

# **Infectious Disease Epidemiology Programs**

## **2006 Annual Report**

Office of Infectious Disease Services  
Bureau of Epidemiology and Disease Control  
Division of Public Health Services

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## TABLE OF CONTENTS

|   |    |
|---|----|
| Executive Summary .....   | 4  |
| I. Introduction .....   | 5  |
| A. Data Sources and Limitations .....                                     | 6  |
| B. Purpose of the Report .....  | 6  |
| C. Reporting .....  | 7  |
| D. Tables of Reportable Diseases .....                                    | 8  |
| E. State and County Health Department Contact Information.....            | 11 |
| II. Disease Statistics.....   | 13 |
| A. Population Estimates for 2006 .....                                    | 14 |
| B. Tables of Cases and Rates of Reportable Diseases.....                  | 14 |
| III. Disease Summaries.....   | 15 |
| A. Coccidioidomycosis (Valley Fever).....                                 | 16 |
| B. Botulism .....   | 20 |
| C. Invasive Meningococcal Disease .....                                   | 23 |
| D. Mumps .....  | 26 |
| E. Nosocomial Outbreaks.....  | 28 |
| F. Salmonella Oranienburg Outbreak in Cochise County .....                | 33 |
| G. Non-O1 <i>Vibrio cholerae</i> Infections .....                         | 39 |
| IV. SURVEILLANCE TOPICS AND STUDY REPORTS .....                           | 43 |
| A. Medical Electronic Disease Surveillance Intelligence System (MEDSIS) . | 44 |
| B. Pandemic and Seasonal Influenza .....                                  | 45 |
| C. Why submit isolates to the State Lab? .....                            | 49 |
| D. Effects of Recommending the DTaP Minimum Interval Schedule.....        | 52 |
| Individuals contributing to this report: .....                            | 53 |

## TABLE OF FIGURES

|  |    |
|--|----|
| Figure 1. Flow of communicable disease reports .....   | 7  |
| Figure 2. Rates of Reported Coccidioidomycosis Cases in Arizona from 1993-2006 .....             | 16 |
| Figure 3. Reported Coccidioidomycosis Cases by Month, Arizona 2001-2006 .....                    | 17 |
| Figure 4. Coccidioidomycosis Rates per 100,000 by Age and Year in Arizona from 2001 to 2006..... | 18 |

|  |    |
|--|----|
| Figure 5. Rate of reported coccidioidomycosis, by county, Arizona, 2006.....                                       | 19 |
| Figure 6. Rates of reported invasive meningococcal disease, Arizona, 1994-2006<br>.....                            | 23 |
| Figure 7. Serogroup type by age group, invasive meningococcal disease, Arizona,<br>1994-1999 .....                 | 24 |
| Figure 8. Serogroup type by age group, invasive meningococcal disease,<br>Arizona, 2000-2006 .....                 | 24 |
| Figure 9. Meningococcal serogroups, invasive disease, Arizona, 1994-2006 .....                                     | 25 |
| Figure 10. Reported cases of confirmed mumps, Arizona, 1996-2006 .....   | 27 |
| Figure 11. Epidemiological curve of the <i>Salmonella</i> Oranienburg outbreak,<br>Cochise County, 2006-2007 ..... | 34 |
| Figure 12. Demographics of <i>Salmonella</i> Oranienburg case patients .....                                       | 34 |
| Figure 13. Statistically-significant foods consumed at Restaurant X (cohort study)<br>.....                        | 35 |
| Figure 14. Statistically-significant foods for <i>Salmonella</i> infection (case-control<br>study) .....           | 37 |
| Figure 15. Influenza-like-illness, Arizona, 2001-2007 .....  | 46 |
| Figure 16. Influenza Activity Level, 1997 – 2007 .....   | 46 |
| Figure 17. Laboratory-confirmed influenza, Arizona, 2005-2007.....   | 47 |
| Figure 18. Culture- or PCR-confirmed influenza, by type or subtype, Arizona,<br>2005-2006 .....                    | 48 |
| Figure 19. Isolate Submission Results of Lab-Reportable Diseases, January 2006-<br>July 2006 .....                 | 50 |
| Figure 20. Isolate Submission Results of Lab-Reportable Diseases, September<br>2006-March 2007 .....               | 50 |
| Figure 21. Standard Group versus Minimum Interval Group Results.....   | 52 |

## Executive Summary

The Office of Infectious Disease Services (OIDS), in the Bureau of Epidemiology and Disease Control, was restructured during 2006. The Office of Infectious Disease Services in the Arizona Department of Health Services (ADHS) is responsible for monitoring and controlling diseases caused by certain infectious agents and toxins. The Office is also responsible for promulgating rules related to infectious disease surveillance, prevention, and control. The Office contains five programs: Vector-Borne and Zoonotic Diseases, Infectious Disease Epidemiology and Investigations, Infectious Disease Surveillance and Preparedness, Tuberculosis Control, and Syndromic Surveillance. This report covers the two "Infectious Disease" programs. The Infectious Disease Epidemiology and Investigations and Infectious Disease Surveillance and Preparedness Programs are together responsible for detecting, preventing, and controlling communicable diseases in several areas: foodborne, vaccine-preventable, nosocomial infections, and antibiotic resistant organisms. Program activities also include coordination of epidemiology and surveillance activities for bioterrorism, emergency preparedness, and pandemic flu, and the programs cover other reportable infectious conditions that do not fit into these categories but are not covered by any of the other programs in the Office or Bureau. Surveillance and programmatic activities for chronic hepatitis C, sexually transmitted diseases, and HIV/AIDS are conducted by the Office of HIV/AIDS, STD, and Hepatitis C.

The two programs involved in this report maintain a registry of over 70 notifiable communicable diseases; provide data and statistics on selected reportable infectious diseases by monitoring disease trends through surveillance and epidemiologic investigations; provide technical assistance to local and tribal health departments regarding prevention and control of disease; and provide information for health care providers and the public.

Some of the highlights for the period of January 1, 2006 through December 31, 2006 include:

- A large outbreak of *Salmonella* Oranienberg involving 60 cases in Cochise County;
- Record levels of reported coccidioidomycosis in Arizona;
- Two cases of non-O1 *Vibrio cholerae*; and
- Transition to Arizona's web-based electronic surveillance system, the Medical Electronic Disease Surveillance Intelligence System (MEDSIS).

# I. Introduction

## **A. Data Sources and Limitations**

The Arizona Department of Health Services (ADHS) maintains registries of selected conditions that are reportable per Arizona Administrative Code R-9-202. The information is collected to assess and monitor the burden of disease, characterize affected populations, assess trends in disease occurrence, guide control efforts and evaluate prevention initiatives. The list of reportable conditions is based upon the list of Nationally Notifiable Infectious Diseases jointly developed by the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC). Additional conditions are included that are considered important for Arizona because of distinctions in the disease epidemiology or surveillance system in the state. The list is revised periodically to add newly emerging pathogens or remove conditions that are no longer considered relevant.

Public health surveillance case definitions are used to increase the specificity of reporting, and to allow comparability of diseases nationwide. Only cases meeting these standardized surveillance case definitions are included in the report. Criteria for surveillance case definitions are usually more stringent than those used by providers to diagnose and treat diseases.

State and local public health officials rely on health care providers, laboratories, hospitals and other facilities to report notifiable diseases or conditions. Local health jurisdictions submit case information to ADHS, which in turn reports case information without personal identifiers to CDC for purposes of compiling national statistics. Incomplete reporting is inherent to any passive surveillance system. Knowledge and awareness of current reporting rules, willingness to comply, severity of the disease, available diagnostic tests, age of the patient, confidentiality issues surrounding the disease, changes in the case definitions over time, and access to or availability of health care services all may influence the likelihood of reporting.

The 2006 population estimates (<http://www.azdhs.gov/plan/menu/info/pop/pop06/pd06.htm>) were used for rate calculations. Disease rates are calculated per 100,000 population unless otherwise specified and are not age-adjusted. Rate calculations based on a small number of reported cases or for counties with populations less than 100,000 are not considered reliable since they can be dramatically influenced by small changes in the number of reported cases.

## **B. Purpose of the Report**

The purpose of this report is to provide disease surveillance information to health care providers, health care organizations, governmental agencies, and other local health partners. This information is intended to assist agencies by providing uniform data on the disease burden in the state, trends in disease incidence and distribution and the evaluation of disease interventions.

Office staff collaborate with colleagues in the local and tribal health departments, as well as other ADHS Offices and Bureaus including: Environmental Health, Immunization Program Office, Office of HIV/AIDS, STD and Hepatitis C, State Health Laboratory Services, and Emergency Preparedness and Response within the Division of Public Health Services. Direct public health services, as they relate to surveillance, investigation, and response to infectious diseases of public health importance, are the responsibility of the 15 county health departments and tribal health departments and/or Indian Health Service Units. This report is designed to be utilized by external stakeholders in identifying trends, targeting prevention efforts, and

determining resource needs. The Programs would like to acknowledge both external and internal partners for their contributions to this report.

### C. Reporting

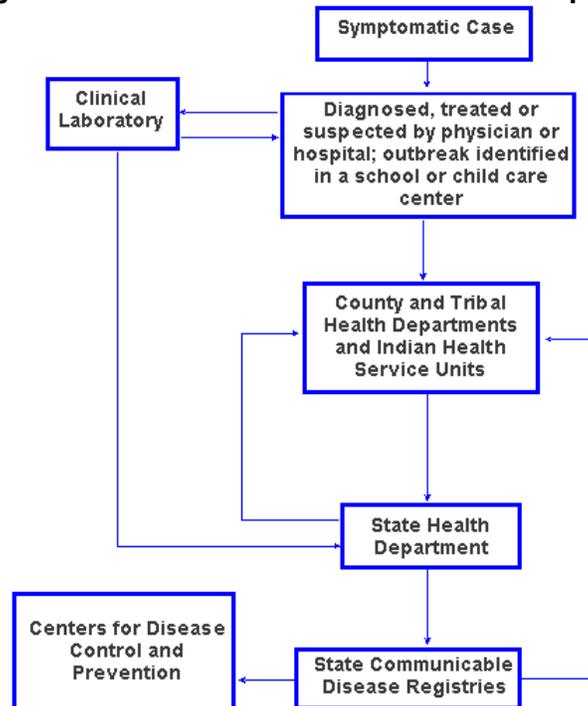
Arizona Administrative Code (AAC) R9-6-202, 203, 204, and 205 describe the morbidities required to be reported by health care providers, administrators of health care facilities, clinical laboratory directors, institutions, schools, pharmacists, and others.

On October 2, 2004, revisions to these sections of the AAC became effective. The 2004 Annual Report describes some of the rule changes. Tables outlining the reporting requirements are below. Additional information on the reporting requirements can be found on the Arizona Secretary of State's website at [http://www.azsos.gov/public\\_services/Title\\_09/9-06.pdf](http://www.azsos.gov/public_services/Title_09/9-06.pdf).

Arizona requires reporting by both health care providers and clinical laboratories as a dual surveillance measure to increase the sensitivity of the surveillance system and improve the completeness of reporting. Diseases are reported via fax, mail, or telephone systems using the communicable disease report (CDR) form. Additional information on communicable disease reporting as well as reporting and investigation forms can be found on the Department's website at: [http://www.azdhs.gov/phs/oids/dis\\_rpt.htm](http://www.azdhs.gov/phs/oids/dis_rpt.htm). In 2006, for the first time in Arizona, some infection control providers were able to start reporting electronically to the state's Medical Electronic Disease Surveillance Intelligence System (MEDSIS), described in section IV A.

Since local health departments are the primary response agency, health care providers report notifiable conditions to the local health departments for immediate investigation and initiation of control measures, as needed. Figure 1 outlines the reporting structure and flow of information in Arizona.

**Figure 1. Flow of communicable disease reports**



## D. Tables of Reportable Diseases

**Table 1. Reporting Requirements for a Health Care Provider or an Administrator of a Health Care Institution or Correctional Facility**

|  |   |  |
|--|---|--|
| ☒*,O Amebiasis                                     | ☒ Hantavirus infection                  | ☒*,O Salmonellosis   |
| ☒ Anthrax  | ☒ Hemolytic uremic syndrome             | O Scabies  |
| ☒ Aseptic meningitis: viral                        | ☒*,O Hepatitis A                        | ☒ Severe acute respiratory syndrome  |
| ☒ Basidiobolomycosis                               | ☒ Hepatitis B and D                     | ☒*,O Shigellosis   |
| ☒ Botulism   | ☒ Hepatitis C                           | ☒ Smallpox   |
| ① Brucellosis                                      | ☒*,O Hepatitis E                        | ☒ Streptococcal Group A: Invasive disease  |
|  |   | ☒ Streptococcal Group B: Invasive disease in infants younger than 90 days of age |
| ☒*,O Campylobacteriosis                            | ☒ Herpes genitalis                      | ☒ <i>Streptococcus pneumoniae</i> (pneumococcal invasive disease)                |
|  |   | ☒ Syphilis   |
| ☒ Chancroid  | ☒ HIV infection and related disease     | ☒*,O Taeniasis   |
| ☒ <i>Chlamydia</i> infection, genital              | ☒ Kawasaki syndrome                     | ☒ Tetanus  |
| ①* Cholera   | ☒ Legionellosis (Legionnaires' disease) | ☒ Toxic shock syndrome   |
| ☒ Coccidioidomycosis (valley fever)                | ☒ Leptospirosis                         | ☒ Trichinosis  |
| ☒ Colorado tick fever                              | ☒ Listeriosis                           | ① Tuberculosis   |
| O Conjunctivitis: acute                            | ☒ Lyme disease                          | ① Tuberculosis infection in a child younger than 6 (positive test result)        |
| ☒ Creutzfeldt-Jakob disease                        | ☒ Lymphocytic choriomeningitis          | ☒ Tularemia  |
| ☒*,O Cryptosporidiosis                             | ☒ Malaria                               | ☒ Typhoid fever  |
|  |   | ① Typhus fever   |
| ☒ <i>Cyclospora</i> infection                      | ☒ Measles (rubeola)                     | ☒ Unexplained death with a history of fever                                      |
| ☒ Cysticercosis                                    | ☒ Meningococcal invasive disease        | ① Vaccinia-related adverse event   |
| ☒ Dengue   | ① Mumps                                 | ☒ Vancomycin-resistant <i>Enterococcus</i> spp.                                  |
| O Diarrhea, nausea, or vomiting                    | ☒ Pertussis (whooping cough)            | ☒ Vancomycin-resistant or Vancomycin-intermediate <i>Staphylococcus aureus</i>   |
| ☒ Diphtheria                                       | ☒ Plague                                | ☒ Vancomycin-resistant <i>Staphylococcus epidermidis</i>                         |
| ☒ Ehrlichiosis                                     | ☒ Poliomyelitis                         | ☒ Varicella (chickenpox)   |
| ☒ Emerging or exotic disease                       | ☒ Psittacosis (ornithosis)              | ☒*,O <i>Vibrio</i> infection   |
|  |   | ☒ Viral hemorrhagic fever  |
| ① Encephalitis, viral or parasitic                 | ① Q fever                               | ☒ West Nile virus infection  |
| ☒ Enterohemorrhagic <i>Escherichia coli</i>        | ☒ Rabies in a human                     | ☒ Yellow fever   |
| ☒ Enterotoxigenic <i>Escherichia coli</i>          | ☒ Relapsing fever (borreliosis)         |  |
| ☒*,O Giardiasis                                    | ☒ Reye syndrome                         |  |
| ☒ Gonorrhea  | ☒ Rocky Mountain spotted fever          |  |
| ☒ <i>Haemophilus influenzae</i> : invasive disease | ①* Rubella (German measles)             |  |
| ☒ Hansen's disease (Leprosy)                       | ① Rubella syndrome, congenital          |  |

**Key:**

- ☒ Submit a report by telephone or through an electronic reporting system authorized by the Department within 24 hours after a case or suspect case is diagnosed, treated, or detected or an occurrence is detected.
- \* If a case or suspect case is a food handler or works in a child care establishment or a health care institution, instead of reporting within the general reporting deadline, submit a report within 24 hours after the case or suspect case is diagnosed, treated, or detected.
- ① Submit a report within one working day after a case or suspect case is diagnosed, treated, or detected.
- ☒ Submit a report within five working days after a case or suspect case is diagnosed, treated, or detected.
- O Submit a report within 24 hours after detecting an outbreak.

**Table 2. Reporting Requirements for an Administrator of a School, Child Care Establishment, or Shelter**

|                          |  |                          |                                 |
|--------------------------|--|--------------------------|---------------------------------|
| <input type="checkbox"/> | Campylobacteriosis                               | <input type="checkbox"/> | Mumps                           |
| <input type="checkbox"/> | Conjunctivitis: acute                            | <input type="checkbox"/> | Pertussis (whooping cough)      |
| <input type="checkbox"/> | Cryptosporidiosis                                | <input type="checkbox"/> | Rubella (German measles)        |
| <input type="checkbox"/> | Diarrhea, nausea, or vomiting                    | <input type="checkbox"/> | Salmonellosis                   |
| <input type="checkbox"/> | Enterohemorrhagic <i>Escherichia coli</i>        | <input type="checkbox"/> | Scabies                         |
| <input type="checkbox"/> | <i>Haemophilus influenzae</i> : invasive disease | <input type="checkbox"/> | Shigellosis                     |
| <input type="checkbox"/> | Hepatitis A                                      | <input type="checkbox"/> | Streptococcal Group A infection |
| <input type="checkbox"/> | Measles  | <input type="checkbox"/> | Varicella (chicken pox)         |
| <input type="checkbox"/> | Meningococcal invasive disease                   |                          |                                 |

**Key:**

- Submit a report within 24 hours after detecting a case or suspect case.
- Submit a report within five working days after detecting a case or suspect case.
- Submit a report within 24 hours after detecting an outbreak.

**Table 3. Clinical Laboratory Director Reporting Requirements**

|         |   |                   |   |         |  |
|---------|---|-------------------|---|---------|--|
| ①       | Arboviruses   | ☞, ⊕              | <i>Haemophilus influenzae</i> , type B, isolated from a normally sterile site   | ☞+      | Respiratory syncytial virus  |
| ☞, ☞, ⊕ | <i>Bacillus anthracis</i>   | ☞, ⊕              | <i>Haemophilus influenzae</i> , other, isolated from a normally sterile site  | ①, ⊕    | <i>Salmonella</i> spp.   |
| ☞, ⊕    | <i>Bordetella pertussis</i>   | ☞                 | Hantavirus  | ☞       | SARS-associated corona virus   |
| ①, ⊕    | <i>Brucella</i> spp.  | ☞                 | Hepatitis A virus (anti-HAV-IgM serologies)   | ①, ⊕    | <i>Shigella</i> spp.   |
| ☞       | <i>Campylobacter</i> spp.   | ☞                 | Hepatitis B virus (anti-Hepatitis B core-IgM serologies, Hepatitis B surface antigen serologies, and detection of viral nucleic acid) | ☞, ⊕    | <i>Streptococcus</i> Group A, isolated from a normally sterile site  |
| ☞       | CD <sub>4</sub> -T-lymphocyte count of fewer than 200 per microliter of whole blood or CD <sub>4</sub> -T-lymphocyte percentage of total lymphocytes of less than 14% | ☞                 | Hepatitis C virus   | ☞       | <i>Streptococcus</i> Group B, isolated from a normally sterile site in an infant younger than 90 days of age |
| ☞       | <i>Chlamydia trachomatis</i>  | ☞                 | Hepatitis D virus   | ☞, ⊕    | <i>Streptococcus pneumoniae</i> and its drug sensitivity pattern, isolated from a normally sterile site      |
| ☞, ☞    | <i>Clostridium botulinum</i> toxin (botulism)   | ☞                 | Hepatitis E virus   | ☞       | <i>Treponema pallidum</i> (syphilis)   |
| ☞       | <i>Coccidioides</i> spp., by culture or serologies  | ☞                 | HIV (by culture, antigen, antibodies to the virus, or detection of viral nucleic acid)  | ☞       | Vancomycin-resistant <i>Enterococcus</i> spp.  |
| ①       | <i>Coxiella burnetii</i>  | ☞                 | HIV—any test result for an infant (by culture, antigen, antibodies to the virus, or detection of viral nucleic acid)                  | ①, ⊕    | Vancomycin-resistant or Vancomycin-intermediate <i>Staphylococcus aureus</i>                                 |
| ☞       | <i>Cryptosporidium</i> spp.   | ☞+                | Influenza virus   | ①, ⊕    | Vancomycin-resistant <i>Staphylococcus epidermidis</i>   |
| ①       | <i>Cyclospora</i> spp.  | ☞, ⊕              | <i>Legionella</i> spp. (culture or DFA)   | ☞, ☞    | Variola virus (smallpox)   |
| ☞, ☞    | Dengue virus  | ①, ⊕              | <i>Listeria</i> spp., isolated from a normally sterile site   | ①, ⊕    | <i>Vibrio</i> spp.   |
| ☞, ☞    | Emerging or exotic disease agent  | ☞ <sup>1</sup>    | Methicillin-resistant <i>Staphylococcus aureus</i> , isolated from a normally sterile site  | ☞, ☞    | Viral hemorrhagic fever agent  |
| ☞       | <i>Entamoeba histolytica</i>  | ☞, ⊕ <sup>2</sup> | <i>Mycobacterium tuberculosis</i> complex and its drug sensitivity pattern  | ①       | West Nile virus  |
| ①       | <i>Escherichia coli</i> O157:H7   | ☞                 | <i>Neisseria gonorrhoeae</i>  | ①, ⊕    | <i>Yersinia</i> spp. (other than <i>Y. pestis</i> )  |
| ①, ⊕    | <i>Escherichia coli</i> , Shiga-toxin producing   | ☞, ⊕              | <i>Neisseria meningitidis</i> , isolated from a normally sterile site   | ☞, ☞, ⊕ | <i>Yersinia pestis</i> (plague)  |
| ☞, ☞, ⊕ | <i>Francisella tularensis</i>   | ☞                 | <i>Plasmodium</i> spp.  |         |  |

**Key:**

- ☞ Submit a report immediately after receiving one specimen for detection of the agent. Report receipt of subsequent specimens within five working days after receipt.
- ☞ Submit a report within 24 hours after obtaining a positive test result.
- ① Submit a report within one working day after obtaining a positive test result.
- ☞ Submit a report within five working days after obtaining a positive test result or a test result specified in Table 3.
- ⊕ Submit an isolate of the organism for each positive culture to the Arizona State Laboratory at least once each week, as applicable.
- + A clinical laboratory director may report aggregate numbers of positive test results every five working days rather than submitting individual reports as required in R9-6-204(B).
- <sup>1</sup> Submit a report only when an initial positive result is obtained for an individual.
- <sup>2</sup> Submit an isolate of the organism only when an initial positive result is obtained for an individual, when a change in resistance pattern is detected, or when a positive result is obtained ≥ 12 months after the initial positive result is obtained for an individual.

## **E. State and County Health Department Contact Information**

### **Arizona Department of Health Services**

#### **Infectious Disease Epidemiology**

150 N. 18th Avenue Suite 140  
Phoenix, AZ 85007-3237  
Phone: (602) 364-3676  
Fax: (602) 364-3199

#### **Emergency Answering Service**

Phone: (480) 303-1191

#### **State Laboratory Services**

250 N. 17th Avenue  
Phoenix, AZ 85007-3231  
Phone: (602) 542-1188  
Fax: (602) 542-1169

#### **Office of Border Health**

4400 E. Broadway Suite 300  
Tucson, AZ 85711  
Phone: (520) 770-3110  
Fax: (520) 770-3307

### **County Health Departments**

#### **Apache County Health District**

395 South 1st Street West  
PO Box 697  
St. Johns, AZ 85936  
Phone: (928) 337-7525  
Fax: (928) 337-2062

#### **Cochise County Health Department**

1415 W. Melody Lane, Bldg A.  
Bisbee, AZ 85603-3090  
Phone: (520) 432-9400  
Fax: (520) 432-9480

#### **Coconino County Health Department**

2625 N. King Street  
Flagstaff, AZ 86004  
Phone: (928) 522-7800  
Fax: (928) 522-7808

#### **Gila County Office of Health Services**

5515 S. Apache Ave. Suite 100  
Globe, AZ 85501  
Phone: (928) 425-3189  
Fax: (928) 425-0794

#### **Graham County Health Department**

826 W. Main  
Safford, AZ 85546  
Phone: (928) 428-0110; Fax: (928) 428-8074

#### **Greenlee County Health Department**

253 5th Street  
Clifton, AZ 85533  
Phone: (928) 865-2601  
Fax: (928) 865-1929

#### **La Paz County Health Department**

1112 Joshua Street #206  
Parker, AZ 85344  
Phone: (928) 669-1100  
Fax: (928) 669-6703

#### **Maricopa County Health Department**

4041 N. Central Ave Suite 1400  
Phoenix, AZ 85012  
Phone: (602) 506-6900  
Fax: (602) 506-6885

#### **Mohave County Health Department**

PO Box 7000  
700 W. Beale Street  
Kingman, AZ 86402  
Phone: (928) 753-0743  
Fax: (928) 718-5547

#### **Navajo County Health Services District**

117 E. Buffalo Street  
Holbrook, AZ 86025  
Phone: (928) 524-4750  
Fax: (928) 524-4754

**Pima County Health Department**

3950 Country Club Suite 1340  
Tucson, AZ 85714  
Phone: (520) 243-7797  
Fax: (520) 791-0366

**Pinal County Health Department**

500 South Central Ave  
PO Box 2945  
Florence, AZ 85232-2945  
Phone: (520) 866-7319  
Fax: (520) 866-7310

**Santa Cruz County Health Department**

2150 N. Congress Drive Suite 115  
Nogales, AZ 85621  
Phone: (520) 375-7900  
Fax: (520) 375-7904

**Yavapai County Health Department**

1090 Commerce Drive  
Prescott, AZ 86305  
Phone: (928) 771-3122  
Fax: (928) 771-3369

**Yuma County Health Department**

2200 W. 28th Street Suite #137  
Yuma, AZ 85364  
Phone: (928) 317-4550  
Fax: (928) 317-4591

## **II. Disease Statistics**

## **A. Population Estimates for 2006**

Office of Vital Statistics, Arizona Department of Health Services  
<http://www.azdhs.gov/plan/menu/info/pop/pop06/pd06.htm>

## **B. Tables of Cases and Rates of Reportable Diseases**

1. [Reported Cases of Notifiable Diseases by County, 2006](#)
2. [Rates of Reported Cases of Notifiable Diseases by County, 2006](#)
3. [Reported Cases of Notifiable Diseases by Year, 1996 - 2006](#)
4. [Rates of Reported Cases of Notifiable Diseases by Year, 1996 - 2006](#)
5. [Reported Cases of Selected Notifiable Diseases by 5 Year Age Groupings and Gender, 2006](#)
6. [Rates of Reported Cases of Selected Notifiable Diseases by 5 Year Age Groupings and Gender, 2006](#)
7. [Reported Cases of Selected Notifiable Diseases by Race/Ethnicity, 2006](#)
8. [Rates of Reported Cases of Selected Notifiable Diseases by Race/Ethnicity, 2006](#)
9. [Reported Cases of Selected Notifiable Diseases by County, 5 Year Age Groupings, and Gender, 2006](#)
10. [Rates of Reported Cases of Selected Notifiable Diseases by County, 5 Year Age Groupings, and Gender, 2006](#)

## **III. Disease Summaries**

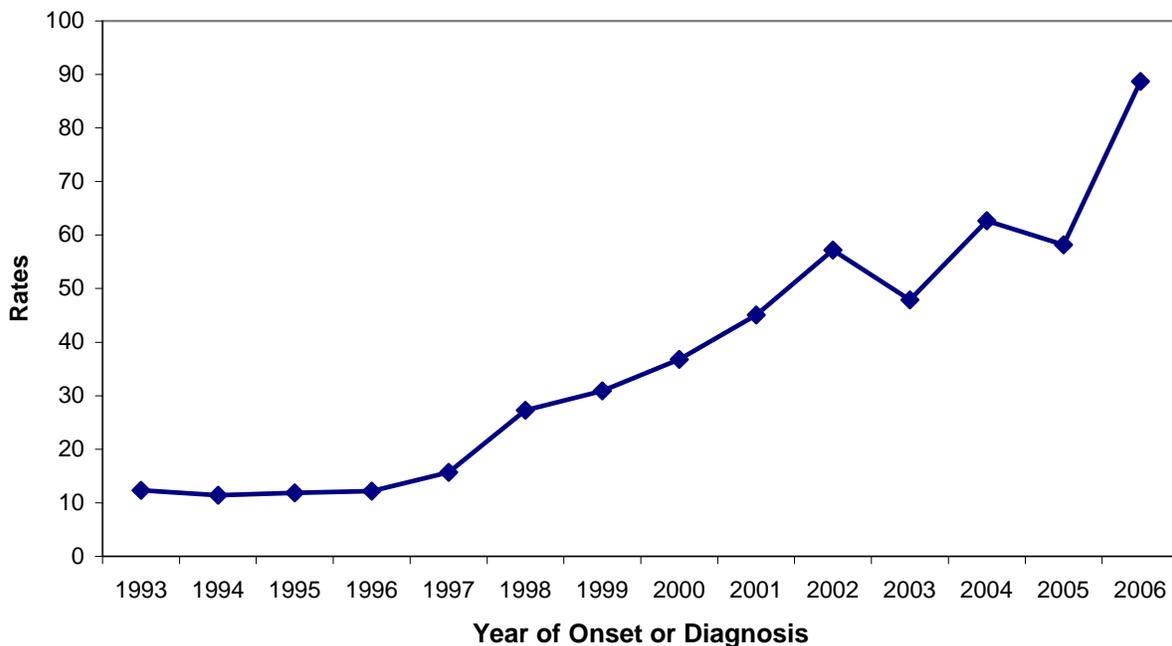
## A. Coccidioidomycosis (Valley Fever)

Since 1995, coccidioidomycosis has been a nationally reportable disease at the southwest regional level and includes a requirement for laboratory confirmation. Arizona began mandatory laboratory reporting in 1997, which led to an increase in the number of reported cases (Figure 2). Subsequently, added benefits of improved timeliness and completeness of reporting have been noted for laboratory reporting.

The number of cases reported continued to steadily increase after 1997, and this increase is not likely to be simply associated with improved methods of reporting.<sup>1</sup> Several potential explanations may be offered, including the large number of susceptible individuals moving into a naturally endemic area with no prior history of exposure. Another factor may include increased awareness of both the general public and physicians, leading to more requests for laboratory testing for *Coccidioides* species. Urban sprawl and the construction that accompanies it may add to the generation of dust-containing spores. Or, climate and weather patterns may cause an increase in coccidioidomycosis. One of these, or more likely a combination, may help us explain why the number of cases and the rate of cases over the past 10 years have continued to rise.

Until this year, the highest number of cases ever reported in Arizona was in 2004. In 2004, a total of 3,665 cases of coccidioidomycosis were reported, with a rate of 62.8 cases per 100,000 Arizona residents, a 281% increase compared to 1997. In 2006, the number of reported cases surpassed these levels, at 5,535 cases or 88.7 cases per 100,000 population.

**Figure 2. Rates of Reported Coccidioidomycosis Cases in Arizona from 1993-2006**



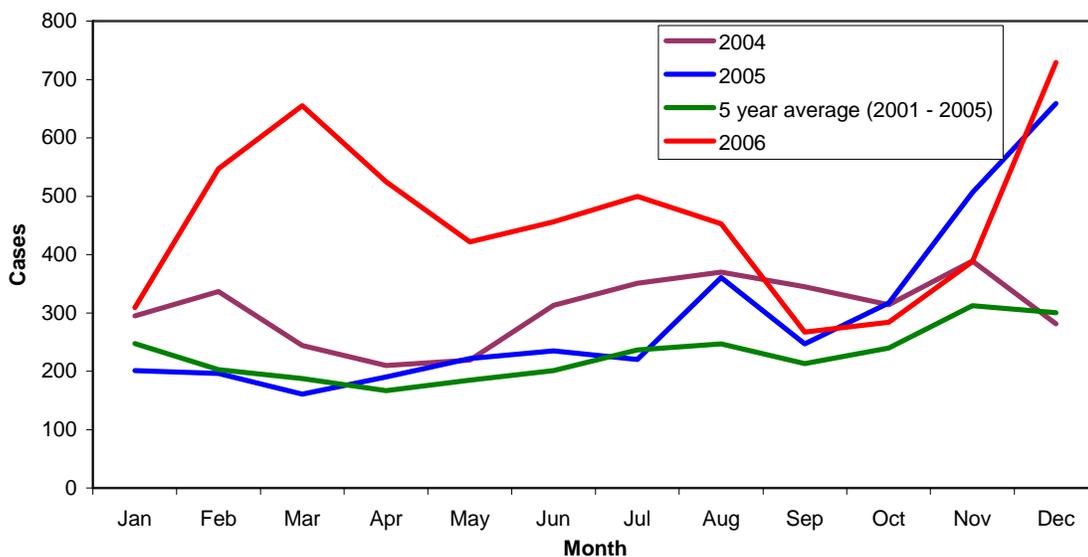
Most infections of *Coccidioides* are sub-clinical or self-limited and clinical manifestations range from influenza-like illness to severe pneumonia and, more rarely, extra-pulmonary or

<sup>1</sup> CDC. Increase in Coccidioidomycosis – Arizona, 1998-2001, 2003. MMWR 2003; 52:109-112.

disseminated disease. It is important to note, however, that hospitalizations associated with a diagnosis of coccidioidomycosis have substantially increased from 1998, indicating an increase in the number of cases that present with severe disease. However, recent years have produced a relatively consistent number of deaths that can be attributed to coccidioidomycosis, even as the rate of disease incidence has increased. Health-care providers in Arizona should consider coccidioidomycosis in the differential diagnosis of patients with influenza-like illness given that the peak activity of influenza and coccidioidomycosis coincides. Recommendations have also been issued to consider testing for *Coccidioides* species when a diagnosis of community-acquired pneumonia (CAP) is given.

Disease incidence in Arizona appears to peak in the winter during the months of November to February. This winter peak in Arizona varies from southern California, where, in an earlier study, infection rates from coccidioidomycosis were higher in late summer/early fall.<sup>2</sup> Reported cases of coccidioidomycosis during 2006 displayed a peak in December, and peaks were also seen in July, and more unusually, March. The number of new cases reported in 2006 was higher in all months than in previous years, except for September through November. The rise of cases early in the year, peaking in March, may have also partially arisen from timelier reporting than observed in previous years. ADHS implemented a new, more efficient electronic case reporting system in late 2005 that may have contributed to a decrease in the lag time associated with traditional means of case reporting. An increase in public awareness of the disease and physician education may have led to increased testing and diagnosis, which in turn could lead to an increase in new cases being reported that might have otherwise been left undiagnosed. These factors alone, however, cannot explain entirely the large increase in cases that occurred in 2006, and rather than just an increase in reporting or diagnosis, the large number of new cases is likely to be an increase in disease and merits further examination in the following year.

**Figure 3. Reported Coccidioidomycosis Cases by Month, Arizona 2001-2006**

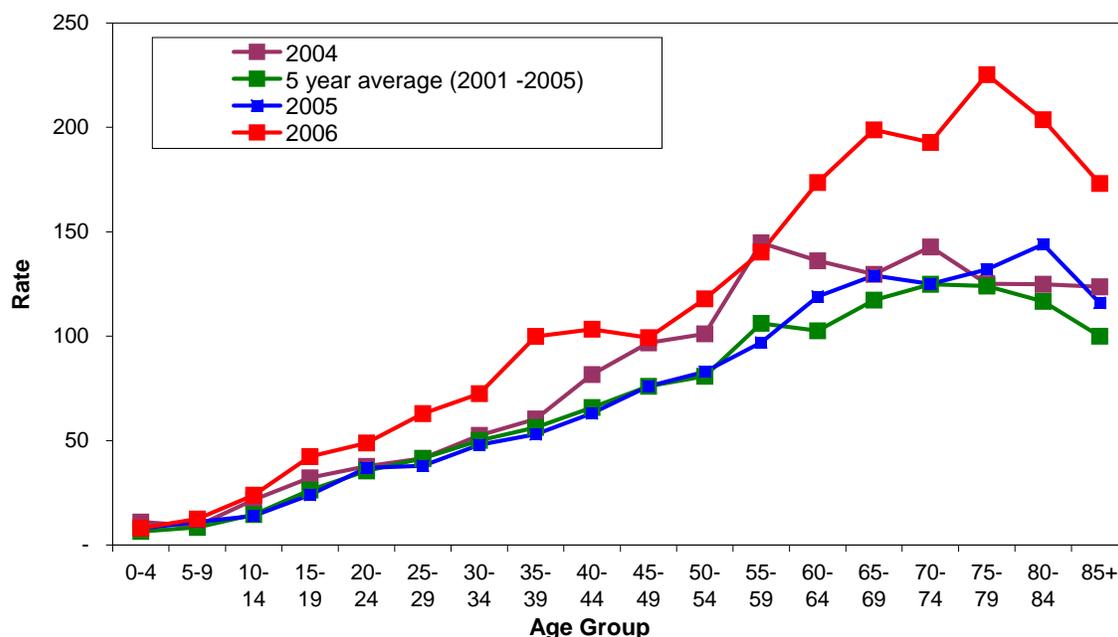


In 2006, the incidence rate of coccidioidomycosis was the same or higher in all age groups as compared to previous years, increasing considerably in the range of 60 to 85+ years (Figure 4).

<sup>2</sup> Smith CE, Beard RR, Whiting EG, Rosenberg HG. Effect of Season and Dust Control on Coccidioidomycosis. JAMA 1946; 132:833-8.

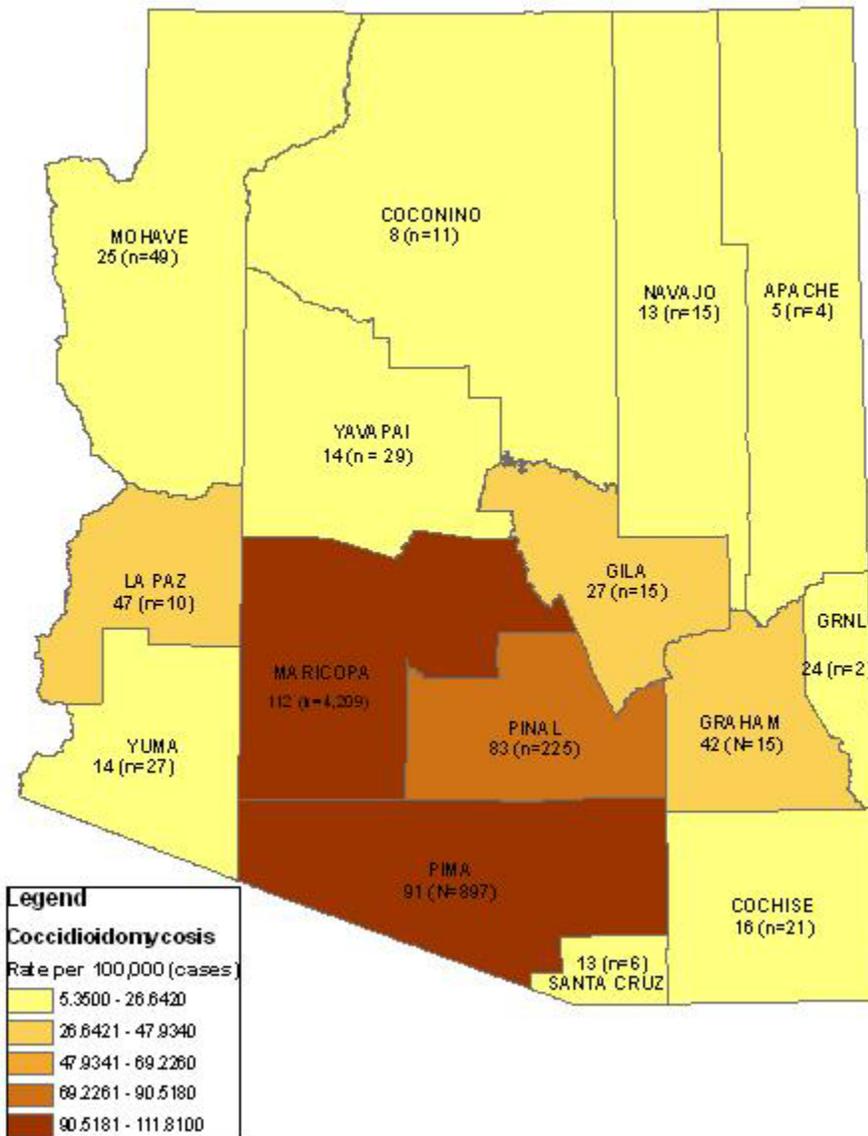
Individuals 60 to 85+ years of age may be more likely to have underlying health conditions that lead to a compromised immune system, and are therefore at highest risk of developing symptoms of disseminated disease and most likely to be diagnosed.

**Figure 4. Coccidioidomycosis Rates per 100,000 by Age and Year in Arizona from 2001 to 2006**



The 2006 incidence rate in males (98.4 per 100,000) is higher than females (77.6 per 100,000), which may be due to factors such as occupational exposure and duration of outdoor activities. Rate of reported cases by county for 2006 (Figure 5) show Maricopa (111.8 per 100,000) to have the highest rate, followed by Pima (91.4 per 100,000), and Pinal (83.4 per 100,000). This is a different ranking than 2005, when Pima had the highest rate, followed by Maricopa and Pinal. However, these three counties have consistently had not only the highest number of cases, which is somewhat a result of their larger populations, but also the highest rates.

**Figure 5. Rate of reported coccidioidomycosis, by county, Arizona, 2006**



## B. Botulism

Botulism is a rare but serious paralytic illness caused by a toxin that is produced by bacteria called *Clostridium botulinum*. These bacteria can be commonly found in soil. The bacteria form spores which allow them to survive in a dormant state until exposed to conditions that can support their growth. There are seven types of botulism toxin designated by the letters A through G; only types A, B, D and F cause illness in humans. Foodborne botulism is rare and causes rapid disease progression, and contaminated products may expose many persons. Foodborne botulism, therefore, represents a medical and a public health emergency that places a premium on rapid, effective communication between clinicians and public health officials.<sup>3,4</sup>

Botulism comes in three main forms, including foodborne, infant and wound botulism. Since 1980, infant botulism has been the most common form of botulism reported in the United States. It is caused when a baby consumes the spores of the botulinum bacteria, which then grow in the intestines and release toxin. It typically affects infants between the ages of 6 weeks and 6 months. Consumption of honey in a child less than one year of age is a known risk factor for development of infant botulism. In several studies, more than 20% of affected infants had ingested honey before the onset of botulism.<sup>5,6,7</sup> Honey should not be fed to children less than 12 months old, although it is safe for persons 1 year of age and older. However, most infants have had no exposure to honey and additional risk factors for infant botulism are poorly described; possible sources of spores include other foods and dust.

Foodborne botulism is caused by ingestion of foods containing the botulism toxin. The harmful bacteria thrive and produce the toxin in environments with little oxygen, such as in canned food. In the United States, foodborne botulism due to commercial foods has been largely controlled by safe canning and food manufacturing processes through heating to a sufficient temperature and for sufficient time to kill the spores. Unheated commercial foods in cans or jars can be made safe by acidification or other manipulations that inhibit the growth of the organism. Most outbreaks of foodborne botulism in the United States result from eating improperly preserved home-canned foods.<sup>8,9</sup> Persons doing home canning and other food preservation should be educated about the proper time, pressure, and temperature required to destroy spores, the need for adequate refrigeration of incompletely processed foods, and the effectiveness of boiling, with stirring, home-canned vegetables to destroy botulinum toxins.<sup>10,11</sup> A pressure

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<sup>3</sup> Shapiro RL, Hatheway C, Swerdlow DL. Botulism in the United States: A clinical and epidemiologic review. *Ann Intern Med* 1998; 129: 221-228.

<sup>4</sup> Shapiro RL, Hatheway C, Becher S, Swerdlow DL. Botulism surveillance and emergency response. A public health strategy for a global challenge. *JAMA*. 1997; 278: 433-435.

<sup>5</sup> Morris JG, Snyder JD, Wilson R, et al. Infant botulism in the United States: An epidemiologic study of the cases occurring outside California. *Am J Public Health* 1983; 73:1385-1388.

<sup>6</sup> Arnon SS, Midura TF, Damus K. Honey and other environmental risk factors for infant botulism. *J Pediatr* 1979; 94:331-336.

<sup>7</sup> Chin J, Arnon SS, Midura TF. Food and environmental aspects of infant botulism in California. *Rev Infect Dis* 1979; 1:693-696.

<sup>8</sup> Centers for Disease Control and Prevention. Foodborne botulism-Oklahoma, 1994. *Morb Mort Wkly Rep* 1995; 44:200-202.

<sup>9</sup> Heymann DL, ed. Botulism/intestinal botulism. In: *Control of communicable diseases manual*. 18th Edition. Washington, D.C.: American Public Health Association; 2004; 69-75.

<sup>10</sup> Heymann DL, ed. Botulism/intestinal botulism. In: *Control of communicable diseases manual*. 18th Edition. Washington, D.C.: American Public Health Association; 2004; 69-75.

cooker should be used to can vegetables at home safely because it can reach temperatures above boiling, which is necessary to kill botulism spores. Botulinum toxin can be inactivated by heating to 176°F (80°C). Thus, heating home-canned foods before consumption can reduce risk of botulism intoxication.

Wound botulism is rare and results from the growth of *C. botulinum* spores in a contaminated wound. Many wound botulism cases occur in persons who use illicit drugs, typically associated with needle puncture sites or with nasal or sinus lesions due to chronic cocaine sniffing.<sup>12,13</sup> Since 1986, the majority of cases were linked to injectable drug use, particularly with “black tar heroin.”

### Surveillance

In the United States an average of 110 cases of botulism are reported each year. Of these, approximately 25% are foodborne, 72% are infant botulism, and the rest are wound botulism. The number of cases of foodborne and infant botulism has changed little in recent years; however, wound botulism has increased because of the use of black tar heroin. A total of 170 cases of botulism were reported to CDC in 2006. Foodborne botulism accounted for 19 (11%) cases, infant botulism for 106 (62%) cases, and wound cases for 45 (26%) cases. Arizona had a total of 5 botulism cases reported, all of which were infant botulism cases.

Case 1 was a 5 month old male from Maricopa County diagnosed with infant botulism Type B. This is a common type in Arizona and is typically found in the soil in temperate climates. The infant survived and his risk factors included exposure to dust as the backyard is all dirt and there was construction occurring next door.

Case 2 was a 5 month old male from Pima County, Case 3 was a 1 month old female from Maricopa County, and Case 4 was a 3 week old female from Maricopa County. All three were diagnosed with Type B infant botulism. These infants survived and no specific risk factors were identified.

Case 5 was an 8 day old female from Maricopa County diagnosed with Type E infant botulism. This type of botulism is rare in Arizona. Type E spores are more often found in aquatic sediments of colder regions of the northern hemisphere, such as Alaska, Canada, Scandinavia, the countries of the former Soviet Republic and also Japan. Type E is mostly associated with fish and marine mammals. This infant survived and the only risk factor for the baby was exposure to dust in the area.

### Clinical Syndrome, Treatment, and Public Health Response

The clinical syndrome of botulism, whether foodborne, infant or wound, is characterized by neurological signs and symptoms. These include double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness. Symptoms tend to occur bilaterally and in descending fashion and eventually cause paralysis of the arms, trunk,

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<sup>11</sup> Benenson AS, ed. Botulism/infant botulism. In: Control of communicable diseases manual. 16th Edition. Washington, D.C.: American Public Health Association; 1995; 66-69.

<sup>12</sup> Heymann DL, ed. Botulism/intestinal botulism. In: Control of communicable diseases manual. 18th Edition. Washington, D.C.: American Public Health Association; 2004; 69-75.

<sup>13</sup> MacDonald KL, Rutherford GW, Friedman SM, et al. Botulism and botulism-like illness in chronic drug abusers. *Ann Intern Med* 1985; 102:616-618.

legs and respiratory muscles. Recovery occurs through the regeneration of new neuromuscular connections. The case fatality rate in foodborne botulism is 5-10%. Major manifestations of infant botulism include constipation, poor feeding, diminished suckling and crying ability, neck and peripheral weakness ('floppy baby' syndrome), and ventilatory failure.

Treatment of foodborne and wound botulism includes 1) administration of botulinum antitoxin to prevent further neurological progression or to shorten the duration of ventilatory failure; 2) careful monitoring of respiratory vital capacity and aggressive respiratory care for those with ventilatory insufficiency; and 3) meticulous and intensive care for the duration of the prolonged paralytic illness. Antitoxin therapy is most effective if undertaken early in the course of illness.

Botulism is considered a public health emergency, especially since contaminated food may still be available to cause illness in others, and an epidemiological investigation should begin immediately. In addition, prompt diagnosis and early treatment of botulism are essential to minimize the severity of illness. Therefore, it is critical for clinicians who suspect botulism to discuss the case immediately with local and state public health epidemiologists. At this time, the only way to receive either adult or infant antitoxin is by contacting the state health department who will facilitate the release of antitoxin from either CDC or the Infant Botulism Protection Program in California. Investigation of a suspected case of botulism includes confirming the diagnosis as well as an immediate search for other possible cases and identification of possible sources of exposure. Diagnostic testing of both case specimens and foods should be performed as needed.

## C. Invasive Meningococcal Disease

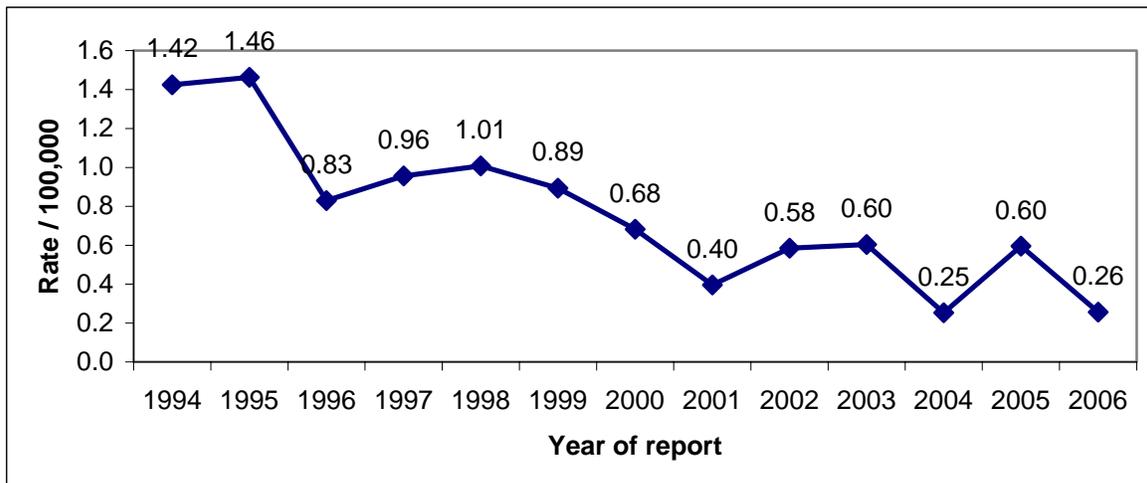
Meningococcal disease, caused by the bacteria *Neisseria meningitidis*, is currently the most common cause of bacterial meningitis for toddlers, adolescents and young adults in the United States. *N. meningitidis* is divided into numerous serogroups based on immunogenicity, but 95% of illness worldwide is caused by one of five serogroups: A, B, C, Y and W-135. *N. meningitidis* is spread via respiratory and nasal secretions. Case fatality decreases with timely antibiotic treatment; however, it remains as high as 15%.<sup>14</sup> For those that survive the illness, 10-20% will suffer long term sequelae including mental retardation, hearing loss, and loss of limb use.<sup>14</sup>

There are currently two quadrivalent meningococcal vaccines available in the United States, meningococcal polysaccharide vaccine (MPSV4), and meningococcal conjugate vaccine (MCV4). Both vaccines cover serogroups A, C, Y and W-135. Neither provides protection against serogroup B, which causes more than half of all infant cases in the United States.<sup>15</sup>

MPSV4 was licensed in the United States in 1974 and is approved for persons 2 years of age or older. This vaccine is currently recommended for persons at increased risk of *N. meningitidis* infection that are 2-10 years of age or > 55 years of age. MCV4 was first licensed in the United States in 2005 and is the preferred vaccine for persons 11-55 years of age. Vaccine recommendations for use of MCV4 target the following groups of increased disease incidence: children 11-12 years of age, unvaccinated adolescents at high school entry, and college freshmen living in dormitories.

The reported rate of invasive meningococcal disease in Arizona has largely been decreasing over the past decade (Figure 6). A total of 16 cases were reported statewide in 2006. Half of all cases were serogroup B. There were three deaths, two in persons less than 5 years of age (both serogroup B) and one in a person greater than 65 years of age (serogroup Y).

**Figure 6. Rates of reported invasive meningococcal disease, Arizona, 1994-2006**

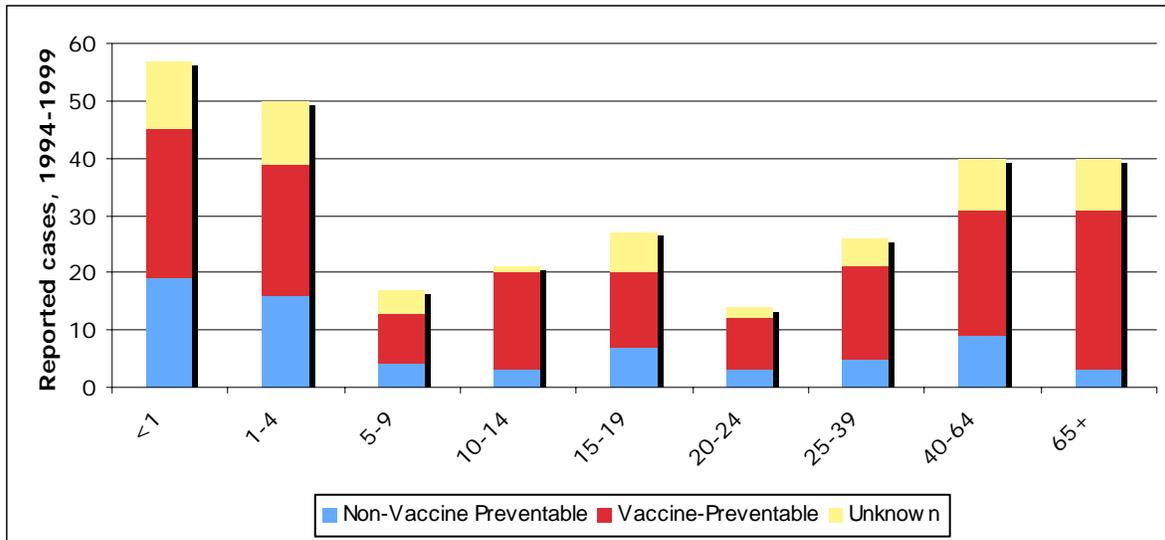


<sup>14</sup> Heyman, D.L (ed). Control of Communicable Diseases Manual, 18<sup>th</sup> ed. Washington D.C., American Public Health Association; 2004. p 359.

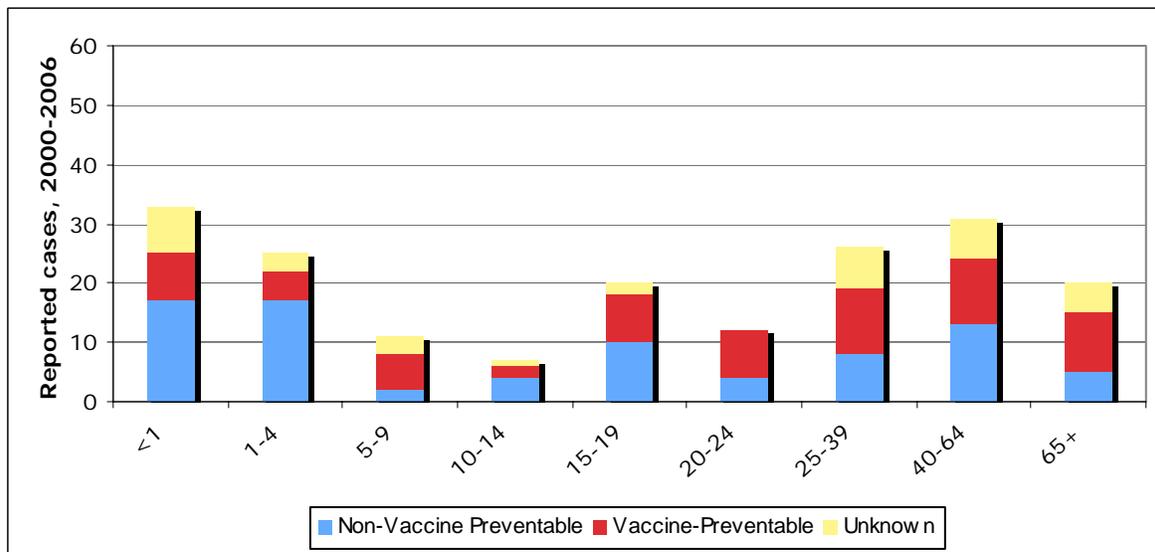
<sup>15</sup> Centers for Disease Control and Prevention. Prevention and Control of Meningococcal Disease Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2005;54(No. RR-7):2.

Rates of meningococcal disease vary by age group (Figure 7 and Figure 8). The highest incidence rate occurs in children under one year, followed by children ages 1-4 years. Compared to cases reported in 1994-1999, disease caused by vaccine serotypes (A, C, Y, and W-135) has decreased for all age groups during 2000-2006. However, disease caused by serogroup B has increased for most age groups for 2000-2006. In 1994-1999, serogroup B accounted for 23.6% of all reported cases. In contrast, 43% of cases reported in 2000-2006 were serogroup B.

**Figure 7. Serogroup type by age group, invasive meningococcal disease, Arizona, 1994-1999**



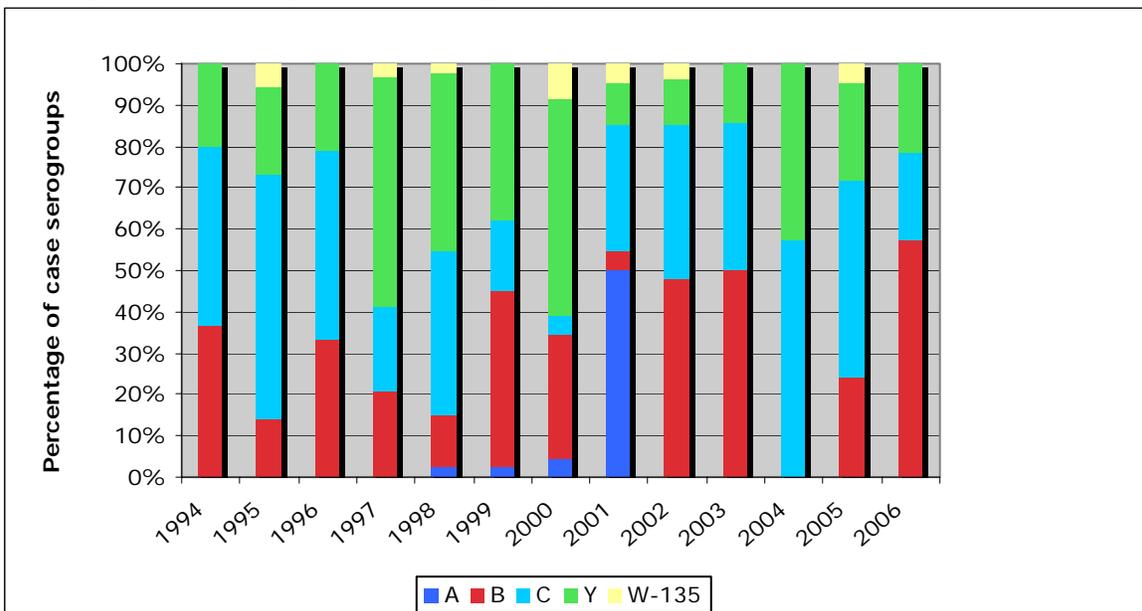
**Figure 8. Serogroup type by age group, invasive meningococcal disease, Arizona, 2000-2006**



The serogroup distribution of reported cases for the years 1994-2006 in Arizona is shown in Figure 9. Nationally, the proportion of meningococcal cases caused by serogroup Y has

increased from 2% in 1989-1991 to 37% in 1997-2002.<sup>16</sup> However, no clear trend in serogroup distribution has been observed in Arizona over the similar time frame shown below. In 2006, serogroup B accounted for 57% of cases with known serogroup. Serogroups C and Y each accounted for 21% of all cases.

**Figure 9. Meningococcal serogroups, invasive disease, Arizona, 1994-2006**



<sup>16</sup> Heyman, D.L (ed). Control of Communicable Diseases Manual, 18<sup>th</sup> ed. Washington D.C., American Public Health Association; 2004. p 359.

## D. Mumps

Mumps is an acute viral illness that continues to circulate at low levels in the United States; only 258 cases were seen in 2004. In 2006, however, a multi-state outbreak resulted in more than 6,000 cases. Arizona was not part of the outbreak, but the increased levels of disease in the U.S. led to enhanced mumps surveillance in the state.

The virus that causes mumps is spread by airborne transmission or by direct contact with infected respiratory droplets. The incubation period for is 12-25 days after exposure, but most cases occur in 16-18 days. Although virus has been isolated from saliva from as early as seven days before onset of parotitis to nine days after, the infectious period is generally considered to be from three days prior to the onset of symptoms to the fourth day after.

Mumps vaccine is available as a single-antigen preparation, combined with rubella vaccine, combined with measles and rubella vaccines (MMR), or combined with mumps, rubella, and varicella vaccine (MMRV). Use of the single-antigen mumps vaccine is not recommended. MMR is the most common vaccine used. Attempts to increase uptake of MMRV have been dampened by reductions in the availability of varicella vaccine. One dose of mumps-containing vaccine is routinely recommended for all pre-school age children 12 months of age and older and for anyone born after 1956 who is not at high risk of mumps exposure.<sup>17</sup> According to the March 2007 National Immunization Survey results, 90% of Arizona children 19-36 months of age had received at least one dose of MMR.<sup>18</sup>

The majority of the mumps cases identified during the 2006 nationwide outbreak – about 2,000 – were reported by Iowa. Kansas, Wisconsin, Illinois, Nebraska, and South Dakota were responsible for most of the remaining cases. The median case age was 22 years and the highest age-specific case rate was among persons aged 18-24 years. Many of these cases were college students. The number of new cases decreased during May – September, when most students were not attending college. Once students began returning to school in August, however, additional small clusters of mumps were identified at college and university campuses.

Several observations were made during the course of the national outbreak that changed the accepted practices for testing and vaccinating for mumps. With regard to lab tests, it became apparent that the available serologic tests were not sensitive enough to accurately detect infection in everyone with clinical illness, and especially in individuals previously vaccinated for mumps. Cases identified as “probable” could no longer be ruled out based on a simple IgM/IgG test. Consequently, multiple tests - including viral culturing and additional serology tests - are now required to determine whether or not someone has mumps.

The Advisory Committee on Immunization Practices responded to the observations made during the nationwide outbreak by creating updated recommendations for the prevention and control of mumps. Adequate vaccination for mumps is now 2 doses of live mumps virus vaccine instead of 1 dose for school-aged children (i.e. grades K-12) and for adults at high risk (i.e. those who work in healthcare facilities, international travelers, and students at post-high school educational institutions). A second dose should be considered for children aged 1-4 years and adults at low risk if they are affected by an outbreak. Routine vaccination of healthcare workers should now

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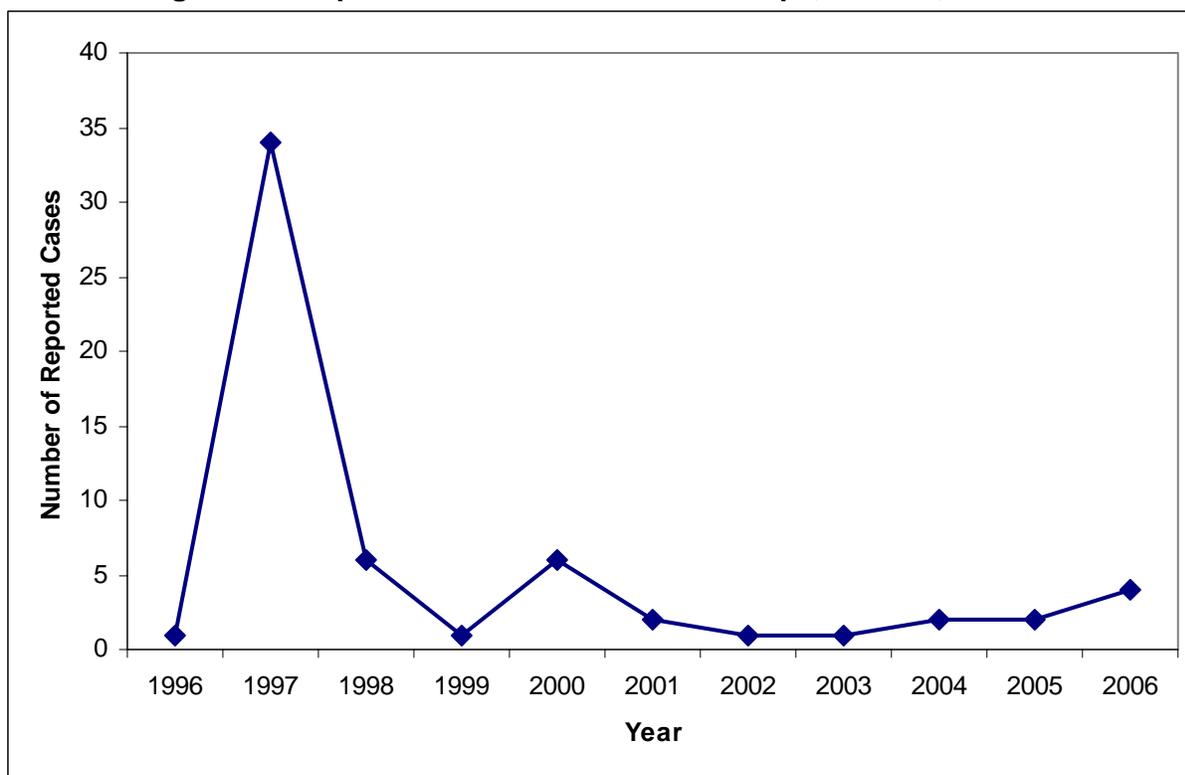
<sup>17</sup> Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Hamborsky J, McIntyre L, Wolfe S, eds. 10th ed. Washington DC: Public Health Foundation, 2007. “Mumps.” p. 149-158.

<sup>18</sup> National Immunization Survey. <http://www.cdc.gov/vaccines/stats-surv/imz-coverage.htm>

consist of 2 doses of live mumps virus vaccine for workers born during or after 1957 who lack other evidence of immunity. Healthcare facilities should also consider recommending 1 dose of a live mumps virus vaccine to workers born before 1957 who lack documented evidence of mumps immunity, and 2 doses in a mumps outbreak setting.<sup>19</sup>

In Arizona, the number of confirmed mumps cases increased slightly in 2006 compared to previous years (Figure 10). This was most likely due to the enhanced surveillance taking place in response to the national outbreak rather than an actual increase in the number of cases present in the state. None of the confirmed cases were linked to the nationwide outbreak. Because of the increase in the laboratory requirements needed to rule out probable mumps cases, many potential cases that would have been ruled out in previous years were also counted. A total of 36 probable cases of mumps were reported in 2006.

**Figure 10. Reported cases of confirmed mumps, Arizona, 1996-2006**



<sup>19</sup> “Notice to Readers: Updated Recommendations of the Advisory Committee on Immunization Practices (ACIP) for the Control and Elimination of Mumps.” MMWR, June 9, 2006, 55(22);629-630.  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5522a4.htm>

## E. Nosocomial Outbreaks

### ***Klebsiella pneumoniae* (multi-drug resistant)**

#### Background

*Klebsiella pneumoniae* is a gram-negative bacterium that lives in the gastrointestinal tract of humans and can cause human disease, especially when introduced into the lungs or bloodstream. It can also survive in the environment, especially in a healthcare facility, if environmental disinfection is inadequate.

In 2006, several isolates of a multidrug-resistant form of *Klebsiella pneumoniae* (MDR KP) were identified among hospitals in Maricopa County. The isolates were sent to CDC for genetic analysis and a common mechanism of antibiotic resistance was identified – *Klebsiella*-producing carbapenemase (KPC). The Arizona data were ultimately combined with data from New Jersey, since they discovered a similar cluster with the same resistance mechanism. In order to gather more information about the cases and potential risk factors for acquiring the infection, ADHS worked with CDC and New Jersey to investigate these cases.

#### Methods & Results

Medical records of MDR KP cases with the identified KPC resistance mechanism were reviewed for demographics, clinical characteristics, other potential risk factors, antibiotic susceptibility patterns, and outcomes.

Fourteen cases were identified in three hospitals for which medical records were readily available. Cases were admitted from 3/26/06 to 9/7/06. Since the data are in the process of being published, only a brief summary of results are presented in this report.

The median age was 64 with a range of 41 to 83 and 50% were male. Cases had a multitude of other medical problems prior to infection and the majority had been hospitalized in the prior year. MDR KP was isolated from the blood, wounds, urine and sputum. The susceptibility patterns of the isolates were variable but only one was susceptible to the third-generation cephalosporins, which are routinely used to treat *Klebsiella* infections. Some strains were susceptible to amikacin, an aminoglycoside, and some showed susceptibility to the carbapenems, although it is not clear if automated methods for carbapenem-susceptibility testing are reliable. Eleven of the patients were discharged to a care facility other than their home and three were discharged to home.

#### Conclusions

A highly antibiotic-resistant strain of *Klebsiella pneumoniae* has been identified in Maricopa County among hospitalized patients. Physicians should use caution when selecting empiric antibiotic regimens for *Klebsiella pneumoniae* infections and be sure to follow up on susceptibility testing for these organisms.

## Nosocomial legionellosis outbreak

*Legionella pneumophila* (LP) are aquatic gram-negative rod bacteria that thrive in warm, moist environments. The bacteria cause two diseases: 1) Legionnaire's Disease, which presents with pneumonia, fever, cough and abdominal pain and diarrhea and can be very severe, and 2) Pontiac Fever, which presents with an acute onset of flu-like illness (no pneumonia) and is a self-limited illness. The overall mortality of Legionnaire's disease is 10-15%. Both diseases are spread by aerosolized contaminated water and there is no person-to-person transmission.

There are 8,000-18,000 cases of Legionnaire's disease per year in the US. Most cases are sporadic; 23% are believed to be healthcare-associated and 10-20% are associated with outbreaks. Although the most common *Legionella pneumophila* serogroup is LP-1, non LP-1 serogroups predominate in Arizona.

*Legionella* may enter hospital water systems in low or undetectable numbers and the most common patient exposures include showers, faucets, aspiration of potable water and respiratory therapy equipment. The definition of nosocomial acquisition is that a person has to have been hospitalized continuously for at least 10 days prior to illness onset. If a nosocomial case is identified (or two cases of possible nosocomial disease are identified), a full-scale environmental investigation is warranted. A nosocomial outbreak is defined as at least two cases at a hospital during a 6-month period. Investigations should include evaluation of cooling towers, evaporative condensers, heated potable-water-distribution systems, and locally-produced distilled water. Areas with severely immunocompromised patients should be the focus of the investigation since these patients are most susceptible to developing Legionnaire's disease.

In May 2006 a nosocomial case of Legionnaire's disease was identified at a Maricopa County hospital. The subsequent investigation and remediation activities are described below.

### Initial Phase

- First case was identified in a bone marrow transplant (BMT) patient, May 2006. Notification occurred to ADHS, Maricopa County Department of Public Health (MCDPH), hospital administration, BMT and transplant management staff, Public Relations (PR) at the hospital, microbiology department, and facilities and safety directors. Initial water samples collected from BMT unit and tap water restrictions were initiated for all BMT, solid organ, and neutropenic patients. Letters were sent to transplant patients and families and hospital management team regarding water restrictions.
- The first conference call was held with CDC, ADHS, hospital infection control (IC) and the hospital administration. Enhanced surveillance for legionellosis was initiated at the hospital and daily rounds on units to educate staff about *Legionella* were conducted by IC. Other hospitals were contacted regarding their legionellosis experience.
- Notification was received of positive water culture results from the BMT unit. A second conference call was conducted with CDC, MCDPH and ADHS to discuss remediation plans.
- Water samples were collected at additional sites throughout facility, and a plan initiated for superheating and flushing of the water system. Meetings were held with PR to discuss potential media coverage. Communication about superheating was sent to medical staff, patients and families, department directors and staff, and other hospitals possibly affected. IC conducted rounds to inform staff about the superheating plan.

- The first superheat and flush was conducted May 20-21, 2006. Additional water samples were collected post-superheat; markedly reduced levels of *Legionella* were found. Cleaning and disinfection of showerheads was initiated on transplant units. Periodic water sampling continued; positive cultures for *Legionella* from water samples were found.
- The hospital consulted with a *Legionella* expert, who recommended cleaning and disinfecting the water storage tanks, and performing enhanced cleaning of all point-of-use fixtures (faucets and shower heads). Environmental staff were educated on shower head cleaning procedure.

#### Second phase

- A second probable case suspected of being nosocomial was identified in July 2006, and reported to ADHS and MCDPH. IC met with the BMT and Transplant units to assure compliance with water restrictions and adequate supplies of bottled water and comfort baths. A second superheat and flushing was planned.
- A conference call was held with ADHS and MCDPH to discuss remediation plans. Communication was sent to patients' families and staff regarding the second superheat and flush on July 21 and 22, 2006. Water sampling continued.
- An ADHS environmental site survey was conducted on August 1-3 and the contract finalized with a *Legionella* expert to perform ongoing water sampling and make recommendations.
- Water cultures continued to remain positive. A decision was made to install a copper/silver ionization system and an automatic chlorine injector. A Joint Commission on Accreditation of Healthcare Organizations (JCAHO) survey on *Legionella* was conducted on August 23, 2006.
- Cultures from water tanks eventually came back negative. Specific procedures for cleaning, disinfecting, and brushing showerheads and sink faucets were developed based on the consultant's recommendations. The decision was made to replace all hand-held shower wands and faucet spouts, and maintenance personnel were in-serviced on the procedure for changing out faucets and showerheads.
- Tap water restrictions continued for transplant and neutropenic patients, as well as continuing enhanced surveillance for additional cases of legionellosis and scheduled water sampling.
- Based on repeated negative *Legionella* tap water cultures (last performed December 7, 2006), ADHS and MCDPH recommended lifting tap water restrictions from all units where neutropenic and transplant patients are treated. The agencies and consultant also recommended continuing quarterly testing of water sources and reinstating water restrictions should *Legionella* be cultured from any of these sources in the future.

### **Multidrug-Resistant *Pseudomonas aeruginosa* Outbreak in a Maricopa County Hospital**

#### Background

On June 30, 2006, the Infection Control Practitioner (ICP) at a hospital in Maricopa County (Hospital A) contacted ADHS to report eight patients with multidrug-resistant *Pseudomonas aeruginosa* (MDRPA). The hospital had not seen this resistance pattern in *Pseudomonas aeruginosa* previously and staff were concerned because of the organism's resistance to multiple antibiotics.

*Pseudomonas aeruginosa* is a gram-negative aerobic bacillus isolated from soil, water, and the surfaces of plants and animals. It is an opportunistic pathogen in humans, meaning that it generally does not cause infection in healthy hosts, but may lead to illness in immunocompromised persons, those in healthcare settings, or individuals with other medical problems. It can infect almost any part of the body including the skin and soft tissue, respiratory and urinary tracts, and the central nervous system. It has been associated with outbreaks in healthcare facilities in the past with sources identified such as bronchoscopes and artificial nails.

## Methods

The following outbreak case definition was developed: A multidrug-resistant *Pseudomonas aeruginosa* isolate from the respiratory tract with a pulsed field gel electrophoresis (PFGE) band pattern matching the outbreak strain, cultured from a patient hospitalized at Hospital A during June or July 2006. The ICP at the hospital had already started an investigation which indicated that most of the cases had a bronchoscopy prior to positive culture.

The subsequent investigation included collecting all MDRPA culture reports from May onwards and conducting chart reviews among cases to examine factors such as location of the patients, respiratory medications, common staff involved in patient care, and respiratory procedures. The investigation also included collecting environmental cultures from the endoscopy rooms, cleaning/reprocessing room, and intensive care unit. Cultures were taken from hospital staff who cared for bronchoscopy patients. Active surveillance was conducted to find more cases by doing respiratory cultures pre- and post-bronchoscopy and among all patients admitted and discharged from the ICU.

## Results

Twelve patients were identified with MDRPA at Hospital A during the dates specified. Of the 12 patients, 11 had isolates available for PFGE at the Arizona State Laboratory. The PFGE results demonstrated that nine of the 11 isolates had the same PFGE banding pattern. One of the nine isolates was from the urine and therefore did not meet the case definition. Records for all eight cases meeting the outbreak case definition were reviewed by ADHS epidemiologists and the ICP at Hospital A.

Seven of the eight cases were admitted for respiratory problems and one for abdominal pain, ascites and chest pain. Six of the eight cases had a diagnosis of respiratory illness and/or sepsis with an abnormal chest X-ray. Six of the eight cases had a past medical history of underlying respiratory problems, including emphysema, asthma, and lung cancer. The median age was 59 years, with a range of 36 to 75 years. Four of the cases were male and four female.

The collection dates of specimens with positive *Pseudomonas* cultures ranged from June 6th to July 17th, 2006. The length of hospitalization prior to positive culture was 2 to 15 days with a median of 8 days. All eight positive specimens originated from a bronchial alveolar lavage (BAL) performed during bronchoscopy. All the cultures grew out scant *P. aeruginosa*, with no gram negative rods on Gram stain. Seven BAL specimens from cases yielded other organisms, including *Candida* spp., coagulase-negative *Staphylococcus*, alpha-hemolytic *Streptococcus*, methicillin-resistant *Staphylococcus aureus*, and diphtheroid bacilli. Most of these organisms are commonly found in the respiratory tract. These findings, including the lack of MDRPA on initial gram stain, suggest MDRPA colonization versus infection of the respiratory tract, i.e., MDRPA was not a likely cause of respiratory illness in these patients. All of the MDRPA isolates were susceptible to either ceftazidime and/or amikacin.

Case Outcomes: The median length of stay in the hospital was 12 days, with a range of seven to 25 days. No particular hospital unit or staff member was associated with all of the cases. Three cases were intubated and in the intensive care unit within the week prior to culture positivity. Three patients died, one patient was transferred to another hospital, and four were discharged home. Of the three deaths, one had metastatic cancer and the other two had multi-organ failure from sepsis; it is unclear if the *Pseudomonas aeruginosa* infections contributed to the deaths of any of the three patients.

Observational Investigation Results: The hospital had one video bronchoscope and several non-video bronchoscopes. The video bronchoscope was used on six of the eight patients per logbook documentation. The specific bronchoscope used for the other two cases was not recorded; however, the physician who performed those two bronchoscopies prefers the video bronchoscope and uses it whenever available. Additionally, all of the eight cases were the first or only bronchoscopy patient of the day. ADHS and the hospital ICP observed the re-processing of the video bronchoscope and noted that there was a kink in the tubing.

Environmental Investigation Results: The outbreak strain of *Pseudomonas* was not recovered from any of the environmental samples or staff members cultured. One culture from the sink in the intensive care unit grew an antibiotic-susceptible *Pseudomonas aeruginosa* with a different PFGE pattern than the outbreak pattern.

#### Conclusions and Recommendations

The investigators concluded that the epidemiology indicated a likely link to the video bronchoscope. The following recommendations were provided to the hospital by ADHS:

- Consider replacing the video bronchoscope or send it to the manufacturer for repair of the kink and thorough re-processing.
- Perform an in-service to teach staff how to re-process the scope according to the manufacturer's recommendations.
- Do not use the video bronchoscope until it is returned from the manufacturer, the in-service has been performed, and the staff have demonstrated the ability to appropriately re-process and store the instrument.
- Resume bronchoscopy with the following safety measures:
  - Perform a sputum culture of all patients undergoing bronchoscopy within 12 hours prior to bronchoscopy in order to rule out the presence of *Pseudomonas*.
  - Perform a follow-up sputum culture 48 hours following bronchoscopy to rule out colonization or infection with *Pseudomonas*.
- Discontinue surveillance cultures after all surveillance cultures have been negative for *Pseudomonas* for a specified period of time.

The video bronchoscope was sent back to the manufacturer. They reported that microbiological sampling prior to testing was negative. Inspection by the manufacturer revealed reddish discoloration in the instrument channel port, a brown discoloration in the instrument and suction channel in the bending (kinking) section, and down-regulation was found to be below the standard. The bending section in the suction channel can lead to a biofilm formation which allows organisms like *Pseudomonas* to attach and remain on the instrument. The discoloration can indicate issues with the cleaning process of the instrument. The bronchoscope was reprocessed by the manufacture and sent back to the hospital. No new multidrug resistant *Pseudomonas aeruginosa* cases have been identified at Hospital A.

## F. *Salmonella* Oranienburg Outbreak in Cochise County

Adapted from the Trip Report written by Christine Olson, MD, MPH, Epidemiology Intelligence Service (EIS) Officer at CDC

### Background

In October 2006, the Arizona Department of Health Services (ADHS) identified 31 cases of *Salmonella* infection among residents of Sierra Vista, Arizona, in Cochise County with illness-onset dates between September 1 and October 14, 2006. All isolates were identified as *Salmonella* Oranienburg, with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern and given the cluster code 0610AZJJx-1c (CDC PulseNet Xbal pattern JJXX01.0035 and BlnI pattern JJXA26.0019). Cochise County Health Department (CCHD) and ADHS investigations did not identify a common source at that time. From November 7 to December 22, 15 additional cases of *S.* Oranienburg matching the outbreak strain were identified. All case-patients to that point, except for two, were residents of Sierra Vista in Cochise County, and many from the second phase (10/15) had a local restaurant (Restaurant X) in common.

Investigations to that point included: inspections of all schools, Head Starts, and daycares in the area and inspections of multiple restaurants; water sampling from a local park's five water fountains and from apartment complexes in areas which seemed to have a higher concentration of cases; and regular Colilert testing of all water systems in Sierra Vista by the Arizona Department of Environmental Quality. No positive results were obtained. Thirteen food handlers at Restaurant X (who were present and worked in a food-handling capacity on Dec. 9, 10, or 11) were cultured on 12/29/06, with two found to be positive for the outbreak strain; however this exposure did not explain all cases, and the restaurant was, in fact, not open at the time of the initial phase of illness.

In January, 2007, ADHS formally requested assistance from CDC.

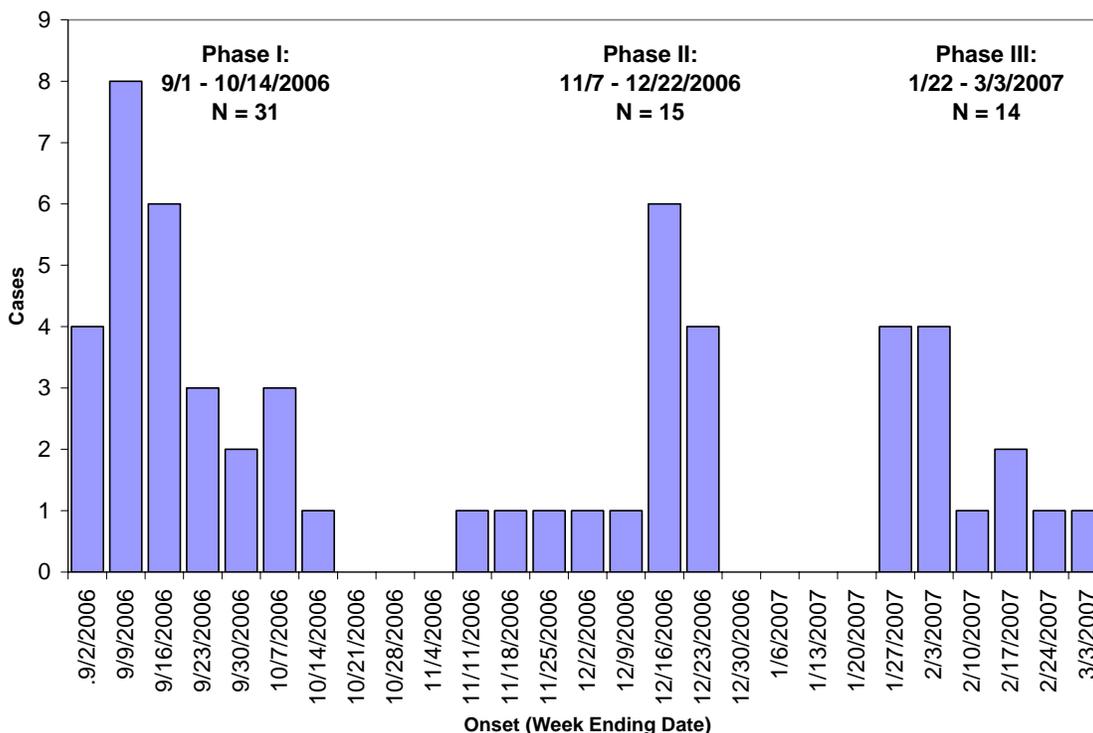
### Methods

For purposes of initial case identification, an outbreak case was defined as *Salmonella* Oranienburg infection in a person with at least one enzyme matching the outbreak PFGE pattern and who resided in Cochise County. When matching isolates were identified, epidemiologic data including symptoms, food history, and environmental information were collected using revised questionnaires which combined information collected from the three previously used questionnaires employed earlier in the outbreak. All samples in phases 2 and 3 of the outbreak (described below) underwent two restriction-enzyme patterning, and were only included in the outbreak if the isolates matched on both enzymes.

Demographic and exposure information obtained from case interviews conducted were reviewed, and all information from the different questionnaires completed to that point (Arizona 2-page *Salmonella* standard form, the Oregon questionnaire, and a modified Minnesota questionnaire) was compiled in a single database.

The outbreak was defined as having three "phases" of illness, based on onset of illness dates: 9/1/2006 to 10/14/2006, 11/7/2006 to 12/22/2006, or 1/22/2007 to 3/3/2007.

**Figure 11. Epidemiological curve of the *Salmonella* Oranienburg outbreak, Cochise County, 2006-2007**



The demographics differed between the three phases in age, sex, and racial composition:

**Figure 12. Demographics of *Salmonella* Oranienburg case patients**

|                       | Phase I<br>N=31   | Phase II<br>N= 15 | Phase III<br>N=14 |
|-----------------------|-------------------|-------------------|-------------------|
| Onset of illness date | Sept 1 – Oct 14   | Nov 7 – Dec 22    | Jan 22 – Feb 22   |
| Mean age              | 18.5 yrs old      | 35.2 yrs old      | 41 yrs old        |
| Median age            | 10 yrs old        | 36 yrs old        | 53.5 yrs old      |
| Age range             | 2 months – 97 yrs | 8 months – 71 yrs | 8 months – 73 yrs |
| % female              | 45                | 53                | 64                |
| % Caucasian           | 77.4              | 46.7              | 58.3 *            |
| % African American    | 12.9              | 40.0              | 25.0              |
| % Hispanic            | 6.4               | 13.3              | 16.7              |
| % Asian               | 3.2               | 0                 | 0                 |

\* data available for only 12 of 14

ADHS and CCHD health officials interviewed 46 culture-confirmed *S. Oranienburg* cases during Phases I and II using standard questionnaires regarding foods eaten in the 7 days prior to their illness onset dates. Depending on the questionnaire utilized, questions focused on specific daily food intake, exposure to other symptomatic people, local restaurant exposure and association with daycares or Fort Huachuca during this time period. Data were analyzed for common exposures and correlation with original food histories. Non-military restaurants, daycares and stores where patients reported eating food were contacted by local officials regarding food handling procedures, produce suppliers and water sources.

## Cohort Study

Based on the association with Restaurant X in Phase II cases, a cohort study was conducted on banquet- and buffet-goers as well as restaurant employees. Restaurant X opened for regular business on November 14, 2006. Because 6 of the 10 case-patients who had eaten at Restaurant X had dined there on December 10, the cohort study was performed on people who had eaten at Restaurant X on that date. The questions focused on known menu items as well as some additional environmental and restaurant exposures. For the purposes of the cohort study, a case was defined as *Salmonella* Oranienburg infection with a PFGE pattern matching the outbreak strain (on 2 enzyme-restriction pattern) in a person who had eaten at Restaurant X on December 10, 2006. The targeted cohort included any person who ate at Restaurant X on December 10th. According to Restaurant X records, there were 38 employees who worked at the facility that day, 130 people who ate at the single plated-meal event, and 61 people at Sunday brunch buffet. Determination of the number and names of the people who ate at the brunch buffet was made by utilizing credit card receipts, and estimating the number of other people (who did not pay by credit card) by the buffet sales revenue from that date divided by the cost of the meal. Additionally, one of the case-patients in Phase II had dined with an organized group of approximately 70 people on December 14 at Restaurant X, and a brief survey was administered to 32 attendees of this event to determine if a full cohort study on this group would be beneficial.

We interviewed cohort-persons with a standard instrument that included a comprehensive list of food items they may have eaten at Restaurant X and questions about their general eating habits, environmental exposures, grocery store preferences, and relationship (if any) to Ft. Huachuca. Case-patients who were interviewed as part of this cohort also answered 25 questions regarding their illness. Interviews were conducted between January 29 and February 7, 2007 in English (and Spanish as necessary). Of the 38 total employees, 18 (47.4%) were available to be interviewed. Of the buffet diners, 26 out of 61 (42.6%) possible interviews were completed. Of the 130 plated-banquet goers, 20 names of attendees were obtained and 8 (6.2%) people were successfully interviewed. Interview rates were impeded by lack of names, telephone numbers not in service and refusal to return interview calls.

Results: Food items that were shown to have a significant relationship with illness are shaded in the table below (specifically, blended vegetables, iced tea, salad, and dressing).

**Figure 13. Statistically-significant foods consumed at Restaurant X (cohort study)**

| Foods consumed at Rest X | Buffet only |                  |         | Buffet + employees |                  |         | Buffet + employees + plated |                  |         |
|--------------------------|-------------|------------------|---------|--------------------|------------------|---------|-----------------------------|------------------|---------|
|                          | OR          | 95% CI           | p-value | OR                 | 95% CI           | p-value | OR                          | 95% CI           | p-value |
| Blended vegetables       |             |                  | .0008   | 6.125              | [1.263 - 29.696] | 0.0266  | N/A                         | N/A              | N/A     |
| Iced Tea                 | 9.167       | [0.860 - 97.694] | 0.0686  | 3.833              | [0.829 - 17.72]  | 0.1087  | 7.886                       | [2.058 - 30.212] | 0.0022  |
| Salad                    | 2.600       | [0.387 - 17.451] | 0.3618  | 2.333              | [0.539 - 10.098] | 0.2779  | 5.867                       | [1.599 - 21.525] | 0.0074  |
| Salad dressing           | 1.750       | [0.230 - 13.310] | 0.6181  | 1.750              | [0.230 - 13.310] | 0.6181  | 6.300                       | [1.325 - 29.945] | 0.0293  |

## **“Oregon” Questionnaire Data**

Because a number of case-patients had been interviewed with a version of the Oregon Foodborne Illness Questionnaire, we analyzed these data as well for any significant associations. The data were compared to the CDC's Population Survey, both national data and New Mexico data (NM was chosen due to geographic proximity and because of a possibly more similar population to AZ). The only significantly associated food item, using either population for comparison, was any burger or ground beef consumed at a fast food restaurant (OR = 4.04, 95% CI [1.51 – 10.82], p-value = 0.006, using the NM comparison).

## **Case-Control Study**

A definitive conclusion had not been reached after the above analyses were conducted, so a case-control study was next conducted from February 19, 2007 to March 2, 2007, with new cases included as they arose. Case-patients were those persons with culture-confirmed *S. Oranienberg* isolates, matching the outbreak strain by 2-enzyme restriction analysis, isolated from a specimen during Phase II (11/07-12/22) or Phase III (1/22 - 3/3). A total of 25 case-patients qualified for the study (15 from Phase II and 10 from Phase III). Participation was achieved for a total of 22 (76%) case-patients (13, 87%, from Phase II and 9, 64%, from Phase III). Two controls for each case-patient were selected randomly from the Sierra Vista White Pages (with 2 controls obtained from the Wilcox phone directory for the only case-patient who resided in Wilcox), using a standardized method (every 10th listing in the phone book was selected if it met zip code criteria and was a residential listing). Controls were frequency-matched for age based on the age distribution of the cases at the time the study was initiated. Adjustments were made to the control selection as the study progressed and as new cases were included to ensure an appropriate age-matched distribution. Interviews were attempted for case-patient children less than one year of age; however, they were excluded from the analysis, and no controls were obtained for them as it was felt they were unlikely to contribute further to the analysis.

**Results:** Results listed below are those items shown to be statistically associated with illness. Data were analyzed as all cases and as only cases who ate at Restaurant X versus controls. Analysis of the six case-patients who did not eat at Restaurant X did not reveal any significant relationships when all variables were analyzed.

Questions included in this questionnaire involved food items, extent of affiliation with Fort Huachuca, environmental factors (including pet contact, drinking and cooking water sources), and Sierra Vista-specific questions. Because only one control ate at Restaurant X and 15 of the 21 case-patients who were over one year old ate at Restaurant X, no meaningful odds ratios could be derived from the data.

Twenty-one cases and 47 controls were interviewed. Significant food items (shown below) for the case-control study included: deli-style ham consumed at home (no significant association with place of purchase or brand) (OR = 3.78, CI 1.18 – 12.2), eating at Restaurant X (OR = 120, CI 12.2 – 1168), eating salad (OR = 5.96, CI 1.67 – 21.3), using salad dressing (OR = 4.36, CI 1.22 – 15.6), using ranch dressing (OR = 9.90, CI 2.15 – 45.6), and eating cherry tomatoes (OR = 7.20, CI 1.24 – 41.9). When analysis was limited to only those cases who ate at Restaurant X, drinking tea (OR 4.60, CI 1.25 – 16.97) and using lemons (OR 4.67, CI 1.07 – 20.32) were also significant.

**Figure 14. Statistically-significant foods for *Salmonella* infection (case-control study)**

| Food item  | # cases | # controls | OR   | CI           |
|--|---------|------------|------|--------------|
| <b>Foods consumed in the home</b>                |         |            |      |              |
| Ham (sliced, deli-style from store deli counter) | 9/20    | 8/45       | 3.78 | 1.18 - 12.14 |
| <b>Foods consumed outside the home</b>           |         |            |      |              |
| Salad Mix  | 11/19   | 6/32       | 5.96 | 1.67 - 21.3  |
| Dressing on salad                                | 12/17   | 11/31      | 4.36 | 1.22 - 15.6  |
| Ranch  | 9/14    | 4/26       | 9.90 | 2.15 - 45.6  |
| Cherry tomato                                    | 6/16    | 2/26       | 7.20 | 1.24 - 41.9  |
| Tea*   | 10/15   | 10/33      | 4.60 | 1.25 - 16.97 |
| Lemons*  | 6/15    | 4/32       | 4.67 | 1.07 - 20.32 |
| <b>Specific restaurant exposure</b>              |         |            |      |              |
| If you ate out, did you eat at Restaurant X?     | 15/19   | 1/33       | 120  | 12.33 - 1168 |

\* significant when cases were limited to only those who ate at Restaurant X

### Environmental Investigation

Initially, a review of environmental health logs indicated 13 possible foodborne illness complaints in Sierra Vista during the period of Phase I. During Phase II, there were eight possible foodborne illness complaints. During Phase III two possible foodborne illness complaints were registered. All complaints were investigated by the Environmental Health Division of Cochise County, and none were found to be related to the *S. Oranienburg* outbreak under investigation.

Additionally, due to the very focal nature of the outbreak (the overwhelming majority of case patients were residents of Sierra Vista), a water source was considered. No environmental commonalities, in particular water sources, were found by plotting home residences of the case-patients by GIS mapping. Analysis of the questions about water source also revealed no significant relationships.

After the case-control study analysis was completed, local and state health officials and CDC personnel visited Restaurant X and obtained 13 environmental samples from surfaces related to the implicated items. This included the salad preparation area, the external and internal surfaces of the industrial-sized tea receptacles (tea is brewed utilizing loose leaves in a filter and collected in a main unit and an auxiliary unit as needed), several drains and sinks, and high-touch surface areas. One of these samples (the external surface of the tea receptacle in use at the time of the visit) was positive for the outbreak strain of *S. Oranienburg*; the remainder were negative. CDC personnel returned to the restaurant and obtained more directed samples of various areas of both tea receptacles as well as some additional kitchen surface cultures. Results for all samples were negative.

**Employee Testing:** Given the ongoing nature of the outbreak, and the possibility that employees could also have continued exposure to become infected, and might be symptomatic or asymptomatic shedders, the decision was made to culture all employees of Restaurant X. Forty-six workers, including the owner, submitted fecal swabs for testing. All final cultures were reported as negative.

## Discussion

This outbreak of *Salmonella* Oranienburg affected 60 cases. The length of time over which this outbreak occurred (approximately 6 months), the wide range of people affected (significantly varying demographics), the very focal nature of the outbreak (essentially only Sierra Vista residents), the strong connection between the military post and the city of Sierra Vista, and the fact that the restaurant to which the latter phases of the outbreak was eventually linked was not open during the first phase contributed to the complex nature of the outbreak.

It is likely that there is an as yet unidentified environmental reservoir of this strain of *Salmonella*. At the present time, the outbreak appears to have been focused at the one restaurant, and control measures were instituted. Several recommendations were made regarding the ware-washing area to include: increased signage at dish washing stations, dedicated tubs for food items and for dirty dish items, discontinuation of stacking of wet dishes on top of each other, dedicated areas for employee drinks. Regarding the food preparation area, an additional three-compartment sink was installed, and is dedicated to produce (produce had been washed at times in the ware-washing area). Additionally, a new prep table, again specifically dedicated to produce, was placed directly adjacent to the new sink, and is separated from the meat preparation area by the baking area. The restaurant was closed for two days to facilitate complete surface disinfection, including the entire kitchen and dining areas (chairs, tables, etc.).

Although the external surface of the tea receptacle was culture-positive, a food or drink source was not clearly identified. Cultures of tea taken earlier in the outbreak (at the time the tea receptacles were pulled from use after *Salmonella* was identified) were negative. Contamination of this surface could have been introduced by a symptomatic or asymptomatic food worker or after a worker had touched another contaminated surface and then touched the tea dispenser. Nevertheless, the outbreak strain was indeed identified in the restaurant, supporting the epidemiologic link already established.

At the time that CDC departed Sierra Vista (3/8/07), there were no further known cases. One additional urinary specimen was submitted to the laboratory on March 9, 2007. The last specimen prior to this was collected on 2/27. This last patient did not have any known exposure to the implicated food establishment and had an illness onset date of 3/3/07. No further cases of illness occurred after the restaurant underwent thorough cleaning and disinfection and reopened. The last case of *S. Oranienburg* matching the outbreak strain occurring in Cochise County in 2007 had a culture isolate date of 4/21/07 and denied any exposure to the implicated restaurant. There have been 3 other cases of *S. Oranienburg* in Arizona since that time, all matching the outbreak strain by 1st enzyme (2nd enzymes were not run), but none in Cochise County: 7/13 culture isolate date (Pima County), 8/28 (Maricopa County), and 10/25 (Pinal County).

## G. Non-O1 *Vibrio cholerae* Infections

In July of 2006, the Arizona Department of Health Services (ADHS) received reports of two people infected with non-O1 *Vibrio cholerae*. An investigation was conducted to determine potential sources of infections. Through interviews, it was determined that one person swam in the Gila River on the San Carlos Indian Reservation in the vicinity of Bylas, Arizona, prior to his illness. The swimmer reportedly had open wounds or abscesses at the time of swimming. No source of exposure was identified for the second case. Both individuals recovered and no additional cases were identified.

Based upon this information, initial environmental sampling was done by ADHS in conjunction with the San Carlos Tribal Environmental Protection Agency, Indian Health Service and Graham County Health Department in August at two swimming locations. Samples collected from both locations tested positive for *V. cholerae* non-O1 and *Escherichia coli* bacteria. Pulsed field gel electrophoresis (PFGE), a method of comparing the DNA of different bacterial isolates, was performed on the patient specimens and environmental samples to determine if they were related. The patient isolates did not match the water isolate, thus reducing the probability that the water was the definitive source of the infection; however, since environmental samples were obtained several weeks after the infection and multiple strains of *Vibrio* spp. may be present in the Gila River, exposure to the river could not be ruled out as a source.

The strains of *V. cholerae* identified in both the patient and water samples were non-O1 and did not produce cholera toxin. This particular serogroup of the bacterium is considered to be less infectious and less dangerous than O1 *V. cholerae* which is responsible for well-known, historical epidemics. The last time non-O1 *V. cholerae* was identified in Arizona was in 2004 with two cases reported that year. Prior to 2006, only toxigenic *V. cholerae* O1 and O139 were nationally notifiable. Therefore, CDC does not have reliable information on the number of non-O1 *V. cholerae* cases nationally; however, the results of voluntary state reporting indicate that 56 cases were identified in 2005 nationally.<sup>20</sup>

Cases of non-O1/non-O139 *V. cholerae* infection have been associated with sporadic cases of foodborne outbreaks of gastroenteritis as well as with wound infections and, rarely, septicemic disease (usually in immunocompromised persons). Cases of non-O1/non-O139 gastroenteritis are usually linked to consumption of raw or undercooked seafood, particularly shellfish. In tropical endemic areas, some infections may be due to ingestion of surface waters. Wound infections arise from environmental exposure, usually to brackish water or from occupational accidents among fishermen, shellfish harvesters, etc.<sup>21,22</sup>

### Environmental Sampling

The San Carlos Apache Tribe, ADHS, and Graham County Health Department requested assistance from the Arizona Department of Environmental Quality (ADEQ) in locating the source of the *V. cholerae* strain and in determining associated *E. coli* levels on the Gila River. The ADEQ Total Maximum Daily Load (TMDL) unit responded to this request with three sampling

<sup>20</sup> CDC. Summary of human *Vibrio* isolates reported to CDC, 2005.  
[http://www.cdc.gov/foodborneoutbreaks/vibrio\\_sum/CSTE\\_2005.pdf](http://www.cdc.gov/foodborneoutbreaks/vibrio_sum/CSTE_2005.pdf)

<sup>21</sup> Centers for Disease Control and Prevention (CDC), 2006.  
[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/cholera\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/cholera_g.htm), August 18, 2006.

<sup>22</sup> Heymann D, ed., *Vibrio cholerae* serogroups other than O1 and O139. Control of Communicable Diseases Manual. 18th ed. Washington, DC: American Public Health Association; 2004:112-4.

trips during August, September, and October, 2006. Each collection effort coincided with a different range of the receding hydrograph for the Gila River and its major tributaries.

The August sampling trip tested river water at ten locations. Site selection was guided by two objectives: testing the upstream extent of the *Vibrio* presence and bracketing of potential contributing sources, including waste water treatment facilities or ponds. *V. cholerae* was present at all ten locations and *E. coli* levels were high and in excess of state water quality standards, ranging from 1300 to 5794 MPN per 100 ml. High levels of *V. cholerae* (non-O1 serotype) occurred sporadically at a number of different locations, with dips in the densities present at intermediate sites.

Because results from the first round of sampling showed unexpected geographic extent and no discernable pattern of variation from site to site, a second round of sampling at 14 sites was conducted. Sampling was extended geographically while retaining sites near where the problem was first identified. *V. cholerae* was present at all but one site, and *E. coli* levels ranged from 55 to 6131 MPN per 100 ml, but were generally lower than in the first round of sampling.

ADEQ followed up on sampling on the Gila River one month later (October) to test whether the impact from an active monsoon season to near historic flow norms would bring about a reduction in *E. coli* and *V. cholerae* counts. The geographic extent of sampling was the same as the September sample collection effort, with fewer stream sites but the addition of six sampling locations. *E. coli* results from the third sample collection effort uniformly met Arizona water quality standards at all lake and stream sites. *Vibrio* counts were low and generally less than the previous sampling. Five sites showed either no presence of the *Vibrio* bacterium or amounts below quantification levels. An additional three sites showed quantifiable results only at reporting limit thresholds.

## Discussion

The environmental sampling indicated the following:

- *E. coli* and *Vibrio* levels generally followed the hydrograph of the Gila River; high flows could generally be correlated with poorer bacteriological water quality as evidenced by water quality standards violations for *E. coli* and sporadic high counts of *V. cholerae*.
- Associations between *V. cholerae* and *E. coli* were correlated only in presence or absence in the Gila River, not numerically.
- All *Vibrio* detections but one occurred in waters having a temperature of greater than 20 degrees Celsius. Were sampling to continue through winter months, it would be expected that *Vibrio* would disappear with the onset of colder water temperatures.
- Non-O1 *V. cholerae* isolated in Arizona waters could not be related to salinity.
- Two areas appear to be contributing disproportionately to the high *E. coli* levels, with a possible impact from agricultural practices in these particular areas.

Available literature on the prevalence and densities of *Vibrio* in inland riverine environments is sparse. The conventional wisdom behind the understanding of *V. cholerae* has been accrued from the knowledge base of the O1 serotype historically responsible for epidemics. Conventional assumptions about *V. cholerae* include the following: *V. cholerae* is found in brackish or saline environments; *V. cholerae* is carried by shellfish and exposure occurs through

ingestion of seafood or the drinking of contaminated water; where *V. cholerae* exists in other environments, it is associated with sewage spills or known exposure to human feces.<sup>23,24</sup>

Several sources suggest that *V. cholerae* is more widespread than previously thought and does not necessarily follow the assumptions listed above. Various studies have found high densities of *V. cholerae* at pristine inland sites at the highest points in a watershed that do not correlate with a saline environment or with known sewage exposure;<sup>25</sup> isolation of non-O1 *Vibrio* from herbivores (horse, lamb, American bison) suggesting that herbivores might act as carriers or possible vectors for the transport of the organism;<sup>26</sup> presence of *V. cholerae* at river, stream, canal, and ditch sites of both high and low salinity;<sup>27</sup> and isolation from aquatic bird feces, suggesting either that *Vibrio* is indigenous to the species there or transported to inland waters by avian migration.<sup>28</sup>

ADEQ's findings in the course of this investigation lend support to some of these alternative hypotheses. The Gila River and its tributaries in the study area can be considered neither brackish nor saline. The area investigated is well inland—200-300 miles from the nearest coastal area. No consistent numerical correlation was noted with *E. coli*, the state water quality indicator organism for bacteriological quality and an indicator of mammalian fecal contamination. Water temperatures were uniformly warm in the course of sampling, ranging from 19.5 to 26.3 degrees Celsius (*Vibrio* has not been observed in the research detailed above at temperatures less than 10 degrees Celsius). No geographic consistency was observed in the location of high *Vibrio* densities during the investigation, nor did any individual site show results over time that were consistent with a point source problem.

The Gila River and its tributaries flowed at record levels for the monsoon season this year. As is typically seen in flood events, *E. coli* counts rose to high levels exceeding Arizona water quality standards along the Gila River and persisted at high levels consistently at several sites through the first two sample collection efforts. Only when flows receded to near historic norms in early October did *E. coli* levels come back into compliance with state standards. This pattern has been frequently observed by ADEQ in Arizona streams statewide during high-flow conditions, with a higher likelihood of occurrence in high-order main-stem streams like the Gila. The correlation with flows was more readily apparent for *E. coli* than for *Vibrio* in this investigation.

We are not able to conclusively point to any particular source for *V. cholerae* non-O1. Initial hypotheses that waste water treatment ponds played a pivotal role were not borne out by consistent high densities in the same locations from one sampling effort to the next. As the investigation proceeded, initial assumptions that a point source (or multiple point sources) could

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<sup>23</sup> Centers for Disease Control and Prevention (CDC), 2006.

[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/cholera\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/cholera_g.htm), August 18, 2006.

<sup>24</sup> Heymann D, ed., *Vibrio cholerae* serogroups other than O1 and O139. *Control of Communicable Diseases Manual*. 18th ed. Washington, DC: American Public Health Association; 2004:112-4.

<sup>25</sup> Perez-Rosas, Nerybelle and Hazen, Terry C., In Situ Survival of *Vibrio cholerae* and *Escherichia coli* in a Tropical Rain Forest Watershed, *Applied and Environmental Microbiology*, Vol. 55 No. 2, February 1989.

<sup>26</sup> Rhodes, John B., Schweitzer, Darrel, and Ogg, James. Isolation of Non-O1 *Vibrio cholerae* Associated with Enteric Disease of Herbivores in Western Colorado, *Journal of Clinical Microbiology*, Vol. 22 No. 4. October 1985.

<sup>27</sup> Rhodes, John B., Smith, Harry and Ogg, James. Isolation of Non-O1 *Vibrio cholerae* Serovars from Surface Waters in Western Colorado, *Applied and Environmental Microbiology*, Vol 51 – 6. June 1986.

<sup>28</sup> Ogg, James E., Ryder, Ronald A, and Smith, Harry L., Isolation of *Vibrio cholerae* from Aquatic Birds in Colorado and Utah, *Applied and Environmental Microbiology*, Vol. 55, No. 1. January 1989.

be isolated began to evolve into a consideration that *V. cholerae non-O1* might be indigenous to the Gila River aquatic environment and could well be present every summer season. Hypotheses include a possible role for sediment as a reservoir for the bacteria or transport of the bacteria by waterfowl.

#### Recommendations

ADHS and ADEQ jointly recommended to the affected Arizona counties (Graham, Greenlee, and Gila) and the San Carlos Apache Tribe that swimming advisories be posted at all easily-accessible points along the Gila River after the first sampling trip confirmed that *Vibrio cholerae* and high levels of *E. coli* were present in the Gila River. The advisories were based on the *E. coli* water quality standard exceedances, since Arizona has established water quality standards for *E. coli* but not *Vibrio* and there are no epidemiological data on safe exposure levels of *V. cholerae*, especially for non-ingestion routes. After the third sampling, when *E. coli* levels had fallen back into compliance with state water quality standards but *Vibrio* was still present at several sites, ADHS issued a general "safe swimming" advisory warning immunocompromised or at-risk populations not to swim in the Gila River with open cuts or sores.

Graham, Greenlee, and Gila Counties and the San Carlos Apache tribe responded to the state's recommendation by posting prominent signs warning against swimming for the duration of the *E. coli* spike at all commonly-used approaches to the river. Public service announcements were made on local cable-access TV channels, and flyers were posted at public locations throughout the area, including convenience stores, post offices, and other commonly-frequented establishments. The State of Arizona augmented this effort through ADEQ's Communication Office by issuing a notice to Eastern Arizona residents regarding elevated *V. cholerae* and *E. coli* levels in the Gila River. The notice was posted at the beaches and recreational areas of the Gila Box National Riparian Conservation Area. At the counties' and tribe's request, the initiation of further studies are being considered. Additionally, the ADEQ Monitoring Unit of the Surface Water Section has incorporated *V. cholerae* presence/absence testing and enumeration into its rotational basin monitoring design for FY 07 on a provisional basis to begin to ascertain whether *V. cholerae* appears elsewhere in Arizona streams.

## **IV. SURVEILLANCE TOPICS AND STUDY REPORTS**

## **A. Medical Electronic Disease Surveillance Intelligence System (MEDSIS)**

The Medical Electronic Disease Surveillance Intelligence System, or MEDSIS, is Arizona's primary disease surveillance database for the diseases included in this report. For many years and through 2005, Arizona had been using the CDC-developed NETSS system, which is limited in its functionality. More recently, CDC has been developing components of NEDSS (the National Electronic Disease Surveillance System), which is an internet-based infrastructure for public health surveillance data exchange. The NEDSS standards and data models were used when building MEDSIS for greater interoperability with other systems and yet it was also important to Arizona to develop a system that best suits the state's needs. MEDSIS is housed on the Secure Integrated Response Electronic Notification (SIREN) platform, which also contains alert notification among other communications tools. MEDSIS was designed according to the Public Health Information Network (PHIN) standards available at the time and has been updated accordingly as these have changed. Compliance with PHIN standards is critical for being able to communicate with other systems nationally as these are developed.

In January, 2006, after several years of development, the Programs described in this report transitioned to MEDSIS. Fourteen of Arizona's fifteen counties also use the system as their primary disease surveillance tracking, and data for the fifteenth county are entered and managed by ADHS so that all the state data are contained within MEDSIS. By the end of the year, infection control practitioners at hospitals in several counties were also on the system and reporting electronically. The reporting structure described in the Introduction has not changed, though MEDSIS has been used to make many of the communications electronic and thus more timely.

There are several features of MEDSIS that have enhanced disease surveillance in Arizona:

- Electronic sharing of data between providers and county health departments, and county and state, for increased timeliness;
- Many more variables available for tracking additional data elements;
- Ability to add multiple laboratory results;
- Incorporation of the paper-based extended surveillance forms for many morbidities;
- Cases within the system can be viewed by both county and state public health users in the appropriate jurisdictions, regardless of who has edit rights or is working on a case;
- Communications and data coordination between county and state agencies have been facilitated by using the same system;
- The internet-based system is accessible anywhere with appropriate log-in credentials.

Future enhancements include electronic laboratory reporting, integration of the fifteenth county, integration of additional program areas, working with Indian Health Services and tribes to bring them into the system as public health entities, and enhanced functionality for the users and morbidities already included.

## B. Pandemic and Seasonal Influenza

The spread of avian influenza (H5N1) in Asia and how it might lead to the next pandemic of influenza was widely broadcast throughout the world during its emergence in 2003 up until 2005. As transmission has continued, attention from the media has waned but the risk of an influenza pandemic is still quite real. A pandemic occurs when a novel influenza virus causing severe disease is efficiently transmitted through a population. Although the highly pathogenic avian influenza virus H5N1 may not be the virus to spark the next influenza pandemic, its continued transmission and expansion throughout the world requires vigilant monitoring. In 2006-2007, the Centers for Disease Control and Prevention granted funds to Arizona to enhance influenza surveillance systems in order to rapidly detect the transmission of novel influenza A viruses.

There are several purposes for influenza surveillance: to determine where and when influenza cases are occurring; to determine the predominant types and subtypes circulating in the state; to assess the intensity and impact of activity; and to identify novel viruses. Multiple layers of influenza surveillance in Arizona are being examined to better identify cases of influenza. The Arizona influenza surveillance system is comprised of laboratory surveillance, sentinel provider reporting of influenza-like-illness, mortality surveillance and, in some counties, hospital emergency department visits or school absenteeism. Sentinel physicians throughout the state submit weekly reports of influenza-like illness (ILI) to the U.S. Influenza Sentinel Provider Surveillance Network, a collaboration between health care providers, state and local health departments, and the CDC. These reports help to determine the period when influenza-like illnesses account for a larger proportion of patient visits, both statewide and nationally. Viral isolation and subtyping at the Arizona State Laboratory and other select laboratories detect the predominant circulating types and subtypes and identify any novel strains. Traditionally surveillance activities for influenza occur between roughly October and May, commonly known as the influenza season. As novel strains of influenza can arise at any time of the year, surveillance is being expanded to occur year round. Additionally, all suspect and laboratory-confirmed cases of influenza occurring during the summer months will be investigated to assess severity and the possibility of infection with a novel influenza A virus (including H5N1).

Children are known to be both the subjects and source of a disproportionate number of influenza infections.<sup>29</sup> School-based monitoring of influenza-like-illness is valuable in its ability to aid in determining the severity and impact of influenza activity in a community. At the end of the 2006-2007 influenza season, a new electronic surveillance system was put in place to track cases of influenza-like-illness directly through the school nurses offices. Over 300 schools currently participate in this program statewide. It is expected that this number will increase as the 2007-2008 school year begins. Initial review of the data indicates a strong correlation between the surveillance data generated by this system and established surveillance programs.

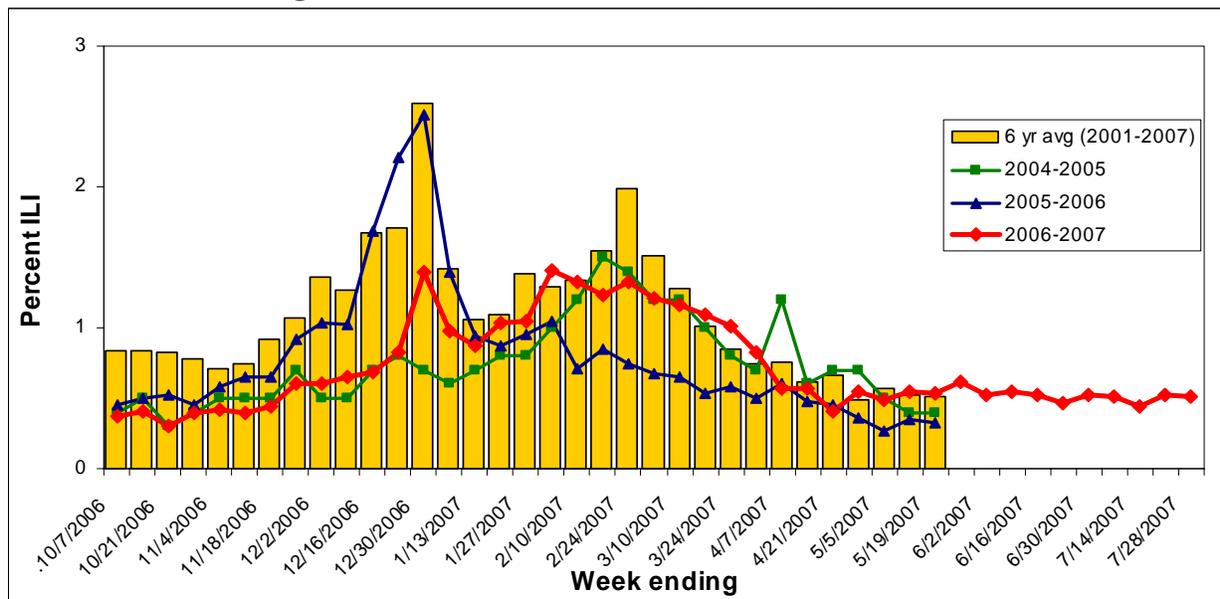
Although pediatric mortality due to influenza has been nationally-notifiable since the 2003-2004 influenza season, mortality from influenza-related illness in the general population has not previously been rigorously monitored. Plans are in place to work towards the goal of identifying influenza-associated deaths within three days of their occurrence.

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<sup>29</sup> Viboud C, et al. Risk factors of influenza transmission in households. *Br J Gen Pract* September 2004;54:684-9.

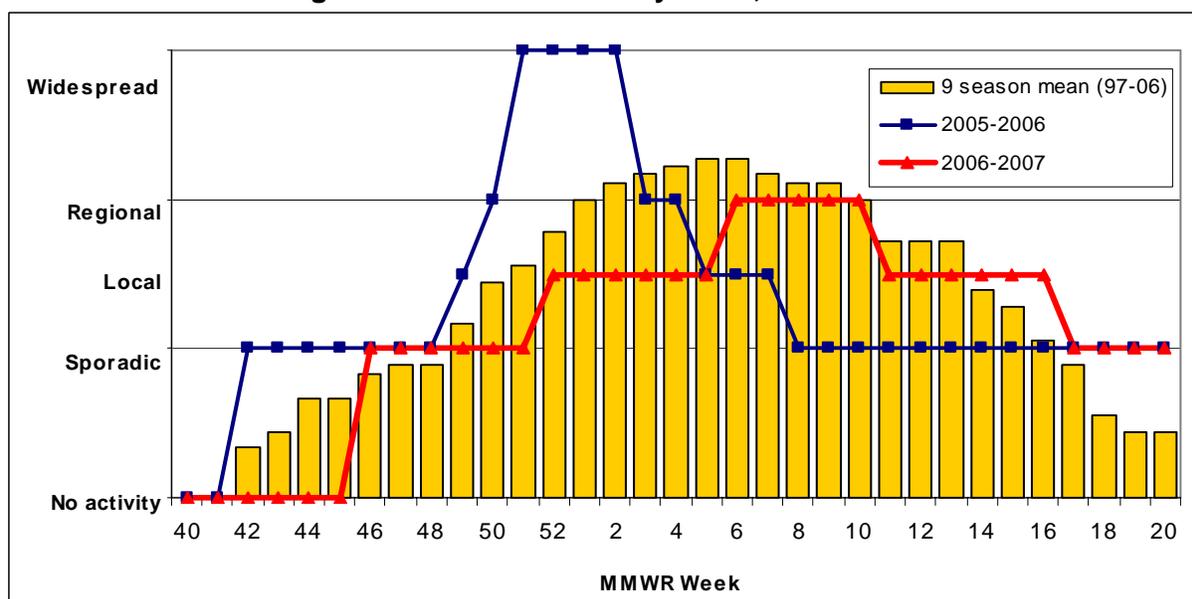
The 2006-2007 influenza season was notably mild both nationally and in Arizona. The ILI data show no sharp peaks with only a moderate rise at the end of December that lasted until mid-March with two slight peaks at the end of December and in early February (Figure 15). Although influenza is generally thought to sweep from the east coast to the west coast, it appears that this year the southwest again experienced the onset of influenza season at an earlier date than the east.

**Figure 15. Influenza-like-Illness, Arizona, 2001-2007**



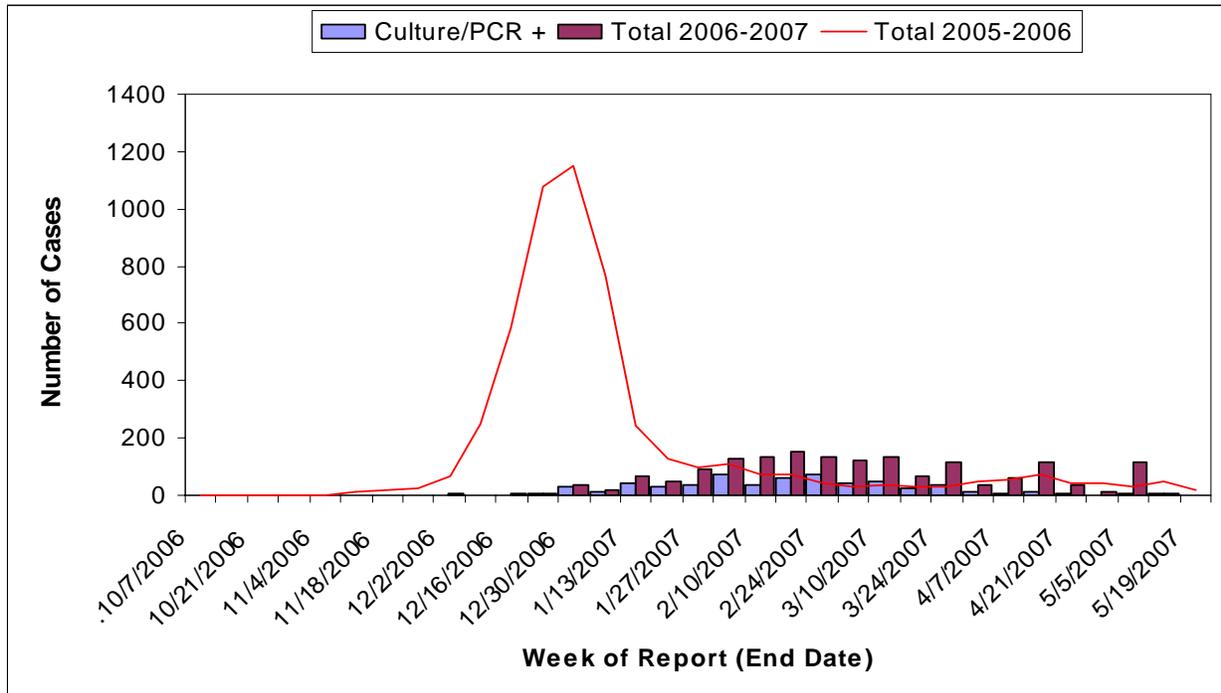
The activity levels reported weekly to CDC are seen in Figure 16. Due to the low level of transmission occurring this past season, the activity level never rose to widespread. In comparison to other seasons the activity level was low and broad.

**Figure 16. Influenza Activity Level, 1997 – 2007**



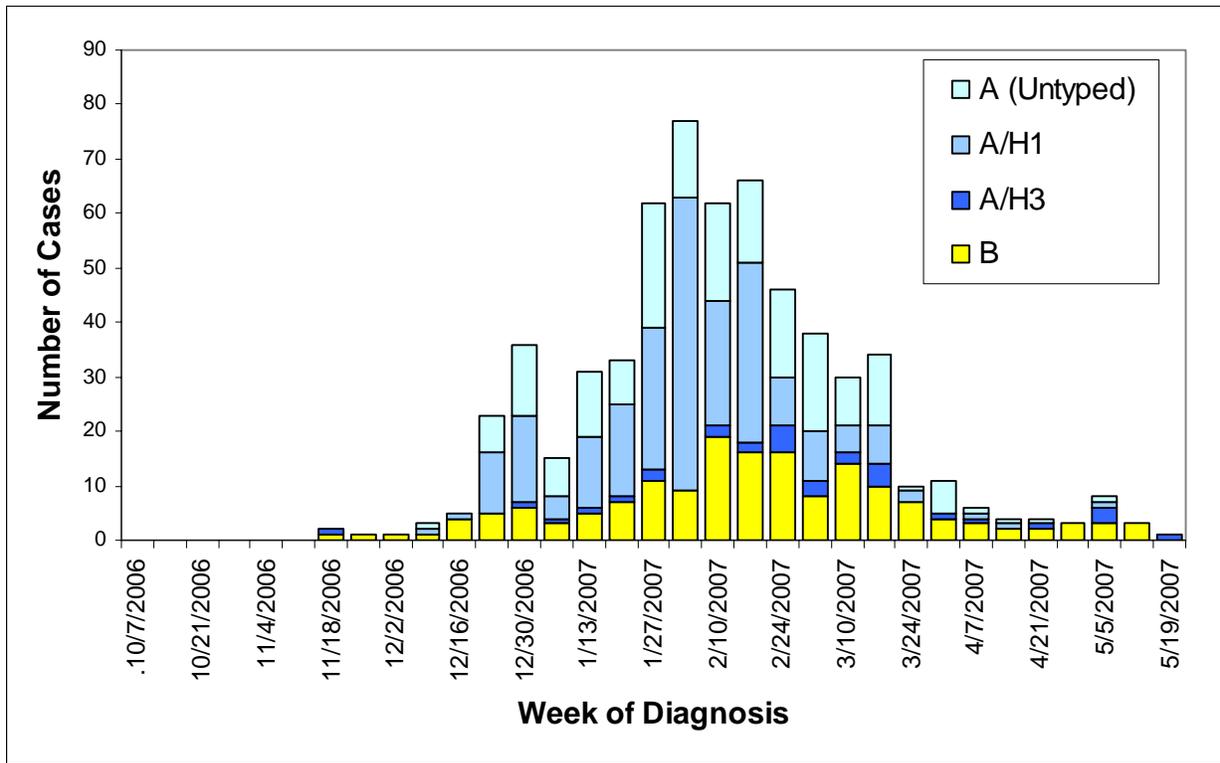
Lab-confirmed reports of flu for the 2006-2007 season are shown in Figure 17. Reporting for the 2006-2007 season was low, coinciding with the mildness of the influenza season. Laboratories are already in the habit of reporting other tests routinely to ADHS and in recent years have been doing more and more flu testing; these factors make laboratories a reliable and effective source of influenza information. Lab-reporting has proven valuable for monitoring the timing of activity in the state and identifying counties where the virus circulated.

**Figure 17. Laboratory-confirmed influenza, Arizona, 2005-2007**



Nationally, influenza A(H1N1) predominated this season while influenza B circulated somewhat later. In Arizona, the influenza activity was comprised of a combination of influenza A (~75%) and influenza B cases (~25%). The majority of influenza A cases were subtyped to influenza A(H1). The peak in influenza B cases was identified later in the season than the peak in influenza A cases. Transmission of both influenza A and influenza B continued through mid May (Figure 18).

**Figure 18. Culture- or PCR-confirmed influenza, by type or subtype, Arizona, 2005-2006**



The three viral components contained in the 2006-2007 influenza vaccine were: A/New Caledonia/20/99-like (H1N1), A/Wisconsin/67/2005-like (H3N2), and B/Malaysia/2506/2004-like viruses. Nationally, A/New Caledonia (Influenza A H1) predominated during the season; some isolates showing weak reactions to A/New Caledonia antisera were identified as A/Solomon Islands/3/2006, a recent antigenic variant of A/New Caledonia/20/99. In Arizona H1 was also the predominate type of influenza virus circulating (Figure 18). The World Health Organization has recommended that the 2007-08 trivalent influenza vaccine for the Northern Hemisphere contain A/Solomon Islands/3/2006-like (H1N1), A/Wisconsin/67/2005-like (H3N2), and B/Malaysia/2506/2004-like viruses.

Two influenza-associated pediatric deaths were reported in Arizona in the 2006-2007 season. Both occurred in the early latter half of the season. One involved infection with influenza A and the other influenza B.

### C. Why submit isolates to the State Lab?

Infectious disease epidemiologists at the Arizona Department of Health Services are constantly monitoring data and analyzing disease trends to detect any deviation from the norm. This method of surveillance allows for the detection of unusual activity and ultimately launches investigations into the cause of such deviations. Lab surveillance specifically monitors infectious disease pathogens that are lab-reportable and pose a legitimate threat to public health. Under Arizona Administrative Code R9-6-204, reporting labs are mandated to submit a positive isolate for a list of specified pathogens that can be found at [www.azdhs.gov/phs/oids/downloads/labrptlist.pdf](http://www.azdhs.gov/phs/oids/downloads/labrptlist.pdf). Lab surveillance of these pathogens has proven invaluable in the public health context. This is especially true as it allows for the detection and monitoring of specific category A and B organisms that are designated by the CDC as easily disseminated and transmissible from person to person.

There are several reasons for requiring submission of isolates for certain organisms. Regular isolate submission allows for confirmation of clinical lab diagnoses for morbidities that have a large public health impact, sometimes with methods that can be more easily performed at a central reference lab (such as the state public health laboratory). Some organisms need to be forwarded to CDC for identification or confirmation of species or serogroups that may or may not matter from a clinical perspective but have a public health impact. Submission to the state lab also allows for further serotyping and speciation/serogrouping, as well as pulse field gel electrophoresis – “DNA fingerprinting”, of specific organisms that will aid in the detection of outbreaks and epidemiological investigations.

This analysis considers the isolate submission trends from hospital, clinical, and commercial diagnostic labs that are required to submit isolates to the Arizona State Lab on a regular basis. Data from the state lab database and the state infectious disease surveillance system were matched to ultimately calculate an isolate submission percentage for a given time period. The basic assumption of this analysis was that if a record was found in both databases then reporting was complete and comprehensive, and an isolate for that reportable pathogen had been received by the state lab. Isolate submission percentages were calculated for the time periods January through July 2006, and September 2006 through March 2007 for the following organisms: Shiga-toxin producing *E. coli*, invasive *Haemophilus influenzae*, *Legionella* spp., *Listeria* spp., invasive *Neisseria meningitidis*, *Bordetella pertussis*, invasive *Streptococcus pneumoniae*, *Salmonella* spp., *Shigella* spp., and *Yersinia* spp. To continue this surveillance and examine isolate submission trends over time, this analysis will be conducted in approximately three-month intervals.

Results of the analysis conducted in the period from January 2006 through March 2007 can be seen in Figure 19 and Figure 20. Preliminary analysis results for the time frame from January 2006 through July 2006 reveal that the isolate submission rate was greater than 70% for Shiga-toxin producing *E. coli*, *Haemophilus influenzae*, *Listeria* spp., *Neisseria meningitidis*, and *Salmonella* spp. In the subsequent time frame from September 2006 through March 2007, only *E. coli* and *N. meningitidis* had an isolate submission percentage of greater than 70%.

**Figure 19. Isolate Submission Results of Lab-Reportable Diseases, January 2006-July 2006<sup>1</sup>**

| Organism                                   | Isolates Submitted <sub>2</sub> | No Isolates Submitted | Total Culture-confirmed Cases <sub>3</sub> | Lab Isolates Submitted <sub>4</sub> (%) |
|--|---------------------------------|-----------------------|--|---|
| <i>E.coli</i> , Shiga-toxin producing      | 33                              | 10                    | 43   | 76.7                                    |
| <i>Haemophilus influenzae</i> , invasive   | 41                              | 15                    | 56   | 73.2                                    |
| <i>Legionella</i> spp.                     | 7                               | 4                     | 11   | 63.6                                    |
| <i>Listeria</i> spp.                       | 1                               | 0                     | 1  | 100.0                                   |
| <i>Neisseria meningitidis</i>              | 13                              | 4                     | 17   | 76.5                                    |
| <i>Bordetella pertussis</i>                | 15                              | 14                    | 29   | 51.7                                    |
| <i>Streptococcus pneumoniae</i> , invasive | 426                             | 222                   | 648  | 65.7                                    |
| <i>Salmonella</i> spp.                     | 330                             | 48                    | 378  | 87.3                                    |
| <i>Shigella</i> spp.                       | 147                             | 91                    | 238  | 61.8                                    |
| <i>Yersinia</i> spp.                       | 2                               | 5                     | 7  | 28.6                                    |

**Figure 20. Isolate Submission Results of Lab-Reportable Diseases, September 2006-March 2007<sup>1</sup>**

| Organism                                   | Isolates Submitted <sub>2</sub> | No Isolates Submitted | Total Culture-confirmed Cases <sub>3</sub> | Lab Isolates Submitted <sub>4</sub> (%) |
|--|---------------------------------|-----------------------|--|---|
| <i>E.coli</i> , Shiga-toxin producing      | 36                              | 14                    | 50   | 70.8                                    |
| <i>Haemophilus influenzae</i> , invasive   | 34                              | 33                    | 67   | 49.2                                    |
| <i>Legionella</i> spp.                     | 3                               | 5                     | 8  | 37.5                                    |
| <i>Listeria</i> spp.                       | 3                               | 3                     | 6  | 50.0                                    |
| <i>Neisseria meningitidis</i>              | 6                               | 1                     | 7  | 85.7                                    |
| <i>Bordetella pertussis</i>                | 3                               | 3                     | 6  | 50.0                                    |
| <i>Streptococcus pneumoniae</i> , invasive | 292                             | 415                   | 707  | 40.0                                    |
| <i>Salmonella</i> spp.                     | 400                             | 247                   | 647  | 59.8                                    |
| <i>Shigella</i> spp.                       | 244                             | 174                   | 418  | 58.2                                    |
| <i>Yersinia</i> spp.                       | 2                               | 4                     | 6  | 33.3                                    |

<sup>1</sup> Under A.A.C. R9-6-204, an isolate of the organism for each positive culture is to be submitted to the Arizona State Lab for the above listed organisms

<sup>2</sup> Data from LITS

<sup>3</sup> Data from MEDSIS

<sup>4</sup> Percent Lab Isolates Submitted= (isolates submitted/total cases) x 100, not accounting for duplicates

The limitations of this analysis are primarily the result of incomplete reconciliation of data from two distinctly different data sources: the state lab database and the state infectious disease surveillance database. Both datasets were matched on a unique identifier consisting of first name, last name, and date of birth. Incomplete matching resulted if at least one of the unique identifier variables was missing for a case in either database. In addition to data reconciliation challenges, fluctuations in submission percentages can be largely due to incorrect, or lack of, lab reporting. Anecdotal evidence suggests that many reporting labs are unfamiliar with lab reporting protocol for specific lab reportable pathogens and many labs are pressed with staffing or organizational issues that prevent them from submitting isolates to the state lab on a routine basis. Regardless, a discrepancy exists in the reporting of these pathogens to public health and subsequent submission of the isolate to the state public health lab. This discrepancy can be addressed through a method of outreach like educational presentations to reporting labs. Additional work is also being conducted to refine the methodology for this analysis. Lastly, although this analysis provides useful information on lab isolate submission trends for specific lab reportable pathogens, due to the limitations at hand, the numbers should be used as an estimate to gauge submission activity and identification of the challenge in lab reporting. The results of this analysis will be used as a valuable assessment tool for isolate submission trends and further facilitate outreach/communication of the importance of submitting isolates to reporting labs.

## D. Effects of Recommending the DTaP Minimum Interval Schedule

Arizona experienced a statewide pertussis outbreak from May through October in 2005. In response to this outbreak, state and local health officials recommended use of the infant minimum interval DTaP immunization schedule. The purpose of this recommendation was to help children receive their doses of DTaP at an earlier age and as quickly as possible. Concerns were raised at the time, however, that this recommendation might disrupt the administration of other vaccines normally given in conjunction with DTaP administered on the standard schedule.

A study was designed to examine selected vaccines administered during the first year of life and to evaluate whether or not use of the minimum interval DTaP schedule had an adverse effect on:

- Receiving 3 doses of DTaP,
- Child's mean age at the time of the third DTaP dose,
- Receiving 3 doses of IPV (inactive polio vaccine), and
- Receiving 3 doses of PCV (pneumococcal conjugate vaccine).

Data from the Arizona State Immunization Information System were used to identify the 48,380 Arizona children born between February 1 and September 30, 2005, who received their initial DTaP dose during the statewide outbreak. These children were split into two groups: the Minimum Interval group and the Standard group. The Minimum Interval group consisted of the 20,205 children who received at least 1 dose of DTaP on the minimum interval schedule. A minimum interval dose was defined as a valid first dose received before seven weeks of age or a second or third dose within 4 – 7 weeks after the prior dose. The Standard group consisted of the 28,175 children who received all doses of DTaP on the Recommended Childhood and Adolescent Immunization schedule.

Analyses of the dataset revealed that recommending use of the minimum interval DTaP schedule during a statewide pertussis outbreak did not have an adverse effect on the receipt of other childhood vaccines normally given at the same time. In fact, during their first year of life, children with any DTaP vaccinations on the minimum interval schedule were:

- 41% more likely to receive 3 doses of DTaP (and to do so at a younger age),
- 33% more likely to receive 3 doses of IPV, and
- 40% more likely to receive 3 doses of PCV,

compared to children on the standard interval DTaP schedule (Figure 21).

**Figure 21. Standard Group versus Minimum Interval Group Results**

|                          | Standard Group | Minimum Interval Group | Relative Risk | p-value |
|--------------------------|----------------|------------------------|---------------|---------|
| DTaP: mean age (dose #3) | 29.9 weeks     | 24.1 weeks             | n/a           | <0.001  |
| DTaP: 3 doses            | 58.8%          | 83.1%                  | 1.41          | <0.001  |
| IPV: 3 doses             | 48.9%          | 64.9%                  | 1.33          | <0.001  |
| PCV: 3 doses             | 57.0%          | 79.5%                  | 1.40          | <0.001  |

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