



# High Risk Conditions and Vaccination Gaps in Invasive Pneumococcal Disease Cases in Tennessee, 2011- 2016

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# Outline

- Brief Introduction of Field Experience
- Minor Project: SNIPP Data Entry
- Major Project: High Risk Conditions and Vaccination Gaps in IPD
- Core Competencies
- Questions

# Field Experience: Emerging Infections Program

VANDERBILT  UNIVERSITY  
MEDICAL CENTER



# Emerging Infections Program

- Established in 1995 by the CDC
- Response to the growing population, an increase in poverty, and the heightened international travels
- Network of state health departments, public health and clinical laboratories, academic establishments, state and federal agencies, and healthcare providers

# Emerging Infections Program

## Goal 1:

- **Surveillance and Response**

- Detect, investigate, and monitor emerging pathogens, the diseases they cause, and the factors influencing their emergence.

## Goal 2:

- **Applied Research**

- Integrate laboratory science and epidemiology to optimize public health practice.

## Goal 3:

- **Infrastructure and Training**

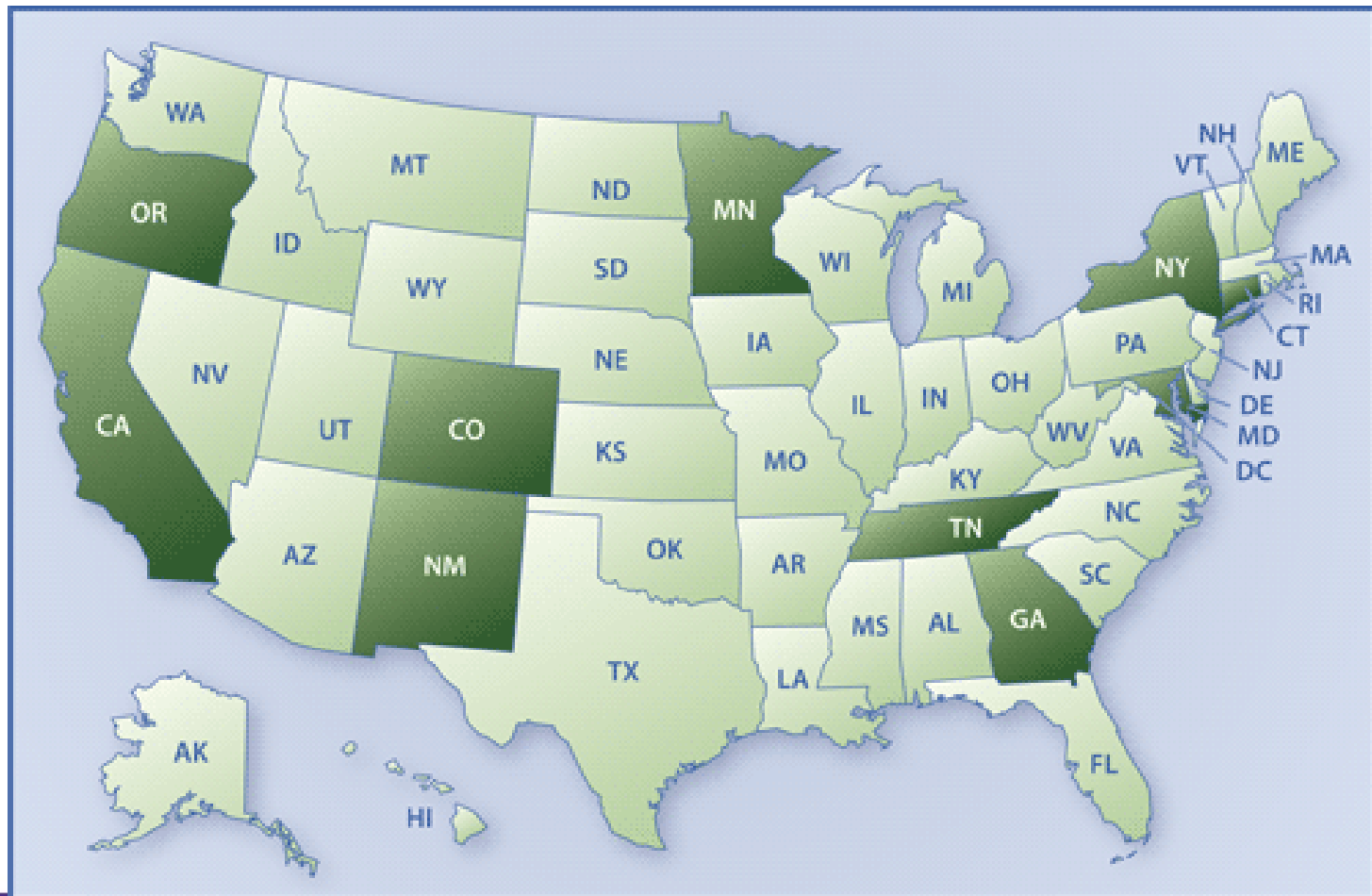
- Strengthen public health infrastructures to support surveillance and research and to implement prevention and control programs.

## Goal 4:

- **Prevention and Control**

- Ensure prompt implementation of prevention strategies and enhance communication of public health information about emerging diseases.

# Emerging Infections Program



# TN Emerging Infections Program

- **Active Bacterial Core Surveillance (ABCs)**
- **FoodNet**
- **Healthcare-Associated Infections (HAI)**
- **Flu-Surv Net**
- **HPV-IMPACT**
- **TickNet**

# Active Bacterial Core Surveillance (ABCs)

- Focuses on the epidemiology and surveillance of invasive bacterial diseases
- Group A *Streptococcus* (GAS), Group B *Streptococcus* (GBS), *Haemophilus influenza*, *Neisseria meningitides*, *Streptococcus pneumoniae*, and Methicillin-Resistant *Staphylococcus aureus* (MRSA)

# Learning Objectives

- Learn to navigate database software used for population-based surveillance and research
- Gain experience extracting pertinent medical information from patient records and CRFs
- Expand knowledge of statistical analyses and additional epidemiological techniques

# Measurable Outcomes

- Shadowed personnel in population-based surveillance, epidemiology, and disease-prevention careers
- Assisted in data entry for SNIIPP project
- Aided in data cleaning and audit for Pneumococcal Carriage Study
- Attended weekly surveillance meetings and discussions at TDH



# Measureable Outcomes

- Assisted in the transfer of data to new software databases (REDCap)
- Participated in monthly EIP meetings to discuss various public health issues
- Designed and implemented an observational study to evaluate high risk conditions in populations with IPD, and to determine vaccination gaps within those identified populations

# Outline

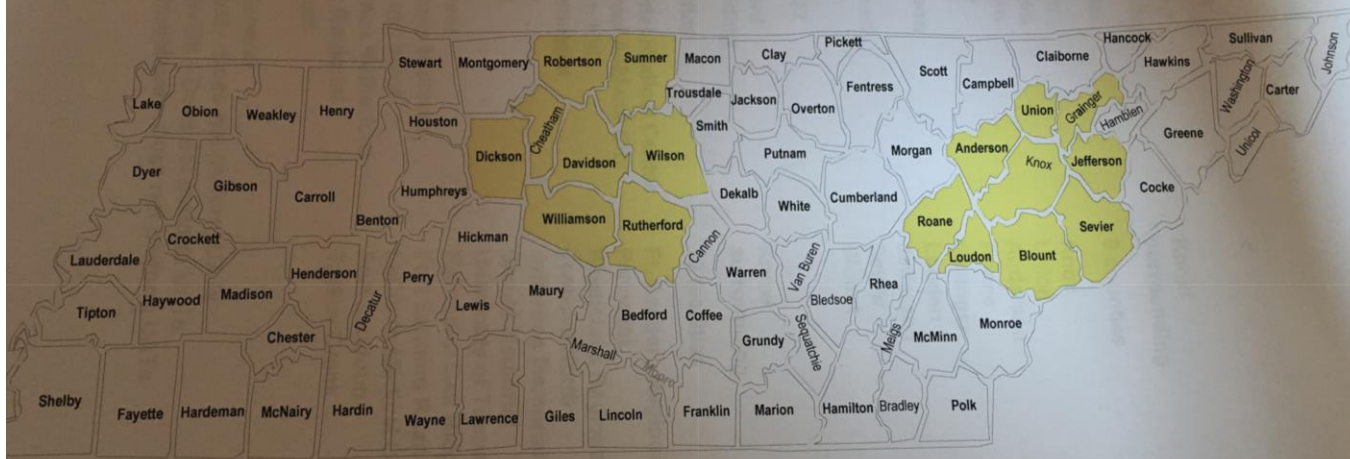
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# Minor Project: SNIIPP

## **SNIIPP: Surveillance for Non-invasive Pneumococcal pneumonia**

- Most common form of pneumococcal disease in adults
- Over **900,000** diagnosed each year in U.S.
- Account for **36%** of community-acquired pneumonia

## Tennessee Emerging Infections Program Surveillance for Non-invasive Pneumococcal Pneumonia



# Urine Antigen Test (UAT)

Appendix V: ABCs form for collecting urine specimens

For site use only—not transmitted to CDC

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Gender: \_\_\_\_\_

Date of Birth: \_\_\_\_\_

STATE: \_\_\_\_\_ SNIPP STATEID: \_\_\_\_\_

COUNTY: \_\_\_\_\_ ACCESSION #: \_\_\_\_\_

HOSPITAL ID WHERE UAT WAS ordered \_\_\_\_\_ HOSPITAL ID WHERE PATIENT TREATED \_\_\_\_\_

DATE UAT SPECIMEN COLLECTED \_\_\_\_/\_\_\_\_/\_\_\_\_

How is the urine being sent to public health laboratory/CDC?

☐ Sterile container (preferred)

☐ Container with boric acid or other (specify \_\_\_\_\_) compound

WAS A STERILE SITE **CULTURE** OBTAINED FROM THIS PATIENT?

☐ yes

☐ no

☐ don't know

IF YES, PLEASE INDICATE SPECIMEN SOURCE(S)(indicate all that apply): \_\_\_\_\_

1= blood

2=csf

3=pleural fluid

12=bone

13=other, specify: \_\_\_\_\_

IF YES, Please include ABCs StateID (for sterile site positive culture) \_\_\_\_\_

WHAT WERE THE RESULTS OF THE CULTURE(S):

☐ no culture was obtained

☐ positive for *S. pneumoniae*, please specify source(s) \_\_\_\_\_

☐ negative for *S. pneumoniae*... specimen was positive for \_\_\_\_\_

☐ don't know

8



# Objectives

- To properly transfer patient medical information from hard copy of the case report form (CRF) to the electronic form entry
- Results from data entry are used to provide population-based estimates that are easily transmitted to the CDC for future studies

# Methods

Healthcare facilities report all possible UAT cases to EIP



Surveillance Officer gets results from hospitals/labs



All UAT (+/- cases) cases are processed through REDCap



# REDCap

**Software solution to develop and manage  
online surveys and databases**

- Established by Vanderbilt
- Over 2,000 institutional partners use REDCap
- TN EIP transfers all data to REDCap

# Methods: Data Entry

The screenshot displays the REDCap web interface. On the left is a sidebar with navigation links: 'My Projects', 'Project Home', 'Project Setup', 'Data Collection' (with a sub-link 'Edit Instruments'), 'Record Status Dashboard', 'Add / Edit Records', 'Record number 10' (with a link 'Select other record'), 'Data Collection Instruments' (with a sub-link 'Participant Information'), 'Labs', 'Observed Behavior', 'Sleep Index', 'Applications', 'Data Exports, Reports, and Stats', 'Logging', 'User Rights', and 'Data Quality'. The main content area is titled 'An Example Sleep Study (demo)'. It includes a top bar with a 'VIDEO: Basic data entry' link and 'Actions' for 'Modify instrument' and 'Download PDF of instrument(s)'. The form is for 'Record number 10' and is titled 'Participant Information'. It contains fields for 'Participant Name' (with a red asterisk and the text '\* must provide value' and a hint 'enter the full name, please!'), 'E-mail address', 'Date subject signed consent form' (with a red asterisk, a date picker set to 'Today', and the format 'YYYY-MM-DD'), and a section for 'Pease upload the signed consent form' (with a red asterisk, a file upload button, and a link 'Upload document'). Below this is a 'Any Notes or Comments?' section with a text area and a 'View data history' link. At the bottom, there is a section for 'Sleep Study Information' with a text area and an 'Expand' link. The footer of the page shows the text 'e.g. mobility issues, schedule requests, special considerations'.

**REDCap™**

Logged in as red\_0005 | Log out

My Projects  
Project Home  
Project Setup  
Project status: Development

Data Collection [Edit Instruments](#)

Record Status Dashboard  
- View data collection status of all records

Add / Edit Records  
- Create new records or edit/view existing ones

Record number 10 [Select other record](#)

Data Collection Instruments:  
**Participant Information**  
Labs  
Observed Behavior  
Sleep Index

Applications  
Data Exports, Reports, and Stats  
Logging  
User Rights  
Data Quality

javascript:; Edit record

## An Example Sleep Study (demo)

[VIDEO: Basic data entry](#)

Actions: [Modify instrument](#) [Download PDF of instrument\(s\)](#)

### Participant Information

Adding new Record number 10

Record number 10

**Participant Information**

**Participant Name**   
\* must provide value enter the full name, please!

**E-mail address**

**Date subject signed consent form**  Today Y-M-D  
\* must provide value YYYY-MM-DD

**Pease upload the signed consent form**  [Upload document](#)

**Any Notes or Comments?**  [View data history](#)

e.g. mobility issues, schedule requests, special considerations

**Sleep Study Information**

# Results

- Submitted over 1,000 negative UAT cases into REDCap
- Approximately over 7,400 negative UAT cases in the REDCap Patient Tracker

# Discussion

- Pneumococcal pneumonia is very common
- Important to enter both positive and negative UAT cases to ensure proper population-based estimates
- EIP analyzes the proportions of pneumonia hospitalizations in hospitals that perform the UATs and those that do not

# Outline

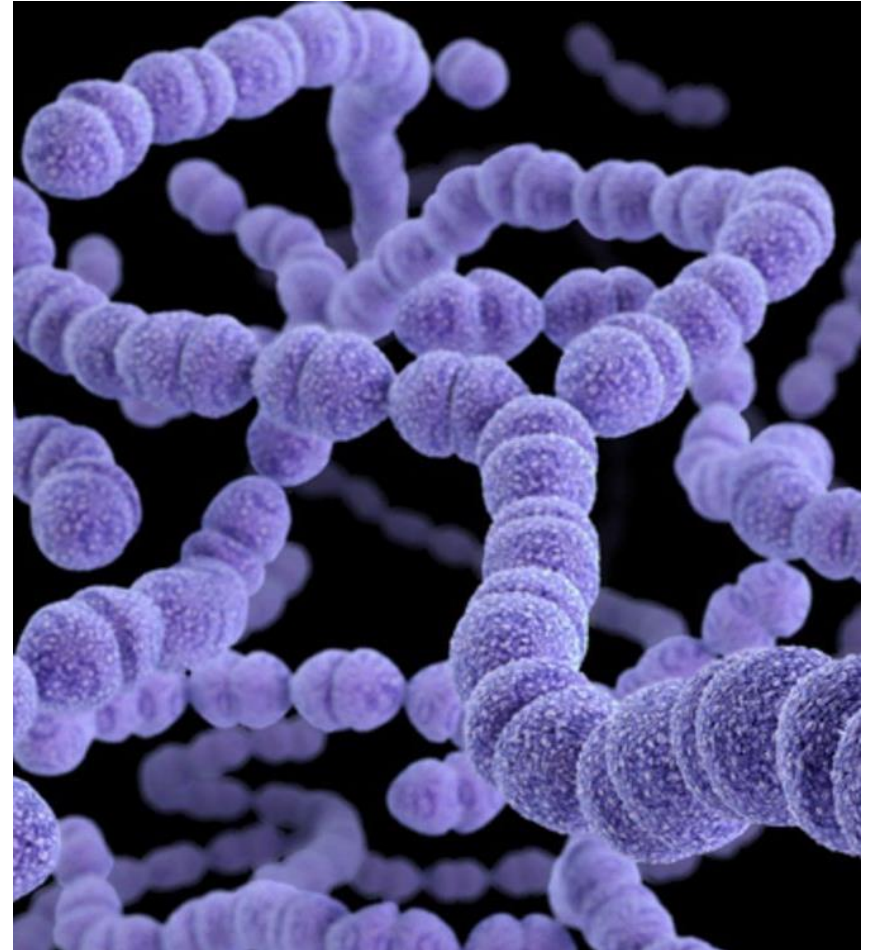
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**Major Project:** High Risk  
Conditions and Vaccination Gaps in  
Invasive Pneumococcal Disease in  
Tennessee, 2011-2016

# History: *Streptococcus pneumoniae*

- Gram + bacteria, also known as pneumococcus
- First isolated by Pasteur in 1881 by a rabies + patient
- As of 2011, over 92 serotypes identified





# Background: *Streptococcus pneumoniae*

- Normal inhabitants of the respiratory track
- Certain serotypes cause serious illness (6A, 14, 19F, and 23F)
- Cause invasive illnesses and/or noninvasive illnesses
- Major clinical illnesses:
  - ✓ Pneumonia
  - ✓ Sinusitis
  - ✓ Otis media
  - ✓ **Bacteremia**
  - ✓ **Meningitis**

# Invasive Pneumococcal Disease (IPD)

-  Morbidity

-  Mortality

- **62%** of invasive disease worldwide
- Over **12,000** bacteremia cases/year in U.S.
- **50%** of meningitis cases in U.S.
- **22,000** deaths/year in U.S.



*“Pneumococcal disease kills more people in the United States each year than all other vaccine-preventable diseases combined.”*

-CDC, 2014

# IPD Risk Factors

- Race
- Age
- Immunosuppressant illnesses

***The CDC lists the following as most prevalent underlying conditions:***

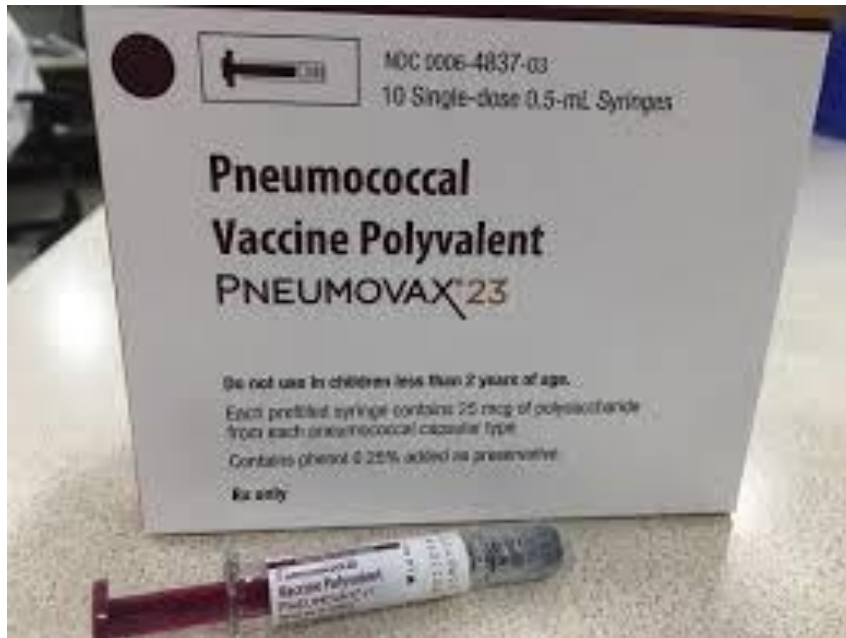
- HIV
- Diabetes
- Liver/Heart Disease
- Smoking
- Asthma



**27. UNDERLYING CAUSES OR PRIOR ILLNESSES:** (Check all that apply OR if NONE or CHART UNAVAILABLE, check appropriate box) ☐ None ☐ Unknown

- |                                                                             |                                                                                        |                                                  |                                                                                                        |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> AIDS or CD4 count <200                             | <input type="checkbox"/> Complement Deficiency                                         | <input type="checkbox"/> IVDU, Current           | <input type="checkbox"/> Peptic Ulcer Disease                                                          |
| <input type="checkbox"/> Alcohol Abuse, Current                             | <input type="checkbox"/> Connective Tissue Disease (Lupus, etc.)                       | <input type="checkbox"/> IVDU, Past              | <input type="checkbox"/> Peripheral Neuropathy                                                         |
| <input type="checkbox"/> Alcohol Abuse, Past                                | <input type="checkbox"/> CSF Leak                                                      | <input type="checkbox"/> Leukemia                | <input type="checkbox"/> Peripheral Vascular Disease                                                   |
| <input type="checkbox"/> Asthma                                             | <input type="checkbox"/> Deaf/Profound Hearing Loss                                    | <input type="checkbox"/> Multiple Myeloma        | <input type="checkbox"/> Plegias/Paralysis                                                             |
| <input type="checkbox"/> Atherosclerotic Cardiovascular Disease (ASCVD)/CAD | <input type="checkbox"/> Dementia                                                      | <input type="checkbox"/> Multiple Sclerosis      | <input type="checkbox"/> Premature Birth (specify gestational age at birth) <input type="text"/> (wks) |
| <input type="checkbox"/> Bone Marrow Transplant (BMT)                       | <input type="checkbox"/> Diabetes Mellitus                                             | <input type="checkbox"/> Myocardial Infarction   | <input type="checkbox"/> Seizure/Seizure Disorder                                                      |
| <input type="checkbox"/> Cerebral Vascular Accident (CVA)/Stroke/TIA        | <input type="checkbox"/> Emphysema/COPD                                                | <input type="checkbox"/> Nephrotic Syndrome      | <input type="checkbox"/> Sickle Cell Anemia                                                            |
| <input type="checkbox"/> Chronic Kidney Disease                             | <input type="checkbox"/> Heart Failure/CHF                                             | <input type="checkbox"/> Neuromuscular Disorder  | <input type="checkbox"/> Smoker (current)                                                              |
| <input type="checkbox"/> Chronic Liver Disease/cirrhosis                    | <input type="checkbox"/> HIV Infection                                                 | <input type="checkbox"/> Obesity                 | <input type="checkbox"/> Solid Organ Malignancy                                                        |
| <input type="checkbox"/> Current Chronic Dialysis                           | <input type="checkbox"/> Hodgkin's Disease/Lymphoma                                    | <input type="checkbox"/> Other Drug Use, Current | <input type="checkbox"/> Solid Organ Transplant                                                        |
| <input type="checkbox"/> Chronic Skin Breakdown                             | <input type="checkbox"/> Immunoglobulin Deficiency                                     | <input type="checkbox"/> Other Drug Use, Past    | <input type="checkbox"/> Splenectomy/Asplenia                                                          |
| <input type="checkbox"/> Cochlear Implant                                   | <input type="checkbox"/> Immunosuppressive Therapy (Steroids, Chemotherapy, Radiation) | <input type="checkbox"/> Parkinson's Disease     | <input type="checkbox"/> Other prior illness (specify): _____                                          |

# Vaccinations



# Vaccination Recommendations

- **PCV 13 (Prennar 13)**

- ✓ Children 2 years of age and younger
- ✓ Adults 65+
- ✓ Adults 19+ with certain illnesses (HIV and kidney disease)

- **PPSV23(Pneumovax 23)**

- ✓ Adults 65+
- ✓ Children under 2 years of age and Adults 19+ with certain illnesses (diabetes and heart disease)

## INFORMATION FOR ADULT PATIENTS

## 2017 Recommended Immunizations for Adults: By Age

If you are this age, talk to your healthcare professional about these vaccines →

|               | Flu<br><i>Influenza</i> | Td/Tdap<br>Tetanus,<br>diphtheria,<br>pertussis | Shingles<br><i>Zoster</i> | Pneumococcal |        | Meningococcal       |      | MMR<br>Measles,<br>mumps,<br>rubella | HPV<br><i>Human papillomavirus</i> |         | Chickenpox<br><i>Varicella</i> | Hepatitis A | Hepatitis B | Hib<br><i>Haemophilus influenzae type b</i> |
|---------------|-------------------------|-------------------------------------------------|---------------------------|--------------|--------|---------------------|------|--------------------------------------|------------------------------------|---------|--------------------------------|-------------|-------------|---------------------------------------------|
|               |                         |                                                 |                           | PCV13        | PPSV23 | MenACWY<br>or MPSV4 | MenB |                                      | for women                          | for men |                                |             |             |                                             |
| 19 - 21 years | ■                       | ■                                               |                           |              | ■      | ■                   | ■    | ■                                    | ■                                  | ■       | ■                              | ■           | ■           | ■                                           |
| 22 - 26 years |                         |                                                 |                           | ■            | ■      | ■                   | ■    |                                      | ■                                  | ■       | ■                              | ■           | ■           | ■                                           |
| 27 - 59 years |                         |                                                 |                           | ■            | ■      | ■                   | ■    | ■                                    |                                    |         | ■                              | ■           | ■           | ■                                           |
| 60 - 64 years |                         |                                                 | ■                         | ■            | ■      | ■                   | ■    |                                      |                                    |         | ■                              | ■           | ■           | ■                                           |
| 65+ year      | ■                       | ■                                               | ■                         | ■            | ■      | ■                   | ■    |                                      |                                    |         | ■                              | ■           | ■           | ■                                           |

### More Information:

You should get flu vaccine every year.

You should get a Td booster every 10 years. You also need 1 dose of Tdap. Women should get a Tdap vaccine during every pregnancy to help protect the baby.

You should get shingles vaccine even if you have had shingles before.

You should get 1 dose of PCV13 and at least 1 dose of PPSV23 depending on your age and health condition.

You should get this vaccine if you did not get it when you were a child.

You should get HPV vaccine if you are a woman through age 26 years or a man through age 21 years and did not already complete the series.

**Recommended For You:** This vaccine is recommended for you unless your healthcare professional tells you that you do not need it or should not get it.

**May Be Recommended For You:** This vaccine is recommended for you if you have certain risk factors due to your health condition or other. Talk to your healthcare professional to see if you need this vaccine.

**If you are traveling outside the United States, you may need additional vaccines.**  
Ask your healthcare professional about which vaccines you may need at least 6 weeks before you travel.

For more information, call 1-800-CDC-INFO  
(1-800-232-4636) or visit [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines)



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Centers for Disease  
Control and Prevention

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## INFORMATION FOR ADULT PATIENTS

## 2017 Recommended Immunizations for Adults: By Health Condition

If you have this health condition, **talk to your healthcare professional about these vaccines**

|                                                                             | Flu<br>Influenza | Td/Tdap<br>Tetanus,<br>diphtheria,<br>pertussis | Shingles<br>Zoster           | Pneumococcal |        | Meningococcal       |      | MMR<br>Measles,<br>mumps,<br>rubella | HPV<br>Human papillomavirus |         | Chickenpox<br>Varicella      | Hepatitis A | Hepatitis B | Hib<br>Haemophilus<br>influenzae<br>type b |
|-----------------------------------------------------------------------------|------------------|-------------------------------------------------|------------------------------|--------------|--------|---------------------|------|--------------------------------------|-----------------------------|---------|------------------------------|-------------|-------------|--------------------------------------------|
|                                                                             |                  |                                                 |                              | PCV13        | PPSV23 | MenACWY<br>or MPSV4 | MenB |                                      | for women                   | for men |                              |             |             |                                            |
| Pregnancy                                                                   |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Weakened<br>Immune System                                                   |                  |                                                 | SHOULD<br>NOT GET<br>VACCINE |              |        |                     |      | SHOULD<br>NOT GET<br>VACCINE         |                             |         | SHOULD<br>NOT GET<br>VACCINE |             |             |                                            |
| HIV: CD4 count<br>less than 200                                             |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| HIV: CD4 count<br>200 or greater                                            |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Kidney disease<br>or poor kidney<br>function                                |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Asplenia (if you<br>do not have a<br>spleen or if it does<br>not work well) |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Heart disease<br>Chronic lung disease<br>Chronic alcoholism                 |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Diabetes<br>(Type 1 or Type 2)                                              |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |
| Chronic Liver<br>Disease                                                    |                  |                                                 |                              |              |        |                     |      |                                      |                             |         |                              |             |             |                                            |

**More Information:**

- Flu:** You should get flu vaccine every year.
- Td/Tdap:** You should get a Td booster every 10 years. You also need 1 dose of Tdap vaccine. Women should get Tdap vaccine during every pregnancy.
- Shingles:** You should get shingles vaccine if you are age 60 years or older, even if you have had shingles before.
- Pneumococcal:** You should get 1 dose of PCV13 and at least 1 dose of PPSV23 depending on your age and health condition.
- MMR:** You should get this vaccine if you did not get it when you were a child.
- HPV:** You should get HPV vaccine if you are a woman through age 26 years or a man through age 21 years and did not already complete the series.
- Hib:** You should get Hib vaccine if you do not have a spleen, have sickle cell disease, or received a bone marrow transplant.

For more information, call 1-800-CDC-INFO  
(1-800-232-4636) or visit [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines)

**Recommended For You:** This vaccine is recommended for you **unless** your healthcare professional tells you that you do not need it or should not get it.

**May Be Recommended For You:** This vaccine is recommended for you if you have certain other risk factors due to your age, health condition or other. Talk to your healthcare professional to see if you need this vaccine.

**YOU SHOULD NOT GET THIS VACCINE**



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# Objectives:

- 1) To evaluate ABC's data from REDCap and Access to identify the high-risk conditions of patients with IPD
- 2) To provide awareness of vaccination gaps within the IPD population

- ## Tennessee Emerging Infections Program
- ### Active Bacterial Core Surveillance
- 
- A map of Tennessee with its 95 counties labeled. Fifteen counties are highlighted in yellow: Shelby, Fayette, Madison, Chester, DeKalb, Maury, Williamson, Davidson, Dickson, Clark, Robertson, Sumner, Macon, Trousdale, Smith, Jackson, Putnam, Morgan, Anderson, Union, Knox, Jefferson, Sevier, Blount, Loudon, Roane, Cumberland, White, Dekalb, Rutherford, Warren, Coffee, Grundy, Marion, Franklin, Lincoln, Giles, Wayne, Hardman, McNairy, Hardin, Lawrence, and Hamilton. The highlighted counties are primarily in the central and eastern parts of the state, with a few in the west and south.

# Case Report Form

ADDRESS: \_\_\_\_\_ (Number, Street, Apt. No.) \_\_\_\_\_ Hospital: \_\_\_\_\_  
(City, State) \_\_\_\_\_ (ZIP Code)

- Patient identifier information is not transmitted to CDC -

2017 ACTIVE BACTERIAL CORE SURVEILLANCE (ABCs) CASE REPORT  
A CORE COMPONENT OF THE EMERGING INFECTIONS PROGRAM NETWORK

DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTERS FOR DISEASE CONTROL AND PREVENTION  
ATLANTA, GA 30333

SHADED AREAS FOR OFFICE USE ONLY

1. STATE: (Patient Residence) ☐ 3a. Was a culture performed? ☐ 1 Yes, Positive ☐ 2 Yes, Negative ☐ 3 No

2. STATE I.D.: \_\_\_\_\_ 3b. DATE FIRST POSITIVE CULTURE COLLECTED \_\_\_\_\_  
Mo. Day Year

3c. DATE FIRST POSITIVE Culture Independent Diagnostic Test (CIDT) (e.g. PCR) COLLECTED \_\_\_\_\_  
Mo. Day Year

4. Date reported to EIP site: \_\_\_\_\_  
Mo. Day Year

5. CRF Status: ☐ 1 Complete ☐ 3 Edited & Correct ☐ 2 Incomplete ☐ 4 Chart unavailable after 3 requests

6. COUNTY: (Residence of Patient) \_\_\_\_\_ 7a. HOSPITAL/LAB I.D. WHERE CULTURE IDENTIFIED: \_\_\_\_\_ 7b. HOSPITAL I.D. WHERE PATIENT TREATED: \_\_\_\_\_

8. DATE OF BIRTH: \_\_\_\_\_ Mo. Day Year 9a. AGE: \_\_\_\_\_ 9b. Is age in day/month? ☐ 1 Days ☐ 2 Mos. ☐ 3 Yes

10. SEX: ☐ 1 Male ☐ 2 Female 11a. ETHNIC ORIGIN: ☐ 1 Hispanic or Latino ☐ 2 Not Hispanic or Latino ☐ 9 Unknown 11b. RACE: (Check all that apply) ☐ 1 White ☐ 1 Asian ☐ 1 Black ☐ 1 Native Hawaiian or Other Pacific Islander ☐ 1 American Indian or Alaska Native ☐ 1 Unknown

12a. BACTERIAL SPECIES ISOLATED FROM ANY NORMALLY STERILE SITE: ☐ 1 *Neisseria meningitidis* ☐ 3 Group B *Streptococcus* ☐ 5 Group A *Streptococcus* ☐ 2 *Haemophilus influenzae* ☐ 4 *Listeria monocytogenes* ☐ 6 *Streptococcus pneumoniae*

12b. OTHER BACTERIAL SPECIES ISOLATED FROM ANY NORMALLY STERILE SITE: (specify) \_\_\_\_\_

13. STERILE SITES FROM WHICH ORGANISM ISOLATED: (Check all that apply) ☐ 1 Blood ☐ 1 CSF ☐ 1 Peritoneal fluid ☐ 1 Bone ☐ 1 Muscle/Fascia/Tendon ☐ 1 Joint ☐ 1 Pleural fluid ☐ 1 Pericardial fluid ☐ 1 Other normally sterile site (specify) \_\_\_\_\_ ☐ 1 Internal body site (specify) \_\_\_\_\_

14. OTHER SITES FROM WHICH ORGANISM ISOLATED: (Check all that apply) ☐ 1 Placenta ☐ 1 Wound ☐ 1 Sinus ☐ 1 Amniotic fluid ☐ 1 Middle ear

15b. CIDT STERILE SITE FROM WHICH ORGANISM WAS DETECTED: ☐ 1 CSF ☐ 1 Other \_\_\_\_\_

INFLUENZA 15. Did this patient have a positive flu test 10 days prior to or following any ABCs positive culture? ☐ 1 Yes ☐ 2 No ☐ 9 Unknown

16. WAS PATIENT HOSPITALIZED? ☐ 1 Yes ☐ 2 No ☐ 9 Unknown

17. If patient was hospitalized, was this patient admitted to the ICU during hospitalization? ☐ 1 Yes ☐ 2 No ☐ 9 Unknown

18a. Where was the patient a resident at time of initial culture? ☐ 1 Private residence ☐ 4 Homeless ☐ 7 Non-medical ward ☐ 2 Long term care facility ☐ 5 Incarcerated ☐ 8 Other (specify) \_\_\_\_\_ ☐ 3 Long term acute care facility ☐ 6 college dormitory ☐ 9 Unknown

18b. If resident of a facility, what was the name of the facility? \_\_\_\_\_ Facility ID: \_\_\_\_\_

19a. Was patient transferred from another hospital? ☐ 1 Yes ☐ 2 No ☐ 9 Unknown

19b. If YES, hospital I.D.: \_\_\_\_\_

20a. WEIGHT: \_\_\_\_\_ lbs. \_\_\_\_\_ oz. OR \_\_\_\_\_ kg OR ☐ Unknown

20b. HEIGHT: \_\_\_\_\_ ft \_\_\_\_\_ in OR \_\_\_\_\_ cm OR ☐ Unknown

20c. BMI: \_\_\_\_\_ OR ☐ Unknown

21. TYPE OF INSURANCE: (Check all that apply) ☐ 1 Private ☐ 1 Military ☐ 1 Other (specify) \_\_\_\_\_ ☐ 1 Medicare ☐ 1 Indian Health Service (IHS) ☐ 1 Uninsured ☐ 1 Medicaid/state assistance program ☐ 1 Incarcerated ☐ 1 Unknown

22. OUTCOME: ☐ 1 Survived ☐ 2 Died ☐ 9 Unknown

22a. If patient died, was the culture obtained on autopsy? ☐ 1 Yes ☐ 2 No ☐ 9 Unknown

22b. If survived, patient discharged to: ☐ 1 Home ☐ 2 LTC/SNF ☐ 3 LTACH ☐ 4 Other \_\_\_\_\_ ☐ 9 Unknown

If discharged to LTC/SNF or LTACH, what is the Facility ID \_\_\_\_\_

24a. At time of first positive culture, patient was: ☐ 1 Pregnant ☐ 2 Postpartum ☐ 3 Neither ☐ 9 Unknown

24b. If pregnant or postpartum, what was the outcome of fetus: ☐ 1 Survived, no apparent illness ☐ 4 Abortion/stillbirth ☐ 9 Unknown ☐ 2 Survived, clinical infection ☐ 5 Induced abortion ☐ 3 Live birth/neonatal death ☐ 6 Still pregnant

24c. Mark if this is a HINSE fetal death with placenta and/or amniotic fluid isolate, a stillbirth, or neonate <22 wks gestation. ☐ 1 Hemolytic uremic syndrome (HUS) ☐ 1 Empyema

25. If patient <1 month of age, indicate gestational age and birth weight. If pregnant, indicate gestational age of fetus, only.

1 ☐ Alcohol Abuse, Past ☐ 1 Leukemia ☐ 1 Peripheral Vascular Disease ☐ 1 Plegias/Paralysis ☐ 1 Premature Birth (specify gestational age at birth) ☐ 1 Seizure/Seizure Disorder ☐ 1 Sickle Cell Anemia ☐ 1 Solid Organ Malignancy ☐ 1 Solid Organ Transplant ☐ 1 Splenectomy/Asplenia ☐ 1 Other prior illness (specify): \_\_\_\_\_

1 ☐ Asthma ☐ 1 Deaf/Profound Hearing Loss ☐ 1 Multiple Myeloma ☐ 1 Multiple Sclerosis ☐ 1 Myocardial Infarction ☐ 1 Nephrotic Syndrome ☐ 1 Neuromuscular Disorder ☐ 1 Obesity ☐ 1 Other Drug Use, Current ☐ 1 Other Drug Use, Past ☐ 1 Parkinson's Disease ☐ 1 Echulizumab (Soliris) - Nmen. cases only

1 ☐ Bone Marrow Transplant (BMT) ☐ 1 Diabetes Mellitus ☐ 1 Emphysema/COPD ☐ 1 Heart Failure/CHF ☐ 1 HIV Infection ☐ 1 Hodgkin's Disease/Lymphoma ☐ 1 Immunosuppressive Therapy (Steroids, etc.) ☐ 1 Immunglobulin Deficiency ☐ 1 Chronic Skin Breakdown ☐ 1 Cochlear Implant

1 ☐ Atherosclerotic Cardiovascular Disease (ASCVD)/CAD ☐ 1 Dementia ☐ 1 Myocardial Infarction ☐ 1 Nephrotic Syndrome ☐ 1 Neuromuscular Disorder ☐ 1 Obesity ☐ 1 Other Drug Use, Current ☐ 1 Other Drug Use, Past ☐ 1 Parkinson's Disease ☐ 1 Echulizumab (Soliris) - Nmen. cases only

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1 ☐ Plegias/Paralysis ☐ 1 Premature Birth (specify gestational age at birth) ☐ 1 Seizure/Seizure Disorder ☐ 1 Sickle Cell Anemia ☐ 1 Solid Organ Malignancy ☐ 1 Solid Organ Transplant ☐ 1 Splenectomy/Asplenia ☐ 1 Other prior illness (specify): \_\_\_\_\_

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1 ☐ Plegias/Paralysis ☐ 1 Premature Birth (specify gestational age at birth) ☐ 1 Seizure/Seizure Disorder ☐ 1 Sickle Cell Anemia ☐ 1 Solid Organ Malignancy ☐ 1 Solid Organ Transplant ☐ 1 Splenectomy/Asplenia ☐ 1 Other prior illness (specify): \_\_\_\_\_

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1 ☐ Asthma ☐ 1 Deaf/Profound Hearing Loss ☐ 1 Multiple Myeloma ☐ 1 Multiple Sclerosis ☐ 1 Myocardial Infarction ☐ 1 Nephrotic Syndrome ☐ 1 Neuromus

# Methods: Data Analysis

- 2011-2012 IPD data extracted from Access
- 2013-2016 IPD data extracted from REDCap

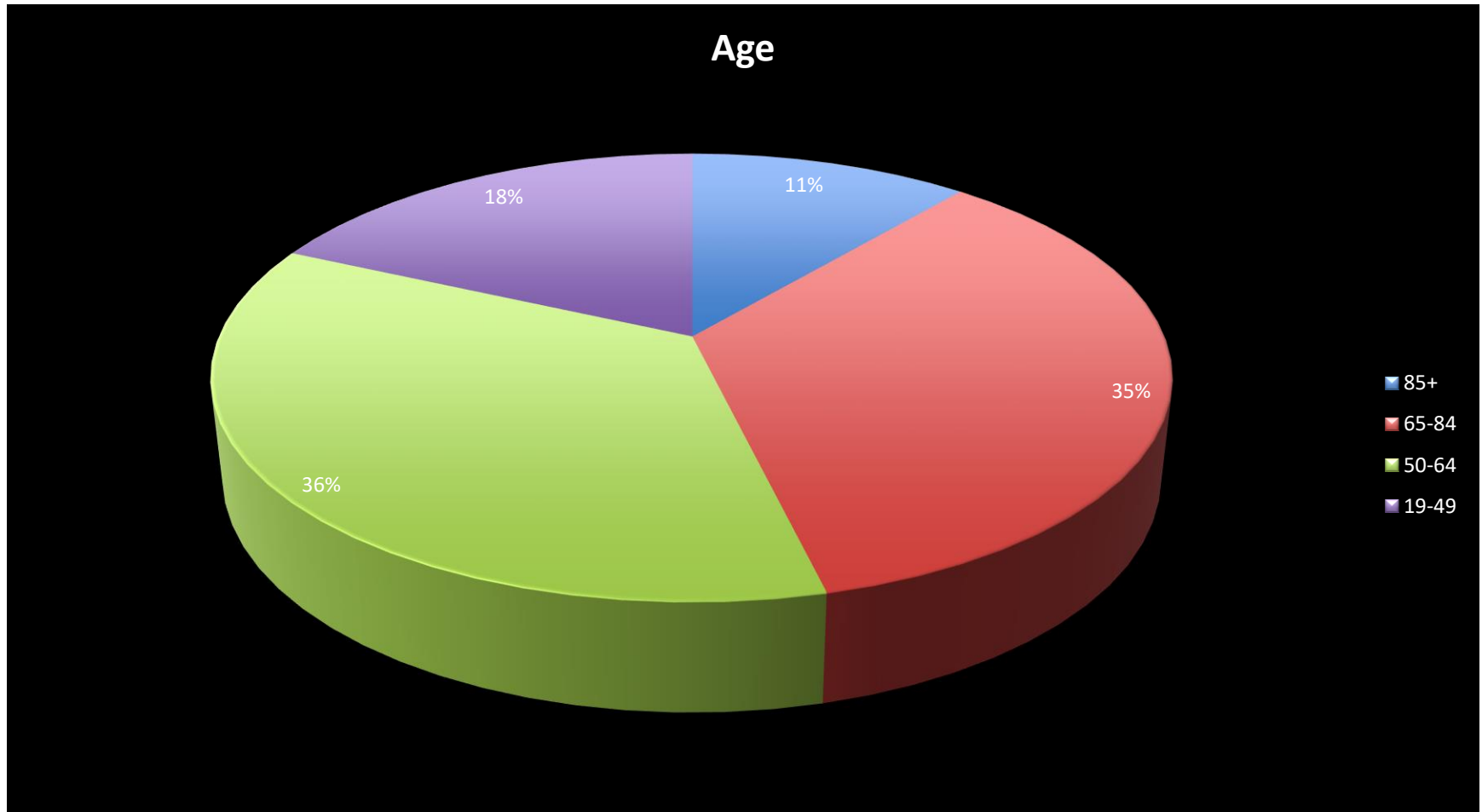
**Total number of IPD cases=2,693  
(years 2011-2016)**

- All data compiled into one excel worksheet

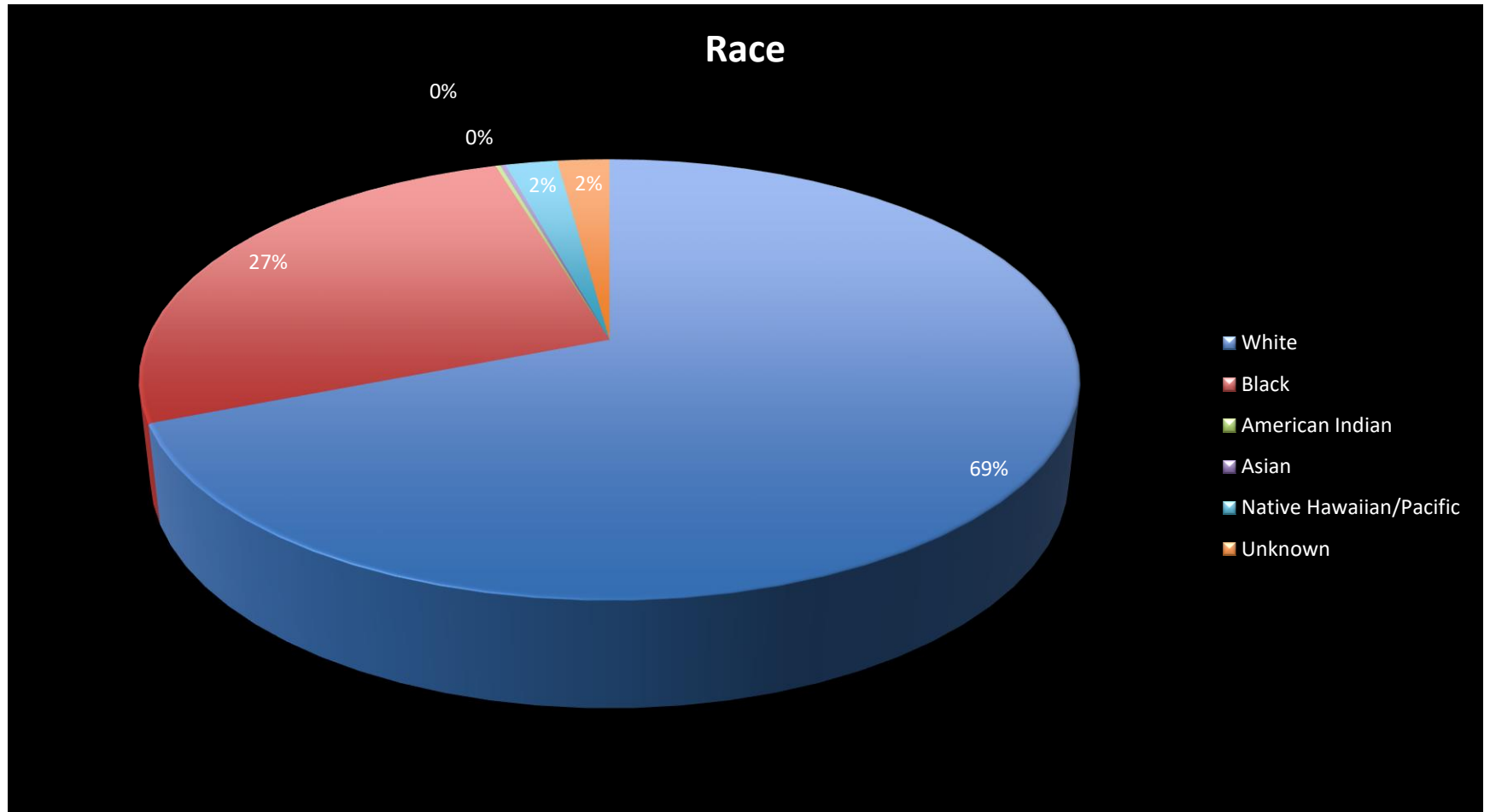


# Phase 1: IPD Study Population Demographics

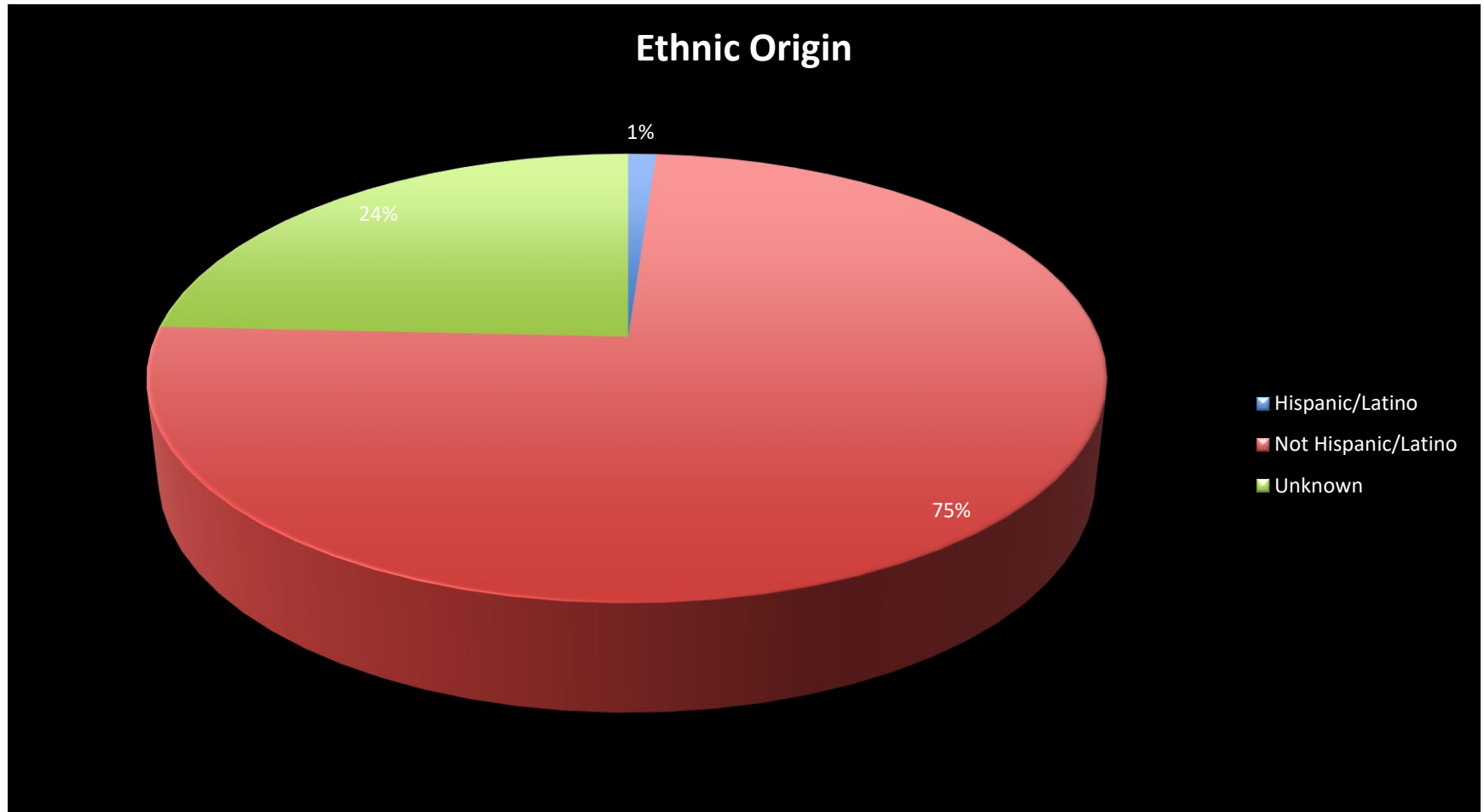
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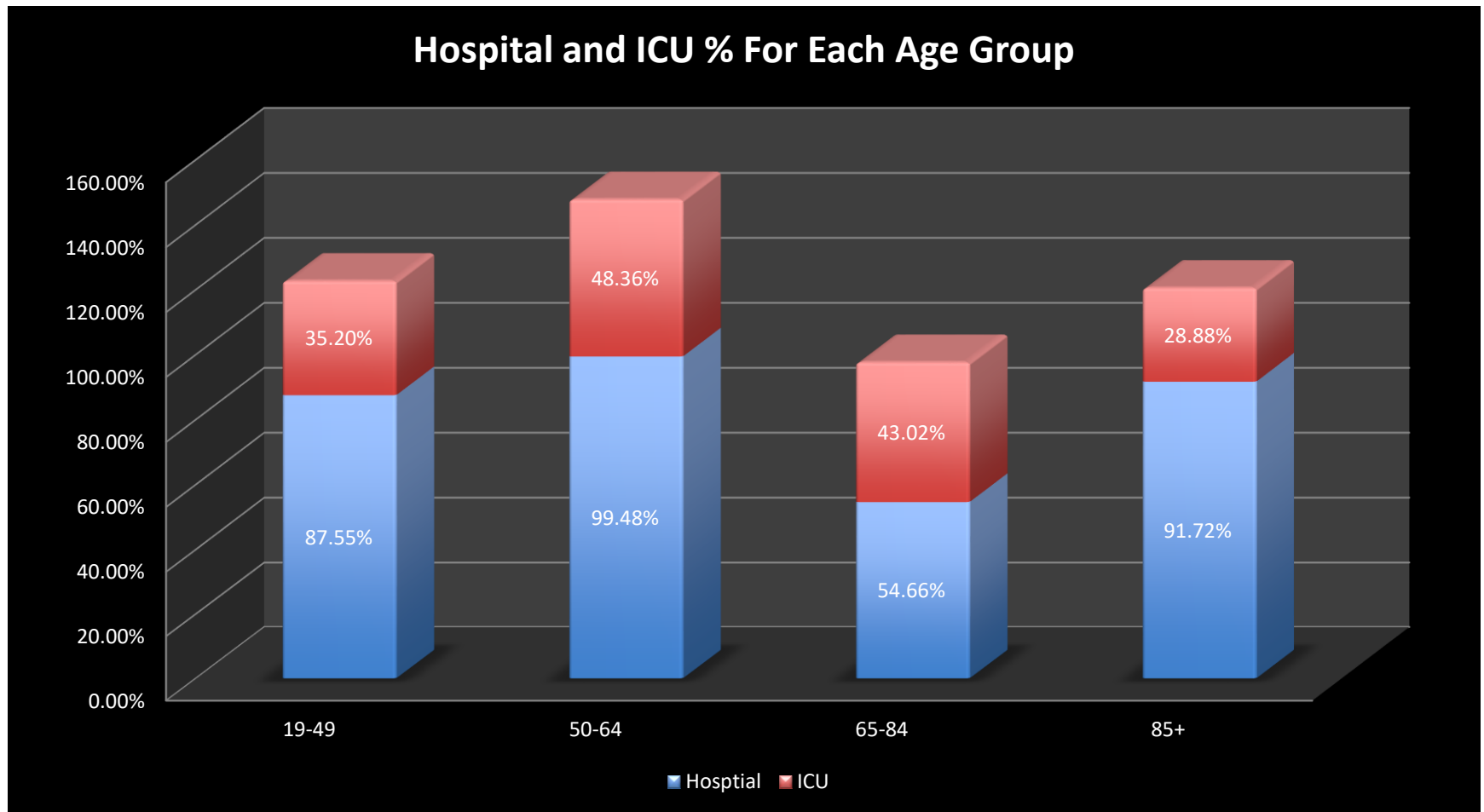
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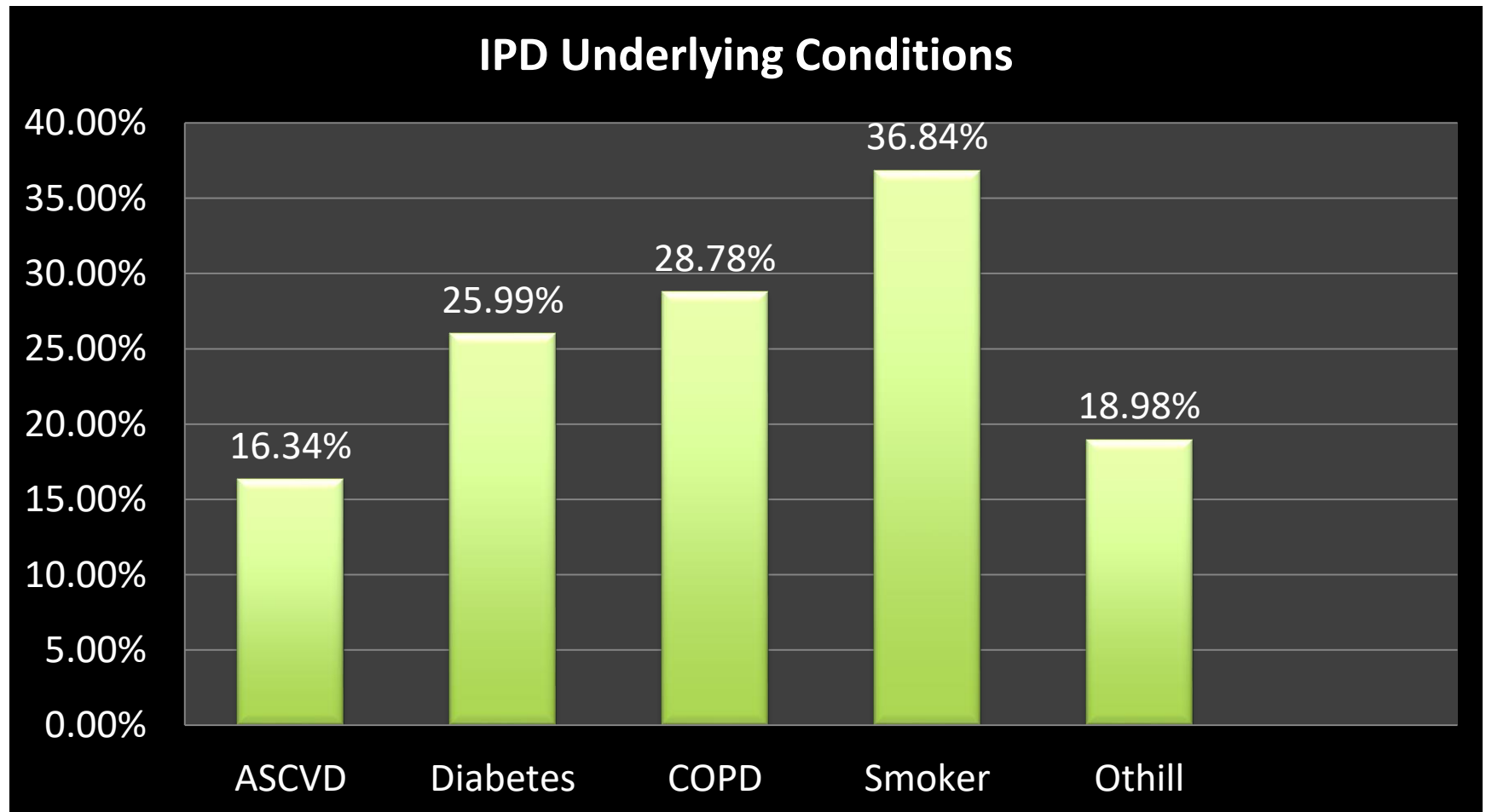
# Ethnic Origin



# Hospital and ICU %



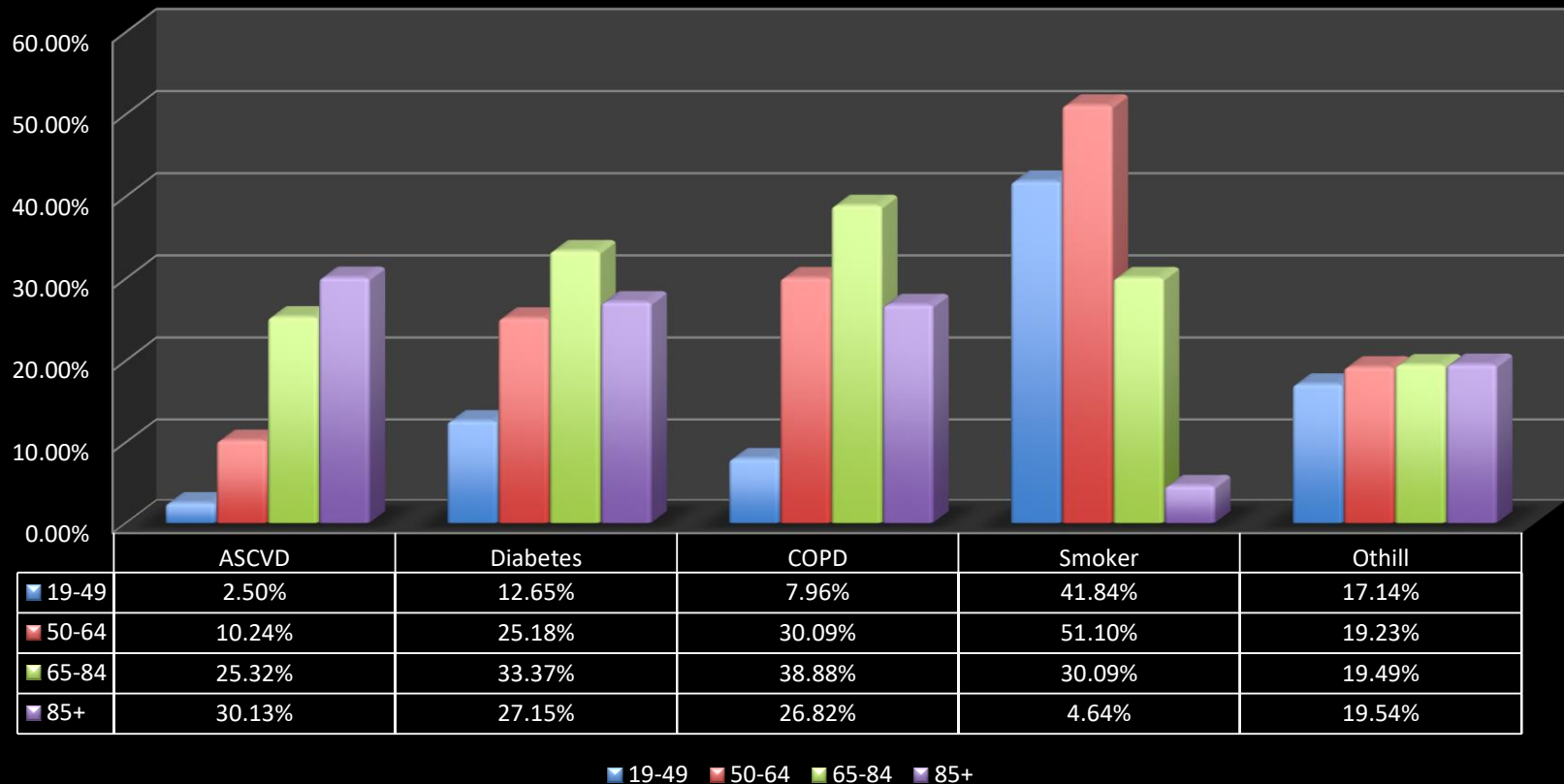
# Prevalent IPD Underlying Conditions





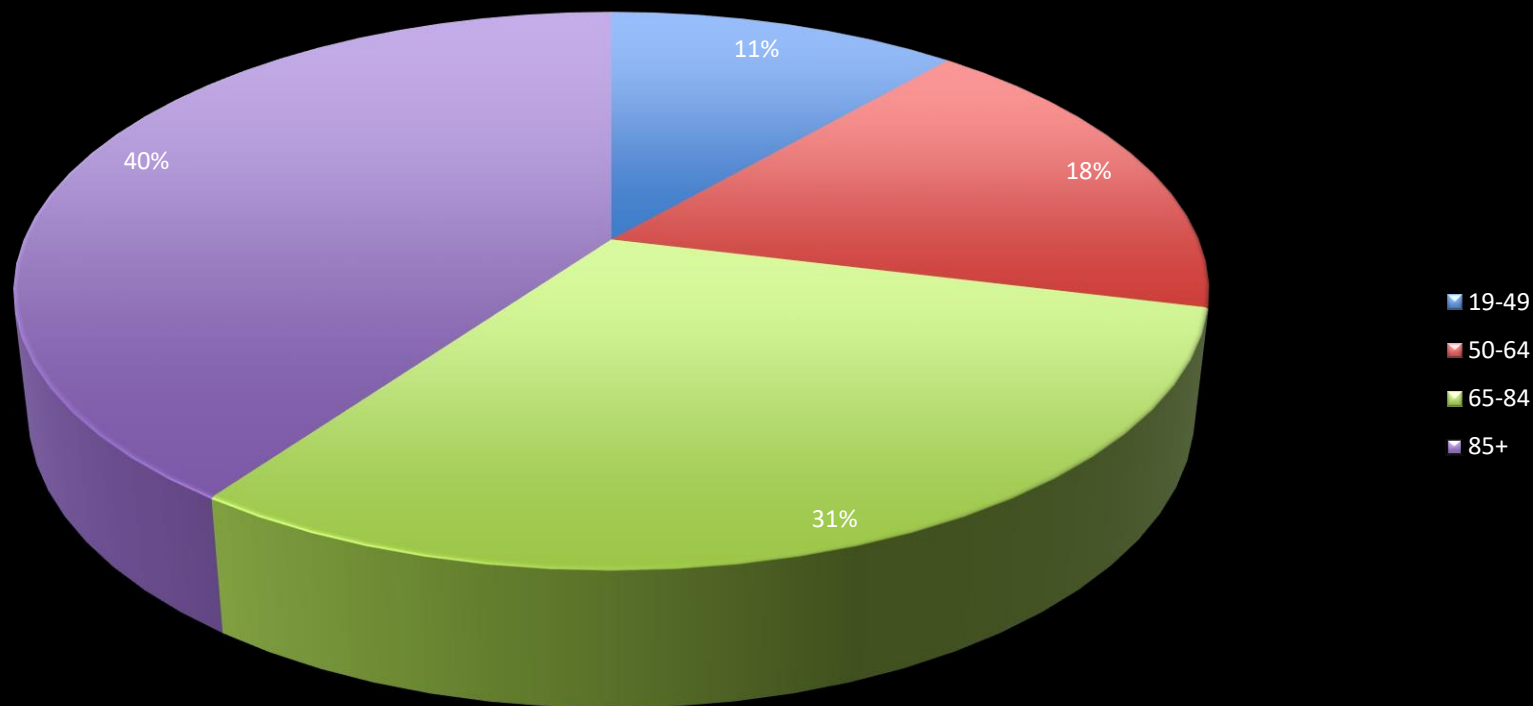
# Phase 2: Most Prevalent IPD Underlying Conditions (by age)

## IPD Underlying Conditions

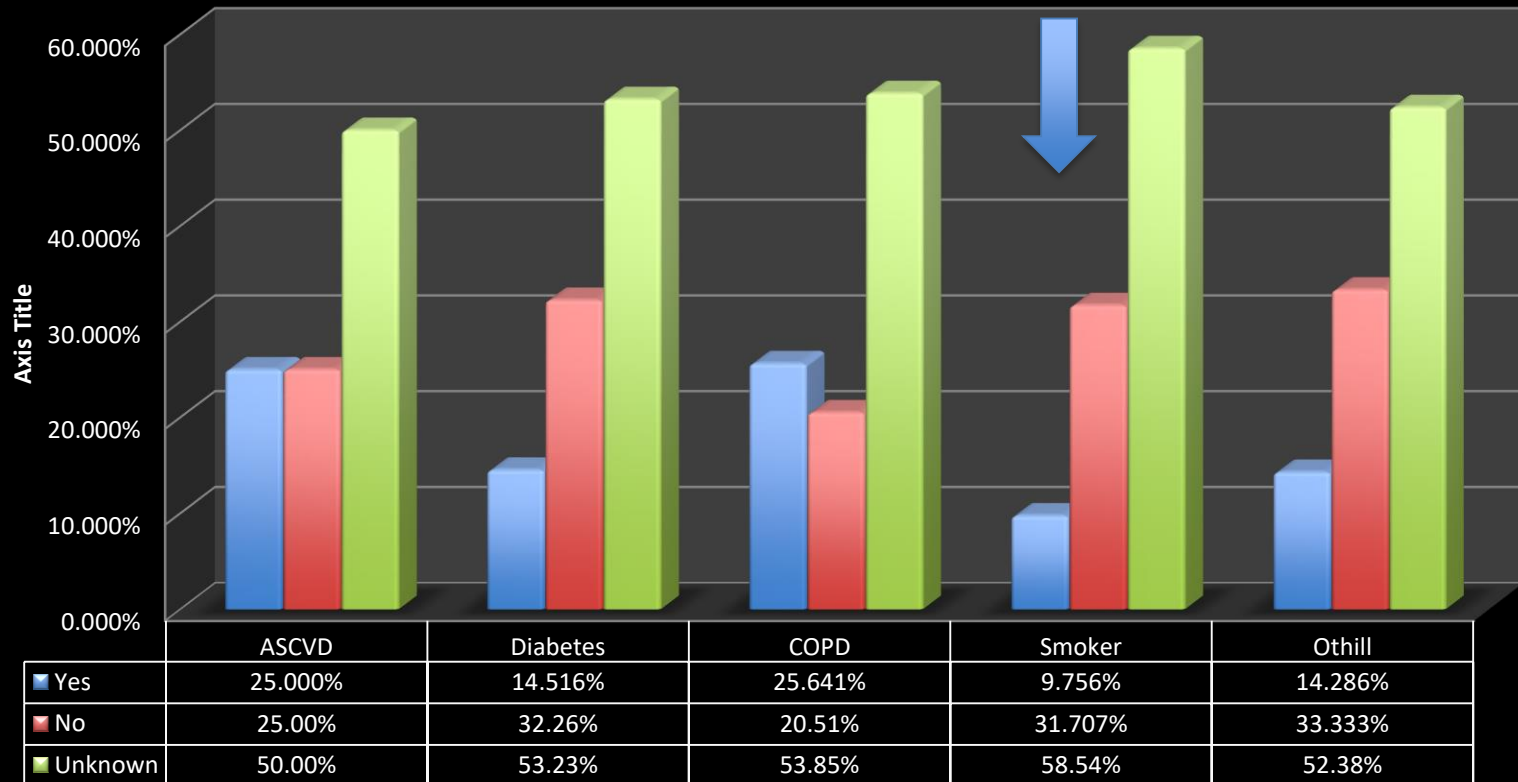


# Phase 3: IPD Vaccination Gaps

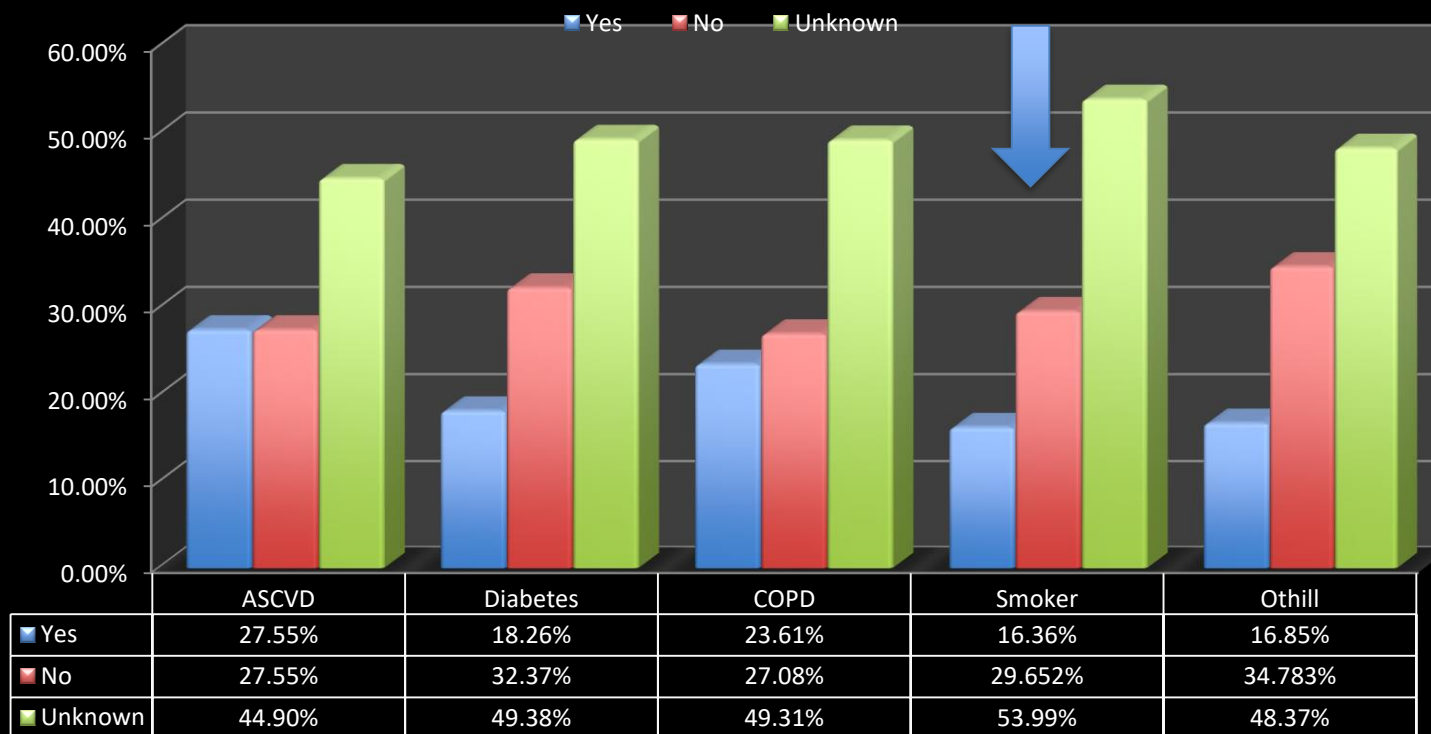
## Vaccination Percentages for Each Age Group



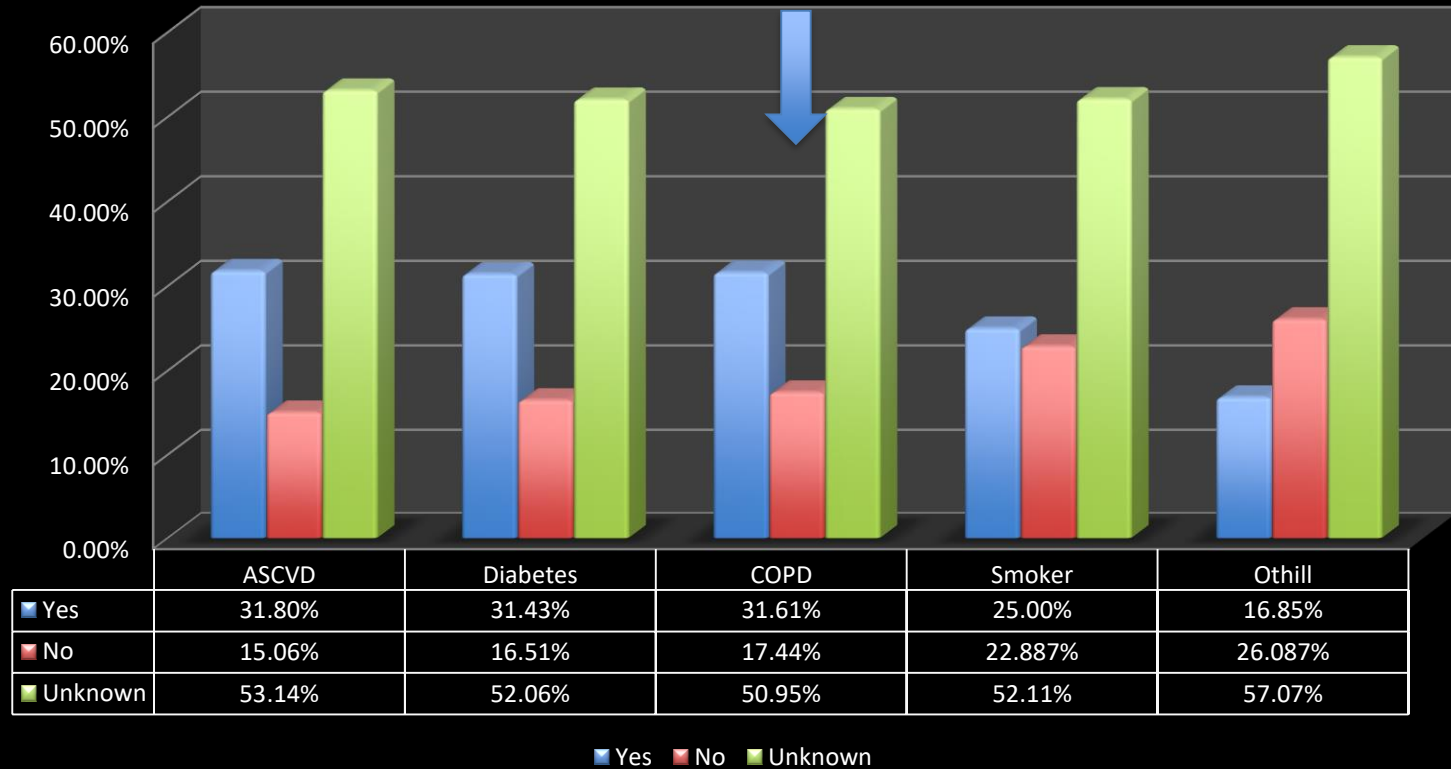
## Vaccination Percentages for 19-49 Age Group



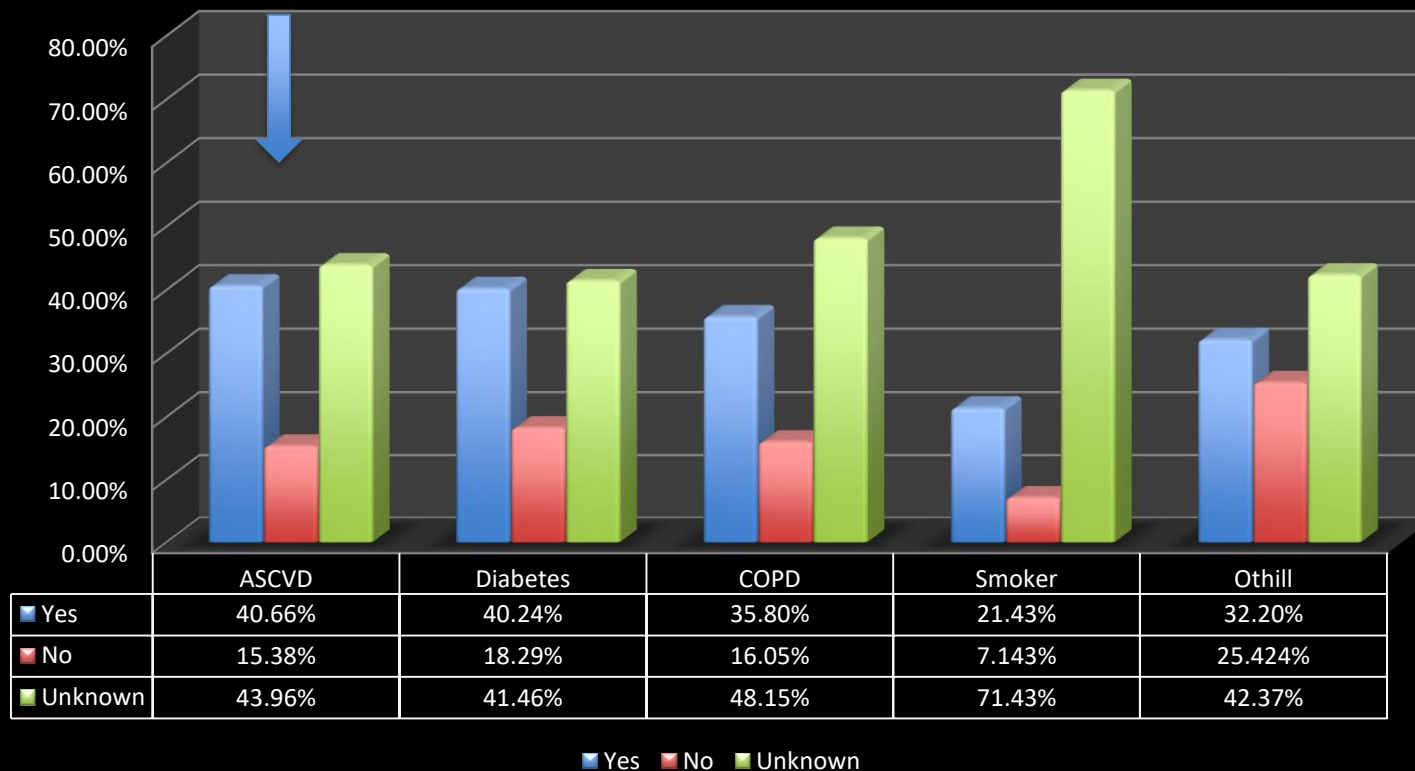
## Vaccination Percentages for 50-64 Age group



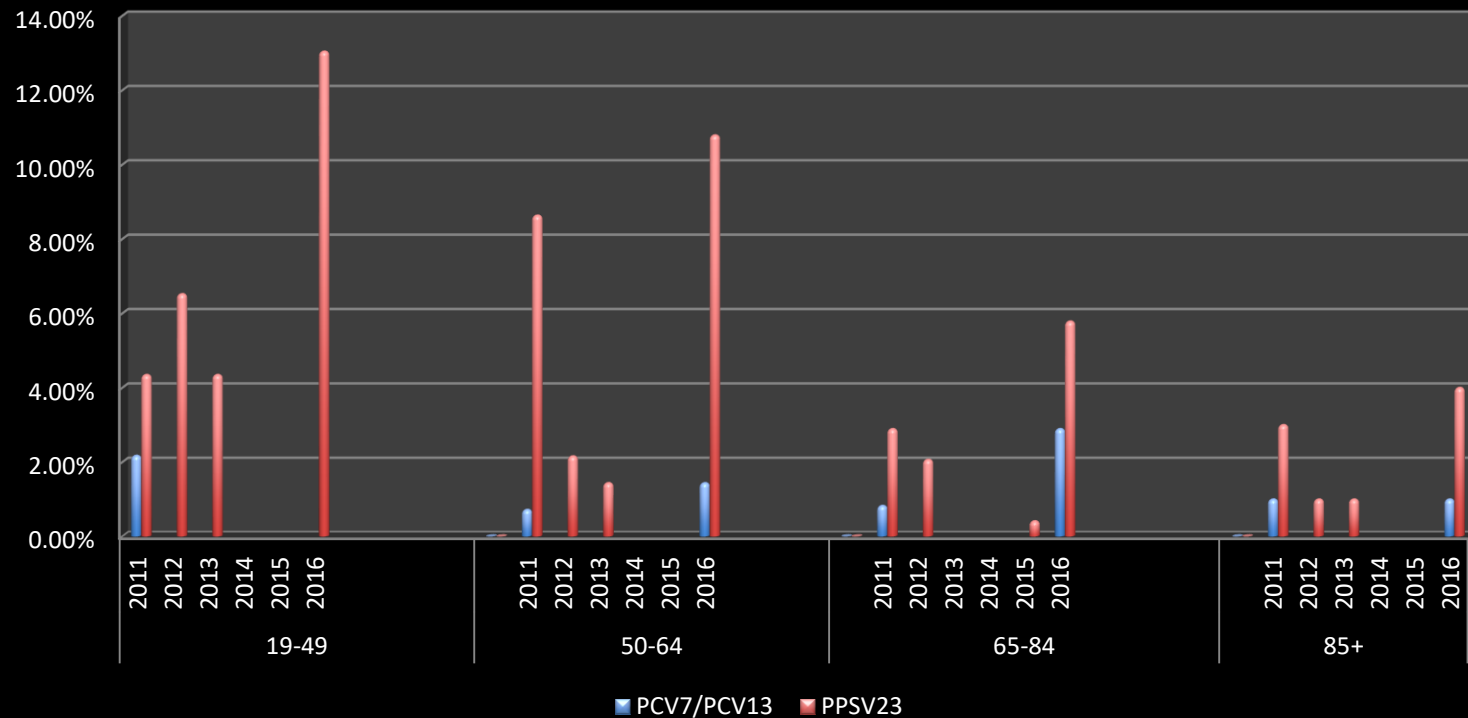
## Vaccination Percentages for Age Group 65-84



## Vaccination Percentages for Age Group 85+

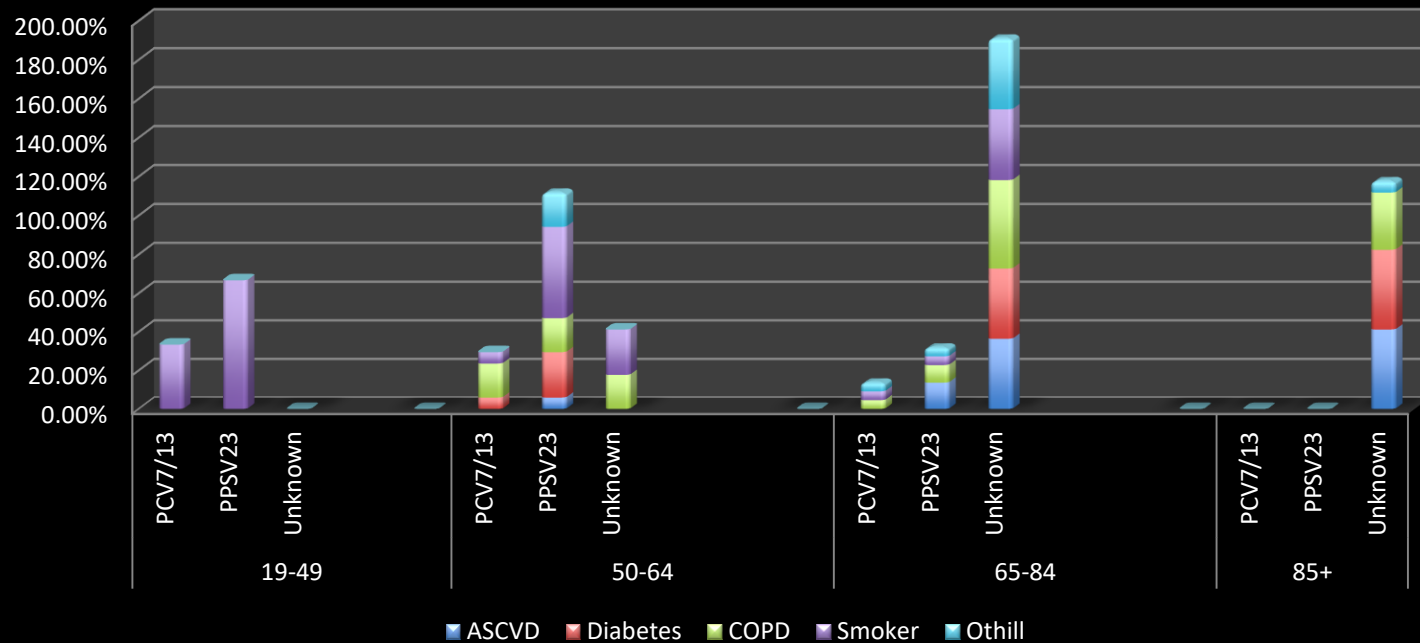


## Vaccine Types for All Age Groups

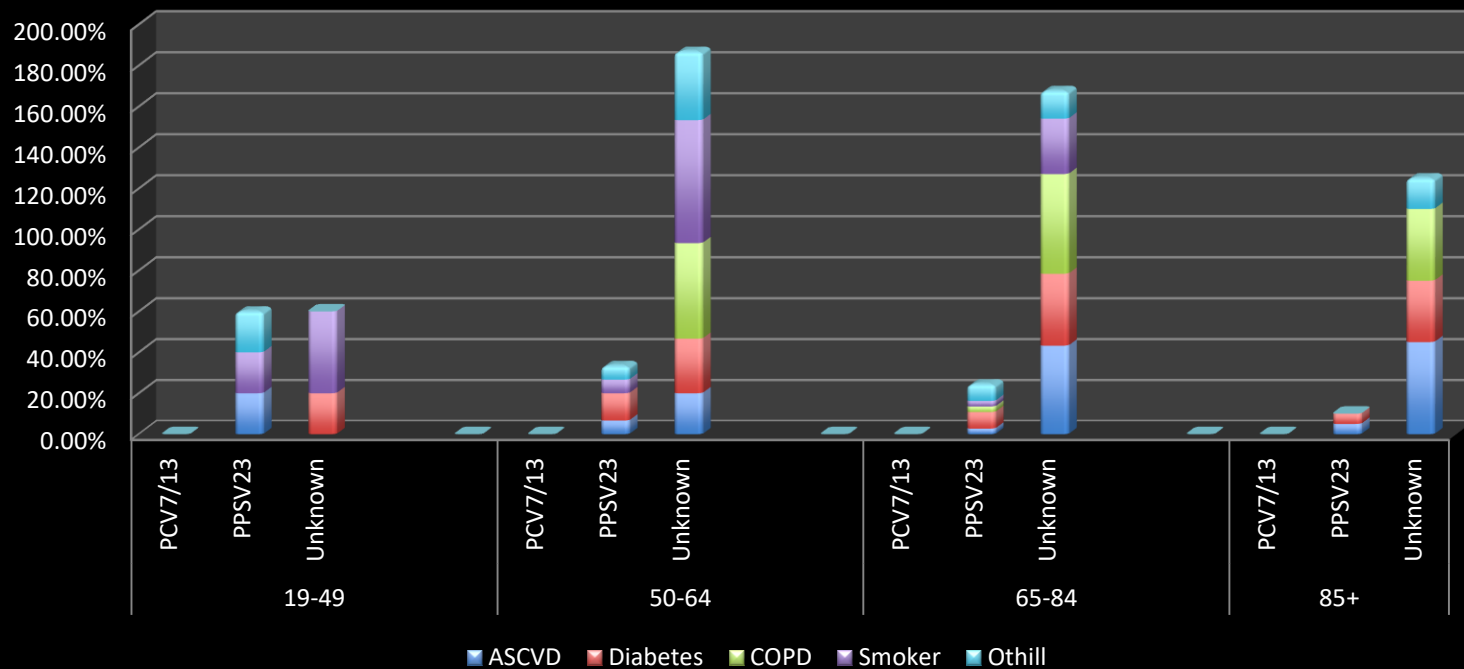




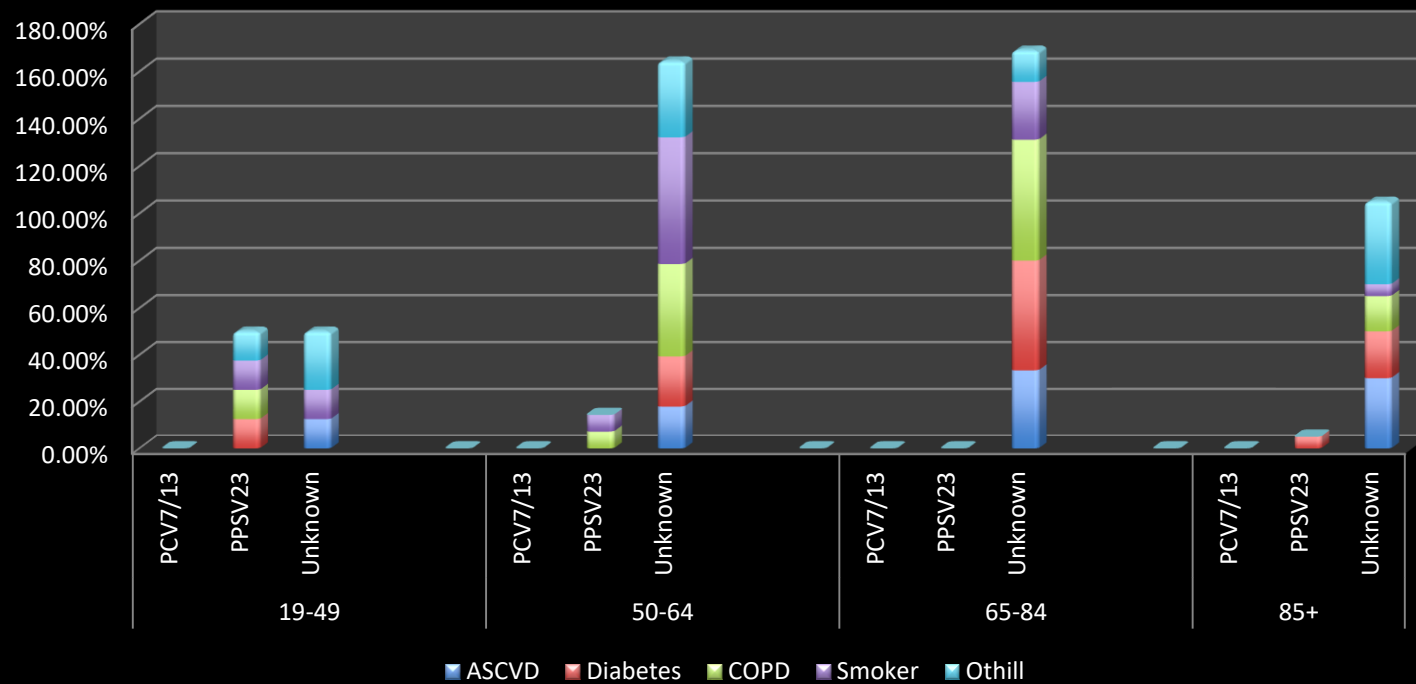
## 2011 Percentages for Underlying Conditions within Vaccine Types by Age



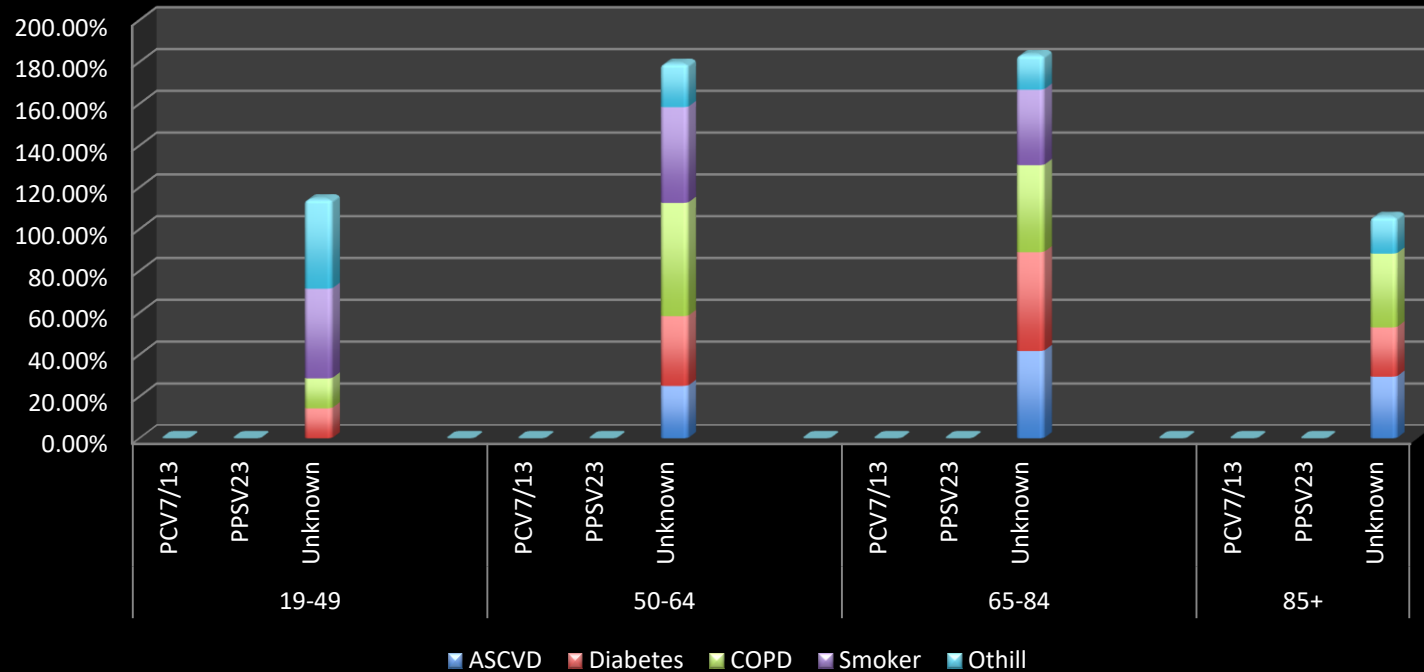
## 2012 Percentages for Underlying Conditions within Vaccine Types by Age



## 2013 Percentages for Underlying Conditions within Vaccine Types by Age

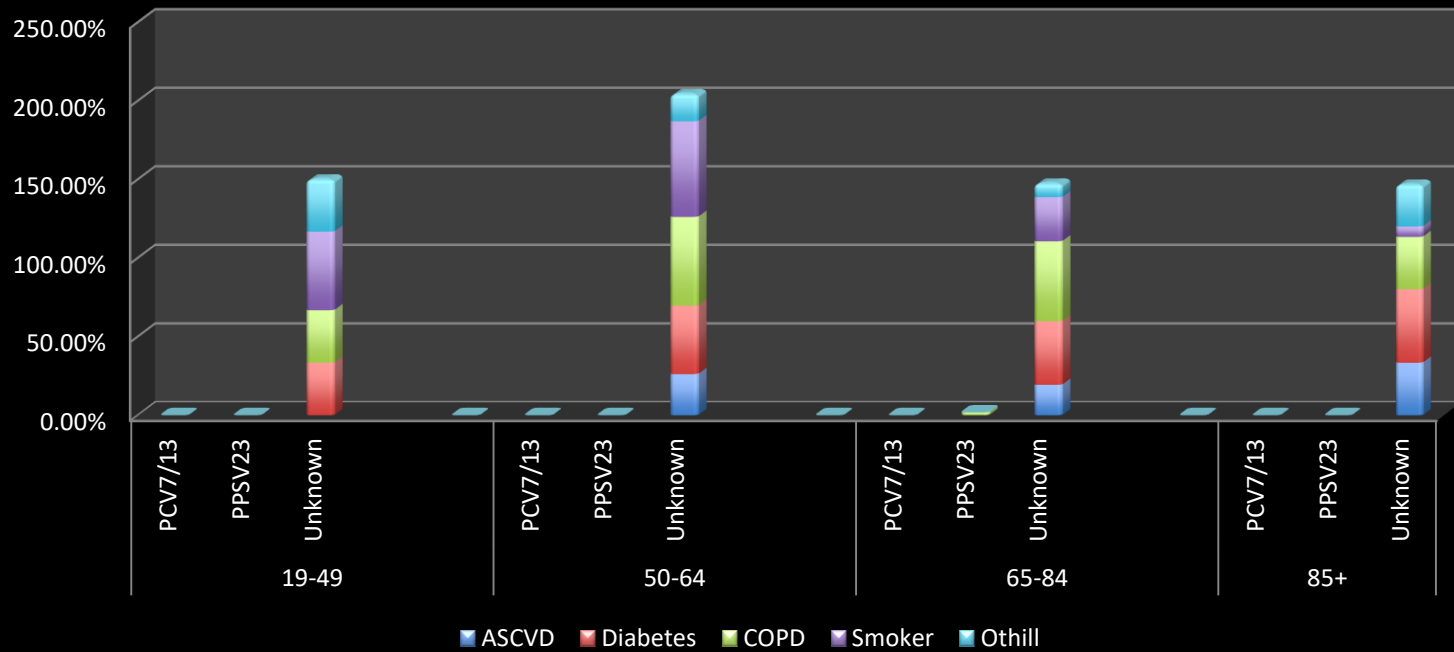


## 2014 Percentages for Underlying Conditions within Vaccine Types by Age

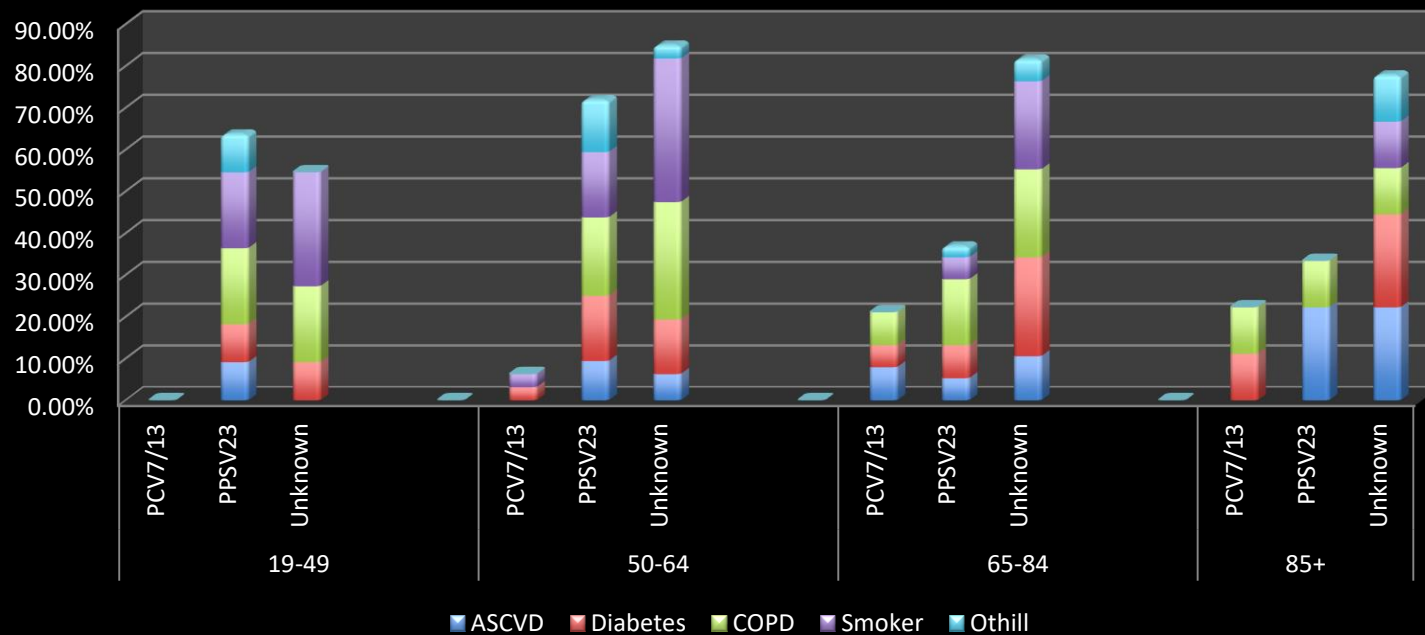




## 2015 Percentages for Underlying Conditions within Vaccine Types by Age



## 2016 Percentages for Underlying Conditions within Vaccine Types by Age



# Dual Vaccine Recommendation

- Evaluated the percentages of the vaccinated population that received dual vaccines
  - less than 1.7% of the age group, 65-84,
  - and less than 2.2% of the age group, 19-49, received the recommended dual vaccines

# Data Summary

- Phase 1 – Largest Populations
  - ✓ Age: 50-64
  - ✓ Race: Caucasian
  - ✓ Ethnic Origin: Not Hispanic
  - ✓ Hospital/ICU group: 50-64
  - ✓ Most prevalent underlying conditions: ASCVD, Diabetes, COPD, Smoker, Other illnesses

# Data Summary:

- Phase 2
  - ✓ 19-49: Smoker
  - ✓ 50-64: Smoker
  - ✓ 65-84: COPD
  - ✓ 85+: ASCVD

# Data Summary:

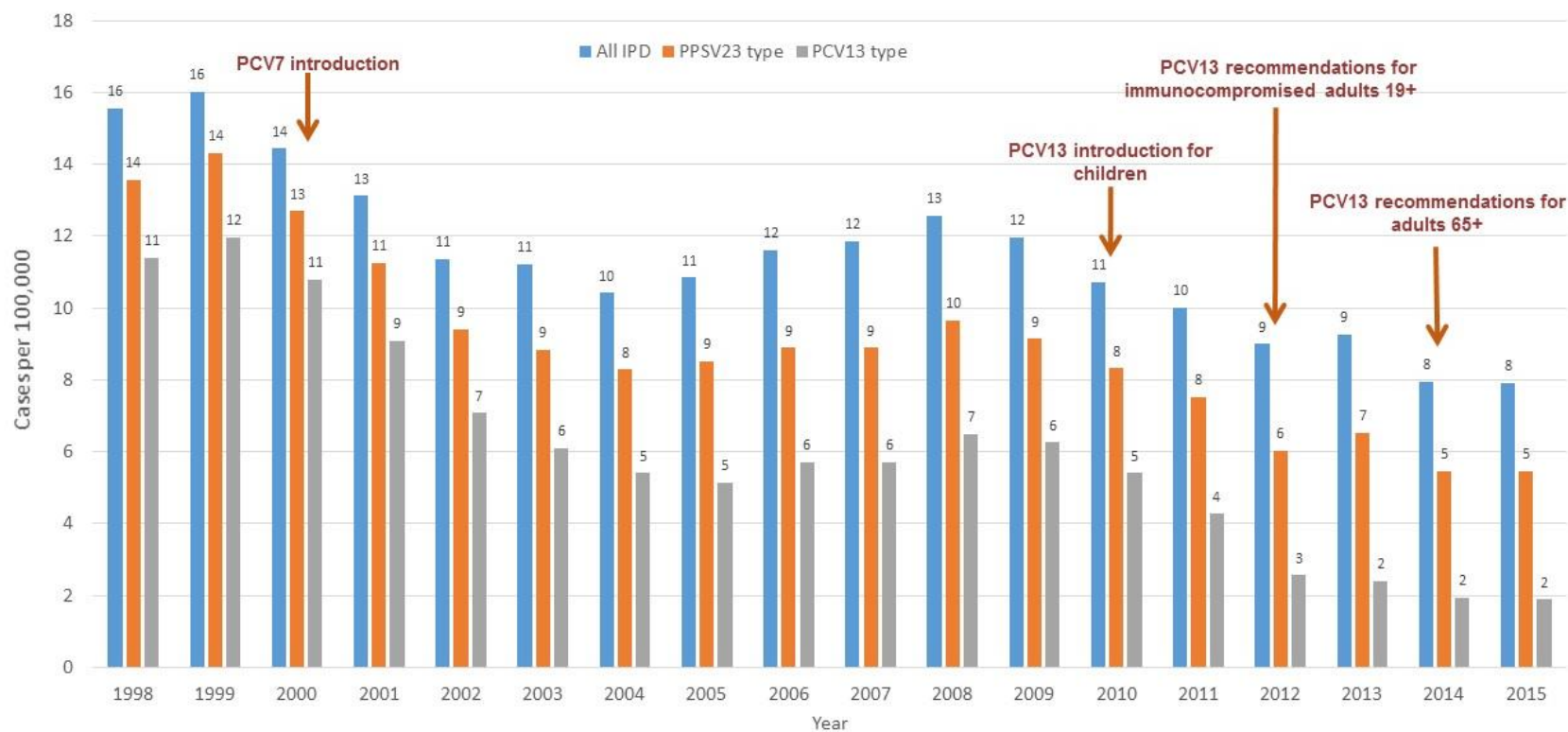
- Phase 3:
  - ✓ Vaccination Percentages for each age group:
    - 19-49: 11%
    - 50-64: 18%
    - 65-84: 31%
    - 85+: 40%
  - ✓ Vaccine Types for all age groups: PPSV 23
  - ✓ Low percentage of dual vaccinations in all age groups

# Conclusion:

**Analyses was conducted to shed light on IPD high-risk conditions and vaccination gaps among those with IPD**

- Most prevalent high-risk condition is smoking
- Younger age groups are going unvaccinated
- Majority of patients mark unknown vaccination status
- Low percentages of dual vaccines

## Trends in invasive pneumococcal disease among adults aged 19-64 years old, 1998–2015

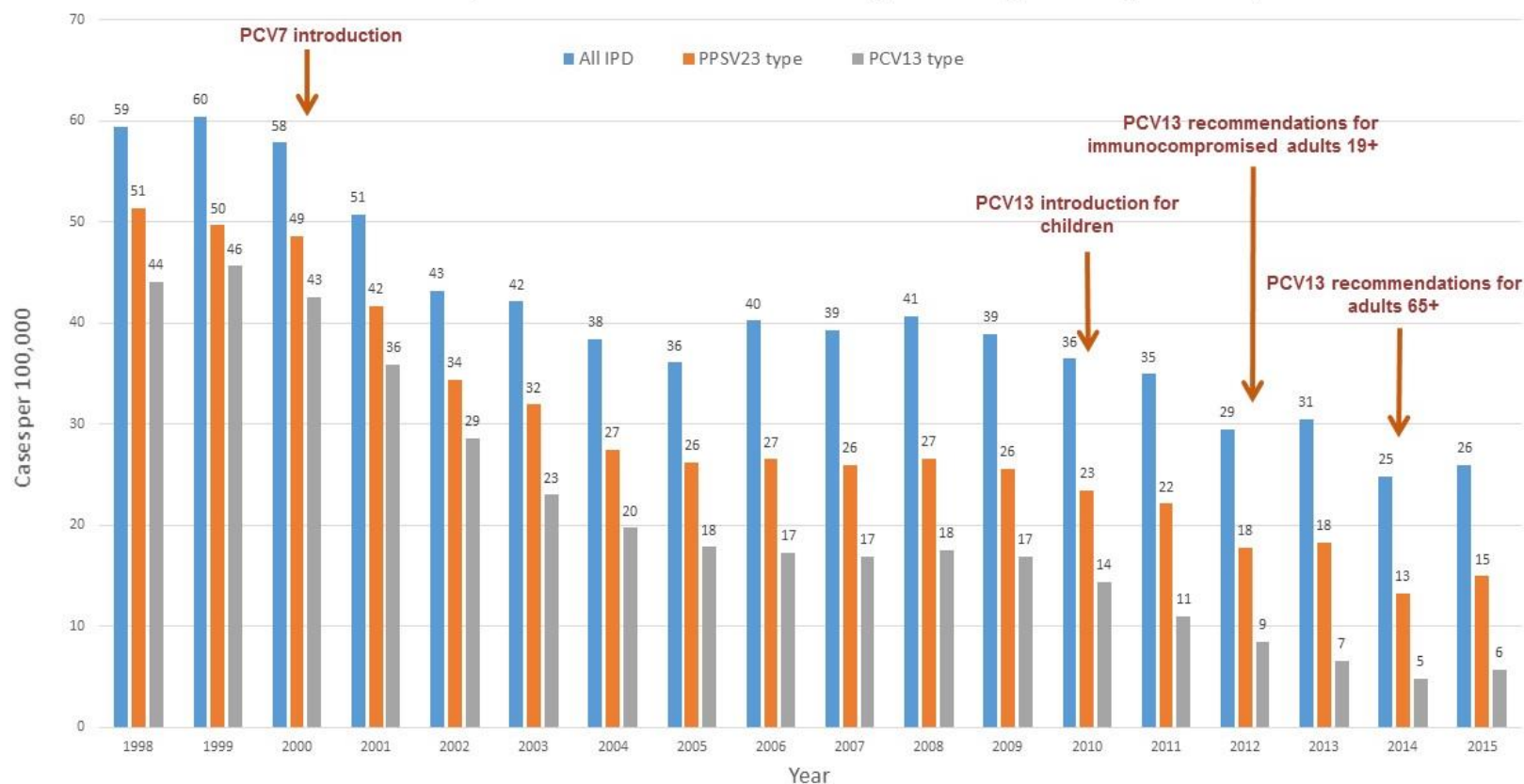


\*PPSV23 serotypes: 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F

\*PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

Active Bacterial Core surveillance data, 1998–2015, unpublished

## Trends in invasive pneumococcal disease among adults aged >65 years old, 1998–2015



\*PPSV23 serotypes: 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F

\*PCV13 serotype: 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F

Active Bacterial Core surveillance data, 1998–2015, unpublished

# Limitations

- Small study population
- Incomplete CRFs
- Unknown Vaccination Statuses
- Lack of communication between patients and healthcare providers (i.e. medical terminology)



# Future Studies

- A larger study population
- Comparison of IPD data within all ten EIP states
- Vaccination gaps among pregnant women with IPD high-risk conditions
- Measure the risk of reoccurrence of IPD in same study population
- Measure the risk of IPD in Hepatitis C patients

# Outline

- Brief Introduction of Field Experience
- Minor Project: SNiPP Data Entry
- Major Project: High Risk Conditions and Vaccination Gaps in IPD
- Core Competencies
- Questions

# Core Competencies

- **Biostatistics:** Use of descriptive statistics and statistical analyses
- **Environmental Health:** Acknowledgement of the link between disease and the environment
- **Epidemiology:** Use and understanding of surveillance methods and terms

# Core Competencies

- **Health Administration:** Use of HIPAA regulations and understanding of the U.S. healthcare system
- **Social and Behavioral Science:**  
Acknowledgment of the link between demographics with certain diseases and health disparities



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- Danielle Ndi
- Dr. John Dunn
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# References

- Baxter, R., Lee, A., Aukes, L., Snow, V., Fireman, B., Atkinson, B., Klein, N. (2016) Risk of Underlying Chronic Medical Conditions for Invasive Pneumococcal Disease in Adults. *Vaccine.*, 34(36), (4293-4297).
- Centers for Disease Control and Prevention. (1994). Addressing Emerging Infectious Disease Threats: a prevention strategy for the United States. Executive Summary. MMWR Recomm Rep, 1-18.
- Centers for Disease Control and Prevention. (2015). Pneumococcal Disease: About Pneumococcal. Retrieved May 1, 2017, from <http://www.cdc.gov/pneumococcal/clinicians/streptococcus-pneumoniae.html>.
- Centers for Disease Control and Prevention (2010). Updates Recommendations for Prevention of Invasive Pneumococcal Disease Among Adults Using the 23-Valent Pneumococcal Polysaccharide Vaccine (PPSV23). Retrieved June 25, 2017, from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5934a3.htm>.
- Centers for Disease Control and Prevention (2014). Manual for the Surveillance of Vaccine-Preventable Diseases. Retrieved June 20, 2017 from <https://www.cdc.gov/vaccines/pubs/surv-manual/chpt11-pneumo.html>
- Henriques-Normark, Birgitta, and Elaine I. Tuomanen. "The Pneumococcus: Epidemiology, Microbiology, and Pathogenesis." *Cold Spring Harbor Perspectives in Medicine*. Cold Spring Harbor Laboratory Press, July 2013. Web. 08 Aug. 2017.
- Tennessee Department of Health (2017). Emerging Infections Programs, (1-4). Retrieved May 1, 2017, from <http://www.tn.gov/health/article/emerging-infections-programs>.