With So Much COVID-19 Data, Why Didn't We Have Better Information About the Pandemic?

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Creighton University School of Medicine
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Iowa SAS Users Group One-Day Meeting
May 22, 2023

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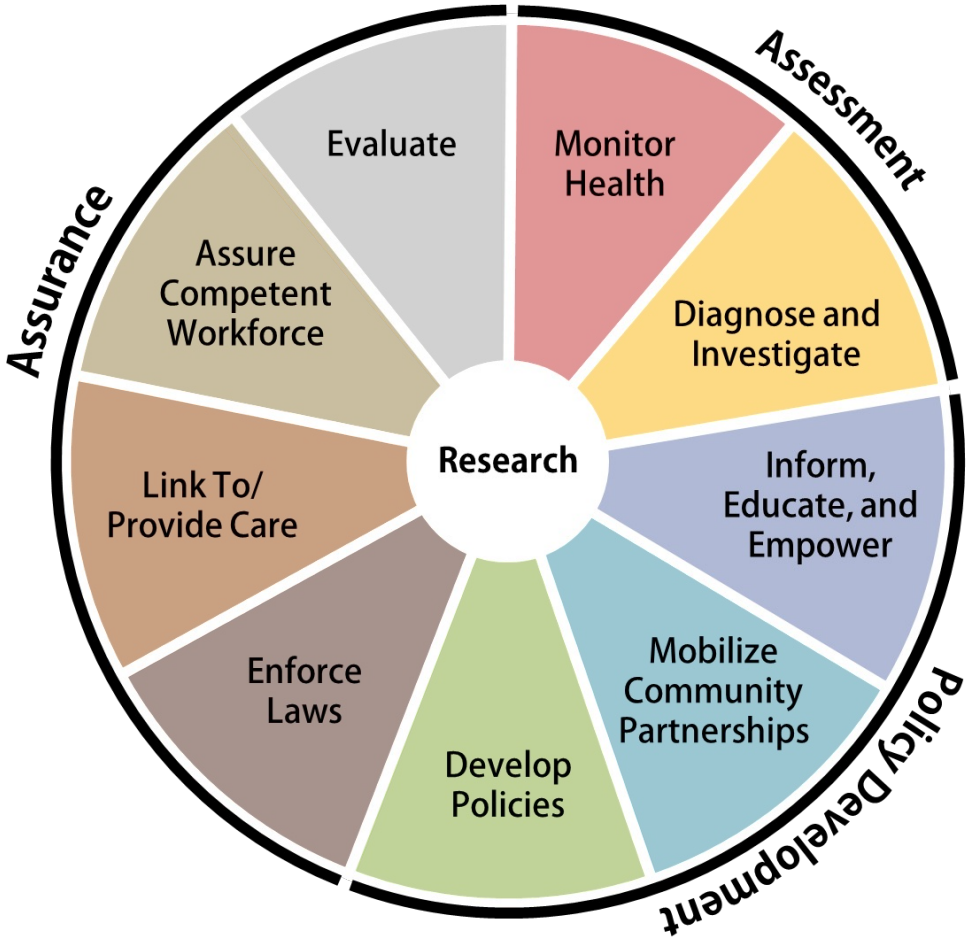
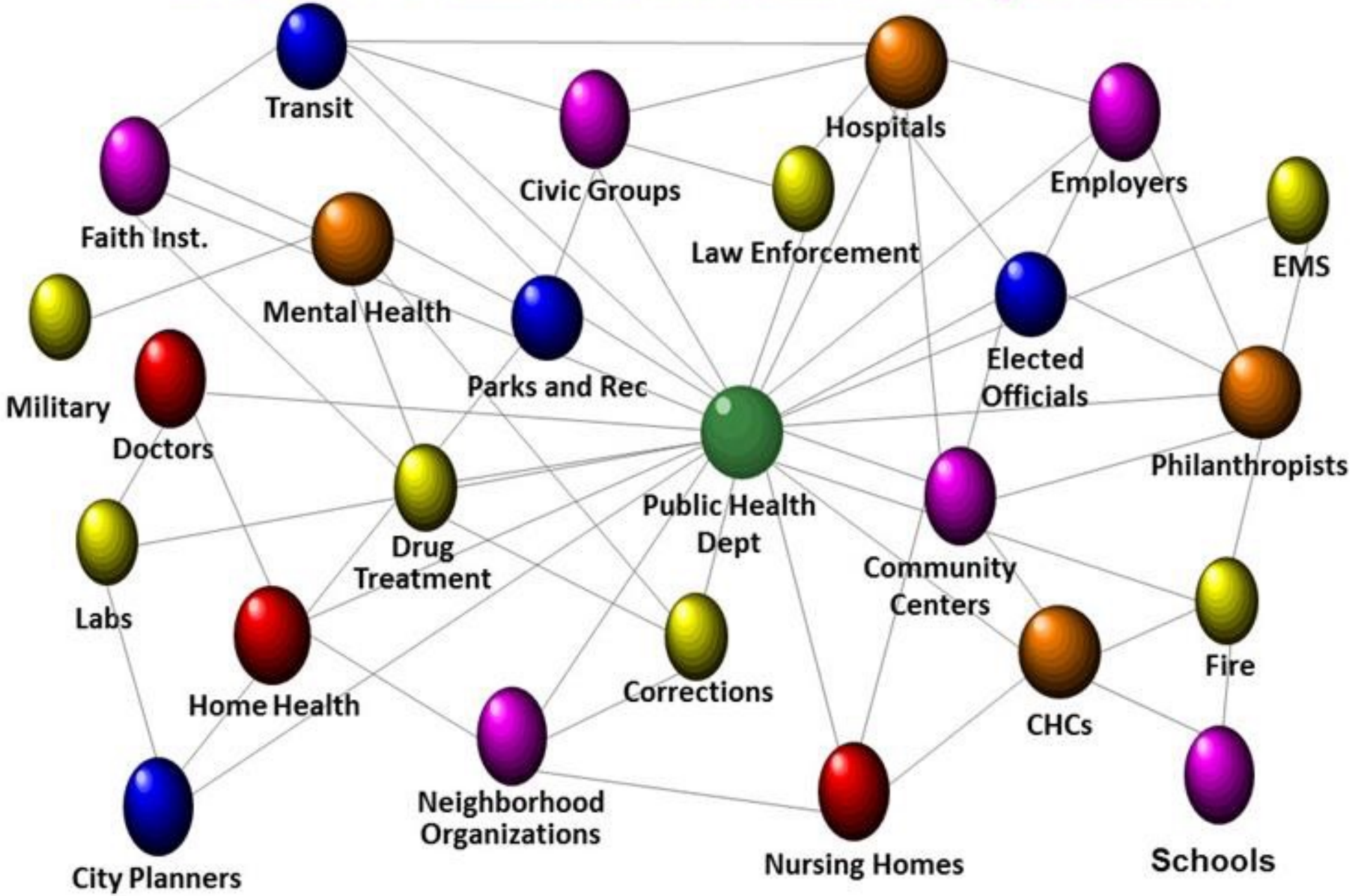
Essential Public Health Services



Local Public Health System



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Epidemiology

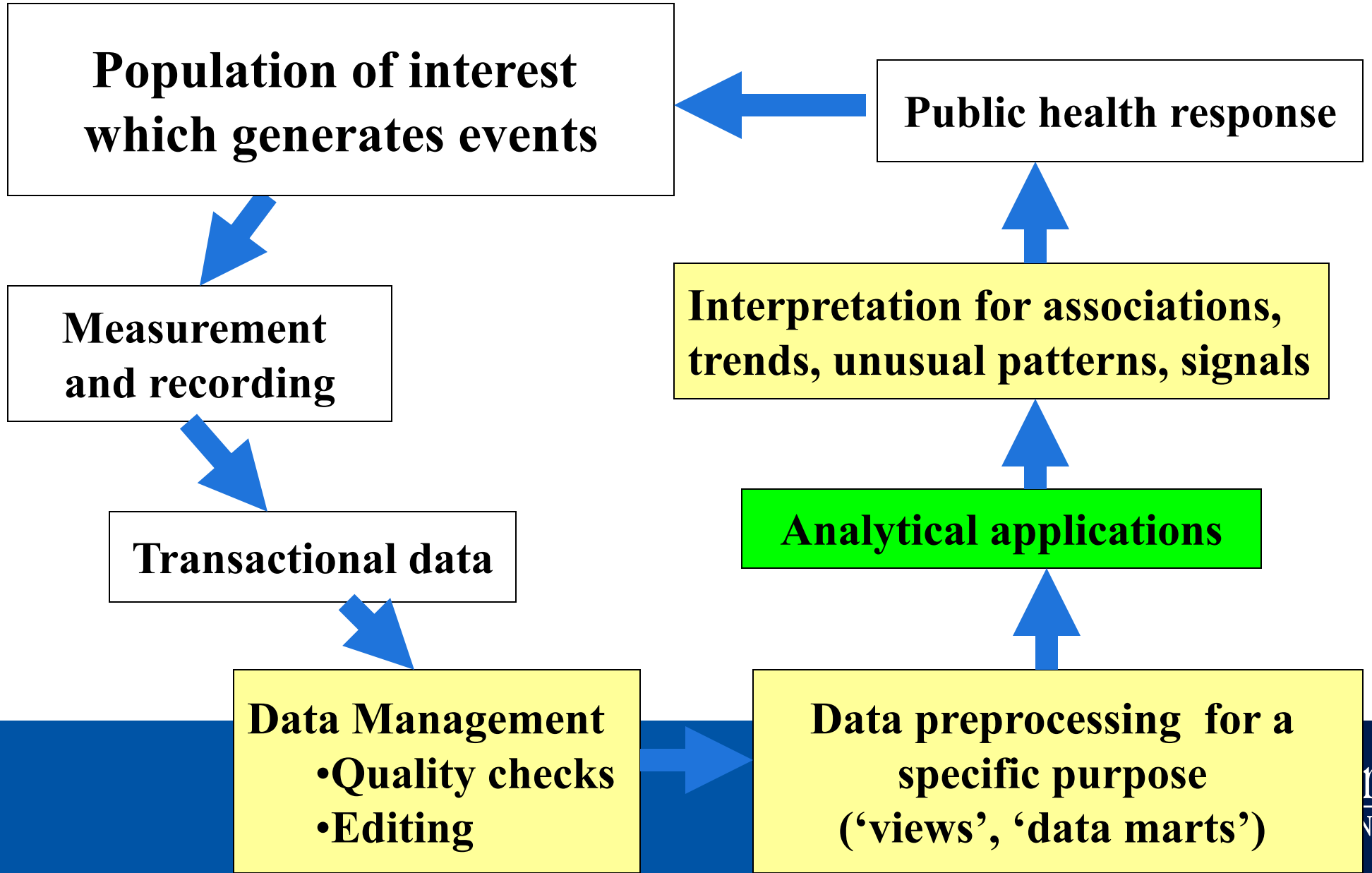
- The study of the distribution and determinants of disease in a population
  - Smoking as a risk factor for lung cancer
  - Hand washing as a protective factor against illness
  - Contribution of age to motor vehicle crashes
  - Cell phones and crashes
  - Source of foodborne outbreaks
- Epidemiologic Methods
  - Randomized, Controlled Trials (RCTs)
  - Observational Studies (Prospective, Retrospective)
  - Case Series

Public Health Surveillance

- "Ongoing systematic collection, analysis, and interpretation of outcome-specific data for use in the planning, implementation, and evaluation of public health practice."

- *Stephen Thacker, CDC

Surveillance System Components



Uses of Public Health Surveillance

- **Estimate magnitude of the problem**
- **Determine geographic distribution of illness**
- **Portray the natural history of a disease**
- **Detect epidemics/define a problem**
- **Generate hypotheses, stimulate research**
- **Evaluate control measures**
- **Monitor changes in infectious agents**
- **Detect changes in health practices**
- **Facilitate planning**

National Notifiable Diseases Surveillance System (NNDSS)

- CSTE/CDC collaboration
- List revised at annual CSTE meeting, case definitions agreed upon
- Health care providers, laboratories report to local HD (county)
- County HD submits reports to State
- Voluntary reporting by states to CDC
- Reportable diseases vary by state

TITLE 173 COMMUNICABLE DISEASES

CHAPTER 1 REPORTING AND CONTROL OF COMMUNICABLE DISEASES

TABLE OF CONTENTS

http://www.sos.state.ne.us/rules-and-regs/regsearch/Rules/Health_and_Human_Services_System/Title-173/Chapter-1.pdf

1-004 REPORTABLE DISEASES, POISONINGS, AND ORGANISMS: LISTS AND FREQUENCY OF REPORTS: The following diseases, poisonings, and organisms are declared to be communicable or dangerous or both to the public. Incidents of diseases, poisonings, and organisms must be reported as described in 173 NAC 1-004.01 through 1-004.03, 1-005, and 1-006.

1-004.01 Immediate Reports

1-004.01A The following diseases, poisonings, and organisms must be reported immediately:

Anthrax (*Bacillus anthracis*^)* ‡
Botulism (*Clostridium botulinum*^)*
Brucellosis (*Brucella abortus*^, *B. melitensis*^, *and B. suis*^* ‡
Cholera *(Vibrio cholerae*^) ‡
Coccidiodomycosis (*Coccidioides immitis/posodasil*^)*
Diphtheria (*Corynebacterium diphtheriae*) ‡
Eastern equine encephalitis (EEE virus^)*
Food poisoning, outbreak-associated
Glanders *[Burkholderia (Pseudomonas) mallei*^*]** ‡
Haemophilus influenzae infection (invasive disease only)^ ‡
Hantavirus pulmonary syndrome (Sin Nombre virus)
Hemolytic uremic syndrome (post-diarrheal illness)
Hepatitis A (IgM antibody-positive or clinically diagnosed during an outbreak)
Influenza due to novel or pandemic strains (includes highly pathogenic avian influenza virus^)*
Measles (Rubeola)
Melioidosis [*Burkholderia (Pseudomonas) pseudomallei*]* ‡
Meningitis (*Haemophilus influenzae*^ *or Neisseria meningitidis*^)
Meningococcal disease, invasive (*Neisseria meningitidis*^)
Monkeypox virus infection*
Pertussis [whooping cough] (*Bordetella pertussis*^)‡
Plague (*Yersinia pestis*^)*‡

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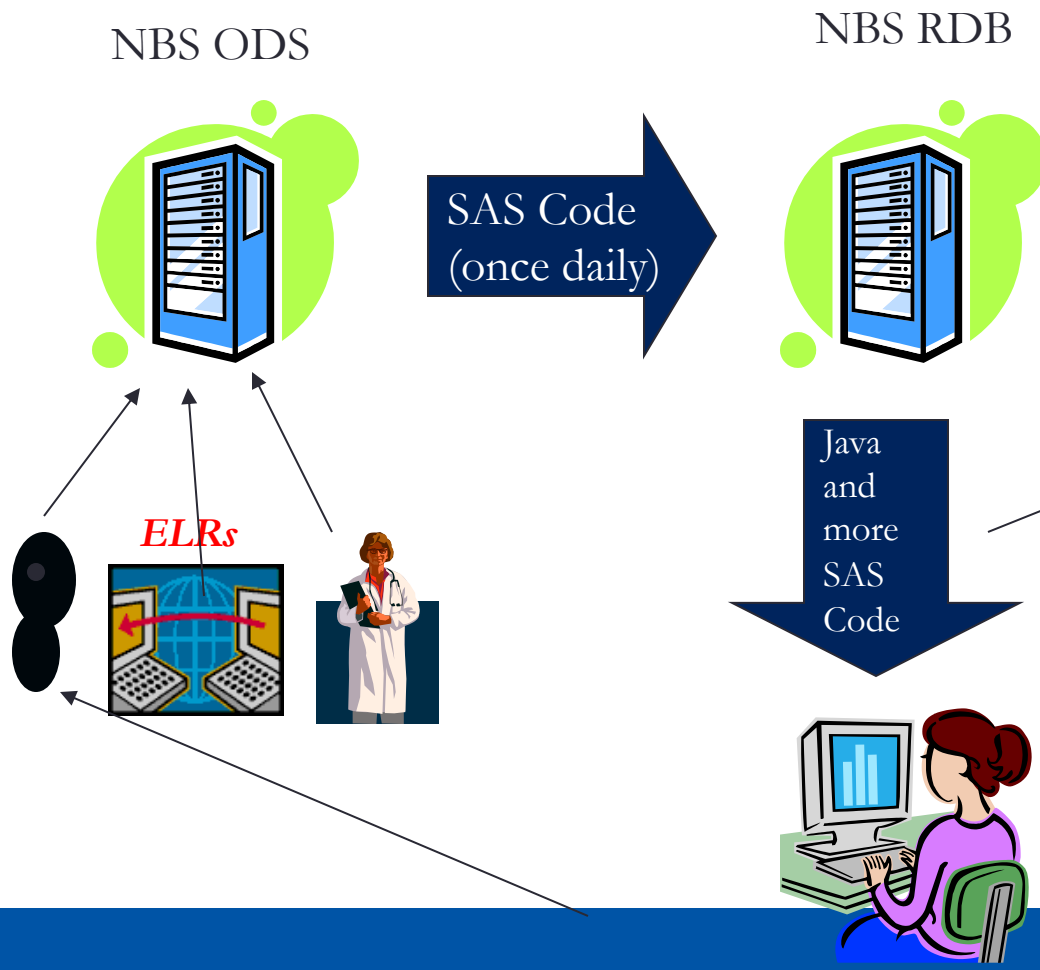
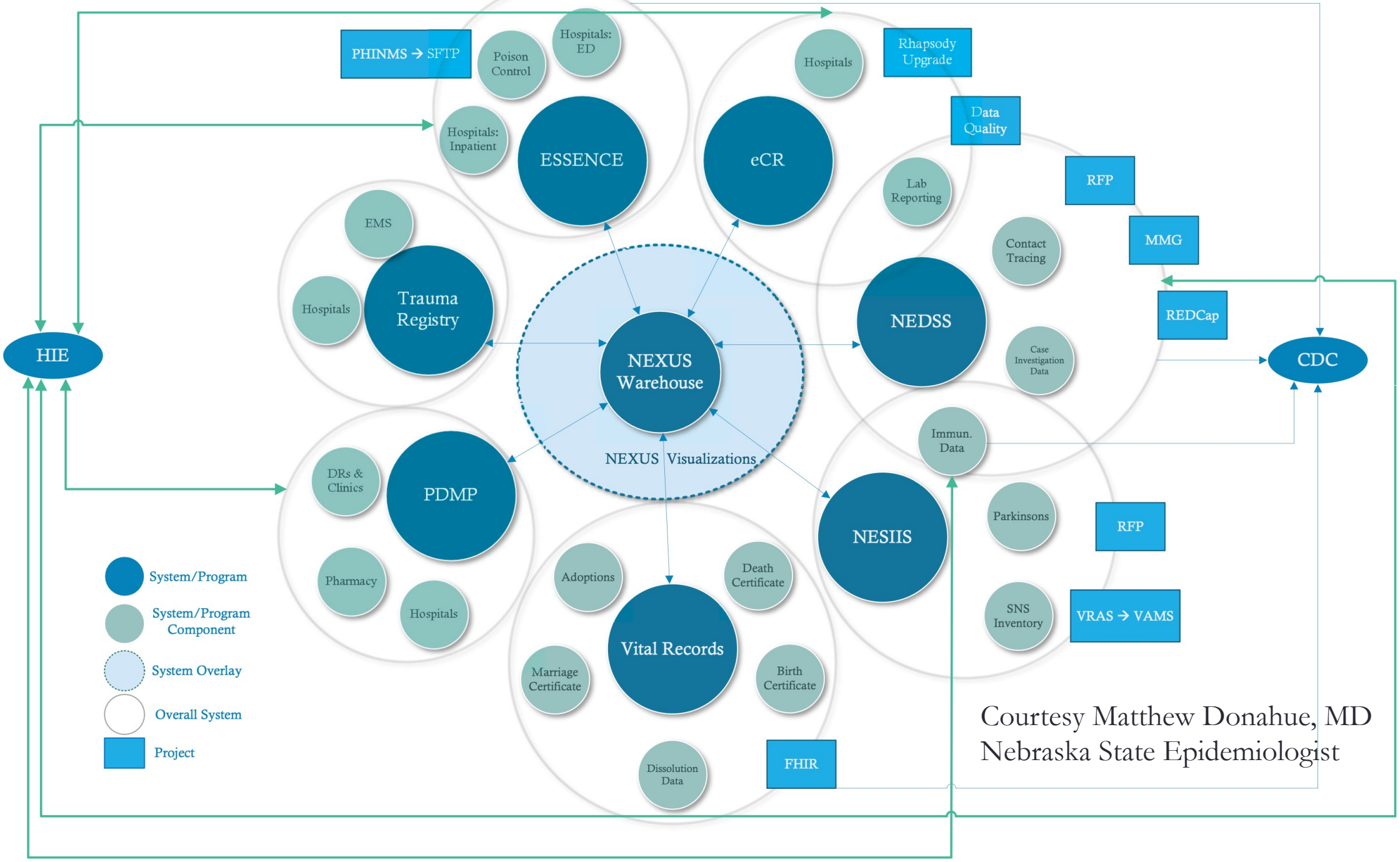
NE NEDSS Data Flow



- Lab Report Datamart
- Investigation Datamart
- Custom Datamarts
  - Hepatitis
  - Pertussis
  - Latent TB Infection
  - Mumps
  - WNV
- Custom “canned” reports
  - Daily lab rpt line list
  - Open investigations
  - Monthly and YTD counts
- Custom data extracts
  - DBF formatted for import into NETSS/EPI6

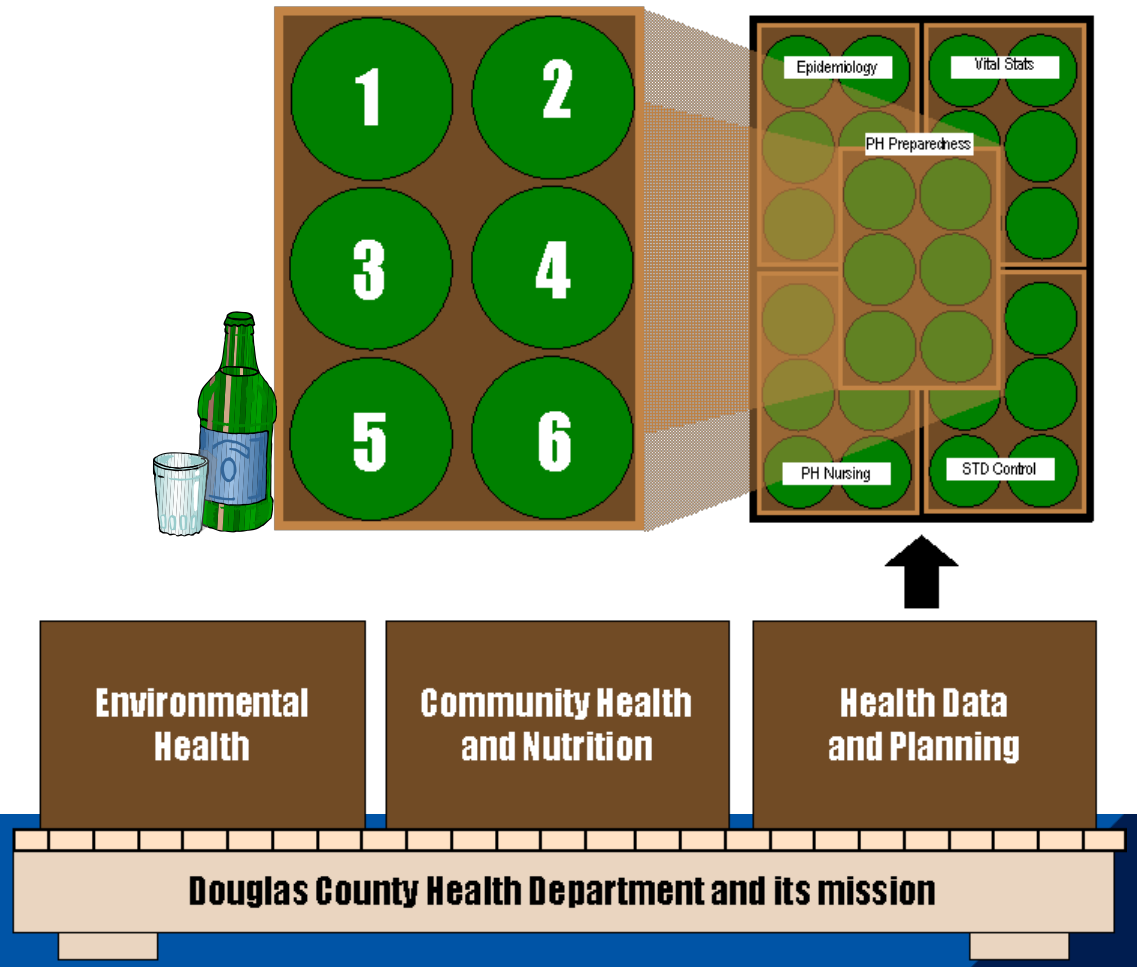
Secure Site: NE Guardian



Courtesy Matthew Donahue, MD
Nebraska State Epidemiologist

Six Essential Functions of Emergency Preparedness

1. Community Leadership and Coordination
2. Early Detection and Ongoing Surveillance
3. Disease Investigation, Control and Community Mitigation
4. Mass Distribution and Vaccination
5. Communication of Essential Information
6. Environmental Surety

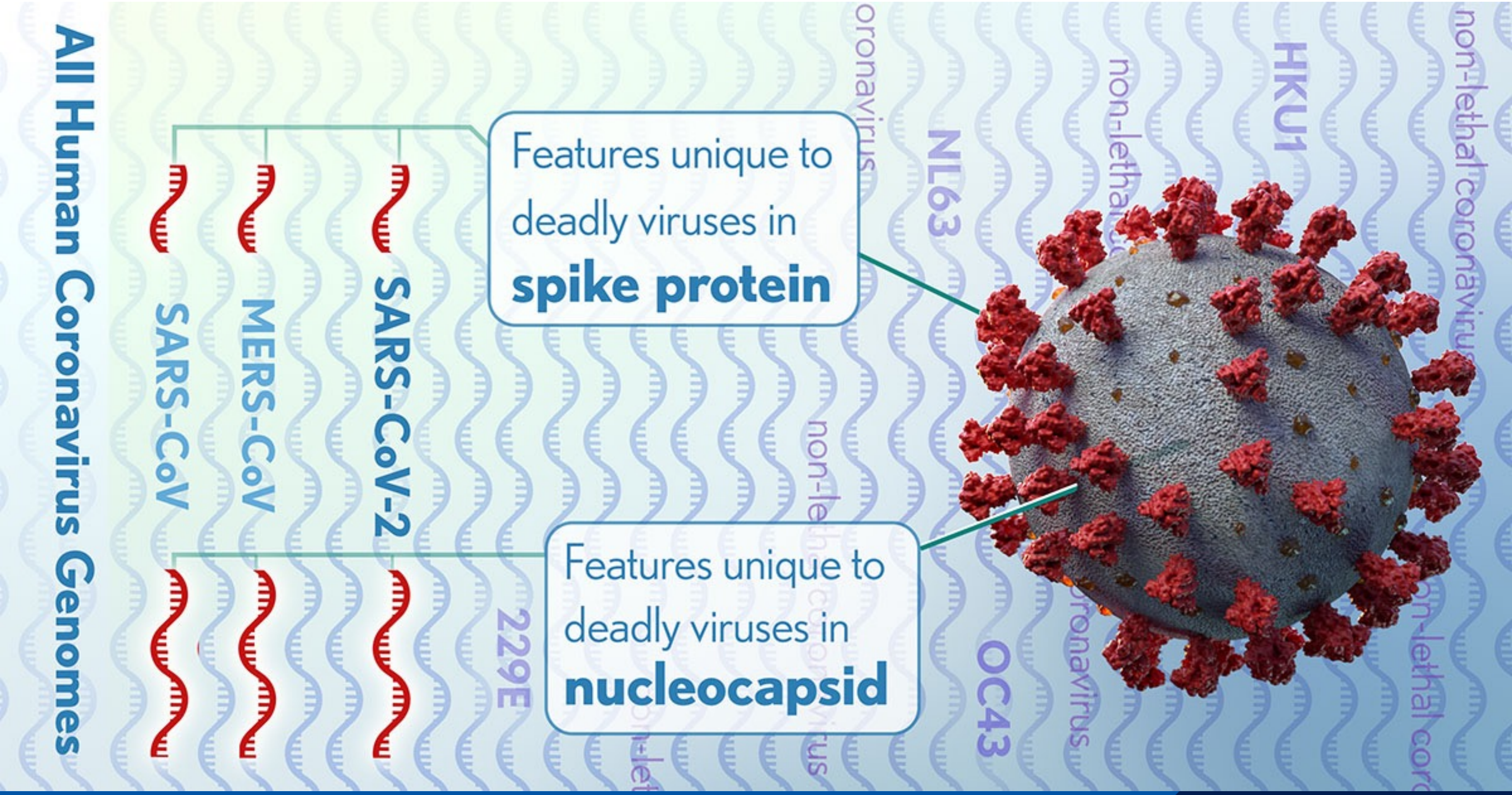


Epidemiology in a pandemic

- Do we have a new disease and what are the symptoms
- Who is it affecting, what are the risk factors
- How severe is it?
- How is it changing

2009 H1N1 Influenza

- Community leadership
- Early detection
  - Douglas Co.'s first case (just days after pandemic identified)
    - Visitor from Southern California
    - Presented to VA emergency department
    - 'Astute clinician' contacted public health
- Ongoing surveillance
  - Enhanced influenza surveillance
  - Monitor strain, antiviral resistance, populations affected, duration of outbreak, institutional outbreaks
- Disease investigation, recommendations to schools
- Vaccine allocation and distribution
- Communication with public, providers


All Human Coronavirus Genomes
SARS-CoV
MERS-CoV
SARS-CoV-2
Features unique to deadly viruses in **spike protein**
Features unique to deadly viruses in **nucleocapsid**
229E
NL63
OC43
HKU1
non-lethal coronavirus

Pandemic Indicators

- #/Rate cases
- % positivity
- #/Rate deaths
- # of COVID patients in hospital/on vent-ICU
- Hospital capacity
- CDC Community Transmission
- CDC Community Level
- #/Rates vaccinated/up-to-date

Laboratory Testing

- Early: public health laboratories only
- Scale-up: rapid development of lab capacity
- NE DHHS – work to ingest rapid expansion of lab testing data HL7 messaging
- Home testing

Electronic Laboratory Reporting (ELR)

- Laboratory information systems – each unique
- Each lab translates it's codes to standard LOINC and SNOMED codes
- Set up filter for reportable diseases, automatic secure message with key information for each reportable result
- Into NEDSS system, assigned to program area and jurisdiction

Pandemic Indicators Based on Labs

- Laboratory-Confirmed Cases
- Percent Positivity
- CDC Indicators
  - Community Transmission

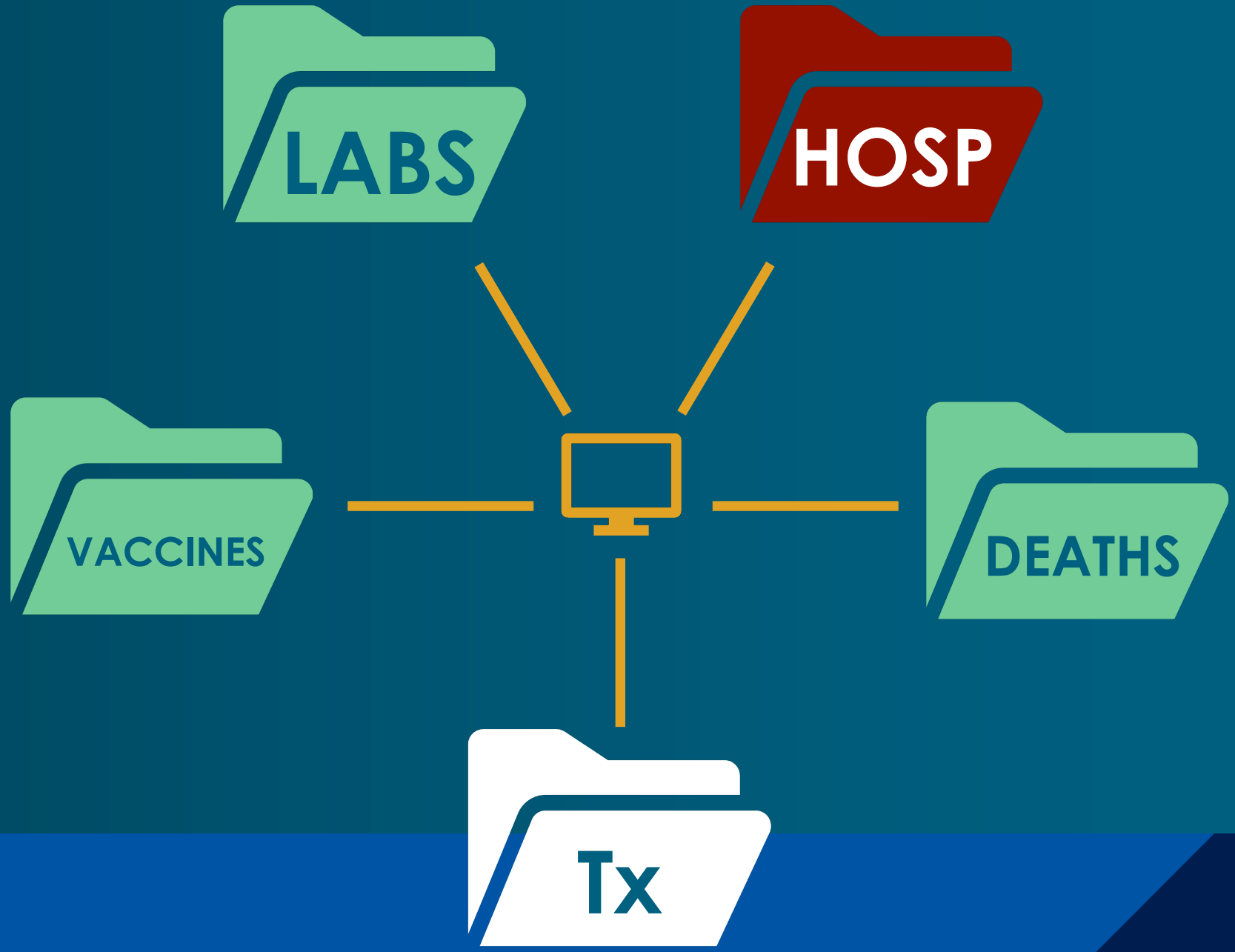
CDC's Indicators of Community Transmission

Indicator	Low Transmission	Moderate Transmission	Substantial Transmission	High Transmission
Total new cases per 100,000 persons in the past 7 days	0-9	10-49	50-99	≥100
Percentage of Nucleic Acid Amplification Test results that are positive during the past 7 days	<5.0%	5.0%-7.9%	8.0%-9.9%	≥10.0%

- First released in September 2020
- Relied on two metrics to define community transmission: Total new cases per 100,000 persons in the past 7 days, and percentage of Nucleic Acid Amplification Test results that are positive during the past 7 days
- Used by CDC to inform setting-specific guidance and layered prevention strategies (e.g., screening testing in schools, masking, etc.)
- Public health practitioners, schools, businesses, and community organizations also rely on these metrics to inform decisions about prevention measures

Needed more real-world monitoring of:

- Incidence and Prevention of severe disease
  - Hospitalized with history of infection, risk factors
- Effectiveness of vaccine to prevent infection, illness, severe illness, long covid, death
- Effectiveness of treatment of disease on preventing death, severe disease long covid



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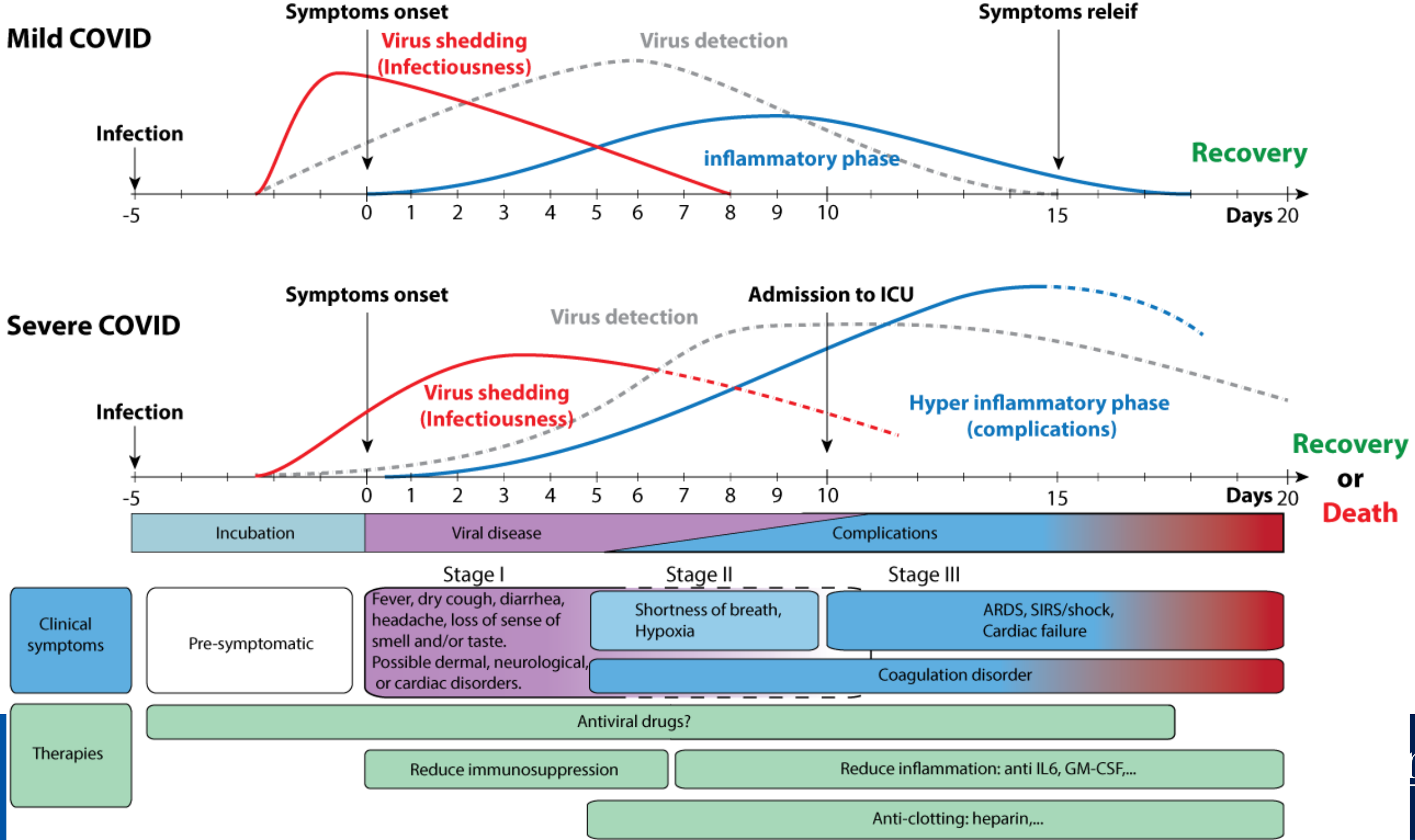
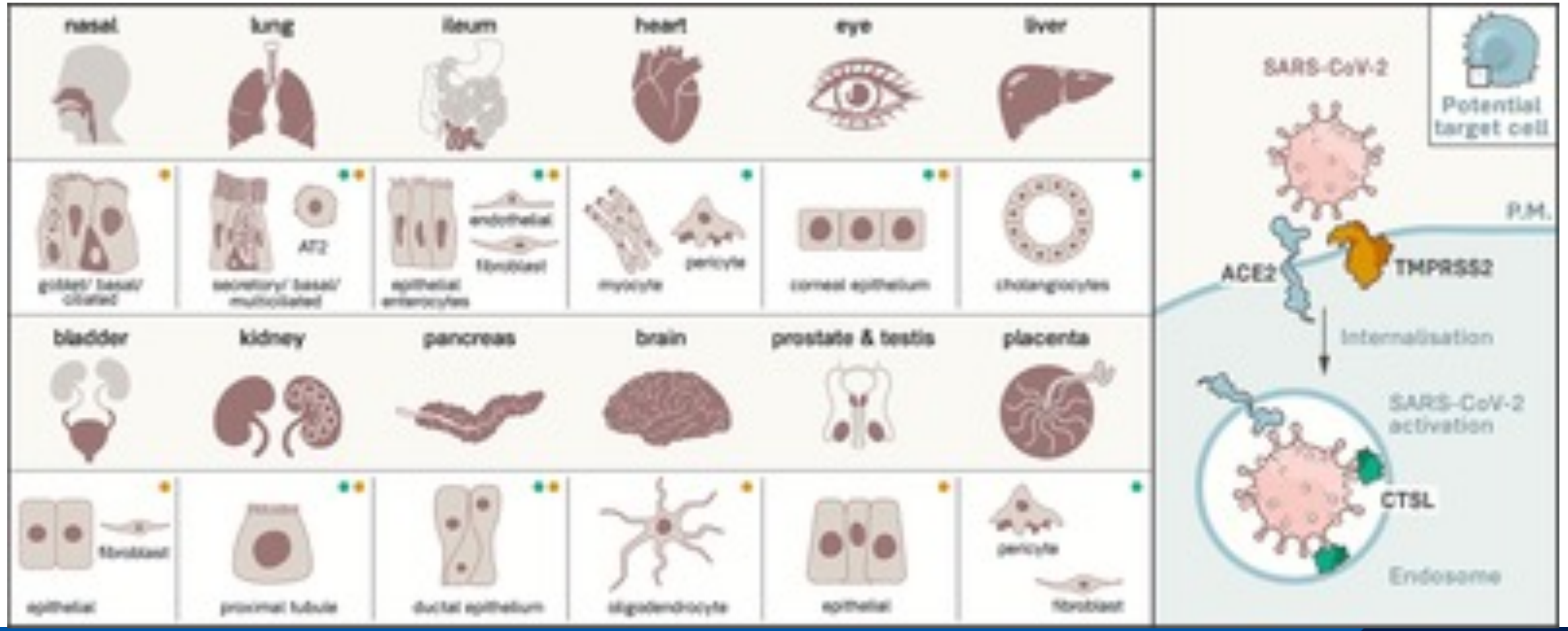
Clinical Data

- Electronic Health Record/Health Information Exchange
- - purpose - document clinical information / billing for insurance
- - access - HIPAA, data use agreements, costs
- Laboratory data - clinical
- Long-term care data
- Hospital reporting - NHSN - HHS Protect
- Prescription drugs - PDMP


Mild COVID
Symptoms onset
Symptoms releif
Virus shedding
(Infectiousness)
Virus detection
Infection
inflammatory phase
Recovery
-5
0
1
2
3
4
5
6
7
8
9
10
15
Days 20
Severe COVID
Symptoms onset
Admission to ICU
Virus detection
Virus shedding
(Infectiousness)
Infection
Hyper inflammatory phase
(complications)
Recovery
or
Death
-5
0
1
2
3
4
5
6
7
8
9
10
15
Days 20
Incubation
Viral disease
Complications
Stage I
Stage II
Stage III
Clinical symptoms
Pre-symptomatic
Fever, dry cough, diarrhea, headache, loss of sense of smell and/or taste.
Possible dermal, neurological, or cardiac disorders.
Shortness of breath, Hypoxia
ARDS, SIRS/shock, Cardiac failure
Coagulation disorder
Therapies
Antiviral drugs?
Reduce immunosuppression
Reduce inflammation: anti IL6, GM-CSF,...
Anti-clotting: heparin,...

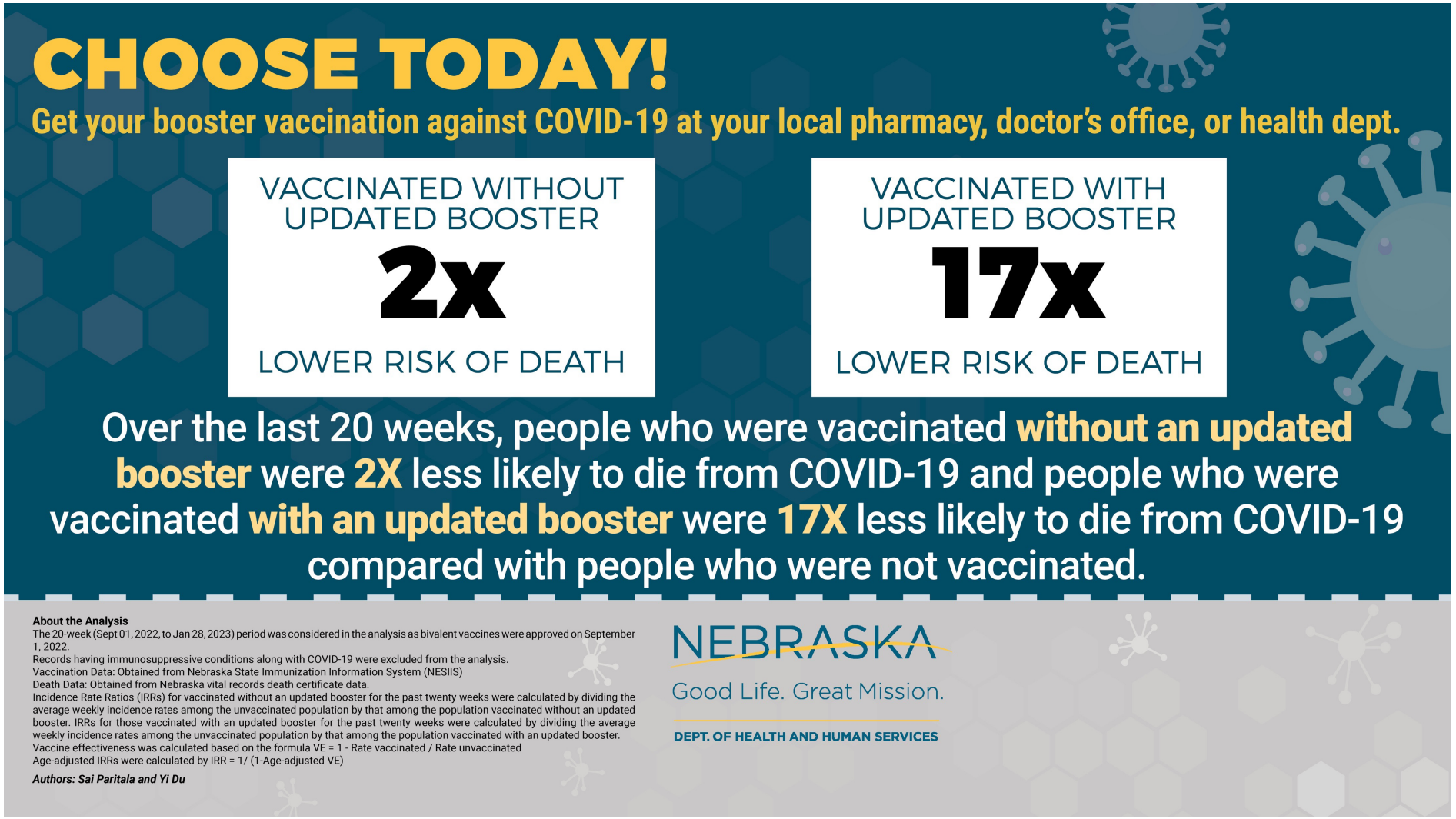
SARS-CoV-2 Receptors On Variety of Human Cells



CDC's COVID-19 Community Levels and Indicators

New Cases (per 100,000 population in the last 7 days)	Indicators	Low	Medium	High
Fewer than 200	New COVID-19 admissions per 100,000 population (7-day total)	<10.0	10.0-19.9	≥20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	<10.0%	10.0-14.9%	≥15.0%
200 or more	New COVID-19 admissions per 100,000 population (7-day total)	NA	<10.0	≥10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	NA	<10.0%	≥10.0%

The COVID-19 community level is determined by the higher of the inpatient beds and new admissions indicators, based on the current level of new cases per 100,000 population in the past 7 days



Death certificate data, not hospitalization data

How well does infection-induced immunity work?

How long does it last?

How well does it protect against infection, hospitalization, and death?

Does it prevent long-COVID-19 or complications like MIS?

How well does cross-variant immunity work?

How vulnerable are we to another big surge?

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We have vaccine effectiveness but what about nuance?

How long do vaccines work?

Against infection, hospitalization, and death?

How does effectiveness differ per variant?

Is there one brand that's better?

What boosting timeline is most effectiveness?

Are these answers different across age groups, races, ethnicities, medical comorbidities, or rural/urban residence?

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What about antiviral effectiveness

How well does nirmatrelvir-ritonavir work IN Nebraska?

Who is accessing it and where are the missed opportunities?

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Epidemiologists: Please Stand Up