Maximizing Health IT, Modeling, Tracking, Tracing, and Other Public Health Tools during the COVID-19 Outbreak

April 20, 2020
Agenda

- Brief introduction to AMIA's Webinar Series and the role of Health Informatics
- Panelists & Presentations
  - **Brian Dixon**, PhD, MPA, FACMI, FHIMSS – Director of Public Health Informatics, Regenstrief Institute, Inc. and Indiana University Richard M. Fairbanks School of Public Health at IUPUI; Associate Professor, Department of Epidemiology, Indiana University Richard M. Fairbanks School of Public Health at IUPUI; Affiliate Scientist, VA HSR&D Center for Health Information and Communication
  - **Paul Halverson**, DrPH, FACHE – Founding Dean & Professor, Richard Fairbanks School of Public Health; Adjunct Professor, IU School of Medicine; Affiliated Scientist, Regenstrief Institute; Senior Fellow, Tobias Leadership Center, Indiana University; Adjunct Professor, Arizona State University College of Health Solutions
  - **Jessie Tenenbaum**, PhD, FACMI – Chief Data Officer, North Carolina Department of Health and Human Services; Assistant Professor, Duke University School of Medicine; AMIA Board of Directors
  - **Nathaniel Hupert**, MD, MPH – Associate Professor of Healthcare Policy and Research and Associate Professor of Medicine, Weill Cornell Medical College
  - **John Loonsk**, MD, FACMI – Chief Medical Informatics Officer, Consultant to the Association of Public Health Laboratories, Adjunct Associate Professor at the Center for Population Health IT, The Johns Hopkins University Bloomberg School of Public Health; Chief Medical Information Officer, CGI Federal
- Audience Q&A
Health Informatics is the science of how to use data, information, and knowledge to improve human health, including the execution of scientific research, the delivery of health care services, and the promotion of public health. AMIA is the multi-disciplinary, inter-professional home for 5,400+ health informatics experts.
Working Groups of AMIA

Biomedical Imaging Informatics
Clinical Decision Support
Clinical Information Systems
Clinical Research Informatics
Consumer and Pervasive Health Informatics
Dental Informatics
Education
Evaluation
Bioinformatics
Ethical, Legal and Social Issues
Genomics and Translational Global Health Informatics
People and Organizational Issues

Intensive Care Informatics
Knowledge Discovery and Data Mining
Knowledge Representation and Semantics
Nursing Informatics
Open Source Student
Pharmacoinformatics
Primary Care Informatics
Public Health Informatics
Regional Informatics Action
Visual Analytics
Natural Language Processing
The Globe of Health Informatics & COVID-19

- DNA
- Small Molecules
- Disease
- Patient
- Practice
- Population
- Global

- Analysis of Coronavirus
- Development of Therapeutics and symptom identification
- Treatment of patients via EHRs & Information Exchange
- Tools for contact tracing and for study of transmission

- TBI
- CRI
- Public Health
- Clinical
- Consumer Health

- $10^{-9}$
- $10^{-6}$
- $10^{-3}$
- $10^{0}$
- $10^{3}$
- $10^{6}$
- $10^{9}$
To highlight how our members and the broader informatics community is addressing this global pandemic we are launching the AMIA COVID-19 Webinar Series.

We will look at the pandemic through a health informatics lens and is designed to share informatics responses to the COVID-19 pandemic. Panelists will share their specific domain expertise, including clinical informatics, public health informatics, translational bioinformatics, clinical research informatics, and consumer health informatics.

We will also have special emphasis webinars covering topics related to global health, telemedicine, and public policy during the COVID-19 pandemic. These webinars are open to all at no cost.
Several additional webinars are being planned to highlight members of AMIA and the wider informatics community

Visit AMIA.org/COVID19
Target Audience

Public health informaticists and other healthcare professionals with an interest in public health informatics.

Learning Objectives

After participating in this activity, the learner should be better able to:

- Describe the role of national and state/local public health agencies in a pandemic
- List and explain the critical data and information needs of national as well as state/local public health agencies during a pandemic
- Discuss the methods by which informatics contributes to the public health response during a pandemic
Brian E. Dixon, MPA, PhD, FACMI, FHIMSS

Director of Public Health Informatics, Regenstrief Institute, Inc., and Indiana University Richard M. Fairbanks School of Public Health at IUPUI

Research Scientist, Clem McDonald Center for Biomedical Informatics and William M. Tierney Center for Health Services Research, Regenstrief Institute

Associate Professor, Department of Epidemiology, Indiana University Richard M. Fairbanks School of Public Health at IUPUI

Affiliate Scientist, VA HSR&D Center for Health Information and Communication

bedixon@regenstrief.org
Introduction to the webinar -- a focus on the role of informatics in public health
“Informatics brings methods, knowledge, and theories from both computer science and information science to support the field of public health.”

“…a discipline concerned not only with automation and computing but also the nature and use of data and information in public health processes and decision-making.”

Magnuson and Dixon, 2020
John Snow…the First PH Informatician?
EXAMPLE

Challenges

- Need to rapidly expand telemedicine capability
- EHR-integrated vs. stand-alone system
- Hardware considerations and high-volume strain on video software
- Including residents and students in workflows
- Specialty-specific design vs. standard deployment
- Documentation requirements
- Rapidly changing CMS regulations on billing
- Over-adoption?
Paul Halverson, DrPH, FACHE

Founding Dean & Professor
Richard Fairbanks School of Public Health, IUPUI

Adjunct Professor
Indiana University School of Medicine

Affiliated Scientist
Regenstrief Institute

Senior Fellow
Tobias Leadership Center, Indiana University

Adjunct Professor
Arizona State University College of Health Solutions

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Public health decisions during a crisis by a state health officer -- the importance of valid and reliable data and information
Jessie Tenenbaum, PhD, FACMI

Chief Data Officer
North Carolina Department of Health and Human Services

Assistant Professor
Duke University School of Medicine

AMIA Board of Directors

Jessie.Tenenbaum@dhhs.nc.gov
Data and information needs in North Carolina during a pandemic -- the role of informatics in state governance
COVID19 from the public health perspective

Jessie Tenenbaum, PhD, FACMI
Chief Data Officer
NC DHHS

April 17, 2020
NC Dept. of Health and Human Services
https://www.ncdhhs.gov/

Sec. Mandy Cohen, MD
Declaration of State of Emergency
March 10
Questions that need answers to enable Data Driven Policy

- How many cases will we see?
- When will it peak?
- Will we run out of beds? ICU beds? Ventilators?
- Should we shut down bars and restaurants? Schools? Businesses?
- How much (extra) PPE is needed, and where can we get it from?
- When can we start things back up?
- What should we start back up first?
Data Sources

- Database for reportable diseases
- Survey tool- for hospital capacity
- HIE
- ED Visits- NSSP/BioSense
Overly simplified testing data flow - NOT verified, likely with some inaccuracies...
NCOEMS (NC Office of Emergency Medical Services) “ReadyOp” survey system

- Daily survey sent to all hospitals
- Measures “stuff, staff, space”
- Manual export to Excel (changing)
- Pilot w/ hospital system using HL7/ADT
- Federal requirements

<table>
<thead>
<tr>
<th>Staffed Bed Capacity</th>
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<tbody>
<tr>
<td>Beds that are licensed and physically available for which staff is on hand to attend to the patient who occupies the bed. Staffed beds include those that are occupied by a patient and those that are vacant.</td>
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<table>
<thead>
<tr>
<th>TOTAL Staffed Inpatient Capacity (all bed types)</th>
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<tr>
<th>Adult Intensive Care Unit Staffed Bed Capacity</th>
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<td>must be numeric entry - enter 0.1 to indicate N/A</td>
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<th>Emergency Department Average Census</th>
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<tr>
<td>must be numeric entry - enter 0.1 to indicate N/A</td>
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...
Lab Test Data

State lab

Staff calls contacts

#’s via phone or email

Private Labs

Health Systems
Removed NCDHHS-specific flow diagrams- not complete or validated (or useful to others, or flattering).
“Fast paced environment”

• Thinking long term- like 2 days...
• PUI forms example- “Person Under Investigation”
  • Paper form faxed to LHD, hand entered
  • Design app to facilitate digital entry
  • 2 days later, minority of tests using PUI form
• Constant phone calls and meetings, all hours (weekends included)
Many moving parts

• DHHS Org chart is already hundreds of pages
• Many people playing new/different roles
• Add:
  • Department of Public Safety
  • State Emergency Response Team
  • National Guard
• New people being brought in over time
Phases of the emergency

- **Need data STAT!**
  - Immediate information to inform decision making

- **Steady state updates**
  - Fire alarm has subsided, need sustainable processes

- **Modeling resolution**
  - How do we know when to ease up?

We Are Here
Data Modeling

Adapted from CDC / The Economist
Our views and findings do not represent any organization.
Current state is untenable.

Flip switch back to on is dangerous.

Ergo a dimmer switch...
Disease modeling and simulation during a pandemic in New York City -- data requirements, methods, and information needs
COVID-19:
How to model an outbreak in several steps...

Nathaniel Hupert, MD, MPH, FACP
Associate Professor of Medicine, Weill Cornell Medicine | Associate Attending Physician, New York Presbyterian Hospital
Co-Director, Cornell Institute for Disease and Disaster Preparedness
Contact: nah2005@med.cornell.edu

Prepared For AMIA Webinar
April 20, 12:00
Disclaimer/COI

The findings and opinions presented here are those of the presenter and do not necessarily represent the official position of Weill Cornell Medicine, Cornell University, NewYork-Presbyterian Hospital, SUTD, The University of Oxford, the U.S. Centers for Disease Control and Prevention (CDC) or the National Academies of Science, Engineering, and Medicine (NASEM).
CAVEAT: STILL NO predictive COVID model

- There is no generally accepted modeling approach or output that can produce a definitive (or even consensus) *future* epidemic curve of the spread and clinical impact of SARS-CoV-2 causing COVID-19 in the United States or other countries.

- Exponential early rise **DOES NOT NECESSARILY MEAN** continued exponential growth at later dates.

- Shape of the epidemic curve and length of stay in hospital units matter for initial hospital load.

- “Propagation of Uncertainty”
How to model an epidemic....

1. Get data
2. Make model
3. Fit curve
4. Modify curve
5. Determine hospitalized + critical care %
6. Determine LOS
7. Simulate epidemic
8. Tell people results, CAREFULLY

NOTE: PUBLIC DATA

Upper image: Lisa White (Oxford), Nathaniel Hupert (WCM), many others, NYS modeling work
Lower image: Alex Washburne (Montana), Colin Parrish (CU), Raina Plowright (Montana), unpublished ms
Two competing views of SARS-CoV-2/COVID

1. Infects a:
   - VERY LARGE NUMBER of people over a relatively
   - LONG PERIOD OF TIME, with a
   - VERY LARGE fraction going to hospital...\(^1\)

2. Infects an:
   - EVEN LARGER NUMBER of people over a
   - MUCH SHORTER PERIOD OF TIME with a
   - MUCH SMALLER fraction going to hospital...\(^2\)

OLDER PARADIGM

NEWER PARADIGM

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\(^1\) IHME, Ferguson 2020, Modandas 2020
\(^2\) https://www.medrxiv.org/content/10.1101/2020.04.01.20050542v2.article-info, Metzger 2004
Created by Lisa White, Wirichida Pan-ngum, Ricardo Aguas, Nathaniel Hupert, Olivier Celhay, Fatima Arifi, Caroline Franco, and others
COVID19 INTERNATIONAL MODEL

Created by Lisa White, Wirichida Pan-ngum, Ricardo Aguas, Nathaniel Hupert, Olivier Celhay, Fatima Arifi, Caroline Franco, and others
Cornell Caseload Calculator C5V

- https://phs.weill.cornell.edu/cornell-covid-caseload-calculator-c5v
## Scenario Parameters

### Inputs
- **Covid-19 parameters**
- **Inputs in blue**

### Outputs
- **Infections rate**
- **Asymptomatic rate**
- **Modified CDC Mild Scenario**
- **Modified CDC Severe Scenario**

### Today's Case

### Step 1
- **Enter age-stratified catchment population:**
  - **In:**
    - Age Range: 0-4
      - Total Area Pop: 1,000,000
      - Hospital System Market: 0
      - Modelled Pop: 0
    - Age Range: 5-17
      - Total Area Pop: 1,000,000
      - Hospital System Market: 0
      - Modelled Pop: 0
    - Age Range: 18-49
      - Total Area Pop: 1,000,000
      - Hospital System Market: 0
      - Modelled Pop: 0
    - Age Range: 60+
      - Total Area Pop: 1,000,000
      - Hospital System Market: 0
      - Modelled Pop: 0
  - **TOTAL:**
    - Total Area Pop: 1,000,000
    - Hospital System Market: 0
    - Modelled Pop: 0

### Step 2
- **Enter your overall assumed attack rate:**
  - **In:**
    - Population that will eventually become infected, even if asymptomatic: 0%

### Step 3
- **Enter the assumed % of people with the infection who are SYMPTOMATIC:**
  - **In:**
    - Symptomatic population: 50%

### Step 4
- **Adjust TOTAL (use hospitalization rates & O/D) over duration of event (1st = 50%)**
  - **In:**
    - Total Medical/Surgical and Critical Care hospitalizations over entire outbreak

### Step 5
- **Adjust LOCAL (use hospitalization rates & O/D) over duration of event (1st = 50%)**
  - **In:**
    - Total Medical/Surgical and Critical Care hospitalizations over entire outbreak

### Step 6
- **Choose the day of maximum cases:**
  - **In:**
    - Day of interest: 45

### Step 7
- **Choose shape of the epidemic curve:**
  - **In:**
    - Shape: Linear

### Critical Care/Inpatient Workload Predictor
- **In:**
  - SARS-CoV: 0
  - Other: 0

---

*Note: LOS inputs assumed correct for both Mild and severe populations

*Note: LOS inputs expressed in hours.*
The BIG QUESTIONS

- **Prevalence?**
  - Slow- vs. Fast-growth models
  - HUGE impact on what comes next

- **Societal Impact?**
  - Why do some epi curves not look at all like others
  - What are local effects?
  - Range: prior air pollution

- **Treatment Variability/Outcomes?**
  - Large variation between countries, counties, hospitals
The NEXT STEPS

- Determine prevalence in multiple locales
- Align public statements based on evidence
- Re-calibrate probability/magnitude of potential “second wave”
- Model “whole health” impact of virus + lockdown on the public’s health
- Revise plans for future on up to date evidence basis
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- WMC Medical students Lior Shtayer and Vruj Patel
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Chief Medical Information Officer
CGI Federal

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Informatics policies during and after a crisis, national initiatives, and long-term strategies
Maximizing Electronic Public Health Surveillance: Working the Curve While Not Jumping the Shark

John W. Loonsk MD FACMI

Consulting Chief Medical Informatics Officer, Association of Public Health Laboratories
Adjunct Associate Professor, Johns Hopkins Bloomberg School of Public Health
Electronic Public Health Surveillance is Not “Done” in U.S.

• Broader public recognition in COVID-19 than ever before
  • Outbreak management, contact tracing, case management, connecting lab results, coordinating response measures, situational awareness, reporting to others

• Not fully addressed by syndromic surveillance or electronic laboratory reporting
  • Syndromic surveillance started with patient chief complaints because those were the data that could be accessed electronically
  • Electronic Laboratory Reporting (ELR) was similar and a helpful start, but lab results do not contain critical clinical data or the patient demographic information for case management and contact tracing
Outbreak Management and Response
Health IT in the United States:
Introduction, Context, and Terminology

John W. Loonsk MD FACMI
Adjunct Associate Professor
Center for Population Health IT
Johns Hopkins Bloomberg School of Public Health
March 2015

Outbreak Management HIT

4. Case management

- Public health receives possible and confirmed cases and works these populations
- Cases confirmed with lab results and / or investigation
- Contact tracing to manage, link, and work what can be a rapidly increasing number of possible cases

Surveillance / Outbreak Management Systems

- Commercial, self-developed, and CDC developed systems
- Implemented at state and local health departments and some mobile applications
- Surveillance, case management, contact tracing, investigation support, reporting to local and state health departments as well as CDC
Not the first rodeo:
• West Nile in NYC
• West Nile in Blood Supply
• Anthrax
• SARS
• Smallpox vaccine program
• Monkeypox
• Katrina
Public Health Event Curves

Events over time
- Cases
- Flare-ups or seasonal resurgence
- Limited progress
Public Health Event Curves

Public Health
  • Attention to...
  • Including earnest clinical care HIT
Public Health Event Curves

Public Health
• Funding for...
• Boluses of money that are rarely enduring
Public Health Event Curves

- HIT progress...
- Is the time for enduring change too
- Does not all have to be transient
Health IT
• Swirl...
• Understand Public Health requirements?
• PHAs have specific needs too

Public Health Event Curves
Electronic Public Health Surveillance

- Not all help is created equal
- Public health has own special needs:
  - State laws
  - Data exchange at scale
  - Public health surveillance systems
- One does not want to refuse immediate solutions
- Public health needs enduring, dual-use solutions at the same time
Electronic case reporting (eCR)

The automated identification of reportable health events in electronic health records and their transmission to state and local public health authorities for review and action.

1. Cohort-based COVID-19 rapid eCR implementations for provider sites that have eCR enabled EHRs

2. A new eCR Now FHIR app that other, non-eCR enabled, EHRs can immediately implement to automate COVID-19 eCR

3. Extension of the existing eHealth Exchange policy framework through a developing Carequality eCR implementation guide

(4/20) Last week we on-boarded new COVID-19 eCR for 4.5 million patients and 13,000 physicians
Audience Q&A
AMIA 2020
COVID-19 Webinar Series
Informatics matters. Now more than ever.

● Visit AMIA.org/COVID19