

# Recent Trends in Coccidioidomycosis in the Department of Veterans Affairs

**VA**



U.S. Department  
of Veterans Affairs

**Cynthia Lucero-Obusan, MD**

VHA Office of Quality, Safety and Value (10E2E)  
Public Health Surveillance and Research Group

# Introduction

- VHA is the largest integrated healthcare system in the U.S. (9 million+ enrollees and 1,200+ sites of care)
- VA's Public Health Surveillance and Research Group is a national program office and essentially functions as VA's internal public health department
  - We direct public health investigations and epidemiologic lookbacks
  - Conduct on-going public health surveillance and assist in coordination of response and containment measures
  - Provide subject matter expertise on public health issues/policies and collaborate with VA, federal, local, state and academic partners
  - Operate VA's Public Health Reference Laboratory (PHRL) which has independent CAP accreditation and CLIA license and is a member of the LRN
- Major surveillance activities center on influenza, emerging infectious diseases (e.g. Zika) and disease outbreaks
- Our interest in Cocci began in 2016 after a CSTE Roundtable Session on improving surveillance for endemic fungal infections and led to a collaboration with CDC Mycotic Diseases Branch on Cocci burden analysis and beginnings of our own internal surveillance activities

# Background

- Incidence is increasing, but little is known about Coccidioidomycosis infections in Veterans
- No national surveillance for Cocci in VA
- Difficult to extract Cocci data from VA data warehouses
  - ICD billing codes can be inaccurate or incomplete
  - No standardized laboratory test naming conventions or consistent use of LOINC codes
  - VA testing for cocci is primarily send-out and is being performed by a large number of different labs
  - VA patients often receive care in the community and this data is not readily available electronically

# Methods

- **National VA data from January 2010 – May 2017 was obtained from VA data warehouses**
  - Hospitalizations and outpatient/ED encounters with Cocci diagnosis code (ICD-9: 114, ICD-10: B38)
  - Laboratory data (serology, immunodiffusion, complement fixation, and *Coccidioides* cultures) based on LOINC code or free text, “key word” search of test names, test results and comment/notes fields
  - Antifungal data was obtained for the subset of patients with coded disseminated/progressive disease or meningitis (more likely to have received treatment and for Cocci indication)
  - Data extracted included patient demographics, location of residence and treating facility, diagnosis codes, lab results, treatment, encounter details and deaths during Cocci-coded hospitalizations
  - Outpatient data came exclusively from VHA facilities, but inpatient data included available data from non-VHA facilities
  - Race/ethnicity data only available for hospitalized patients

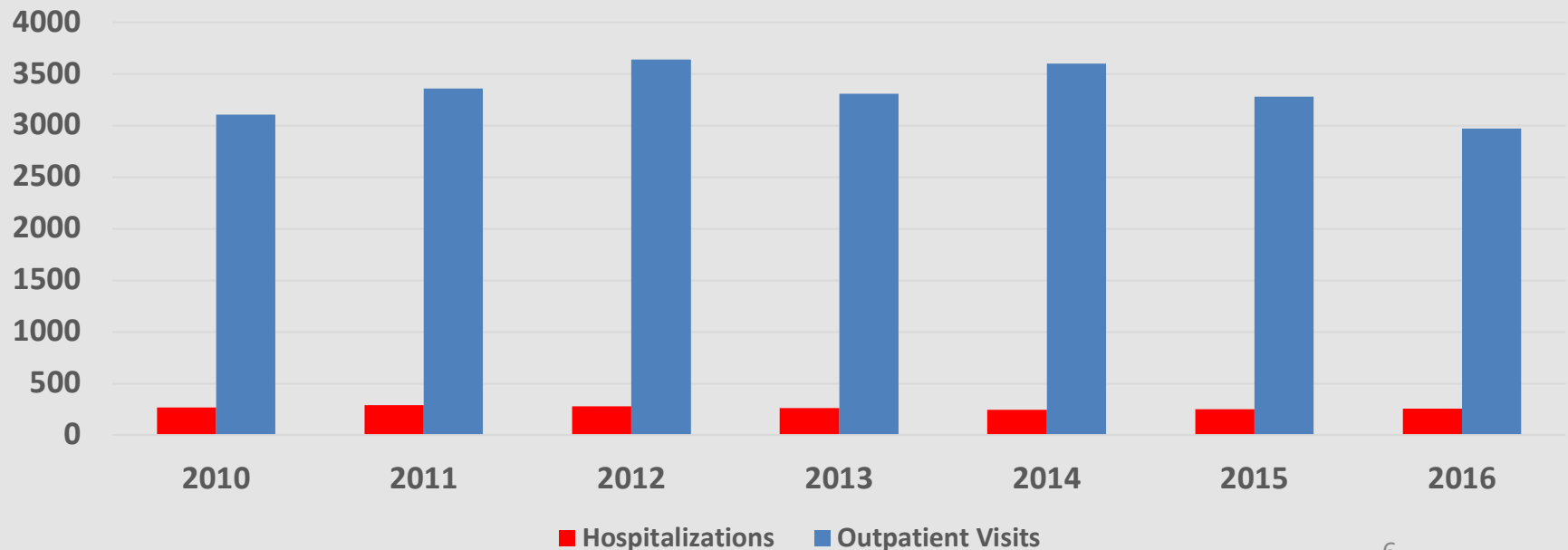
# Results

- **4,523 unique Veteran patients identified**
  - Median age: 63 years (range 20-95 years)
  - Gender: 4,228 (93%) male
  - Residence: Over 76% (3,447) in the West US Census region. Top counties: (1) Maricopa, AZ (769, 17%), (2) Pima, AZ (712, 16%), (3) Los Angeles, CA (242, 5%), (4) Pinal, AZ (159, 4%), (5) Kern, CA (113, 3%).
- **Hospitalizations**
  - 1,916 hospitalizations among 1,202 unique individuals
  - Median length of stay: 5 days
  - Principal diagnosis code: 342 (18%)
    - DRG: Respiratory 27%, Circulatory 13%, Infectious/Parasitic 10%, Nervous System 8%, Digestive 5%
  - Time in intensive care unit: 318 (17%)
  - Deaths: 89 (5%)

# Results

- **Outpatients**
  - 24,415 outpatient/ED visits among 3,981 unique individuals
  - Principal diagnosis code: 14,195 (58%)
  - Location: ID- 37%, Primary Care/Internal Med- 36%, Pulm- 11%, ED- <2%
- **Encounter volume relatively stable over time**

### VA Coccidioidomycosis Encounters



# Results

## Coccidioidomycosis Encounter Details, Jan 2010-May 2017

|  | Inpatient<br>Stays<br>N=1,916 | Unique<br>Inpatients <sup>†</sup><br>N=1,202 | Outpatient<br>Visits<br>N=24,415 | Unique<br>Outpatients <sup>†</sup><br>N=3,981 |
|--|-------------------------------|--|----------------------------------|---|
| <b>Types of Cocci, N (%)<sup>‡</sup></b> |                               |  |                                  |   |
| <b>Pulmonary</b>                         | 901 (47)                      | 552 (46)                                     | 8,682 (36)                       | 1,584 (40)                                    |
| <b>Primary pulmonary</b>                 | 311 (16)                      | 232 (19)                                     | 3,264 (13)                       | 627 (16)                                      |
| <b>Disseminated/Progressive</b>          | 262 (14)                      | 129 (11)                                     | 2,259 (9)                        | 141 (4)                                       |
| <b>Meningitis</b>                        | 137 (7)                       | 50 (4)                                       | 1,369 (6)                        | 77 (2)  |
| <b>Primary extrapulmonary</b>            | 25 (1)                        | 18 (1)                                       | 464 (2)                          | 93 (2)  |
| <b>Unspecified</b>                       | 635 (33)                      | 479 (21)                                     | 12,052 (49)                      | 2,125 (53)                                    |

<sup>†</sup>Based on the first coccidioidomycosis-coded hospitalization record or outpatient encounter.

<sup>‡</sup>Based on ICD-9/10-CM diagnoses for the coccidioidomycosis-coded encounter. Outpatient visits include up to 25 codes. Hospitalizations include a principal discharge and up to 25 secondary codes. Categories are not mutually exclusive, more than one type of code can be applied to each encounter.

# Results

## Coccidioidomycosis Encounter Details, Jan 2010-May 2017

|  | Inpatient<br>Stays<br>N=1,916 | Unique<br>Inpatients <sup>†</sup><br>N=1,202 | Outpatient<br>Visits<br>N=24,415 | Unique<br>Outpatients <sup>†</sup><br>N=3,981 |
|--|-------------------------------|--|----------------------------------|---|
| <b>Select Comorbidities, N (%)<sup>‡</sup></b> |                               |  |                                  |   |
| Diabetes Mellitus                              | 666 (35)                      | 392 (33)                                     | 2,730 (11)                       | 454 (11)                                      |
| COPD   | 367 (19)                      | 223 (19)                                     | 1,587 (7)                        | 335 (8)                                       |
| Malignant Neoplasm                             | 242 (13)                      | 163 (14)                                     | 1,092 (4)                        | 231 (6)                                       |
| HIV/AIDS                                       | 67 (3)                        | 34 (3)                                       | 721 (3)                          | 84 (2)  |
| Transplant                                     | 59 (3)                        | 19 (2)                                       | 296 (1)                          | 25 (0.6)                                      |
| Inflammatory Bowel Dx                          | 29 (2)                        | 18 (1)                                       | 108 (0.4)                        | 16 (0.4)                                      |

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# Results

## • Meningitis or disseminated/progressive Disease

- 500 unique individuals, with 84% receiving antifungal(s)
- Higher percentage were African American and Asian

| VA Pharmacy Data           | Patients<br>N=500 |
|----------------------------|-------------------|
| Antifungal, N (%)          |                   |
| Fluconazole                | 362 (72)          |
| Itraconazole               | 69 (14)           |
| Voriconazole               | 56 (11)           |
| Posaconazole               | 39 (8)            |
| Amphotericin B (all forms) | 32 (6)            |
| Micafungin                 | 7 (1)             |
| Ketoconazole               | 4 (0.8)           |
| Isavuconazole              | 2 (0.4)           |
| Interferon gamma           | 1 (0.2)           |
| Caspofungin                | 1 (0.2)           |

| Race/Ethnicity            | Unique<br>Inpatients<br>N=1,202 | Meningitis/<br>Disseminated<br>N=231 |
|---------------------------|---------------------------------|--------------------------------------|
| Race, N (%)               |                                 |                                      |
| White                     | 814 (68)                        | 112 (48)                             |
| Black/African American    | 248 (21)                        | 88 (38)                              |
| Asian/Pacific Islander    | 33 (3)                          | 14 (6)                               |
| Amer Indian/Alaska Native | 24 (2)                          | 7 (3)                                |
| Missing/Unknown           | 96 (8)                          | 14 (6)                               |
| Ethnicity, N (%)          |                                 |                                      |
| Hispanic/Latino           | 112 (9)                         | 24 (10)                              |
| Not Hispanic/Latino       | 1,033(86)                       | 197 (85)                             |
| Missing/Unknown           | 57 (5)                          | 10 (4)                               |

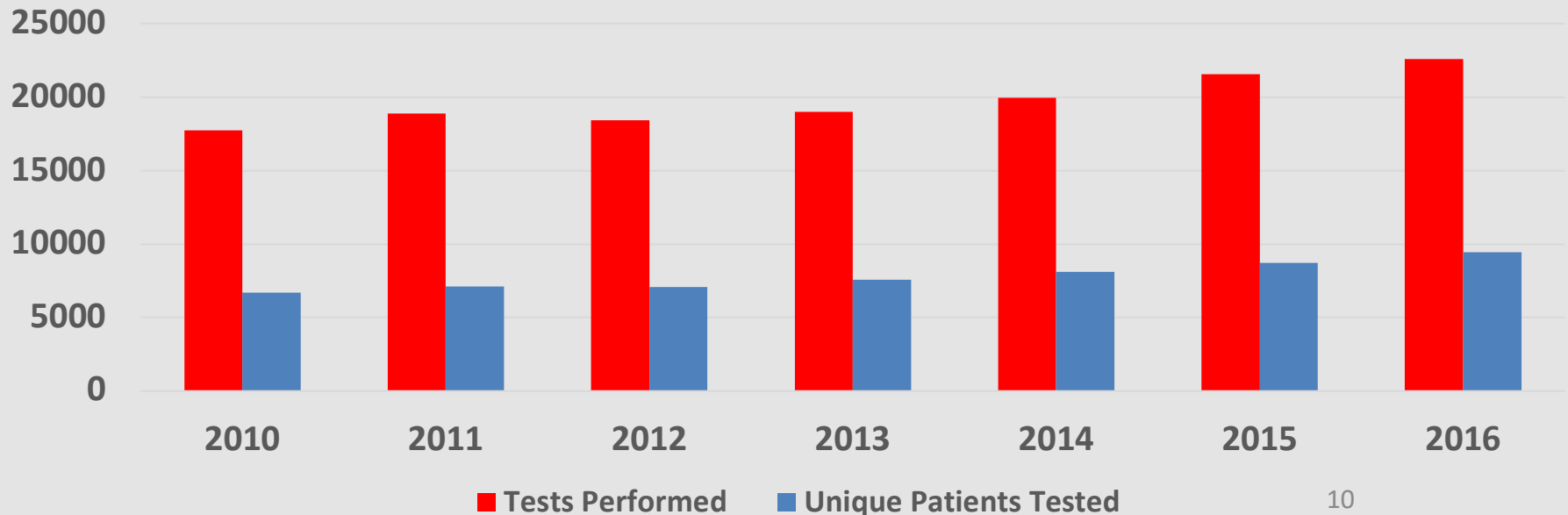
Overall Veteran population: White 81.7%, Black 12.6%, Asian/Pacific Islander 1.6%, AI/AN 0.8%, Hispanic 7.1%

# Results

## • Laboratory Testing

- Micro: 329 patients with positive *Coccidioides* culture
- Lab/Chem: Bulk of testing in a handful of facilities- Tucson, 29%; Phoenix, 18%; Los Angeles, 8%; San Diego, 6%; San Antonio, 4%; Fresno, 3%; Long Beach, Dallas, N. Arizona/Prescott, Loma Linda, 2% each
- Testing Breakdown (2016): Comp Fix (8772, 39%), ID (8606, 38%), EIA/ELISA (4065, 18%), LA/LPA (988, 4%)

VA Coccidioidomycosis Lab Testing



# Bringing Cocci Testing to PHRL?

- No centralized information available regarding where testing is being performed and how much facilities are paying for each test
- We have approx. 150 VA hospitals and labs must be contacted individually to determine costs
- Good potential clinical tests for PHRL to offer because testing is concentrated in a few facilities
- We may be able to offer testing at a lower cost than commercial labs which could translate into significant cost savings for high volume facilities

# Future Projects/Collaborations

- **CDC-VA SuperNOVA ARI Active Surveillance Platform**
  - CDC NCIRD Respiratory Viruses Branch, CDC NCEZID Mycotic Diseases Branch, VA Greater Los Angeles, VA-PHSR
  - Sub-study proposal for FY 2019 to include Cocci testing for patients enrolled for ARI at Los Angeles VA facility
  - Testing of acute serum samples and evaluating point of care performance of total antibody lateral flow assay (LFA), assessing seroconversion for coccidioidomycosis antibody in convalescent samples, compare concordance of LFA with EIA and ID, evaluating demographic and clinical characteristics
- **Other Coccidioidomycosis Collaborations**
  - Univ. of Arizona, Valley Fever Center of Excellence
  - On-going retrospective study with partners at the Phoenix VA looking at demographics, variation in diagnosis practices, time to diagnosis, antibiotic utilization and treatment regimens
  - Prospective evaluation study aimed at reducing delays in diagnosis and improving antimicrobial stewardship
  - PHRL as a potential reference lab to do EIA and LFA validation studies

# Limitations & Next Steps

- **Cases identified was based on diagnosis codes and some miscoding/misclassification may have occurred**
  - We did not perform chart review to assess accuracy or completeness of coding
  - Continue to review lab results to understand testing practices and identify additional case patients
  - Extend our surveillance for the remainder of 2017 and 2018
- **Race/ethnicity data was available only for hospitalized patients**
  - We will gather race/ethnicity and additional demographic and clinical characteristics in future analyses (e.g. time to diagnosis, expenditure)
  - Further review the deaths that occurred among Cocci-coded hospitalizations
- **Data from non-VA outpatient and some non-VA hospitalizations are not available**
  - Veterans with acute presentations may be preferentially seen at closer non-VA facilities
- **Pharmacy review was limited to a subset of patients**
  - We did not confirm via chart review the indication for treatment
  - Pharmacy data is not available for treatment received outside VA
  - Expand pharmacy review to look at all patients and to review antibiotic use

# Conclusions

- Coccidioidomycosis causes substantial morbidity and mortality in Veterans, with the majority of cases and testing occurring in Arizona and Southern California
  - Veterans represent a unique patient population to study due to older age and more co-morbidities than the general US population
- Number of VA encounters coded with Coccidioidomycosis has remained relatively stable over the last 7 years although testing has increased
- Black/African Americans and Asian/Pacific Islanders were over-represented compared to the general US Veteran population (especially for disseminated disease and meningitis) consistent with previous reports of ethnic predisposition for severe disease
- Additional study needed to further understand the epidemiology of Coccidioidomycosis among Veterans, particularly testing, delays in diagnosis/misdiagnosis and inappropriate antimicrobial utilization



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