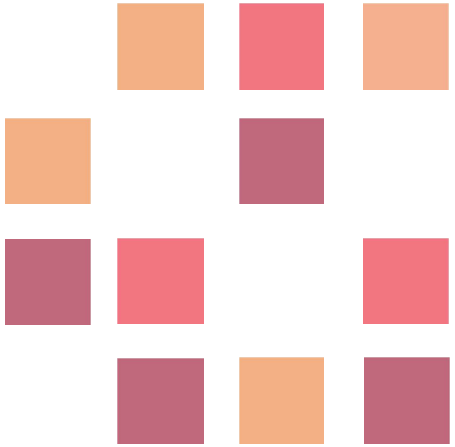
DMI
Data Modernization
INITIATIVE



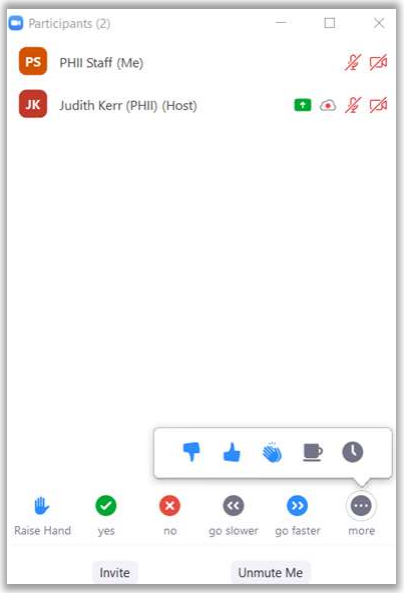
Machine learning to support the capture and use of data

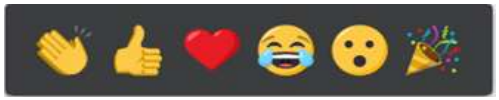
Facilitator: Samantha Chao, MPH, Public Health Informatics Institute | May 20, 2021

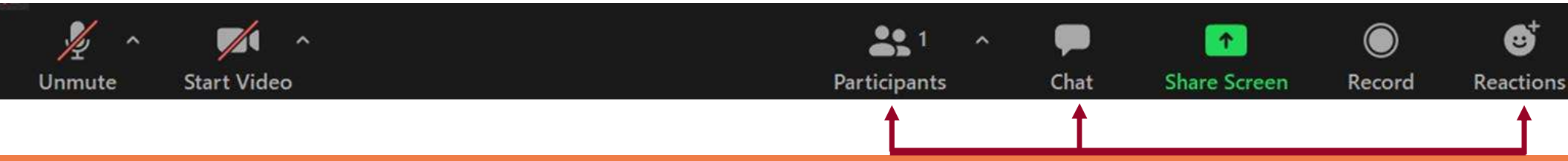
Better data. Better decisions. Better health.

Finding your way around Zoom

- The audience is muted.
- Type your questions into the chat or use reactions to communicate with presenters.





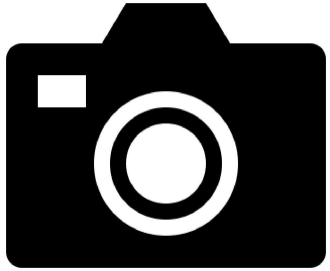


PLUNGED INTO THE FUTURE

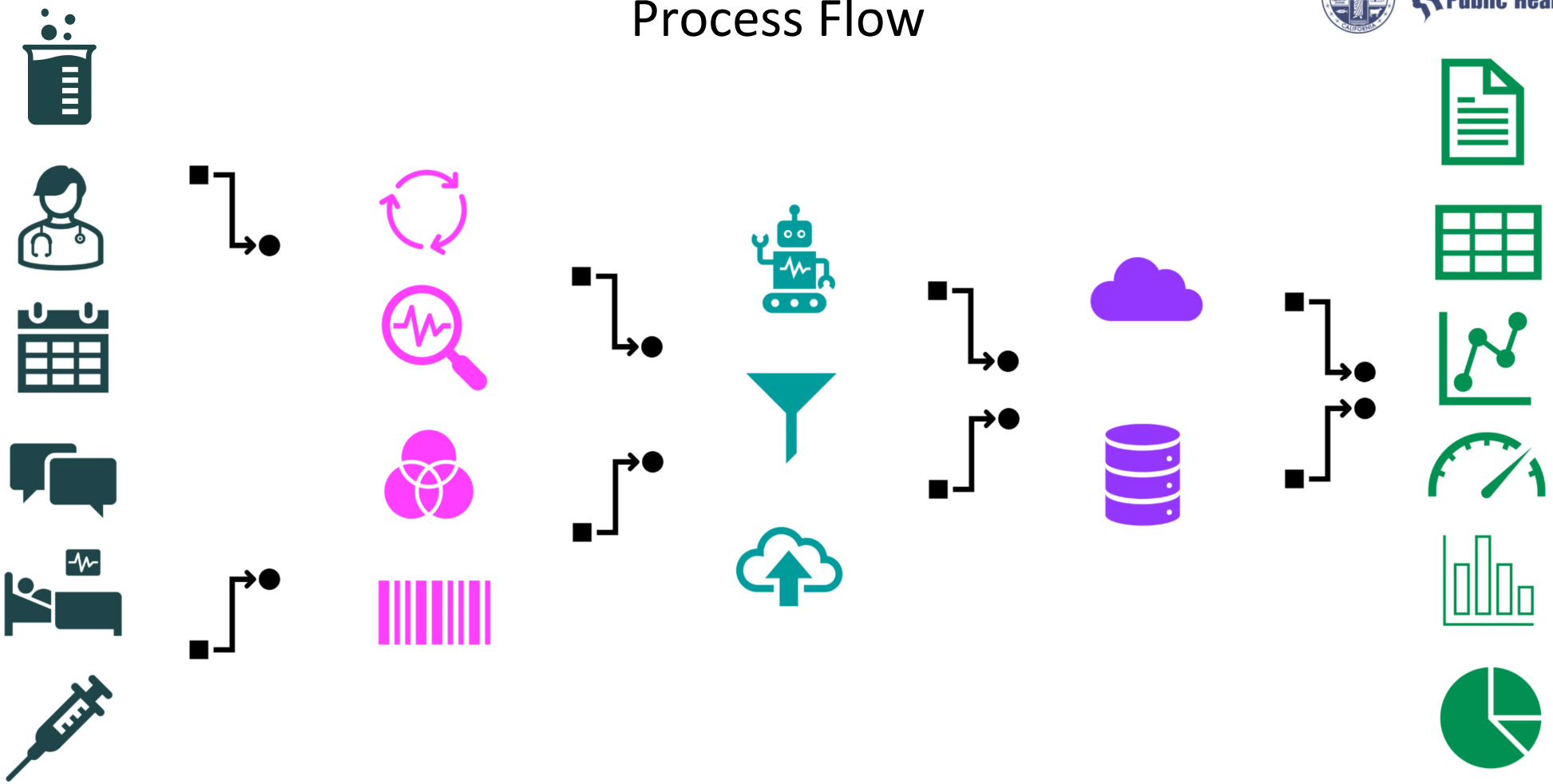
Efforts in surveillance data modernization (*survival*) in Los Angeles County under COVID-19

Framing

- Issues:
  - Volume of data
  - Surveillance data system age
  - Limited import utility in surveillance system
  - Proliferation of laboratories not yet on ELR
  - Expectation of data reporting and interest
    - Agency leadership, media and the public
- General approach:
  - Acceptance, standardization, automation
  - Data intake, integration, analysis, reporting



Process Flow



Web-based Reporting

Medical Provider Report of COVID-19 Laboratory Results

Include positive PCR/NAAT or Antigen tests ONLY. To report point-of-care test results, please see Provider/Clinical Facility Reporting of Point of Care Test Results

Please ONLY submit for residents of LA County (excluding Pasadena and Long Beach)

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MEDICAL PROVIDER INFORMATION

Physician/Infection Preventionist Name *

Facility Name *

Physician/ Infection Preventionist Pager/Phone *

E-mail Address *

Date of Report *

May 11, 2021

PATIENT INFORMATION

Patient Last Name *

Patient First Name *

Middle

Facility Name (if not living at home)

Date of Birth *

Provider/Clinical Facility COVID-19 Point of Care Test Result Report Form

Resize font:

It is recommended that all SARS CoV-2 POCT test results (e.g. positive, negative and indeterminate) be reported, but it is only required to report the positive results.

Complete the form below to report the POCT results of each patient.

This reporting replaces the requirement to submit a Medical Provider Report Form for positive results.

***NOTE** – Before completing form, a one-time registration is required so your clinic information can be pre-collected and then pre-populated in the reporting portal below. Click here to register.

For questions regarding POCT reporting email POCReportQA@ph.lacounty.gov.

Patient Information

First Name
* must provide value

First

Last Name
* must provide value

Last

Patient Identifier

This may include the following: medical record number, social security number, account number, etc.

Date of Birth
* must provide value

M-D-Y

Gender
* must provide value

Race
* must provide value

Ethnicity
* must provide value

Patient Address
* must provide value

Include house number, direction, and street name. Note - Homeless, if known.

Tools

Intake

Matching, Analysis, Reporting

ETL

Integration

Aspirations for the future

- Big data infrastructure and tools for communicable disease surveillance
  - Hadoop data lake—engineering is in progress
- Surveillance system import API
  - Vendor development in progress for multi-threaded RESTful API
- Data science
  - Hired four data scientists and a python engineer
  - Develop and deploy models using data science framework
  - Professional development for epidemiologists
- Extend novel intake processes to other diseases
- Refine standardization and automate matching processes
- New supplemental data source identification and integration

Questions?

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National Institute for Occupational Safety and Health

Applying Machine Learning to Coding Work Information for Public Health Surveillance

Stacey Marovich, MHI, MS, PMP
Lead Health Informatics Scientist
CDC/NIOSH

Public Health Informatics Institute Data Modernization Workshop

May 20, 2021

Background

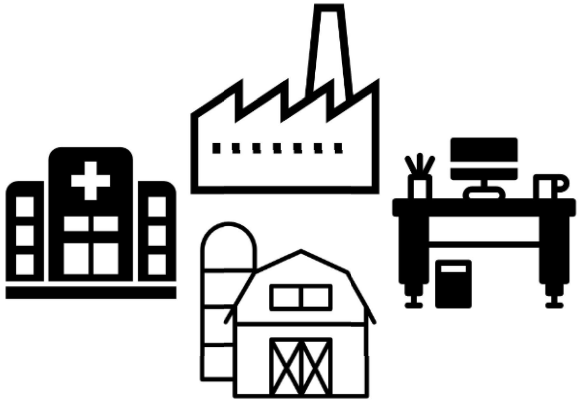
- Health and work are interrelated but work information is inadequately collected in public health activities.

- Critical need for industry and occupation (I&O) to be collected and coded into structured categories to facilitate care and inform interventions.

What is industry and occupation?

- **Industry** – The kind of business where a person works
  Examples: *Grocery Store, Hospital, Bank, Auto Manufacturer*

- **Occupation** – The kind of work a person does to earn a living
  Examples: *Bank Teller, Nurse, Inspector, Waiter*



Industry and occupation coding challenges

Industry	Occupation	Issues
Automobiles	Administrative	**Inadequate information**
Hole Sail	CRC Rep	**Misspellings, abbreviations**
9 thru 12	Math Teacher	**Unusual terms**
Jones & Sons	Secretary	**Company names for industry**
Welder	Construction	**Reversed entries**
Metal Smith – Jewelry Designer – Studio	Make handmade jewelry and small objects	**Lengthy/complicated responses**

NIOCCS: What is it?

- NIOSH developed the **NIOSH Industry and Occupation Computerized Coding System** (NIOCCS), a web-based software tool, to translate industry and occupation (I&O) narratives to standardized I&O codes.

- Reduces high cost of manually coding I&O information while simultaneously improving uniformity of the codes.

- NIOCCS has coded over 67 million records to date.

NIOCCS: past, present, and future

- Version 1 was released in late 2012.
- Versions 1 through 3 used rules-based logic for industry/occupation auto-coder.
- Just released NIOCCS Version 4 for public use in early 2021.
  - Nearly 17 million records already coded through the system
- Version 4 uses machine learning (ML) for the industry/occupation auto-coder.

NIOCCS: who uses it?

- NIOCCS has nearly 900 user accounts.
  - Over 140 accounts requested so far for new version of NIOCCS
- Global user base includes U.S. and 21 foreign countries.
- Used by variety of organizations that collect and/or evaluate information using I&O, including:
  - Occupational researchers
  - Federal government agencies
  - State/local health departments
  - Academic institutions
  - Cancer registries

Machine learning in I&O coding

- NIOCCS Version 4 applies machine learning methods to auto-code I&O narratives into standardized coding classification schemes (NAICS, SOC, Census).

- Building blocks of the NIOCCS I&O auto-coder are:
  - **Word vectors** – technique used to encode text for use in machine learning algorithms
  - **Neural networks** – machine learning algorithms used to classify I&O text into I&O codes

- Technologies used:
  - Python, Scikit Learn, Keras, TensorFlow, and pre-trained word vectors

- Training data:
  - ~1 million industry and occupation records coded by professional coders
  - Mostly comprised of free text I&O responses from death certificates
  - Split 80/10/10 between training/cross validation/testing

Key benefits of applying machine learning to I&O coding

- **Speed**
  - Orders of magnitude faster execution times
- **Easier to maintain and more adaptable**
  - Transition from rules-based to data-driven
- **Improve uniformity of coding**
  - Reducing human factor
- **Support more occupational safety and health (OSH) research**
  - Increase NIOSH and others' ability to code more data for OSH research
- **Auto-codes 100 percent of records**

NIOCCS Version	V1	V2	V3	V4
Period Used	2013-2014	2015-2017	2018-2019	2020-
Auto-Coded Rate	59%	66%	84%	100%
Accuracy Rate	~90%	~90%	93%	>90%

Tools for coding I&O data

- **Batch Coding**
  - NIOCCS – Code a file function

- **Single Record Coding**
  - CDC EPI Info
    - I&O template released in May 2020 in Version 7.2.4
  - Custom, localized implementations
  - NIOCCS web service

Tools for coding I&O data

- NIOCCS web service
  - Uses same machine learning models as NIOCCS
  - Accessed for free via a simple web call
  - No login or account required
  - Non-proprietary/system agnostic
    - JSON output
  - No data is stored/retained on the NIOSH server
  - Example code and more information available at: https://csams.cdc.gov/nioccs/HelpWebService.aspx

Acknowledgements

NIOCCS System Development Team
Stacey Marovich (NIOSH), Project Officer
Kelly Vanoli (NIOSH), Lead Developer
Jennifer Cornell (NIOSH), Technical Information Specialist
Jeff Purdin (Contractor), Developer/Data Manager
Pam Schumacher (Contractor), I&O Coding SME

Industry and Occupation Data Coding Team
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Liz Smith (Contractor), QC Coder
Katrina Bicknaver (Contractor), Coder
Sue Burton (Contractor), Coder
Crystal Greene (Contractor), Coder
Krista Purdin (Contractor), Coder
Rebecca Purdin (Contractor), Coder
Joetta Thornton (Contractor), Coder
Surprese Watts (Contractor), Coder

Contact Us

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https://csams.cdc.gov/nioccs/

Next steps

- Continue the discussion on the message board (link provided in the chat)
- Ten-minute break: 1:30– 1:40 PM EST
- Next session: 1:40 – 1:55 PM EST
  - *Data modernization planning toolkit overview*

Thank you.

DMI

Better data. Better decisions. Better health.