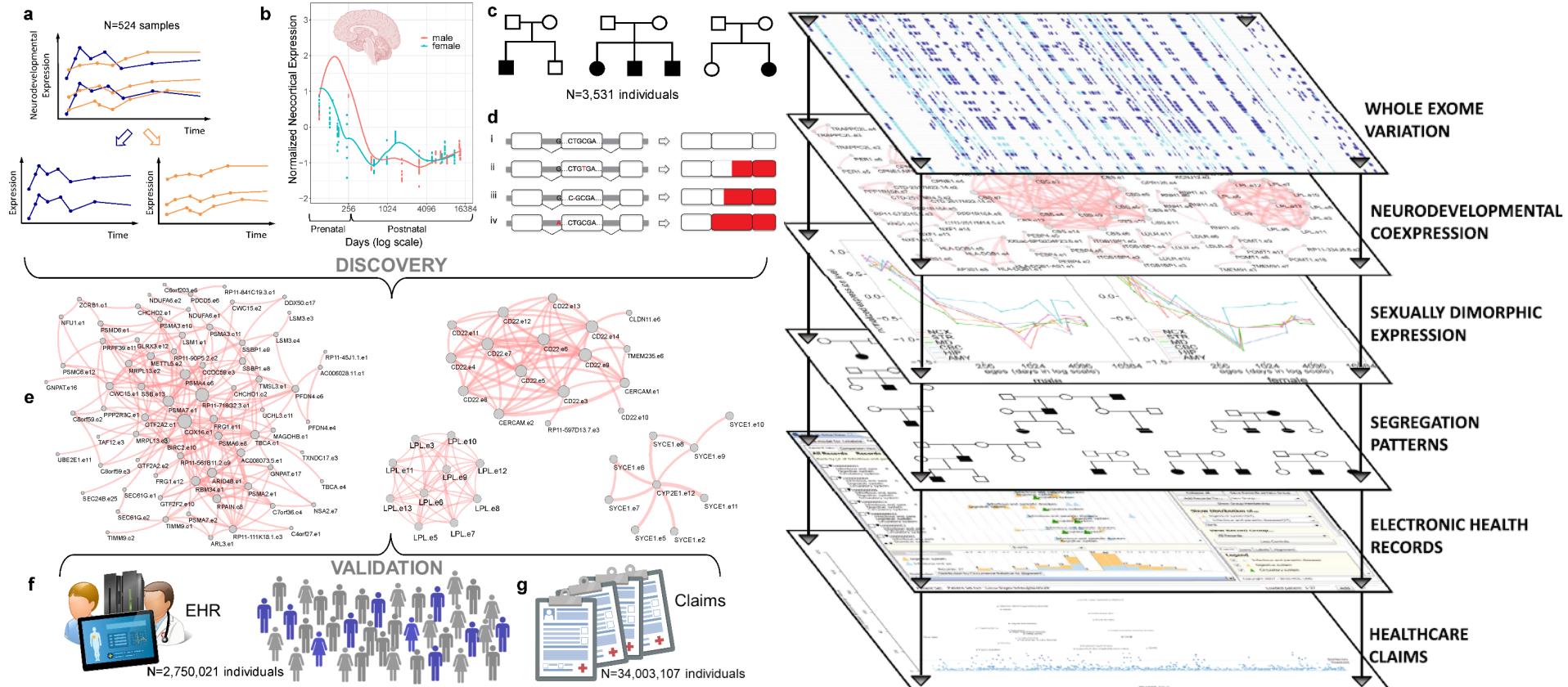


*A multidimensional precision medicine approach identifies an autism subtype characterized by dyslipidemia - Nature Medicine*

- Yuan Luo...Isaac Kohane – Northwestern U...Harvard
- No one type of data can provide complete personalization
- This study: insurance claims, EHRs, family WES, gene expression patterns
- Smith-Lemli-Opitz Syndrome: rare autism spectrum disorder with dyslipidemia
- This study: non-syndromic association of ASD and dyslipidemia

Luo et al.: Autism Subtype with Dyslipidemia  AMIA  
INFORMATICS PROFESSIONALS. LEADING THE WAY

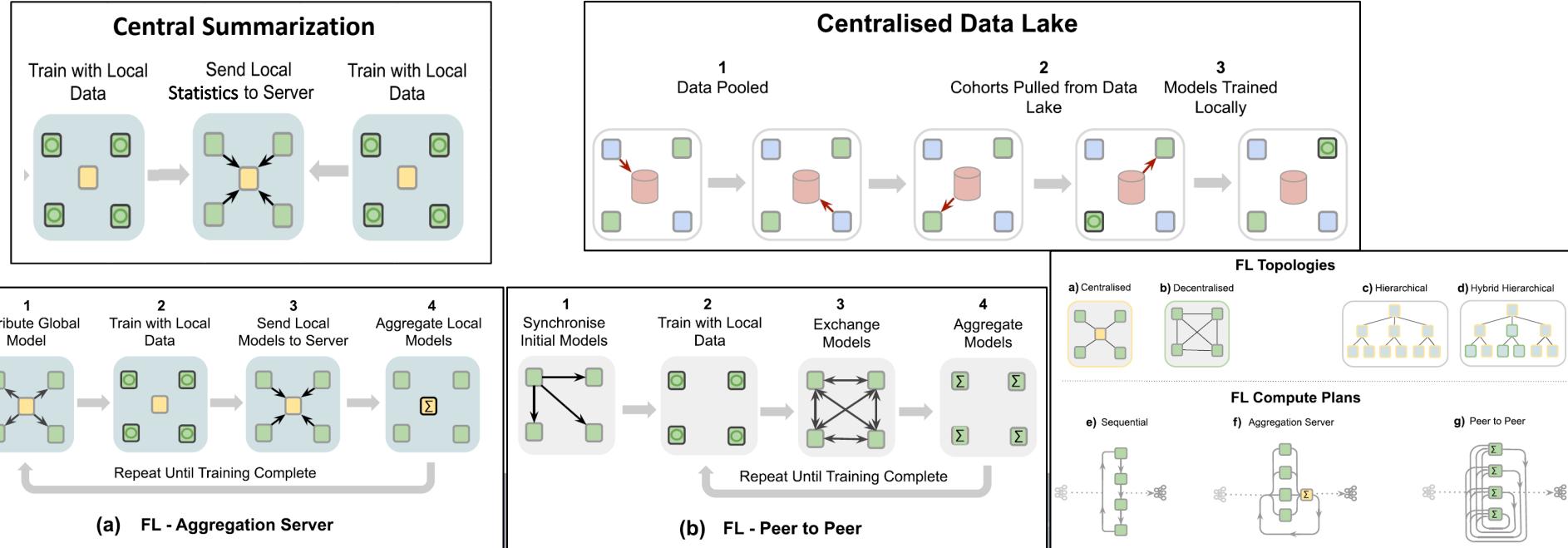
**AMIA**  
INFORMATICS PROFESSIONALS. LEADING THE WAY



# Knowledge Discovery and Data Mining

## The future of digital health with federated learning - npj Digital Medicine

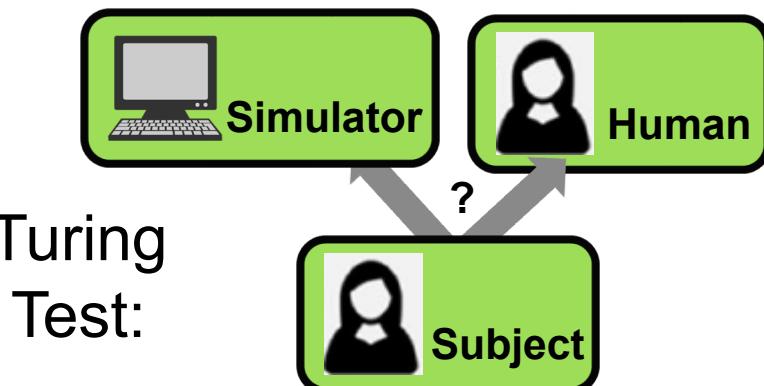
- Nicoal Rieke...M. Jorge Cardoso – NVIDIA and others
- Federated learning overcomes privacy, bandwidth and population size issues



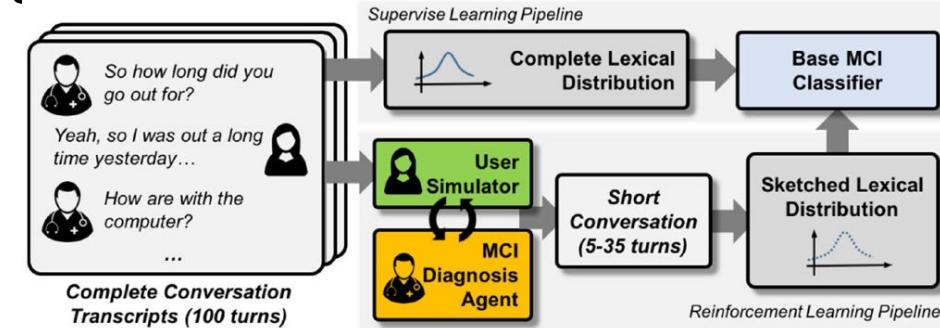
# Natural Language Processing

*Scalable diagnostic screening of mild cognitive impairment using AI dialogue agent - Scientific reports*

- Fengyi Tang...Jiayu Zhou  
– Michigan State



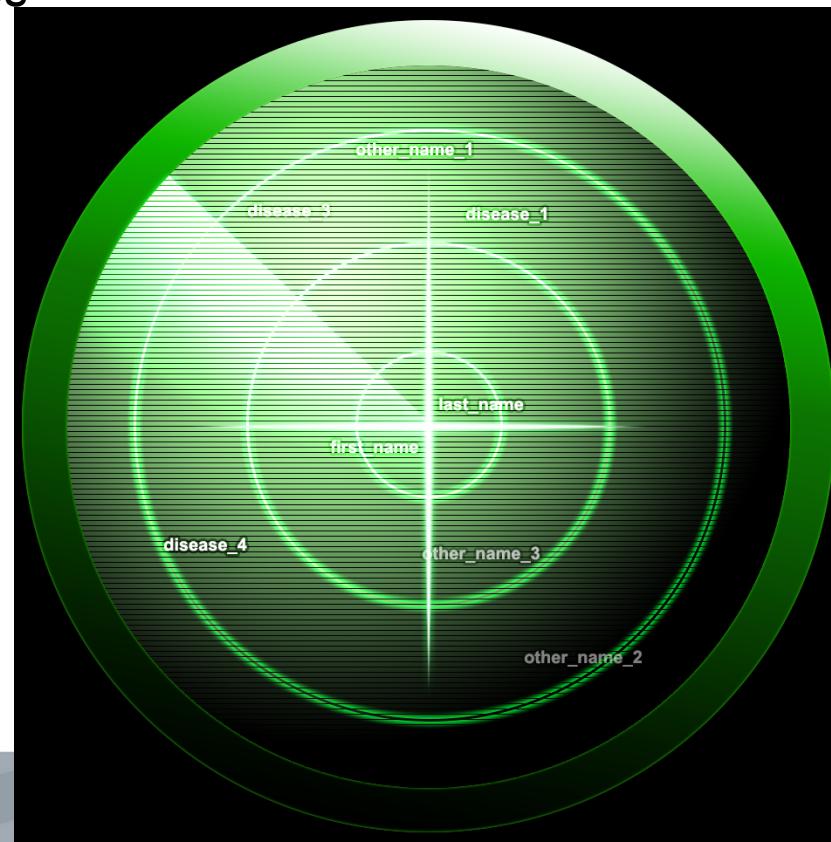
Turing  
Test:



Reverse  
Turing  
Test:

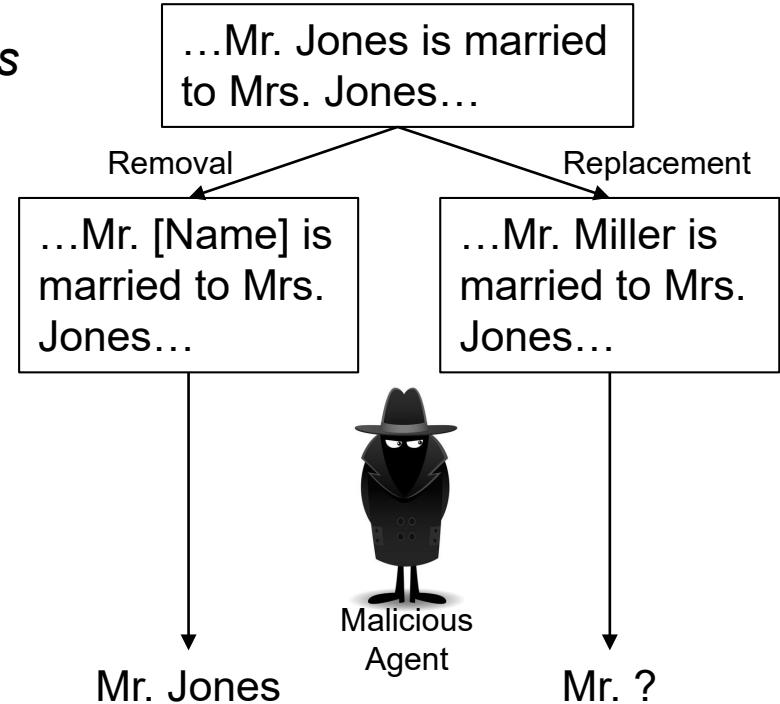
# Natural Language Processing

- *Exploring the Privacy-Preserving Properties of Word Embeddings: Algorithmic Validation Study - J Med Internet Res*
  - Mohamed Abdalla...Frank Rudzicz – University of Toronto
  - Word embeddings: numeric vectors for representing language in neural nets



# Natural Language Processing

- *Exploring the Privacy-Preserving Properties of Word Embeddings: Algorithmic Validation Study - J Med Internet Res*
  - Mohamed Abdalla...Frank Rudzicz – University of Toronto
  - Word embeddings: numeric vectors for representing language in neural nets
  - Able to reconstruct up to 68.5% of names
  - Authors recommend replacement



# Natural Language Processing



*Kinkead L, Allam A, Krauthammer M (2020). AutoDiscern: rating the quality of online health information with hierarchical encoder attention-based neural networks - BMC Med Inform Decis Mak*

- Laura Kinkead, Ahmed Allam, Michale Krauthammer – University of Zurich

# NLP: DISCERN Criteria

Charnock D, Shepperd S, Needham G, Gann R. DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. J Epidemiol Community Health. 1999 Feb;53(2):105-11.

## IS THE PUBLICATION RELIABLE?

1. Are the aims clear?
2. Does it achieve its aims?
3. Is it relevant?
4. Is it clear what sources of information were used to compile the publication?
5. Is it clear when the information used or reported in the publication was produced?
6. Is it balanced and unbiased?
7. Does it provide details of additional sources of support and information?
8. Does it refer to areas of uncertainty

## HOW GOOD IS THE QUALITY OF INFORMATION ON TREATMENT CHOICES?

9. Does it describe how each treatment works?
10. Does it describe the benefits of each treatment?
11. Does it describe the risks of each treatment?
12. Does it describe what would happen if no treatment is used?
13. Does it describe how the treatment choices affects overall quality of life?
14. Is it clear that there may be more than one possible treatment choice?
15. Does it provide support for shared decision-making?

## OVERALL RATING OF THE PUBLICATION

16. Based on the answers to all of the above questions, rate the overall quality of the publication as a source of information about treatment choices. (Serious or extensive shortcomings, Potentially important but not serious shortcomings, Minimal shortcomings)

# Kinkead et al.: Automating DISCERN Criteria

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The screenshot shows a web browser window with the URL <https://www.paddisonprogram.com/how-irina-overpowered-rheumatoid-arthritis-with-the-paddison-program/>. The page title is "How Irina Overpowered Rheumatoid Arthritis with the Paddison Program". Below the title is a photo of a woman (Irina) and a man (Clint). To the right is a search bar and a "Disclaimer" section. At the bottom is a green button with white text: "Get FREE email training from Clint Paddison!". A large red circle with a white "X" is overlaid on the top right corner of the browser window.

## This article:

- X Does not name its sources**
- ✓ Describes the **benefits** of the treatment**
- X Does not describe the **risks** of the treatment.**

# Kinkead et al.: Automating DISCERN Criteria



The screenshot shows a web browser displaying the WebMD website at <https://www.webmd.com/arthritis/arthritis-basics#1>. The main title is "The Basics of Arthritis". The page includes a sidebar with links to various health topics like Arthritis Home, News, Reference, Slideshows, Quizzes, Videos, Questions & Answers, Message Board, Medications, Drug Interaction Checker, and Pill Identifier. Below the main title, there's a section titled "IN THIS ARTICLE" with links to Causes, Symptoms, Types of Arthritis, When to See a Doctor, How It's Diagnosed, Treatments, and Manage Your Arthritis. To the right, there's a "TODAY ON WEBMD" section with links to "Easy Exercises for Joint Health", "What Triggers Gout?", "Tips to Keep Joints Healthy", and "Assess Yourself". A green circle with a checkmark is overlaid on the top right of the screenshot.

## This article:

- ✓ Does name its **sources**
- ✓ Describes the **benefits** of each treatment
- ✓ Describes the **risks** of the treatment.

# Kinkead et al.: Automating DISCERN Criteria

AMIA  
INFORMATICS PROFESSIONALS. LEADING THE WAY.

The screenshot shows a WebMD article titled "The Basics of Arthritis". The page includes a sidebar with links to "ARTHROSIS HOME", "RELATED TO ARTHRITIS", and various medical conditions. The main content discusses the definition of arthritis, its causes, symptoms, types, diagnosis, treatment, and management. A sidebar on the right provides links to related articles like "Easy Exercises for Joint Health" and "What Triggers Gout?". The URL is https://www.webmd.com/arthritiss/arthritiss-basics#1.

## This article:

- ✓ States the **currency** of the information

Based on this sentence:

Last edited: 01 August 2012

- ✓ Describes how the treatment works.

Based on this sentence:

Monoclonal antibody therapy uses antibodies made in the laboratory from a single type of immune system cell.

- ✓ Names its **sources**

Based on this sentence:

Clinical Primer of Rheumatology, Lippincott Williams and Wilkens, edited by William Koopman, et al., 2003

# Natural Language Processing



*Kinkead L, Allam A, Krauthammer M (2020). AutoDiscern: rating the quality of online health information with hierarchical encoder attention-based neural networks - BMC Med Inform Decis Mak*

- Laura Kinkead, Ahmed Allam, Michale Krauthammer – University of Zurich

“Overall, the neural network based models achieved 81% and 86% average accuracy at 100% and 80% coverage, respectively, compared to 94% manual rating accuracy.”

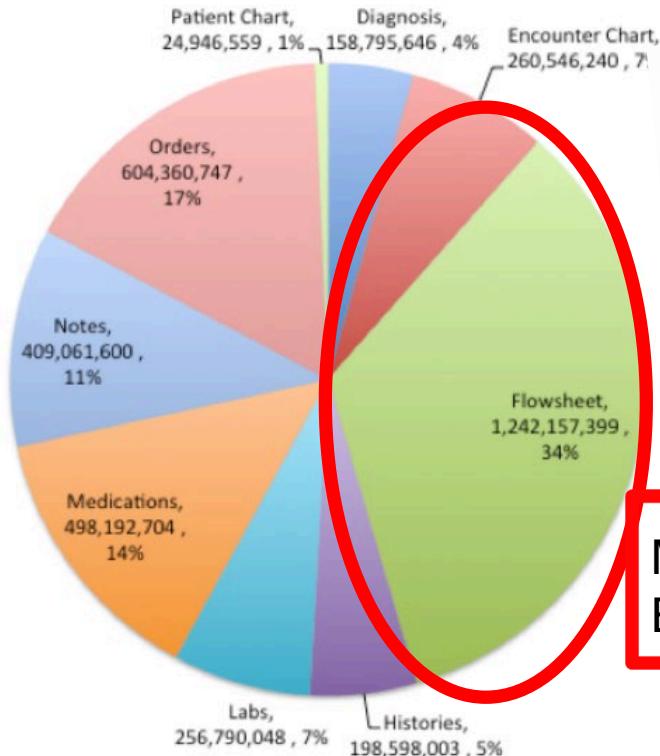
# Nursing Informatics



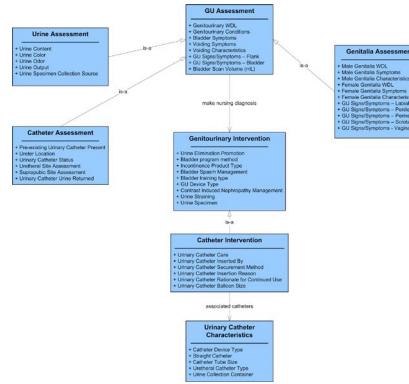
*Machine Learned Mapping of Local EHR Flowsheet Data to Standard Information Models using Topic Model Filtering - AMIA Symposium*

- Steven Johnson, Lisiane Pruinelli, Bonnie Westra – U of Minnesota

34% of EHR observations are structured, but most not coded



## Develop Information Model



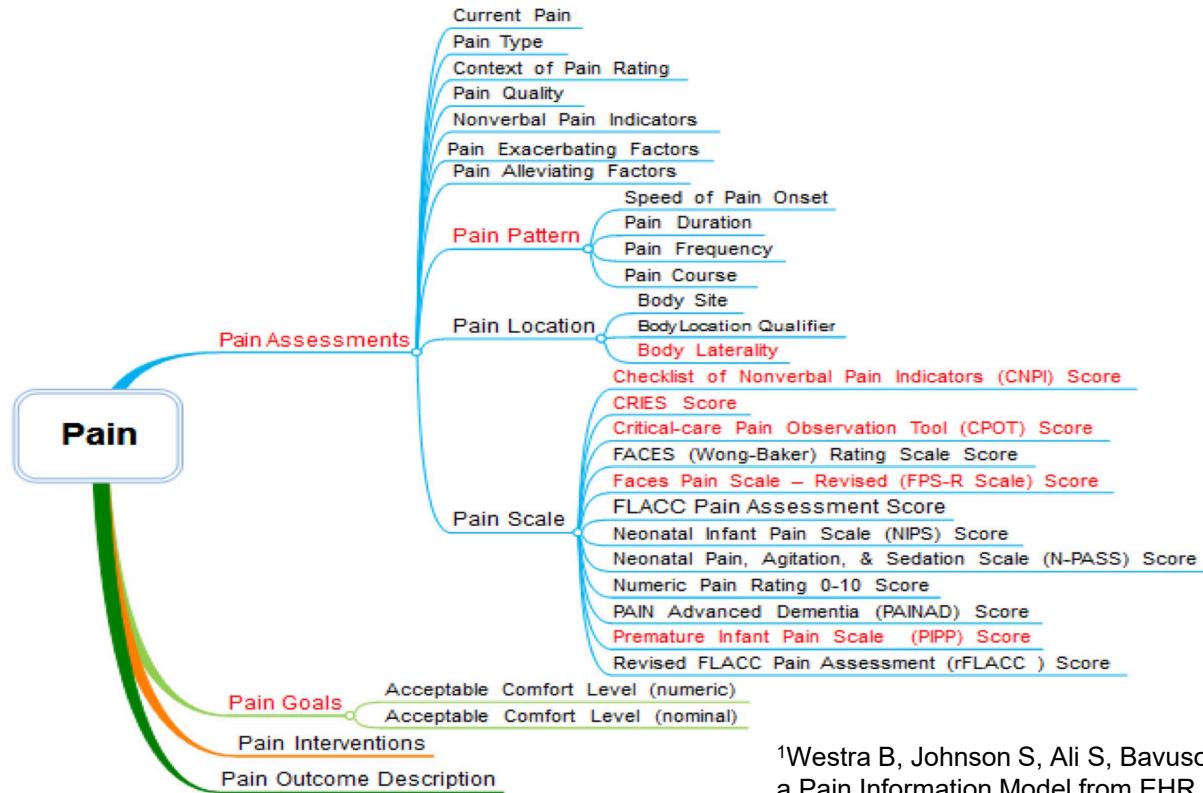
Submit for coding

Wait



LOINC	Longname	Component	Property	Timing	System	Rate	Method	edit2000units
4501-3	Hemostat [Volume Fraction] of blood by Automated count	Hemostat	VFR	m	Wt	Qn	Automated count	%
4501-3	Hemostat [Volume Fraction] of blood	Hemostat	VFR	m	Wt	Qn		%
21190-3	Hemostat [Volume Fraction] of blood by impedance	Hemostat	VFR	h	Wt	Qn	Impedance	%
3650-3	Hemostat [Volume Fraction] of blood by Coagulation	Hemostat	VFR	h	Wt	Qn	Coag.	%
21190-3	Hemostat [Volume Fraction] of body fluid	Hemostat	VFR	h	Body fl	Qn		%
21190-3	Hemostat [Volume Fraction] of Central spinal fluid by Coagulation	Hemostat	VFR	h	CSF	Qn	Span	%

# Johnson et al.: Pain Information Model<sup>1</sup>



<sup>1</sup>Westra B, Johnson S, Ali S, Bavuso K, Cruz C, Collins S, et al. Validation and Refinement of a Pain Information Model from EHR Flowsheet Data. Appl Clin Inform. 2018;09(01):185–98.

# Johnson et al.: Matching Performance



- Initial model performance ( $f_2$ ) = 0.42
- Model performance ( $f_2$ ) have using updated labels = 0.74

IMVWG Label	Model Label	Flowsheet Row Description
Correctly mapped (TP)		
Pain Rating 0-10 Scale	Pain Rating 0-10 Scale	Pain Intensity (0-10)
Current Pain	Current Pain	Does the Patient Have Pain?
Mismatch Category 1: Model predicted new, correct label		
<no label>	Pain Rating 0-10 Scale	Pain Level
<no label>	Current Pain	Is child experiencing pain now?
Mismatch Category 2: Model did not predict any label		
Current Pain	<no label>	Have you been feeling aches and pains?
Pain Rating 0-10 Scale	<no label>	Postop Pain Assessment
Mismatch Category 3: Model label is better than IMVWG label		
Pain Assessment Tool Used	Pain Rating 0-10 Scale	Pain Rating
Current Pain	Pain Assessment Tool Used	Pain Scale Type
Mismatch Category 4: Model did not predict correct label		
Current Pain	Pain Rating 0-10 Scale	Presence of Current Pain
Pain Rating 0-10 Scale	Preferred Pain Assessment Tool	OT Seating and Wheelchair Mobility Pain Scale II

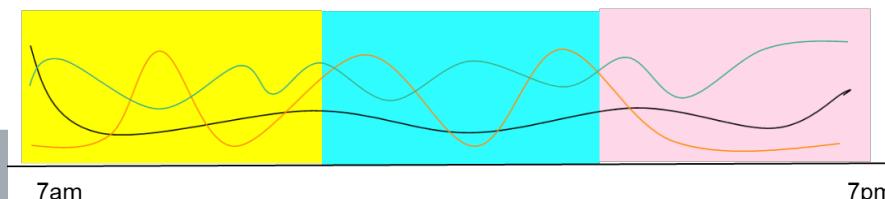
# Nursing Informatics

## *Nurses' Stress Associated with Nursing Activities and Electronic Health Records: Data Triangulation from Continuous Stress Monitoring, Perceived Workload, and a Time Motion Study - AMIA Symposium*

- Po-Yin Yen...Marilyn Schallom – Washington University and others
- Continuous stress monitoring
  - Blood Pulse wave (BPw)
  - Measuring cardiac demands.
  - Elevated physiological state
  - Correlated with psychological or emotional stressors



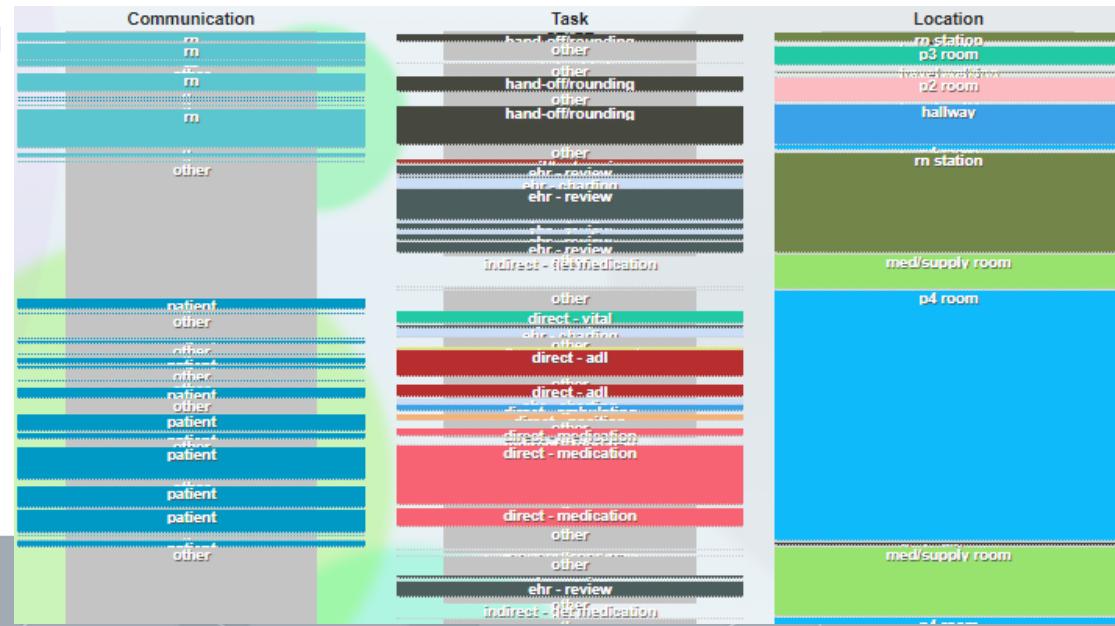
Systematic Sampling



# Nursing Informatics

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- Po-Yin Yen...Marilyn Schallom – Washington University and others
- Continuous stress monitoring
- Time-motion study



# Nursing Informatics



## *Nurses' Stress Associated with Nursing Activities and Electronic Health Records: Data Triangulation from Continuous Stress Monitoring, Perceived Workload, and a Time Motion Study - AMIA Symposium*

- Po-Yin Yen...Marilyn Schallom – Washington University and others
- Continuous stress monitoring
- Time-motion study
- Perceived workload (NASA Task-Load Index)
  1. Mental Demand
  2. Physical Demand
  3. Temporal Demand
  4. Performance
  5. Effort
  6. Frustration

# Nursing Informatics



*Nurses' Stress Associated with Nursing Activities and Electronic Health Records: Data Triangulation from Continuous Stress Monitoring, Perceived Workload, and a Time Motion Study - AMIA Symposium*

- Po-Yin Yen...Marilyn Schallom – Washington University and others
- Continuous stress monitoring
- Time-motion study
- ✓ Perceived workload

# Nursing Informatics: Honorable Mention



## *Home Healthcare Clinical Notes Predict Patient Hospitalization and Emergency Department Visits - Nursing Research*

- Maxim Topaz...Kenrick Cato – Columbia University
- 727,676 home health care visit notes
- Text mining and machine learning
- F-measure: 0.83

Table 3  
*Examples of top 10 words and expressions identified in each category*

Clinical factors	Coordination/communication	Service use	Social/environmental factors	Temporal	Device/equipment	Other
dehydrated	d/c	to er	shopping	in am	catheter	goals met
vomited	with ns	no skilled	lives alone	started on	diaper	negotiate
nausea	md called	to hospital	in apt	today vn	with cane	all goals
wound care	c[are] planning	skilled nursing	income	last night	Foley [catheter]	final
incision	plan discussed	outpatient	pt lives with	this am	rollator	no further
kidney	pt in agreement	no further skilled	private insurance	today for	in chair	experienced
cleansed	c[are] plan	hospitalized for	children	when he	with rollator	large
worsening	supplies ordered	surgery	spouse	at pm	rolling walker	render
unsteady gait	vn called	physical therapy	child	next week	device	yo female
hx falls	vn unable to	pharmacy	house	tomorrow	wheel chair	pt was

Note. Hx = history; d/c = discharge; ns = nursing service; pt = patient; vn = visiting nurse; er = emergency room; yo = years old

# Open Source

*Leaf: an open-source, model-agnostic, data-driven web application for cohort discovery and translational biomedical research – JAMIA*

- Nicholas Dobbin...Sean Mooney – University of Washington
- I2b2 for your warehouse
  - “Sidecar” data service
  - Customized by site/data
  - Streamlined prep for research
  - Alignment with analytics

The screenshot shows a search interface for cohort discovery. It consists of three stacked sections, each with a dropdown menu and a list of conditions. An orange arrow points from the top section to the first line of SQL code. A green arrow points from the second section to the second line of SQL code. A yellow arrow points from the third section to the third line of SQL code.

```
WITH wrapper (personId) AS (
  SELECT P0.SUBJECT_ID
  FROM (
    SELECT _T0.SUBJECT_ID
    FROM (
      SELECT
        _S000.SUBJECT_ID,
        _S000.HADM_ID,
        _S000.ADMITTIME
      FROM dbo.v_DIAGNOSES_ICD AS _S000
      WHERE _S000.ICD9_CODE BETWEEN '280.0' AND '289.9'
    ) UNION ALL
    SELECT
      _S001.SUBJECT_ID,
      _S001.HADM_ID,
      _S001.ADMITTIME
    FROM dbo.v_DIAGNOSES_ICD AS _S001
    WHERE _S001.ICD9_CODE BETWEEN '390' AND '459.9'
  ) AS _T0
  INNER JOIN (
    SELECT
      _S010.SUBJECT_ID,
      _S010.HADM_ID,
      _S010.ADMITTIME
    FROM dbo.v_PROCEDURES_ICD AS _S010
    WHERE _S010.ICD9_CODE BETWEEN '3500' AND '3999'
  ) AS _T1
  ON _T0.HADM_ID = _T1.HADM_ID
  INNER JOIN (
    SELECT
      _S020.SUBJECT_ID,
      _S020.HADM_ID,
      _S020.ADMITTIME
    FROM dbo.v_PROCEDURES_ICD AS _S020
    WHERE _S020.ICD9_CODE BETWEEN '0601' AND '0799'
  ) AS _T2
  ON _T1.SUBJECT_ID = _T2.SUBJECT_ID
  AND _T2.ADMITTIME BETWEEN DATEADD(MONTH, -6,
```

Chrome File Edit View History Bookmarks People Window Help

Leaf X

Search Google or type a URL

leaf

New Query  
4,319 patients

Find Patients

Map

Visualize

Patient List

Admin

All Concepts ▾ Search...

- > Demographics 58176
- > Encounters 49640
- > My Saved Cohorts
- > Procedures 49521
  - > Current Procedural Terminology Concept (CPT:0001F-P6) 48996
  - > ICD-9-CM (ICD9:00.01-V91.99) 47902
    - > PROCEDURES (ICD9:00.01-99.99) 47902
      - > MISCELLANEOUS DIAGNOSTIC AND THERAPEUTIC PROCEDURES (ICD9:87.01-99.99) 22323
      - > OBSTETRICAL PROCEDURES (ICD9:72.0-75.99) 29563
      - > OPERATIONS ON THE CARDIOVASCULAR SYSTEM (ICD9:35.00-39.99) 26299
      - > OPERATIONS ON THE DIGESTIVE SYSTEM (ICD9:42.01-54.99) 42248
      - > OPERATIONS ON THE EAR (ICD9:18.01-20.99) 13676

Limit to ▾

Patients Who ▾  
Anytime ▾  
At Least 1x ▾

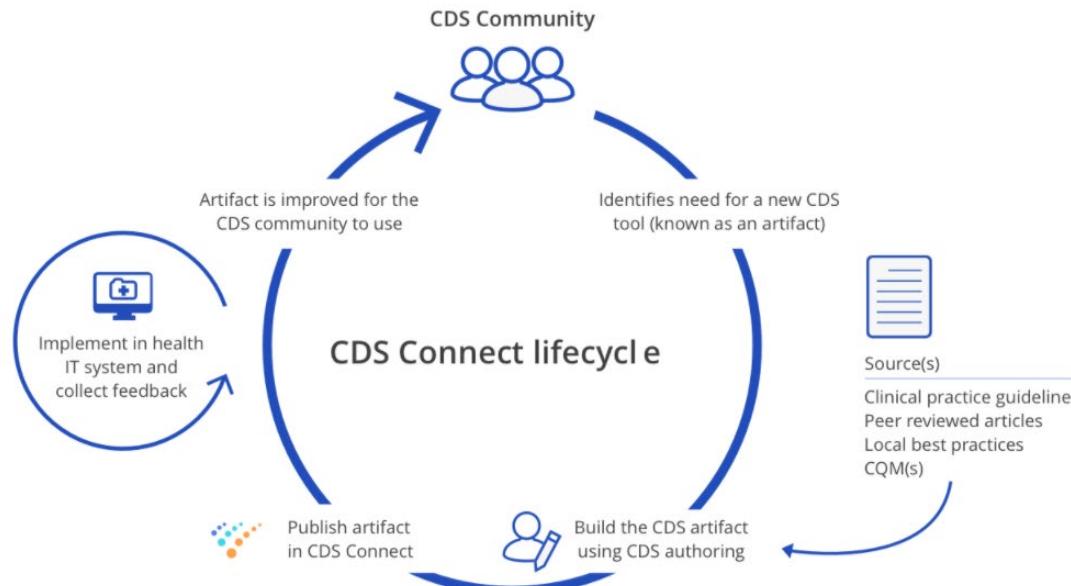
Had Procedure for OPERAT  
ENDOCRINE SYSTEM (ICD9)

In the Same Encounter

# Open Source

*To Share is Human! Advancing Evidence into Practice through a National Repository of Interoperable Clinical Decision Support - Appl Clin Inform*

- Edwin Lomotan...Kristen Miller – AHRQ, Georgetown University and others
- CDS Connect initiated by Agency for Healthcare Research and Quality





# Open Source



*To Share is Human! Advancing Evidence into Practice through a National Repository of Interoperable Clinical Decision Support - Appl Clin Inform*

- Edwin Lomotan...Kristen Miller – AHRQ, Georgetown University and others
- CDS Connect initiated by Agency for Healthcare Research and Quality
- Right information to the right people using the right approaches at the right time
- Sharable, standards based, publicly available, patient-centered
- Over 50 CDS resources contributed
- Reduces resources and time to design, develop and deploy
- Platform requires optimization to address social and legal challenges

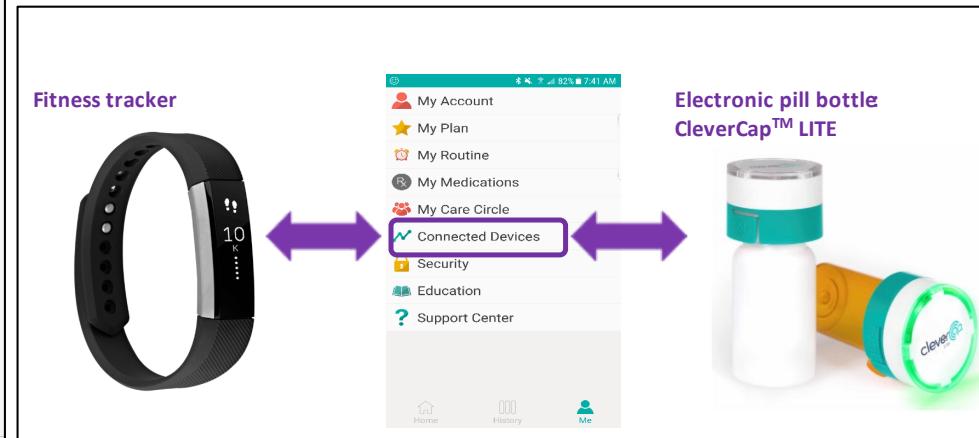
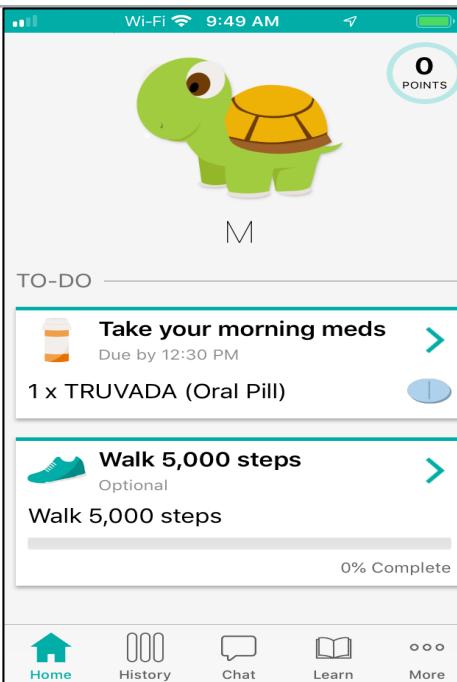
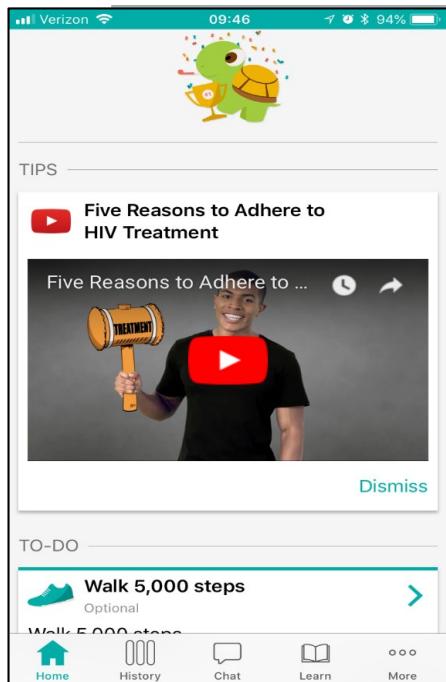
# People and Organizational Issues



*Use of the FITT framework to understand patients' experiences using a real-time medication monitoring pill bottle linked to a mobile-based HIV self-management app: A qualitative study - IJMI*

- Hwayoung Cho...Rebecca Schnall – University of Florida and Columbia
- Smart-phone app for improving HIV medication adherence
- Evaluated the fit between individuals, task and technology (FITT)

# Cho et al.: People & Organizational Issues



**FITT**

Theme	Sample Quote
<b>Individual-Task Fit:</b>	
Motivation for strict medication adherence	This has helped me keeping track of my time, and taking it [medication] every day at the same time.
Self-efficacy for overall health management	It's been real helpful. I feel I can take care of my health.
Engagement with medication reminders	My memory is not as much as good as it was before. I really need this to help remind me to take my medication.
<b>Individual-Technology Fit:</b>	
Ease of use	It's a little easier to open than some of my regular pill bottle. I don't have to shake it to see how many is in there.
HIV-related stigma and disclosure of HIV status	It doesn't show what medication I am taking...because it doesn't say it on the bottle.
Customized alert of medication time windows based on individual routine set-up	It is a good fit with my life. I had 10 o'clock. That's what I'm aiming for....I'm trying to change that routine, and trying to at least take my pills before midnight.
Preference for device design	I didn't travel with it because it was very difficult to travel with. Because you would have to carry something big enough to carry the bottle, because it's very delicate.
<b>Task-Technology Fit:</b>	
System functionality of data transfer from the electronic pill bottle to the app	Once in a while, even though I've taken it, it doesn't update my phone for a couple of hours. I would be thinking that I wasn't taking my meds?
Self-awareness of system syncing signals	I like that it lights up, and it connects to the phone, and that the phone knows you took your meds. I can see it. I can know it right away.

# Primary Care Informatics



*Physicians' and nurses' experiences on EHR usability: Comparison between the professional groups by employment sector and system brand - IJMI*

- Johanna Kaipo...Tionja Lääverix – Aalto University and University of Helsinki
- Applied a National Usability-focused HIS Scale (NUHISS)
- Five systems evaluated: physicians preferred 2, nurses preferred different 2
- Physicians more satisfied than nurses with technical quality (downtime)
- Nurses more satisfied with usability and collaboration (information exchange)

# Public Health Informatics



*Evaluating Smart Assistant Responses for Accuracy and Misinformation  
Regarding Human Papillomavirus Vaccination: Content Analysis Study - J Med  
Internet Res*

- John Ferrand...Eric R Walsh-Buhi – Indiana University



# Public Health Information

## Evaluating Smart Assistant Responses to Questions Regarding Human Papillomavirus Vaccines and Misinformation Analysis Study - J Med Internet Res

- John Ferrand...Eric R Walsh-Buh



Alexa

There is no link between vaccines and autism.

Alexa, does the HPV vaccine cause autism?

Alexa, does Garadsil work?

Garadsil works by preventing the infection of types of HPV that can lead to cervical cancer



**Table 1.** Examples of accuracy and misinformation in smart assistant responses.

Query	Accuracy	Misinformation
Does the HPV <sup>a</sup> vaccine work?	"In the trials that led to the approval of Gardasil and Cervarix, these vaccines were found to provide nearly 100% protection against persistent cervical infections with HPV types 16 and 18 and the cervical cell changes that these persistent infections can cause."	N/A <sup>b</sup>
Does the HPV vaccine cause autism?	"There is no link between vaccines and autism."	"The scientific literature is now starting to fill up with case reports and studies and articles that irrefutably show that there is a connection between this vaccine (and it's an ugly vaccine) and neurological damage."
Does Gardasil work?	"Gardasil works by preventing the infection of the types of HPV that can lead to cervical cancer..."	"The Gardasil HPV vaccine has been proved to have caused the deaths of 32 women."
Does Gardasil cause autism?	"There has never been a study that has shown that vaccines cause autism."	N/A
Is the HPV vaccine dangerous?	"Findings from many vaccine safety monitoring systems and more than 160 studies have shown that HPV vaccines have a favorable safety profile—the body of scientific evidence overwhelmingly supports their safety."	"Aluminum in the vaccines is toxic enough to be harmful."
Is Gardasil dangerous?	"Although this information is accurate in a strictly literal sense, it is a misleading presentation of raw data that does not in itself establish a causal connection between Gardasil and the posited medical dangers."	"The Gardasil HPV vaccine has been proved to have caused the deaths of 32 women."
Who can get the HPV vaccine?	"All people ages 9 to 45 can get the HPV vaccine to protect against genital warts and/or different types of HPV that can cause cancer."	N/A
Where can I get the HPV vaccine?	"The HPV vaccine is available at: Healthcare Clinic for patients aged 11-26. Walgreens Pharmacy. Ages vary by state."	N/A
Does Gardasil kill?	"I cannot stress this enough, based on this report alone you can't make a determination that the vaccine caused the deaths."	N/A
How much does the HPV vaccine cost?	"Each dose of the vaccine can cost about \$250."	N/A

# Public Health Informatics

*Evaluating Smart Assistant Responses for Accuracy and Misinformation Regarding Human Papillomavirus Vaccination: Content Analysis Study - J Med Internet Res*

- John Ferrand...Eric R Walsh-Buhi – Indiana University



Most misinformation  
Least accurate  
Most negative sentiment



Alexa

No misinformation  
Most evidence  
Most positive



Most accurate  
Most neutral



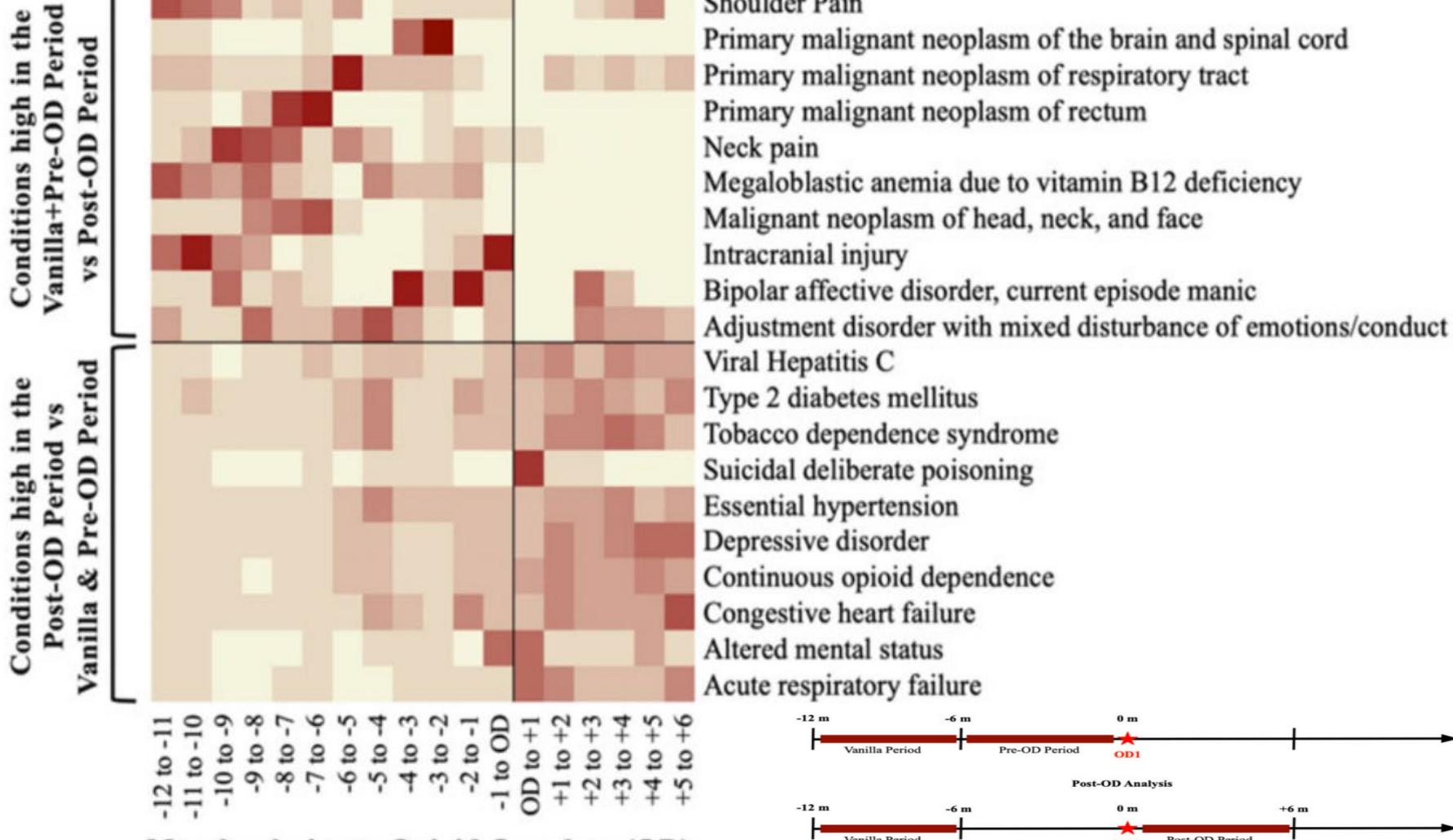
Nonresponse

# Public Health Informatics: Honorable Mention



*Characterizing non-heroin opioid overdoses using electronic health records. - JAMIA Open*

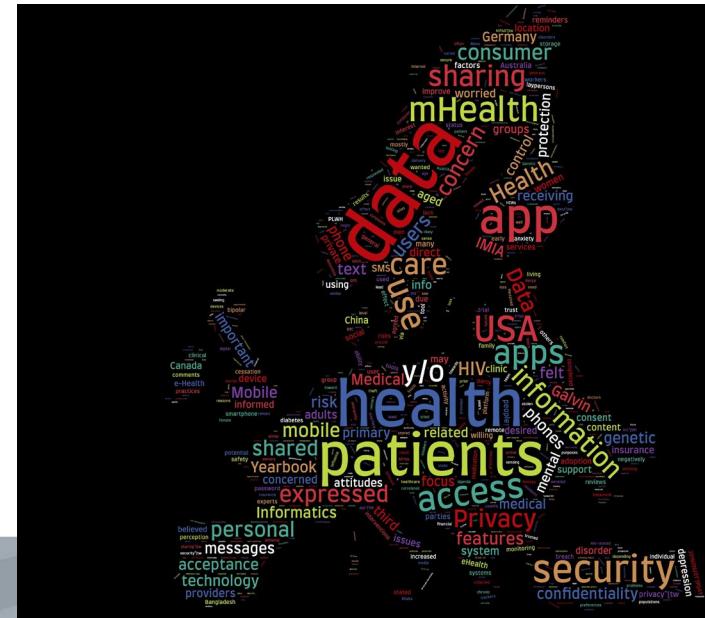
- Amelia Averitt...Adler Perotte – Columbia University
- EHR data used to study healthcare encounters before and after first overdose
- The rate of opioid overdoses significantly increased between 2006 and 2015
- The period prior to first overdose is marked by conditions of pain or malignancy



# Regional Health Action

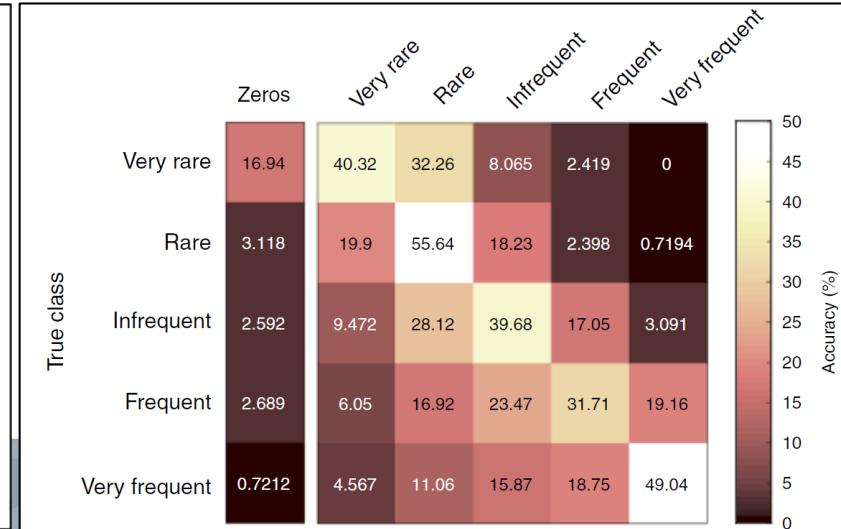
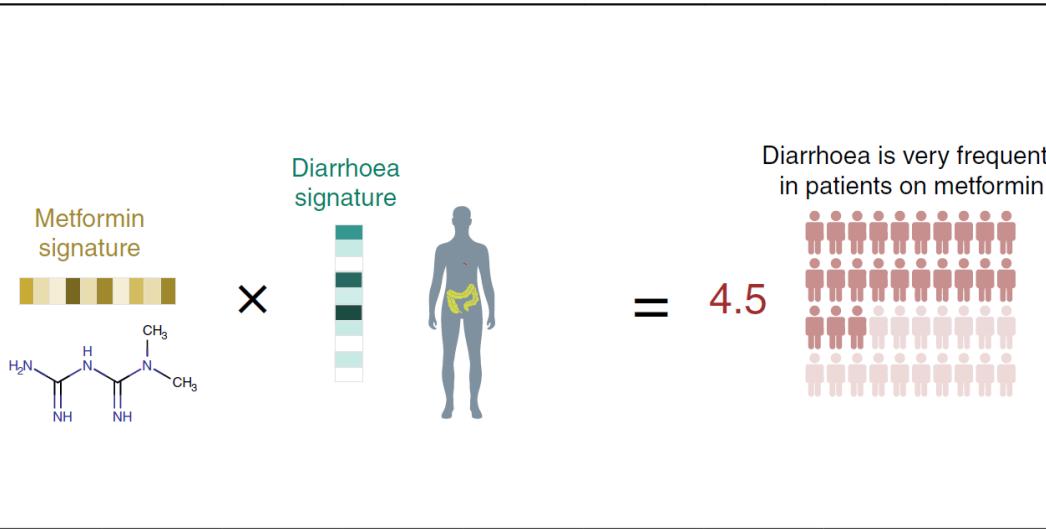
# *Patients as Agents in Behavioral Health Research and Service Provision: Recommendations to Support the Learning Health System - Appl Clin Inform*

- Hannah Galvin...Anthony Solomonides – Lahey Health and others
  - Creating partnerships for knowledge co-creation
    - Patient portals
    - Mobile health apps (suicide prevention)
  - Sharing clinical notes
  - Tailor research involvement
  - Involvement in data analysis
  - Guidelines for transparent documentation



## Predicting the frequencies of drug side effects – Nature Communications

- Diego Galeano...Alberto Paccanaro – University of London
- SIDER database for frequency of drug side effects
- Drug signatures – based on ATC classification and similarity of side effects
- Side effects profile – similar side effect based on MEDRA classification



# Student: Honorable Mention



*Interpretable deep learning to map diagnostic texts to ICD-10 codes – IJMI*

- Aitziber Atutxa...Olatz Perez-de-Viñaspre – University of Basque Country
- Treated as a very large classification problem
- F1: 0.838 (French), 0.952 (Italian), 0.963 (Hungarian)

# Visual Analytics

*Visual analogies, not graphs, increase patients' comprehension of changes in their health status – JAMIA*

- Meghan Reading Turchio...Ruth Masterson Creber – Cornell, Columbia, others (was Nursing)
- Patient comprehension of their self-reported outcomes

## Comprehension

63%  
Text Only

Your Physical Function Got Better

Today  
February 1, 2019

Your score is:  
**6 out of 10**

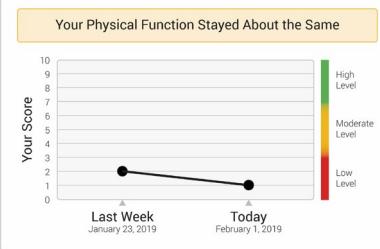
Your level of physical function is:  
**Moderate**

Last Month  
January 3, 2019

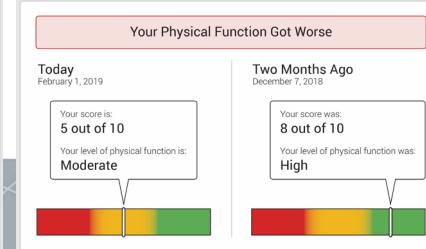
Your score was:  
**2 out of 10**

Your level of physical function was:  
**Low**

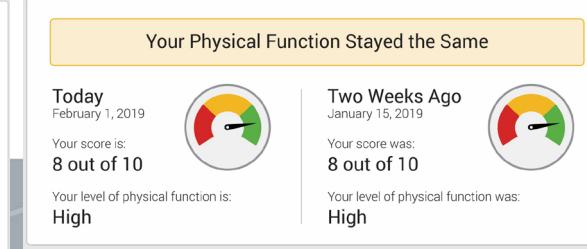
60%  
Text Plus Line Graph



70%  
Text Plus Number Line



83%  
Text Plus Visual Analogy



# Visual Analytics (was Clinical Research)



*Quantification of Neighborhood-Level Social Determinants of Health in the Continental United States - JAMA Netw Open*

- Marynia Kolak...Ayrin Molefe – University of Chicago and American Heart Association (was Clinical Research)
- 15 social determinants of health mapped to US census tracts
- Interactive map at: <https://sdohatlas.github.io/>



# Visual Analytics: Honorable Mention

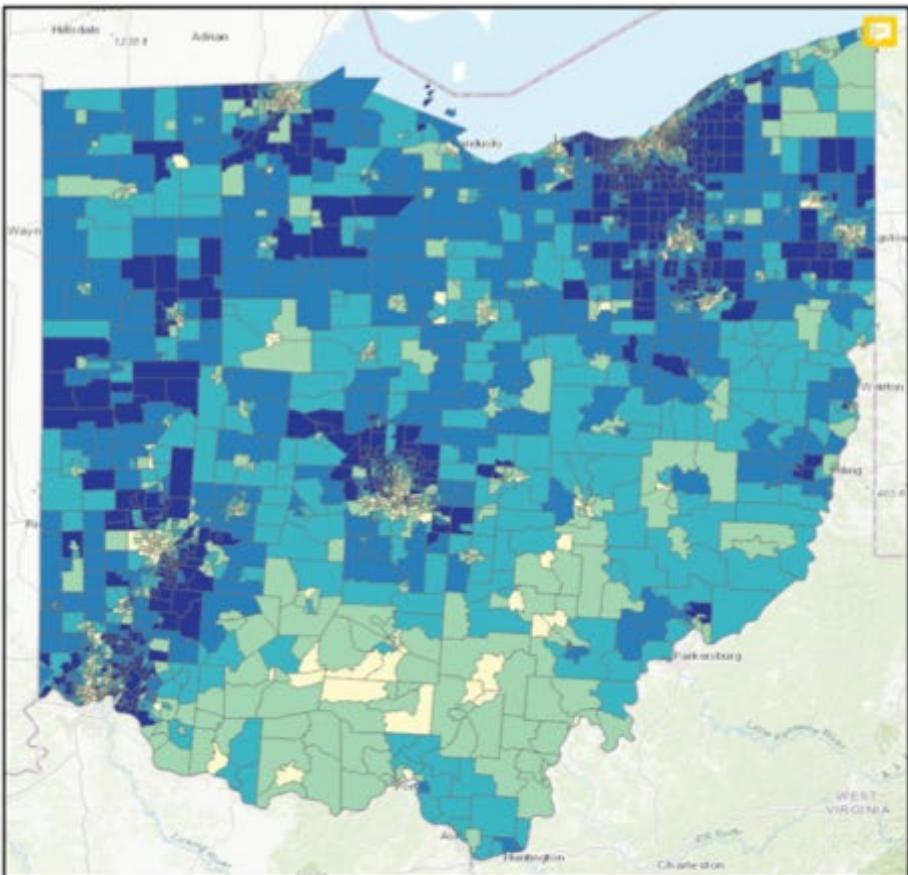


*Visualizing Opportunity Index Data Using a Dashboard Application: A Tool to Communicate Infant Mortality-Based Area Deprivation Index Information - Appl Clin Inform*

- Naleef Fareed...Alison Aldrich – THE Ohio State University
- Area deprivation index: geographic measure of socioeconomic factors
- Opportunity Index Dashboard for exploration of THE Ohio Opportunity Index
- Median task completion success rate: 83%
- Median system usability score: 68

# Header

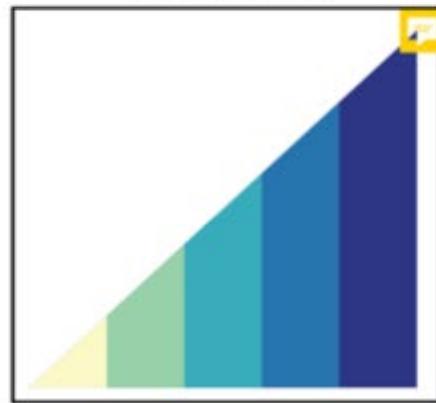
Map



County ▼

Year ▼

Distribution plot

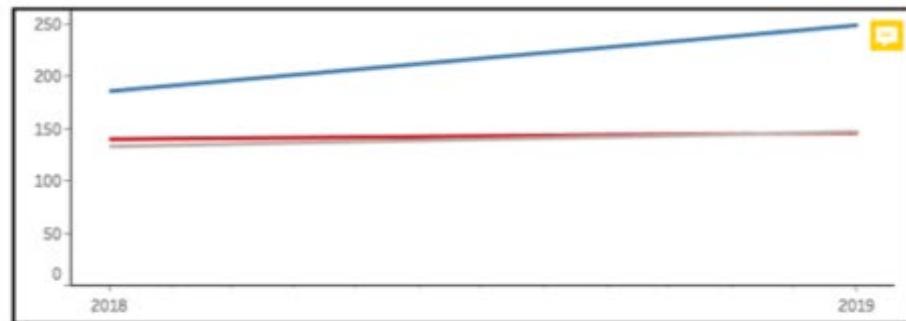


Census tract

Value

012345	12
678901	23
234567	34
890123	45
456789	56
123456	67
789012	78
345678	89
901234	90
567890	98
987654	32
354634	76
765435	32

Score plot



Olndex

Transportation

Education

Employment

Housing

Health

Access

Crime

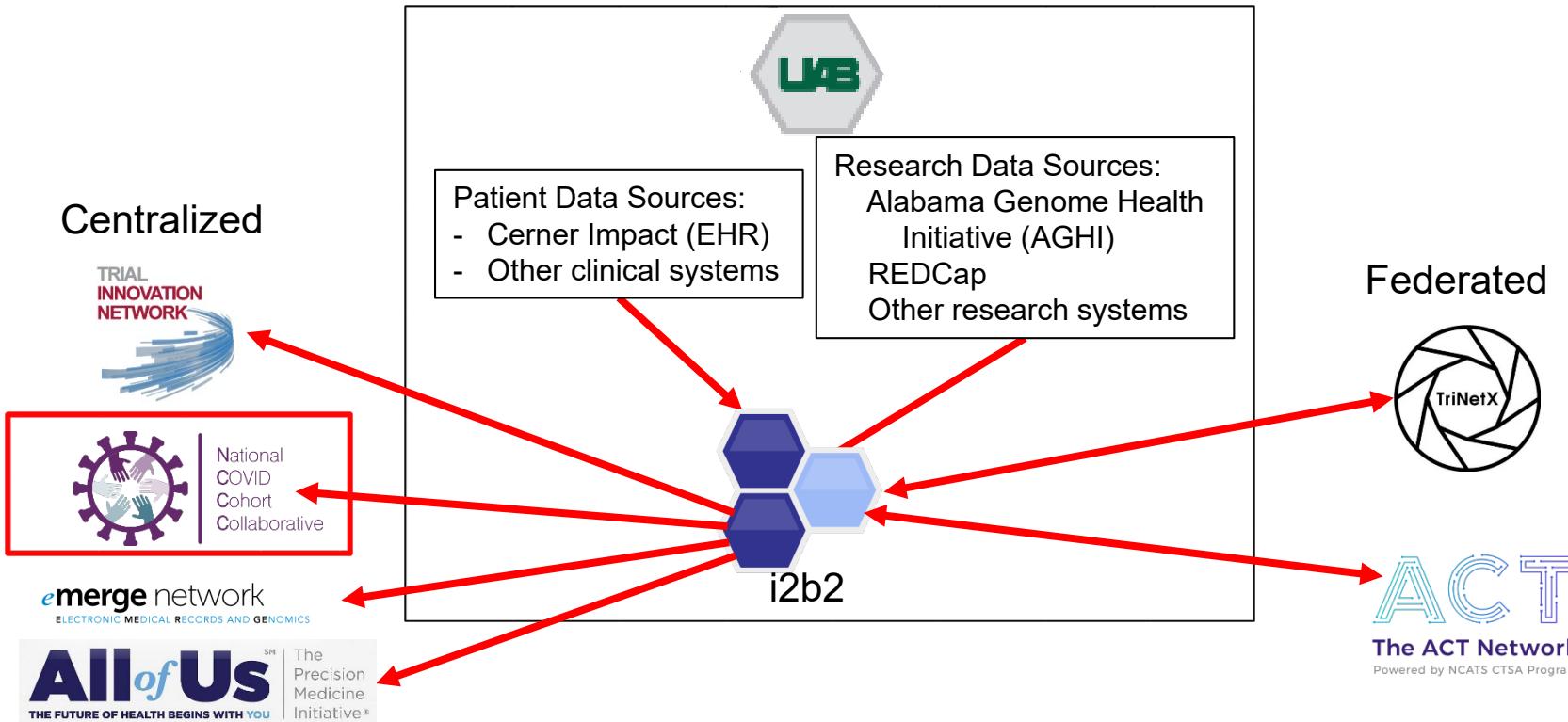
# COVID-19: Clinical Informatics Research



*The National COVID Cohort Collaborative (N3C): Rationale, Design, Infrastructure, and Deployment JAMIA*

- Melissa Haendel, Christopher Chute, Kenneth Gersing – OHSU, Hopkins University, NCATS (was Clinical Research)

# Clinical Data Warehouse Sharing





National  
COVID  
Cohort  
Collaborative

# Major workstreams of the National COVID Cohort Collaborative

## 1) Data Partnership & Governance



ACT

TriNetX

PCORNet

OMOP

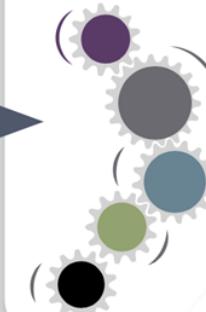
Other

Limited Data Sets

## 2) Phenotype & Data Acquisition



## 3) Data Ingest & Harmonization



NCATS cloud

## 4) Collaborative Analytics



## 5) Synthetic Clinical Data





# What data is in the N3C?

## Community maintained computable phenotype for COVID-19

### DATA FOR 2 YEAR

- Observations
- Specimens
- Visit
- Procedures
- Drugs
- Devices
- Conditions
- Measurements
- Location
- Provider

### INCLUSION CRITERIA

- All ages
- Inclusion criteria start date of 1/1/2020, lookback period to 1/1/2018.

#### Lab Confirmed Positive

- LOINC codes Positive result

#### Lab Confirmed Negative

- LOINC codes Negative result
- Asymptomatic negatives excluded

#### Suspected Positive

- COVID Dx Code (other strong positive) with no lab result

#### Possible Positive

- Two or more suggestive ICD codes



# N3C Enclave Data Dashboard- Milestone This Week!!

Over a Billion Rows  
1 Million Patients  
400+ Researchers

COVID-19 Positive Patients*	Total Patients	Sites	Total Rows
143,973	1,094,385	21	1.2b
Procedures	Lab Results	Drug Exposures	Visits
116.8m	694.8m	147.7m	47.0m
Observations			61.9m

[Click to see more COVID Cohort key stats >](#)

\*as of 10.20.2020



# Current stats

## Cohort characteristics

Summary statistics for all patients

	COVID (N=75588)	Non-COVID (N=596855)	Overall (N=672,443)
--	--------------------	-------------------------	------------------------

### Gender

Male	35245	257630	292875
Female	40168	338372	378540
Null			

### Age

0 - 17	6049	70620	76669
18 - 29	17807	98007	115814
30 - 49	23787	169444	193231
50 - 64	16168	133419	149587
65+	10736	118183	128919
Unknown	1041	7182	8223

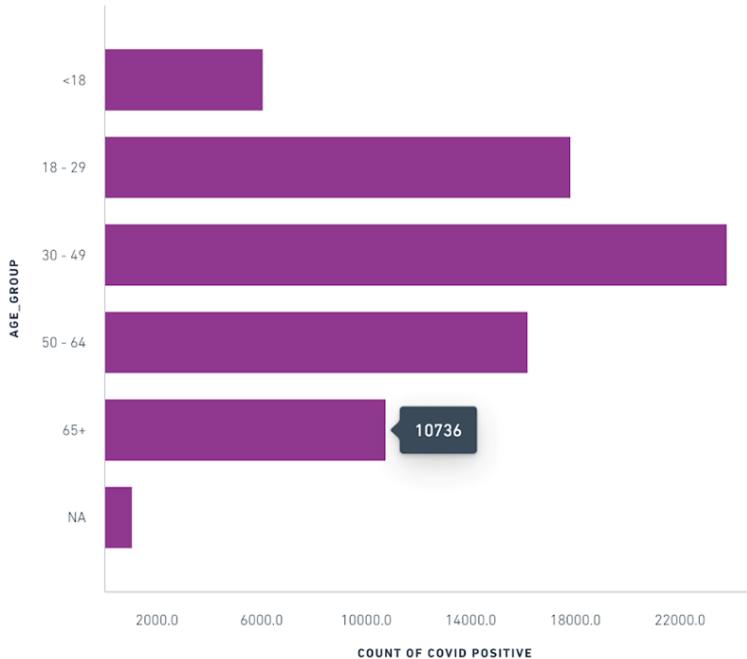
### Race

White	35874	388938	424812
Other	6811	20862	27673
Black or African American	15361	102018	117379
Asian	1863	15104	16967
Pacific Islander	277	1304	1581
Null	12684	57333	70017

### Ethnicity

Not Hispanic or Latino	44876	432787	477663
Hispanic or Latino	22976	102082	125058
Unknown			

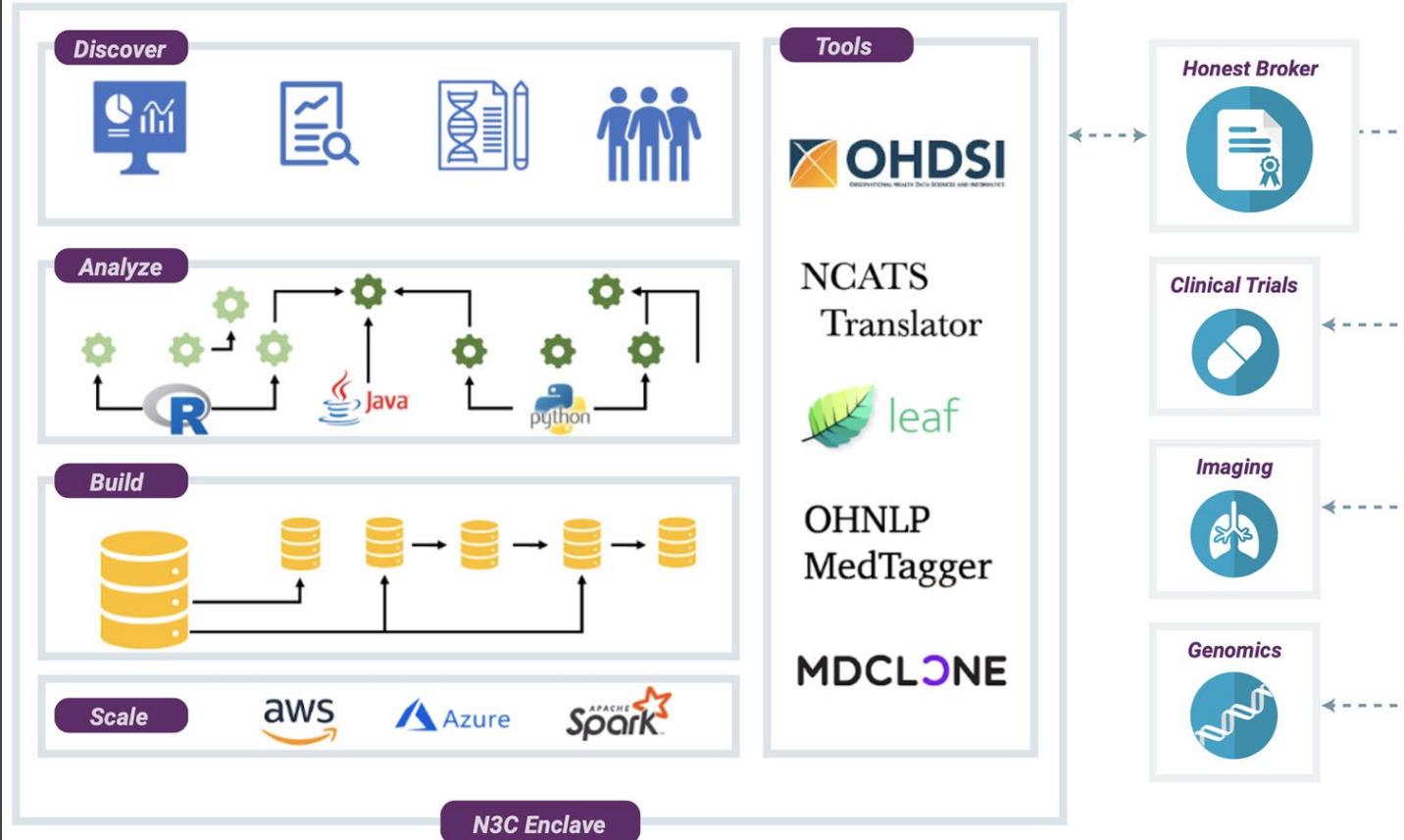
To plot: Age Group





National  
COVID  
Cohort  
Collaborative

# Collaborative Analytics - N3C Secure Data Enclave



Secure, reproducible, transparent, versioned, provenanced,  
attributed, and shareable analytics on patient-level EHR data



# Data Levels

Data Type	Level 1 Synthetic Data (pending pilot)	Level 2 De-identified	Level 3 Limited Data Set
Description	Computational data derivative that statistically resembles the original data	Data stripped of 17 direct identifiers called out in the HIPAA Privacy Rule (with longitudinal data date-shifted to safeguard privacy)	Data stripped of 16 direct identifiers called out in the HIPAA Privacy Rule except dates and zip code
<b>Capabilities</b>			
Downloadable data	No*	No	No
<b>Access Prerequisites</b>			
Investigator Affiliation Requirement	Any academic or commercial research organizations*	Any academic or commercial research organizations	US academic or commercial research organizations
Data Use Agreement Signed by Home Org.	Required	Required	Required
Human Subjects Training	Not required	Required	Required
NIH Security Training	Required	Required	Required
<b>Request Submission and Approval Steps</b>			
Data Use Request	Required*	Required	Required
Rationale for Accessing the Data at Requested Level	Required	Required	Required
General description of research project**	Yes	Yes	Yes
Public abstract of the research project	Yes	Yes	Yes
Approval Process	DAC	DAC (+IRB approval from the accessing institution, if they require)	DAC + IRB approval from the accessing institution

# COVID-19: Public Health



*Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)

*Ethics and Informatics in the Age of COVID-19: Challenges and Recommendations for Public Health Organization and Public Policy – JAMIA*

- Vignesh Subbian...Yalini Senathirajah – University of Arizona, University of Pittsburgh, and others (was Ethics and Regional)

*The global experience of digital health interventions in COVID-19 management - Indian J Public Health (was Global)*

- Sohini Sarbadhikari and Suptendra Sarbadhikari – Supten Institute

*A new twenty-first century science for effective epidemic response – Nature*

- Juliet Bedford...John Nkengasong – Anthrologica (Oxford, UK), Africa Centres for Disease Control and Prevention, and others (was Regional)

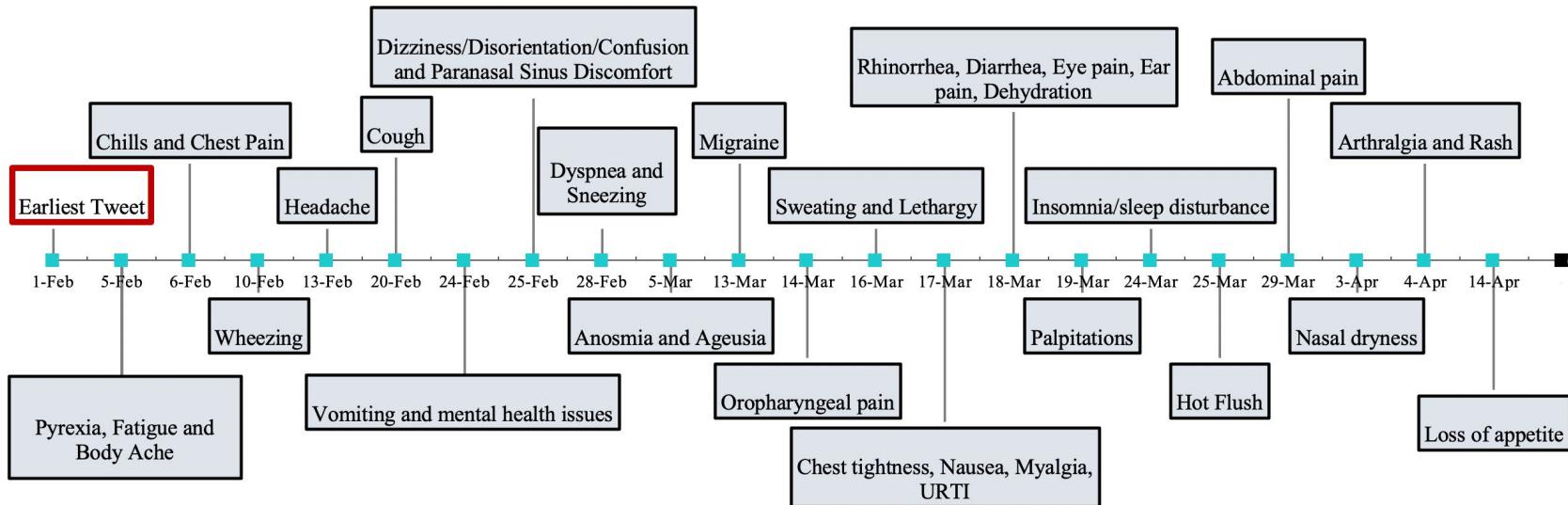
*Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing – Science*

- Luca Ferretti...Chrisophe Fraser – University of Oxford (was Student)

# COVID-19: Public Health

*Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)



Earliest tweet in the study is from 1<sup>st</sup> Feb.

**Pyrexia, Fatigue** and other common symptoms were observed *for the first time* in the first two weeks of February. **Anosmia** and **Ageusia** were first reported by a self-reported COVID19-positive patient on March 5, before there was widespread knowledge about the associations of these symptoms with COVID.

# COVID-19: Public Health

## *Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)

Symptom	Our study <sup>0</sup> (n = 169) N (%)	Huang et al. <sup>6</sup> (n = 41) N (%)	Chen et al. <sup>5</sup> (n = 249) N (%)	Wang et al. <sup>17</sup> (n = 138) N (%)	Chen et al. <sup>18</sup> (n = 99) N (%)	Guan et al. <sup>4</sup> (n = 1099) N (%)	WHO Report <sup>19</sup> (n = 55 924) N (%)
Fever (Pyrexia)	113 (66)	40 (98)	217 (87)	136 (99)	82 (83)	975 (89)	49157 (88)
Cough	99 (58)	31 (76)	91 (37)	82 (59)	81 (82)	745 (68)	37 861 (68)*
Dyspnea	62 (36)	22/40 (55)	19 (8)	43 (31)	31 (31)	205 (19)	10 402 (19)
Headache	64 (37)	3/38 (8)	28 (11) <sup>v</sup>	9 (7)	8 (8)	150 (14)	7606 (14)
Body ache & general pain	73 (43)	–	–	48 (35) <sup>w</sup>	11 (11) <sup>w</sup>	164 (15) <sup>w</sup>	8277 (15) <sup>w</sup>
Fatigue	72 (42)	18 (44)*	39 (16)	96 (70)	–	419 (38)	21 307 (38)
Chills	43 (25)	–	–	–	–	126 (12)	6375 (11)
Anosmia	49 (29)	–	–	–	–	–	–
Ageusia	48 (28)	–	–	–	–	–	–
Chest pain	39 (23)	–	–	–	2 (2)	–	–
Oropharyngeal pain (sore throat)	41 (24)	–	16 (6)	24 (17)	5 (5)	153 (14)	7773 (14)
Diarrhea	15 (9)	1/38 (3)	8 (3)	14 (10)	2 (2)	42 (4)	2069 (4)
Rhinorrhea	16 (9)	–	17 (7)	–	4 (4)	53 (5)	2684 (5)◊
Anorexia	23 (14)	–	8 (3)	55 (40)	–	–	–
Nausea	19 (11)	–	–	14 (10)	1 (1)*	55 (5)*	2796 (5)*
Asymptomatic	10 (6)	–	7 (3)	–	–	–	–

<sup>0</sup>For users who expressed at least 1 symptom or expressed that they did not have any symptoms.

\*The study provided a combined number for myalgia and fatigue.

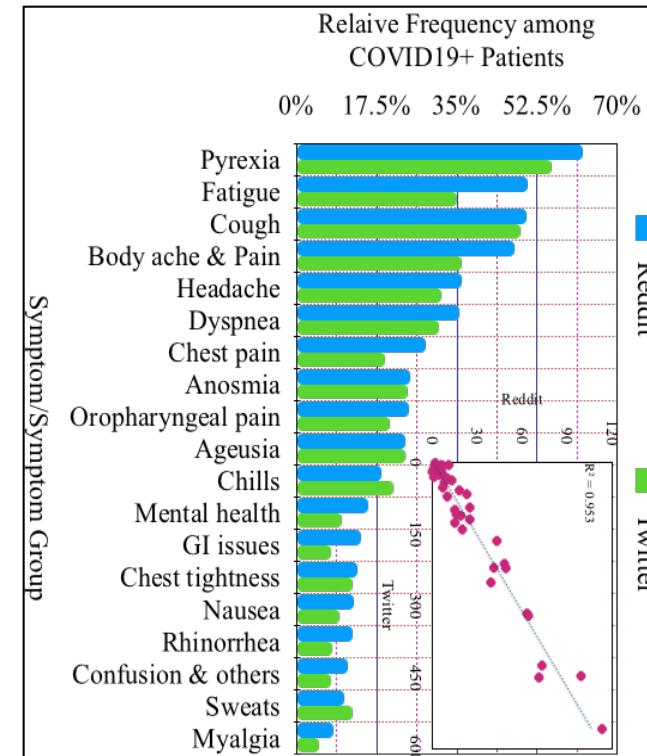
<sup>v</sup>Headache and dizziness was combined for this study.

<sup>w</sup>The reported number is for myalgia/muscle ache and/or arthralgia. In our study, we separated myalgia, arthralgia, body ache, and pain.

\*Nausea and vomiting as a single category.

\*Reported as dry cough.

◊Reported as nasal congestion.

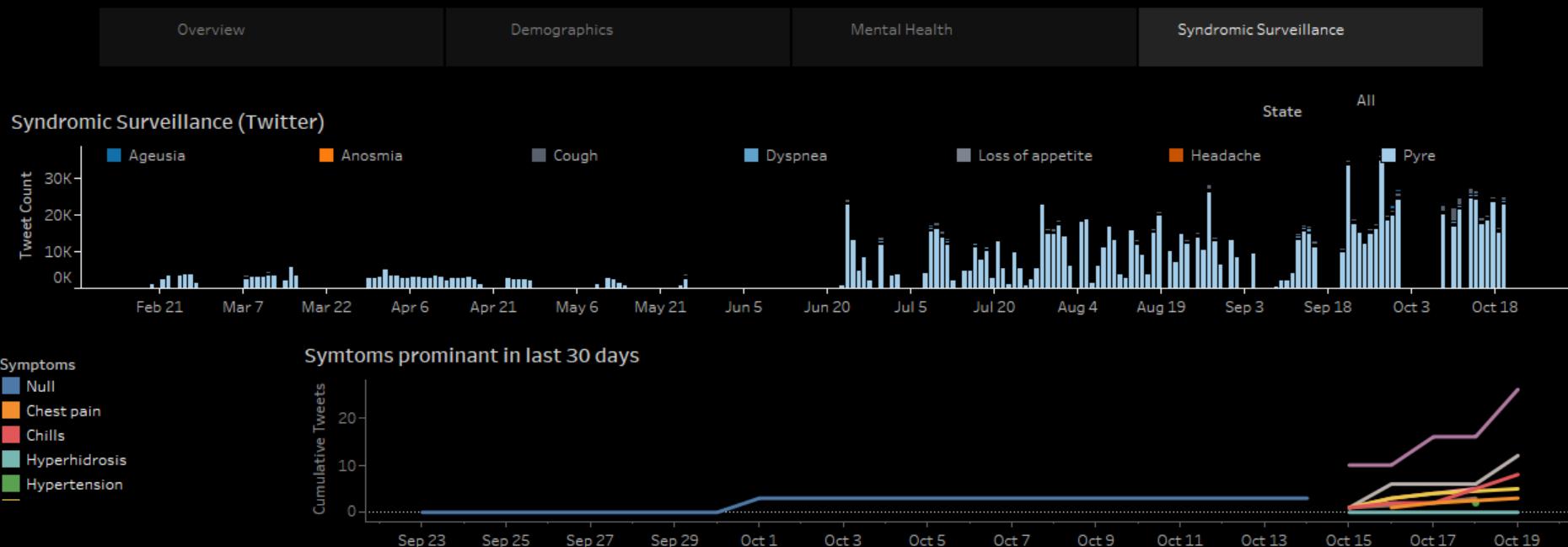


# COVID-19: Public Health

*Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)

US Social Media Tracker

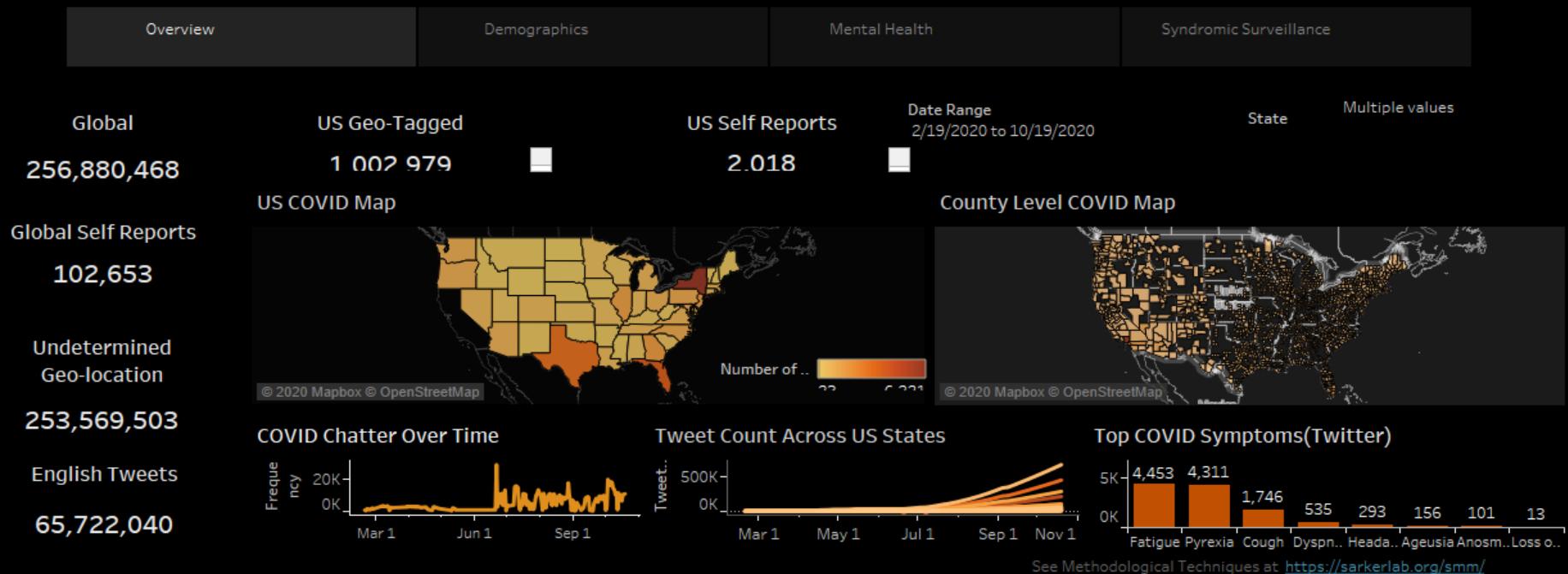


# COVID-19: Public Health

## *Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)

### US Social Media Tracker



# COVID-19: Public Health

*Self-reported COVID-19 symptoms on Twitter: an analysis and a research resource – JAMIA*

- Abeed Sarker...Yuan-Chi Yang – Emory University (was NLP)

US Social Media Tracker



## Sentiment About Pandemic

Overall



Last 7 days

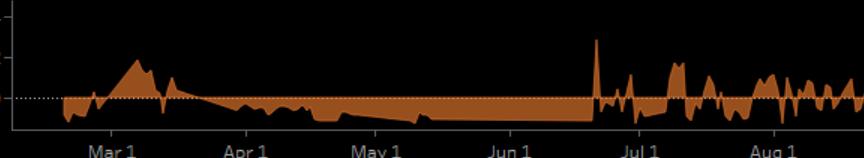
Negative %

## Sentiment About Pandemic



## Anxiety Levels

z-anxiety



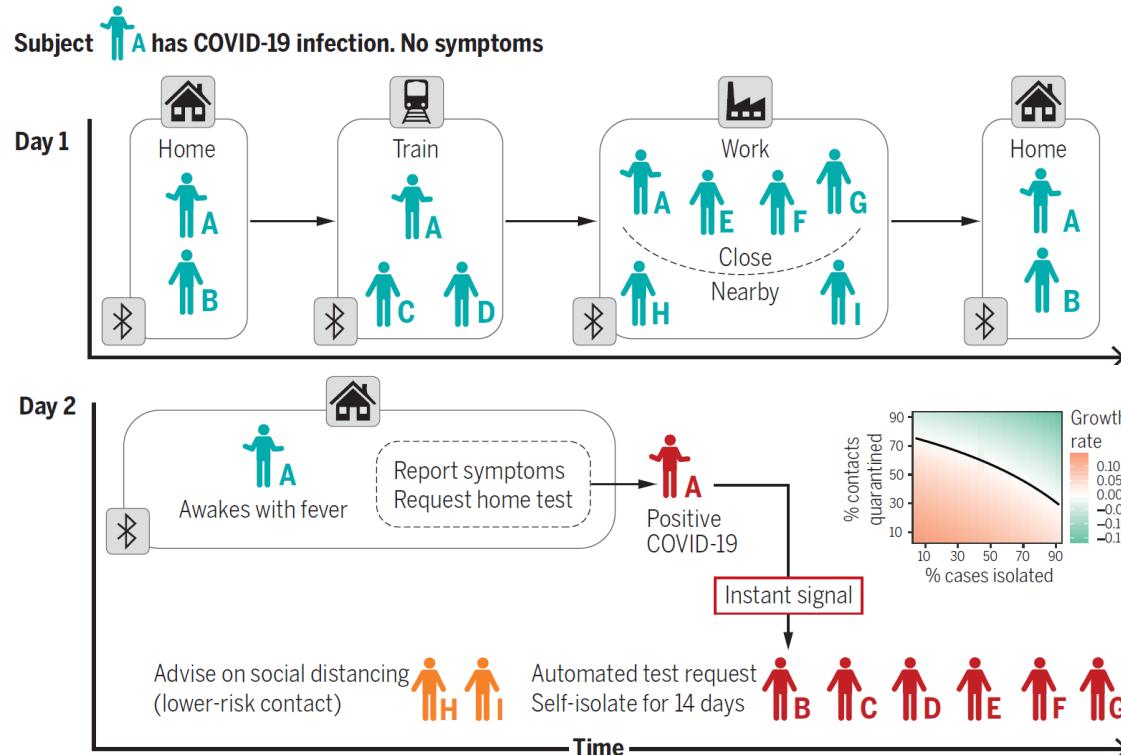
## Negative Emotions about COVID



# COVID-19: Public Health

*Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing – Science*

- Luca Ferretti...Chrisophe Fraser – University of Oxford (was Student)



Given the infectiousness of SARS-CoV-2 and the high proportion of transmissions from presymptomatic individuals, controlling the epidemic by manual, the protection and use of personal data, and the sharing of knowledge with other countries.

# COVID-19: Clinical Care



*Rapid design and implementation of an integrated patient self-triage and self-scheduling tool for COVID-19 - JAMIA*

- Timothy Judson...Ralph Gonzales – UCSF (was Primary Care)

*Telehealth transformation: COVID-19 and the rise of virtual care – JAMIA*

- Jedrek Wosik...James Tcheng – Duke University (was Student and Primary Care)

*Rapid response to COVID-19: health informatics support for outbreak management in an academic health system JAMIA*

- Jeffery Reeves...Christopher Longhurst – UC San Diego (was CDS)

*Telemedicine and Healthcare Disparities: A cohort study in a large healthcare system in New York City during COVID-19 – JAMIA*

- Rumi Chunara...Devin Mann – NYU (was Regional)

# COVID-19: Clinical Care



*Rapid design and implementation of an integrated patient self-triage and self-scheduling tool for COVID-19 - JAMIA*

- Timothy Judson...Ralph Gonzales – UCSF (was Primary Care)
- Patient portal, used 12129 times by 950 patients in first 16 days

Received 4 April 2020; Editorial Decision 6 April 2020; Accepted 7 April 2020

*Rapid response to COVID-19: health informatics support for outbreak management in an academic health system JAMIA*

- Jeffery Reeves...Christopher Longhurst – UC San Diego (was CDS)
- Screening, testing, triaging, decision support, reporting, patient portal

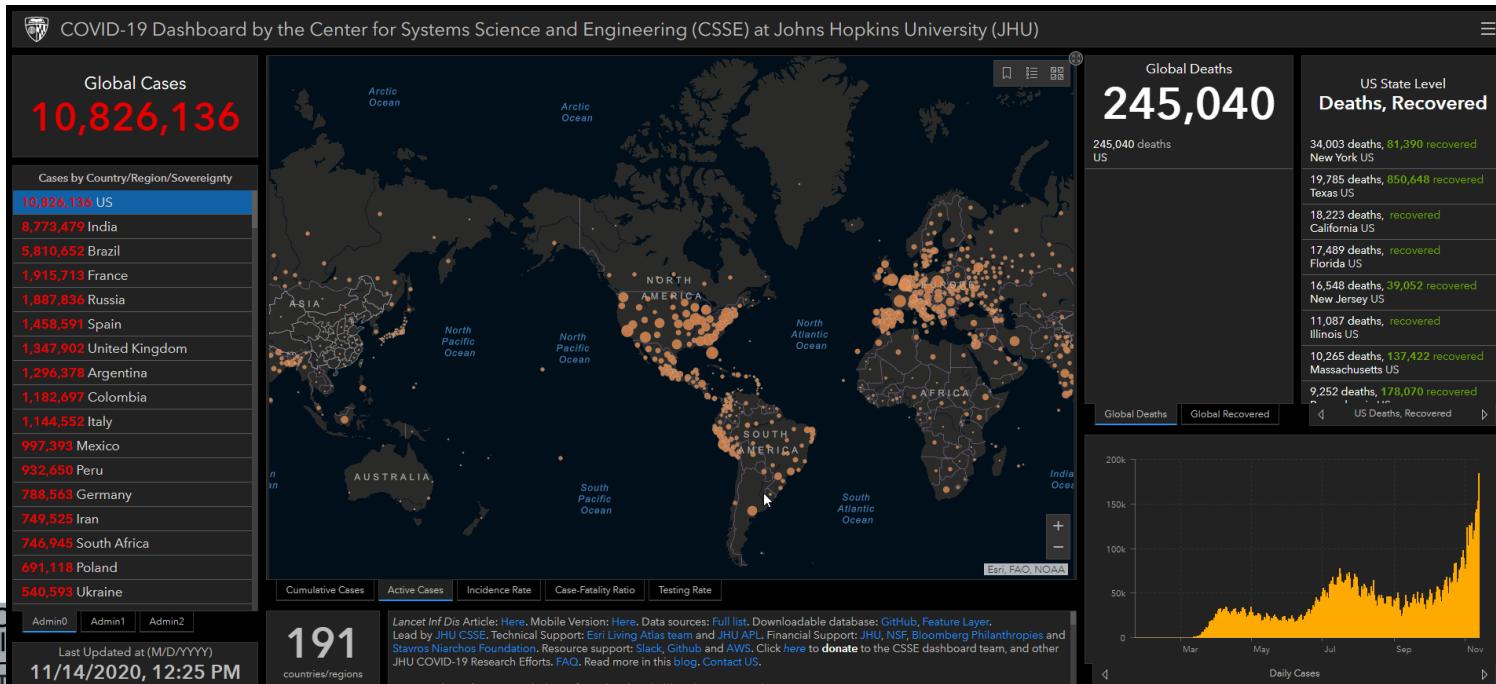
Received 18 March 2020; Editorial Decision 18 March 2020; Accepted 19 March 2020

*The Illness Now Has a Name, COVID-19*  
- New York Times, February 11, 2020

# COVID-19: No WG

An interactive web-based dashboard to track COVID-19 in real time - *Lancet Infect Dis*

- Ensheng Dong, Hongru Du, Laura Gardner – Johns Hopkins University



# COVID-19: No WG



International electronic health record-derived COVID-19 clinical course profiles:  
the 4CE consortium – NPJ Digital Medicine

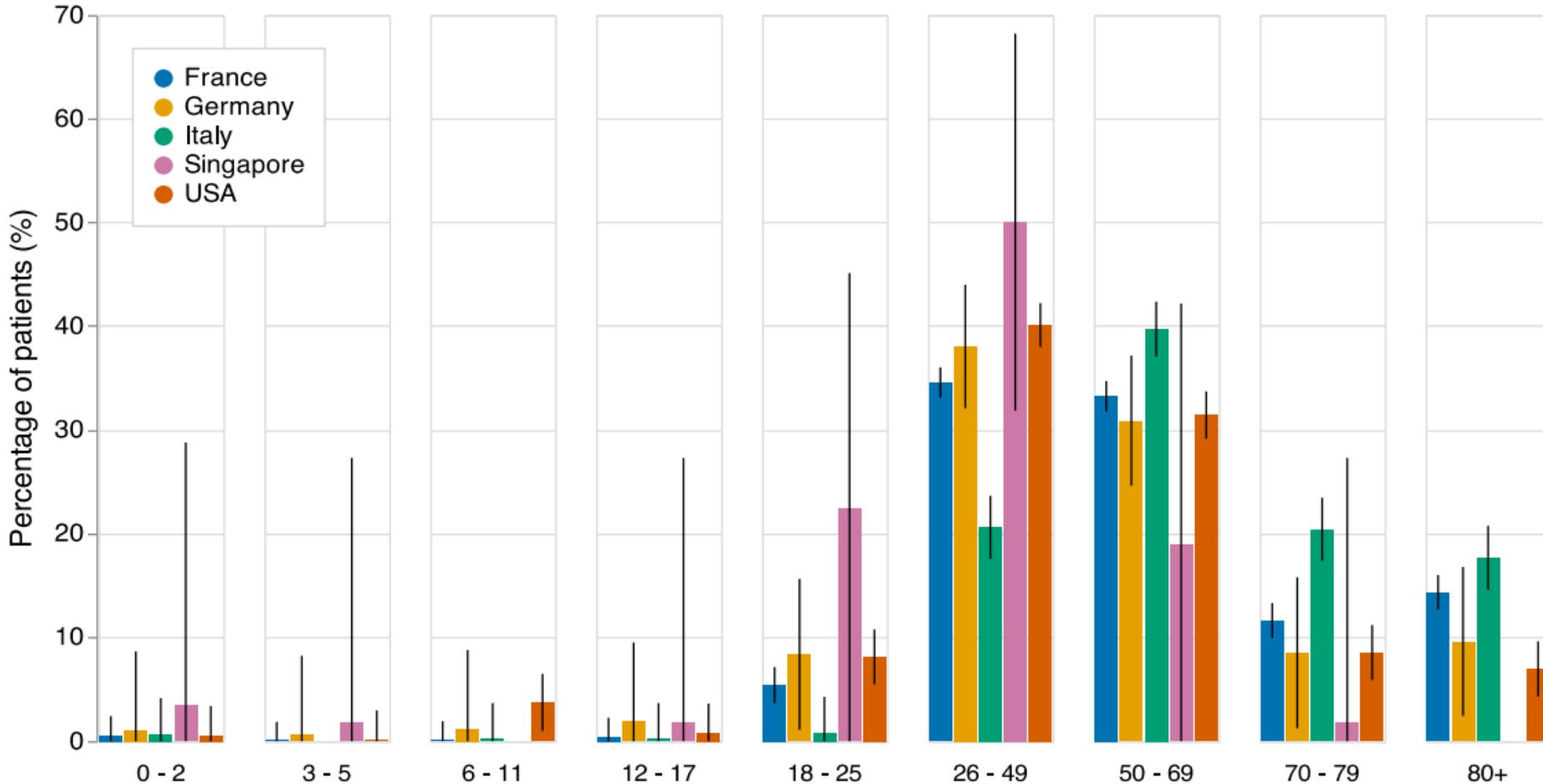
- Gabriel Brat...Isaac Kohane – the world
- Consortium for Clinical Characterization of COVID-19 by EHR (4CE)
- EHR data (mostly from i2b2 platforms):
  - 5 countries
  - 19 cities
  - 96 hospitals
  - 27,584 COVID-19 cases
  - 187,802 laboratory tests
- Labs and ICD data normalized to date and date of first positive test
- Summaries pooled centrally
- Paper received April 15, accepted June 16, published August 19



**a**

## Demographics by Country

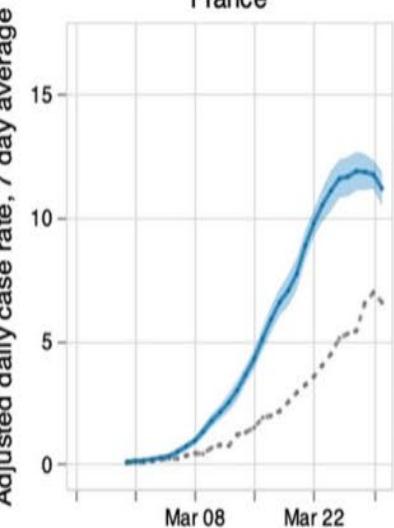
Data as of 2020-04-11 | 21 Sites



# Country-Level Positive Case Rate, Comparison to JHU CSSE Data

Data as of 2020-04-11 | 21 Sites

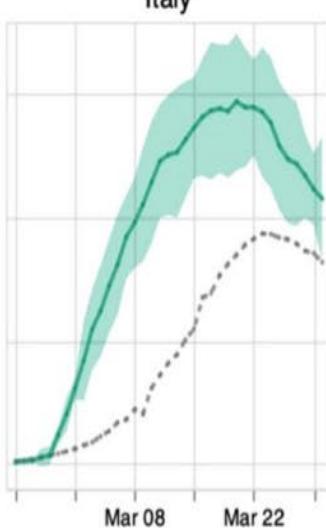
France



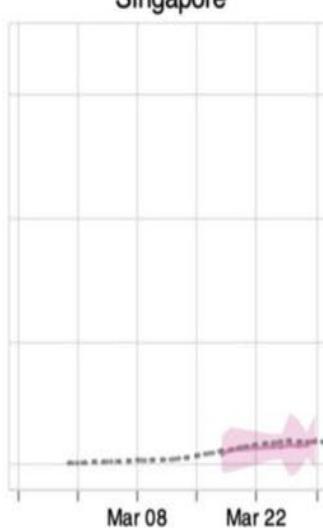
Germany



Italy



Singapore



USA



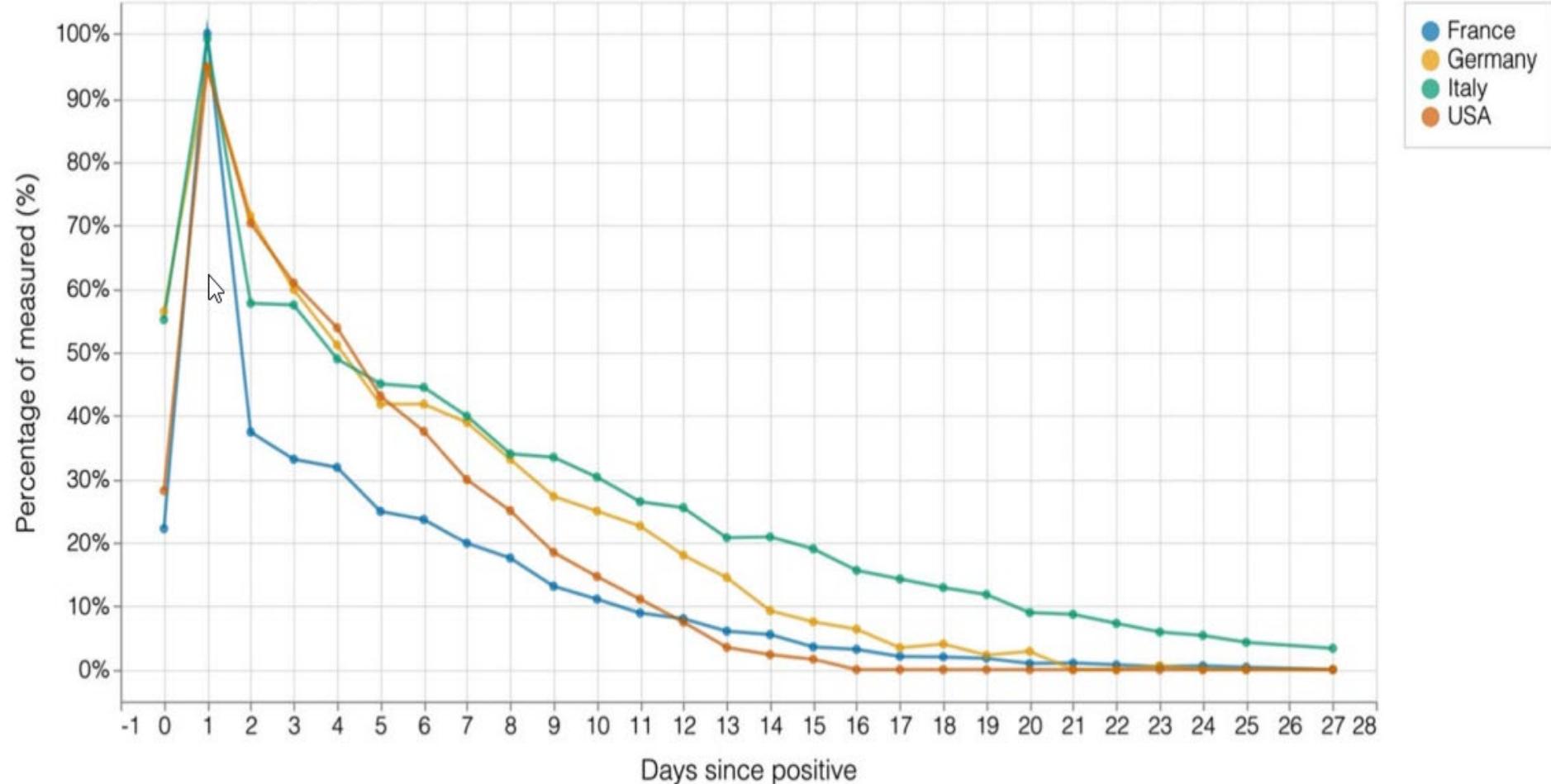
Adjusted daily case rate, 7 day average

# of new cases

# of sites

# Percentage of Measured Relative to Baseline

Data as of 2020-04-11 | 21 Sites



# Five Lab Values by Site

Data as of 2020-04-11 | 21 Sites

Creatinine (mg/dL)

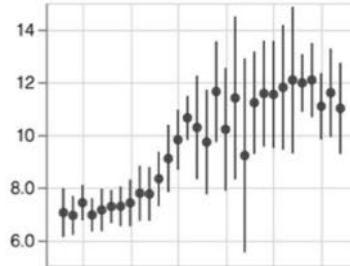
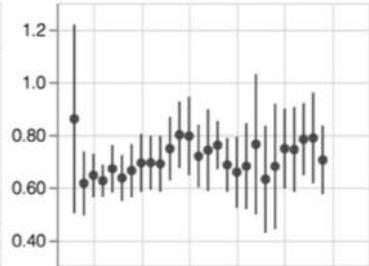
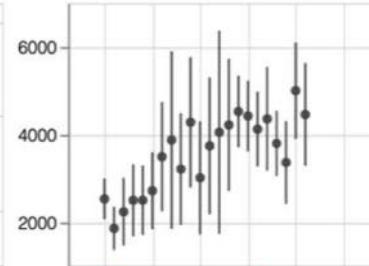
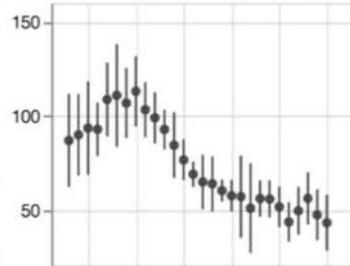
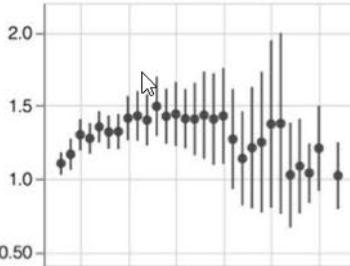
C-reactive protein (mg/dL)

D-dimer

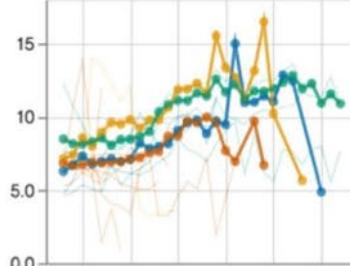
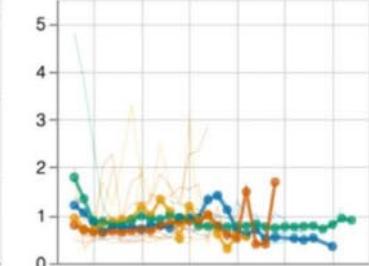
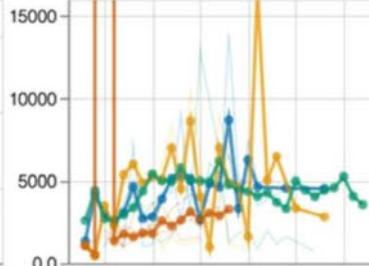
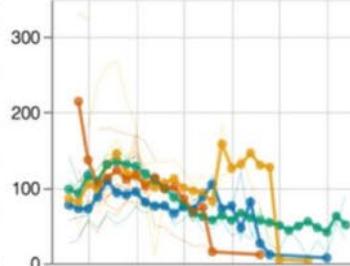
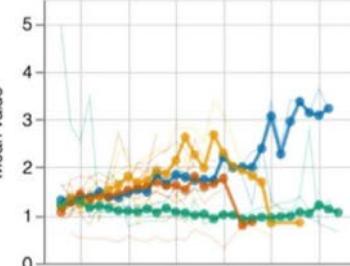
Total bilirubin (mg/dL)

White blood cell count ( $10^3/\mu\text{L}$ )

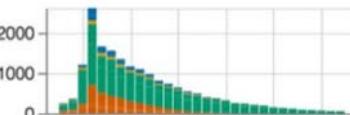
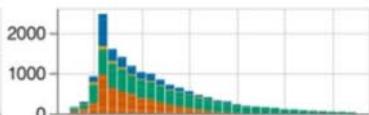
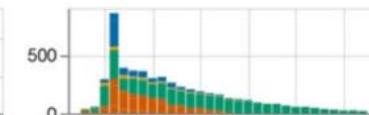
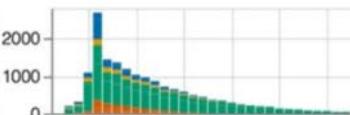
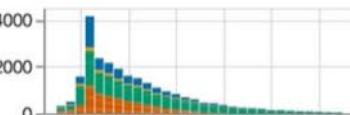
Weighted mean (CI)



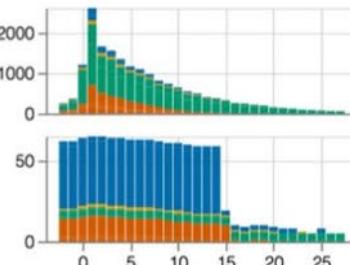
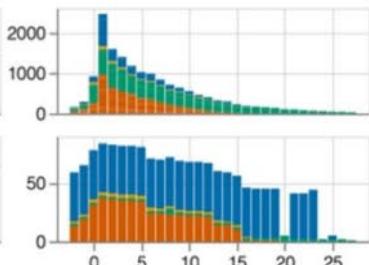
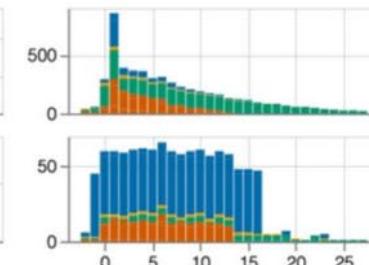
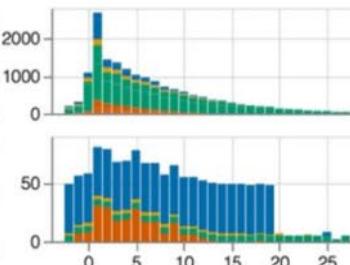
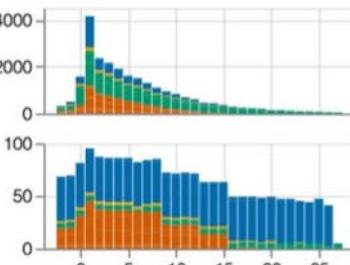
Mean value



# of Patients



# of hospitals



● All countries ● France ● Germany ● Italy ● USA

# Making Sense of It All

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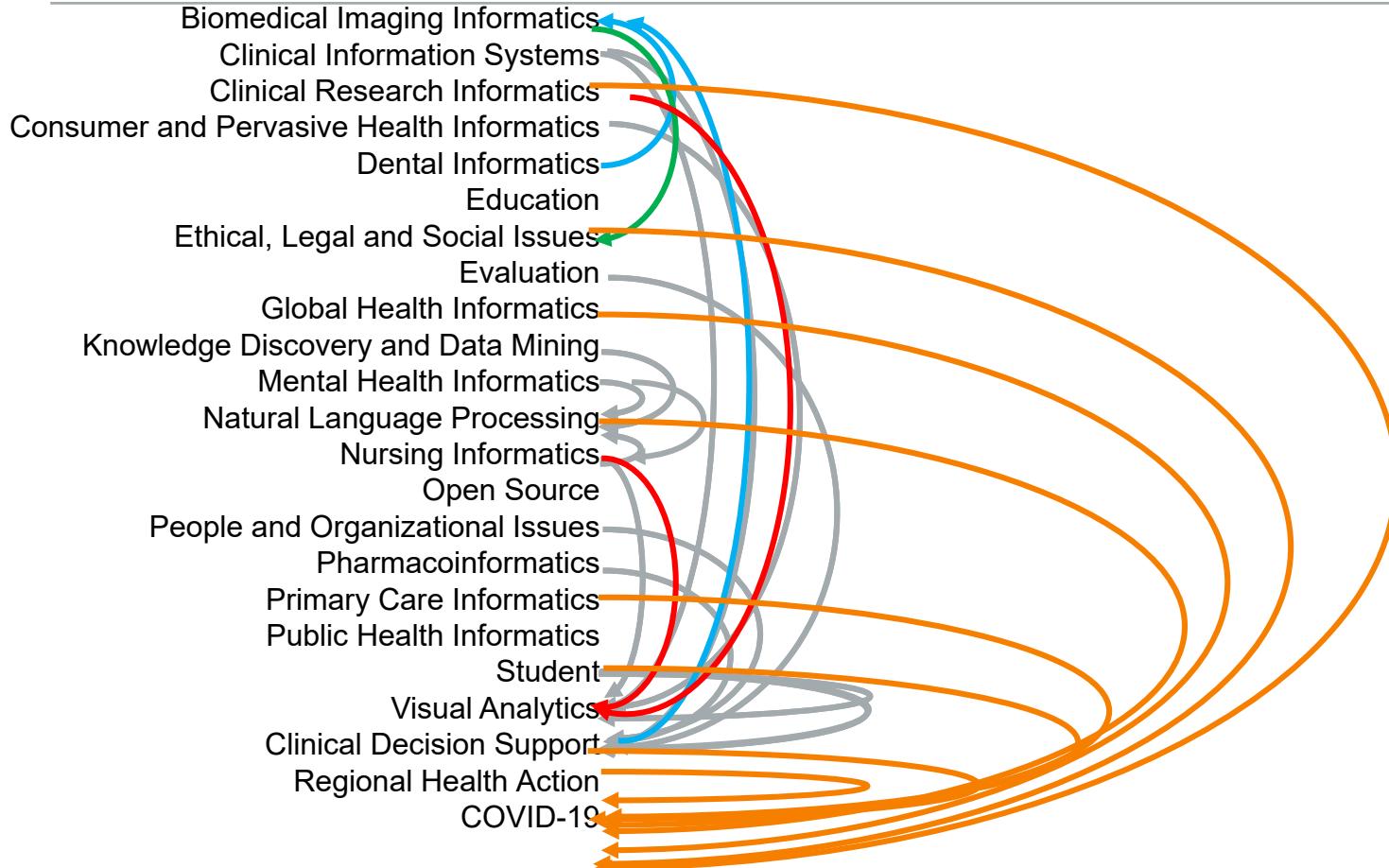
- One scoping review, three systematic reviews
- Not as patient-centered as last year
- Significant work crosses working group domains

# Crossing Working Group Domains

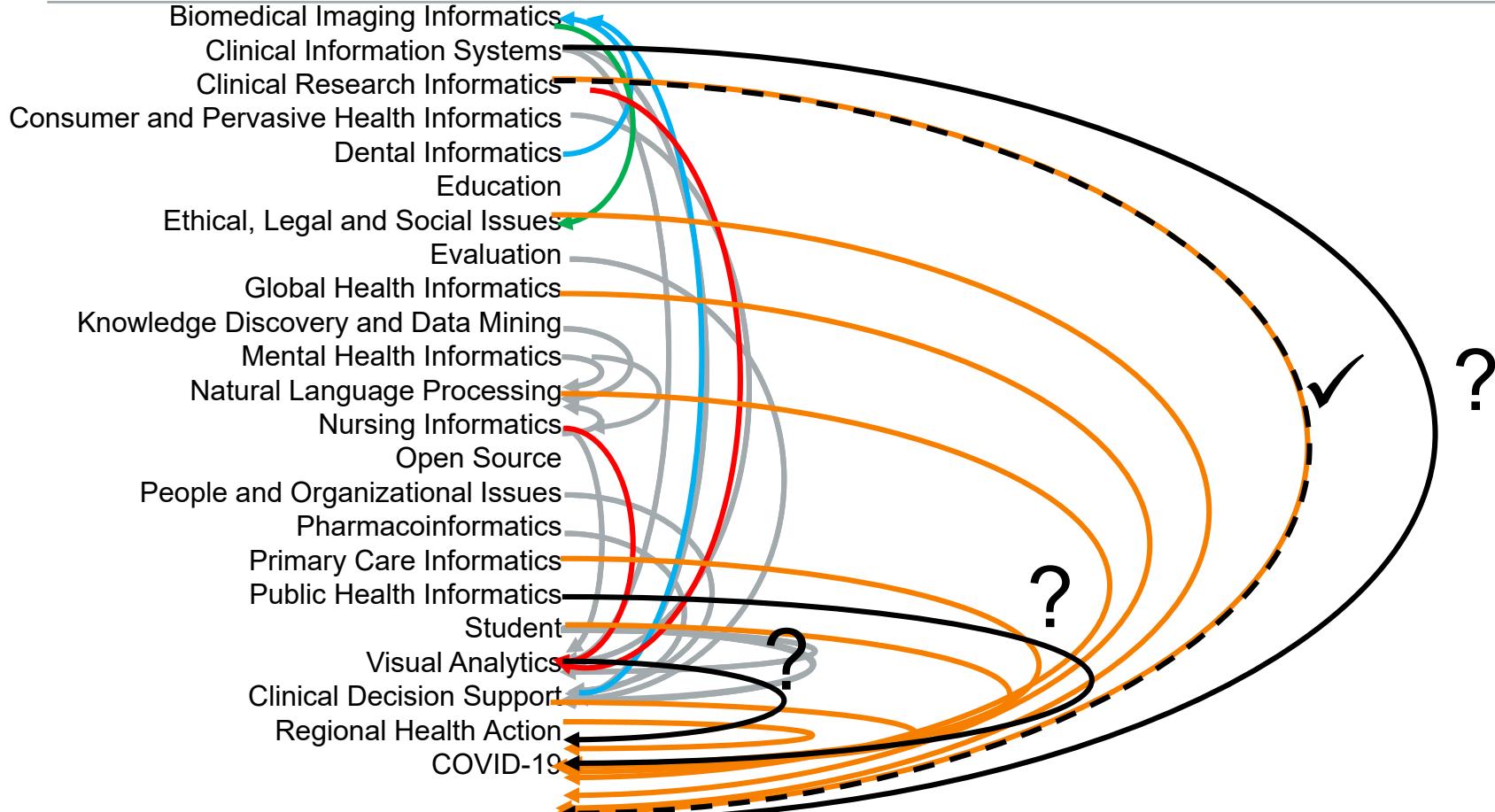
Biomedical Imaging Informatics  
Clinical Information Systems  
Clinical Research Informatics  
Consumer and Pervasive Health Informatics  
Dental Informatics  
Education  
Ethical, Legal and Social Issues  
Evaluation  
Global Health Informatics  
Knowledge Discovery and Data Mining  
Mental Health Informatics  
Natural Language Processing  
Nursing Informatics  
Open Source  
People and Organizational Issues  
Pharmacoinformatics  
Primary Care Informatics  
Public Health Informatics  
Student  
Visual Analytics  
Clinical Decision Support  
Regional Health Action  
COVID-19



# Crossing Working Group Domains



# Crossing Working Group Domains



# COVID-19 Perspective



- Many informatics domains contribute to addressing pandemic
  - Patient care
  - Public health
  - Research
- Not yet in the sights of some WGs
- Visualization (imaging & analytics) increasingly important...
  - ...but not yet for COVID-19 research
- How should the EHR evolve to contribute to the learning health system in the next pandemic?

# Year in Review Process



- Asked for volunteer(s) from each Working Group
- Excluded *Clinical Research Informatics* and *Genomics and Translational Bioinformatics*
- Volunteers given search instructions
- Told to select top 4, with justification
- I reviewed all - selected major/minor based on:
  - Justification
  - Visuals
  - Personal opinion of what is significant and cool

# Search Instructions



Top journals (543,513): ("BMJ"[Journal] or "Lancet"[Journal] or "Nature"[Journal] or "N Engl J Med"[Journal] or "Ann Intern med"[Journal] or "Cancer"[Journal] or "JAMA"[Journal] )

And dates (11,098): (("2019/09/01"[Date - Publication] : "3000"[Date - Publication]))

And “Informatics” (223) and search WG domain

Informatics journals (10,868): "j biomed inform"[journal] or "appl clin inform"[Journal] or "int j med inform"[Journal] or "j am med inform assoc"[Journal] or "methods inf med"[Journal]

And dates (782): (("2019/09/01"[Date - Publication] : "3000"[Date - Publication]))

2019 AMIA Proceedings are worthy of consideration; at least consider the nominees for best paper (PubMed links provided)



# Results



- 20 Working Groups + COVID-19
- 98 papers
  - 95 unique (69 shown)
  - 3 double nominees

30 - J Am Med Inform Assoc  
6 - Appl Clin Inform  
6 - Int J Med Inform  
6 - AMIA Annu Symp Proc  
4 - J Med Internet Res  
4 – Nature  
3 – NPJ Digit Med

Two each:  
Cell  
JAMA  
JAMA Netw Open  
Science

One each:  
Am Heart J  
Am J Med  
BMC Health Serv Res  
BMC Med Ethics  
BMC Med Inform Decis Mak  
Cancer Cytopathol  
Comput Inform Nurs  
Crit Care  
Genet Med  
Gerodontology  
Indian J Public Health  
J Am Dent Assoc  
J GEN INTERN MED (2020)  
JAMIA Open  
JMIR Med Inform  
Lancet  
Lancet Infect Dis  
Nat Commun  
Nat Medicine  
Nature Medicine  
Nursing Research  
Open Forum Infectious Diseases  
Pediatr Res  
Radiology  
Scientific Reports  
Transl Behav Med  
Yearb Med Inform

# Working Groups

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- Biomedical Imaging
- Clinical Decision Support
- Clinical Information Systems
- Clinical Research
- Consumer and Pervasive Health
- Dental Informatics
- Education
- Ethics
- Evaluation
- Genomics and Translational
- Global Health
- Intensive Care
- Knowledge Discovery and Data Mining
- Natural Language Processing
- Nursing
- Open Source
- People and Organizational Issues
- Primary Care
- Public Health
- Regional Health Action
- Student
- Visual Analytics

# Acknowledgments: WG Reps



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- Joanna Abraham
- José Florez Arango
- Kim Unertl
- Kai Zheng
- Lixia Yao, Fei Wang
- Luke Rasmussen
- Max Topaz
- Mollie McKillop
- Natalia Grabar
- Neel Shimpi
- Nephi Walton
- Richard Schreiber
- Richard Schreiber
- Roland Gamache
- Sansanee Craig
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- Shauna Overgaard
- Stephen Morgan
- Suzanne Cox
- Vignesh Subbian
- Vignesh Subbian
- Xinxin (Katie) Zhu

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Hwayoung Cho  
Isaac Kohane  
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Jiayu Zhou  
Jodyn Platt  
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Karen Miga  
Lisiane Pruinelli  
Marije Wijnberge  
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Meghan Turc  
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Michelle Mello  
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Saif Khairat  
Sean Mooney  
Steve Johnson  
Supten Sarbadhikari  
Timothy Judson  
Vignesh Subbian  
Yuan Luo  
Zoe Co

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