CHLAMYDIA PSITTACI INFECTION IN HUMANS (PSITTACOSIS) AND PET BIRDS (AVIAN CHLAMYDIOSIS)

I. DESCRIPTION AND EPIDEMIOLOGY

A. Overview

Avian chlamydiosis is an infection in birds by the gram-negative, coccoid, obligate intracellular bacterium *Chlamydia psittaci*. *C. psittaci* is found worldwide and has been documented in at least 460 avian species from 30 orders. The order Psittaciformes (parrot type birds) is the most commonly implicated source of human infection. Columbiformes (pigeons and doves) are also known to be commonly infected. Galliformes (landfowl, e.g., chickens), particularly turkeys, have been the source of human infections at slaughter facilities and farms. Human infection with *C. psittaci* is called “psittacosis”.

B. Psittacosis and Avian Chlamydiosis in California

Psittacosis is a reportable disease in California. The California Department of Public Health (CDPH) receives an average of 0-1 report of psittacosis per year. Psittacosis is likely an underreported disease, as symptoms may be non-specific, diagnostic testing is not readily available through standard commercial laboratories, and test results can be difficult to interpret.

Avian chlamydiosis in poultry and pet birds is reportable to the California Department of Food and Agriculture (CDFA); however, CDFA typically conducts follow-up and mitigation only for poultry. Reporting of avian chlamydiosis in pet birds to CDPH is voluntary. Since 2010, CDPH receives reports of an average of three cases of avian chlamydiosis in pet birds per year. Avian chlamydiosis in pet birds is likely underreported, as clinical signs are non-specific, birds shed the organism intermittently, few laboratories offer diagnostic tests, and it can be challenging to interpret test results.

C. Transmission

A 2021 meta-analysis estimated that approximately 20% of birds harbor *C. psittaci*; this figure was consistent across continents and bird orders (Sukon, et al, 2021). *C. psittaci* are shed principally in bird feces but can also be found in oral secretions, ocular and nasal discharges, and feather dust. Birds can shed the organism intermittently and over long periods of time; shedding is often exacerbated by stress, such as relocation, shipping, crowding, illness, or reproductive activities. The organism can survive in dried feces for months.

The organism is transmitted to other birds and people chiefly via inhalation of aerosolized infectious material. Exposure to infected birds, dried bird feces and feather dust, and culture isolates in laboratories are the primary sources of infection for humans. *C. psittaci* can potentially be transmitted by ingestion of food contaminated

with dried infectious urine, feces, or respiratory secretions. Equivocal evidence has been reported for rare person-to-person transmission of *C. psittaci*, which appears limited to familial and nosocomial close contacts of patients with severe illness. People at increased risk for psittacosis include those who keep and raise birds, pet store workers, veterinarians and veterinary technicians, poultry processing plant workers, veterinary pathologists, and microbiologists.

D. Psittacosis

i. Incubation Period

The incubation period is typically 5-14 days in people.

ii. Symptoms and Clinical Signs

Humans with psittacosis usually present with fever, chills, headache, myalgia, and a dry cough. Occasionally people develop severe pneumonia requiring intensive-care support and non-respiratory complications, such as endocarditis, hepatitis, and encephalitis. Infected persons can also be asymptomatic or show very mild signs of illness.

iii. Diagnosis

See Sections **II-A *Case Definitions*** and **III-D *Case Investigation, Surveillance, and Reporting***.

iv. Clinical Management

Tetracycline antibiotics are the drug of choice to treat *C. psittaci* infection in people. Health care providers should consult a formulary for drug doses and protocols and can consult with an infectious disease specialist.

E. Avian Chlamydiosis

i. Incubation Period

The incubation period ranges from three days to several weeks in birds. Some birds may have latent illness in which no clinical sign of the disease is evident until the bird is stressed, months or years after initial infection.

ii. Symptoms and Clinical Signs

Clinical signs of chlamydiosis in birds are non-specific and can include: lethargy, anorexia, weight loss, ruffled feathers, oculonasal discharge, conjunctivitis, diarrhea, excretion of yellow-green urates, ataxia, dehydration, and death. An unknown proportion of birds can carry the organism without apparent illness. Signs of illness can be variable and intermittent and are often precipitated by stress.

iii. Diagnosis

See Sections **II-B *Case Definitions*** and **III-D *Case Investigation, Surveillance, and Reporting***.

iv. Clinical Management

Birds with avian chlamydiosis should be isolated and treated under the supervision of a licensed veterinarian. For detailed recommendations for clinical management of infected birds, see the Compendium of Measures to Control *Chlamydia psittaci* Infection Among Humans (Psittacosis) and Pet Birds (Avian Chlamydiosis), 2017 from the National Association of State Public Health Veterinarians (NASPHV).

II. CASE DEFINITIONS

A. Psittacosis

Note: The surveillance case definitions for psittacosis were approved by the Council of State and Territorial Epidemiologists (CSTE) in 2010.

i. Clinical Definition

- Psittacosis is an illness characterized by fever, chills, headache, myalgia, and a dry cough with pneumonia often evident on chest x-ray. Severe pneumonia requiring intensive-care support, endocarditis, hepatitis, and neurologic complications occasionally occur.

ii. Laboratory Criteria for Diagnosis

- Supportive
  - Supportive serology (e.g., *C. psittaci* antibody titer [Immunoglobulin M {IgM}] of greater than or equal to 32 in at least one serum specimen obtained after onset of symptoms), **OR**
  - Detection of *C. psittaci* DNA in a respiratory specimen (e.g., sputum, pleural fluid, or tissue) via amplification of a specific target by polymerase chain reaction (PCR) assay.
- Confirmed
  - Isolation of *C. psittaci* from respiratory specimens (e.g., sputum, pleural fluid, or tissue), or blood, **OR**
  - Fourfold or greater increase in antibody (Immunoglobulin G [IgG]) against *C. psittaci* by complement fixation (CF) or micro-immunofluorescence (MIF) between paired acute- and convalescent-phase serum specimens obtained at least 2-4 weeks apart.

iii. Case Classification

- Probable
  - A compatible illness and supportive laboratory criteria
- Confirmed
  - A compatible illness and confirmatory laboratory criteria

B. Avian Chlamydiosis

Note: Avian chlamydiosis is not currently reportable in California nor nationally notifiable by public health regulations. Case definitions are for information and investigation purposes only. The following case definitions for avian chlamydiosis were developed by NASPHV and can be found in NASPHV's Compendium of Measures to Control *Chlamydia psittaci* Infection Among Humans (Psittacosis) and Pet Birds (Avian Chlamydiosis), 2017.

i. Clinical Definition

- An avian disease characterized by lethargy, anorexia, ruffled feathers, ocular and nasal discharge, conjunctivitis, diarrhea, excretion of yellow-green urates, emaciation, dehydration, and death.

ii. Laboratory Criteria for Diagnosis

- Supportive
  - A high serological titer or detection of *Chlamydia* sp. antigen (identified by ELISA, PCR, or fluorescent antibody) in feces, cloacal swab, or respiratory or ocular exudates, **OR**
  - Identification of *Chlamydia* sp. nucleic acid by PCR-based testing in conjunctival, choanal, or cloacal swabs; blood; or feces.
- Confirmed
  - Isolation of *C. psittaci* from a clinical specimen, or
  - Identification of *C. psittaci* nucleic acid, **OR**
  - A fourfold or greater increase in serologic titer in two blood specimens collected at least two weeks apart and assayed simultaneously in the same laboratory, **OR**
  - Identification of suggestive intracellular bacteria and *C. psittaci* DNA within the same diseased cells in smears or tissues.

iii. Case Classification

- Suspect
  - A compatible illness, not laboratory confirmed, but is epidemiologically linked to a confirmed case in a human or bird, **OR**
  - A compatible illness with supportive laboratory results.
- Confirmed
  - Any case with confirmatory laboratory test results.

III. CASE SURVEILLANCE, INVESTIGATION, AND REPORTING

A. Purpose of Reporting and Surveillance

Psittacosis is a §2500 reportable condition for which cases should be reported and investigated:

- To identify sources of transmission
- To prevent further transmission from those sources
- To educate people about how to reduce their risk of exposure

Psittacosis is also a §2505 reportable condition, which requires laboratories to report findings of *C. psittaci*.

Avian chlamydiosis is included in CDFA's List of Reportable Conditions for Animals and Animal Products (3 CCR §797). Avian chlamydiosis is not currently listed as a condition reportable to the local health authority (17 CCR §2500). However, voluntary reporting enables local and state public health officials to implement measures to reduce the risk that infected birds will become a source of infection to humans.

B. Local Health Jurisdiction General Investigation Guidelines (Appendix A)

i. Confirmed or probable psittacosis:

- LHD staff should ask the patient if he/she had known contact with birds or possible laboratory exposure to *C. psittaci* within one month prior to the onset of illness.
    - If the case-patient reports working in a laboratory near isolates of *C. psittaci* or performing bird necropsies, the LHD should contact the laboratory to determine the probability of exposure.
    - If the case-patient reports contact with bird(s):
        - LHD staff should assess the level of risk of infection posed by the type of contact with the bird(s). Staff can consult with an avian or public health veterinarian to determine the risk of zoonotic transmission.
        - LHD staff should provide recommendations for environmental hygiene and infection prevention measures to prevent future infections as described in Section ***IV Management and Control Measures***.
- Management of index (infected) person:
    - Human cases should be managed according to the clinical management guidelines described in Section ***I-D-iv Description and Epidemiology***.
- Management of bird contacts:
    - Any captive birds with which the patient had contact in the month prior to illness onset should be evaluated by a veterinarian. Birds that test positive for *C. psittaci* infection should be managed according to the below guidelines.

ii. Confirmed or suspect avian chlamydiosis:

- LHD staff should investigate cases of avian chlamydiosis in birds that were:
  - Procured from a pet store, breeder, or dealer within 60 days of onset of signs, or
  - Linked to a confirmed or probable human case of psittacosis, or
  - Associated with other confirmed or suspect avian cases from the same source.
- Trace back/forward:
  - Trace back: Identify locations where the index (infected) bird resided during the 60 days preceding illness onset. Begin by identifying the most recent location of the bird and determine the disposition of any birds that have had direct contact with, or have shared the same confined airspace with, the infected bird, then work backward to identify any additional contacts. Identify any persons who have had contact with the infected bird, such as breeders, sellers, or previous owners.
  - Trace forward: Determine the current location(s) for any persons or birds identified to have had direct contact with or have shared airspace with the index bird.
  - Notify the CDPH Veterinary Public Health Section (CDPH-VPHS) of any people, birds, or locations identified during the trace back or trace forward that are outside the local health jurisdiction of the index case (email VetPH@cdph.ca.gov, phone 916-552-9740). VPHS will coordinate with other local public health authorities to conduct necessary site visits in other jurisdictions.
- Management of infected bird(s):
  - Avian cases should be managed according to the clinical management guidelines described in Section **I-E-iv *Description and Epidemiology***.
  - Infected birds should be isolated in a room with an airspace separate from both exposed and non-infected/non-exposed birds. Infected birds can be housed together.
  - Birds are typically treated for 30-45 days, depending on the species.
  - Infected birds can be released from isolation after satisfactory completion of treatment, negative result on post-treatment PCR testing no sooner than two weeks after completion of treatment, and cleaning and disinfection of the room where the birds have been housed.
  - Provide bird owners/breeders with the “Cleaning and Disinfection for Avian Chlamydiosis” document (**Appendix B**). This fact sheet provides instructions to decontaminate isolation areas that have housed infected birds and quarantine areas for birds exposed to infected birds (contact birds). It also provides recommendations for personal protective equipment to wear when working with infected or contact birds or cleaning known or potentially infected areas.

- Management of contact birds:
  - Birds that have shared the same air space with the infected birds (i.e., contacts) are considered exposed to *C. psittaci* and should be quarantined. Contact birds can be housed together.
  - Contact birds should be evaluated by a veterinarian and screened for *C. psittaci* infection.
    - Treatment of birds that have not tested positive for chlamydiosis is discouraged as it may lead to development of antimicrobial resistance.
    - If the birds remain healthy after two weeks, the birds can be removed from quarantine.
    - If a contact bird develops clinical signs suggestive of avian chlamydiosis, it should be treated or euthanized. The contact bird to be treated can be housed with the infected bird(s).
  - The cages where the contact birds have been housed and any bowls, equipment, or other supplies used with the birds should be thoroughly cleaned and disinfected.
- Management of human contacts:
  - Anyone who develops symptoms of illness following exposure to bird(s) should seek care from their health care provider.

C. Local Health Jurisdiction Reporting

Cases of psittacosis must be reported to CDPH. Avian chlamydiosis is voluntarily reportable to CDPH-VPHS. CDPH-VPHS is available to provide guidance to LHDs and coordinate response activities that cross jurisdictional boundaries (email VetPH@cdph.ca.gov, phone 916-552-9740).

Avian chlamydiosis cases are reportable to CDFA, however only situations involving commercial poultry are routinely subject to follow-up and mitigation.

D. Viral and Rickettsial Diseases Laboratory (VRDL) and Other Laboratory Resources

CDPH-VRDL does not routinely test human or avian specimens for Chlamydiaceae.

Testing Human Specimens

Laboratories that test human specimens for Chlamydiaceae:

- Laboratory Corporation of America, Burlington, NC: (800) 222-7566; https://www.labcorp.com/
- Quest Diagnostics Nichols Institute, Valencia, CA: (800) 421-4449; https://www.questdiagnostics.com/
- Pneumonia Response and Surveillance Laboratory, Respiratory Diseases Branch, CDC, Atlanta, GA: (404) 639-4921; https://www.cdc.gov/laboratory/specimen-submission/list.html

Of note, previous studies have showed conflicting results regarding a causal link between psittacosis and ocular adnexal lymphoma and response to antibiotic treatment.

- LHDs may receive questions from clinicians regarding testing.
- Testing of human tissues for this purpose is available through CDC and may be coordinated via CDPH Infectious Diseases Branch Subject Matter Experts at 510-620-3434.

Testing Avian Specimens

Laboratories that test avian specimens for Chlamydiaceae include:

- Diagnostic Center for Population and Animal Health, Michigan State University, East Lansing, MI: (517) 353-1683; https://cvm.msu.edu/vdl
- Comparative Pathology Laboratory, University of Miami, Miami, FL: (800) 596-7390; https://med.miami.edu/departments/pathology
- Infectious Diseases Laboratory, University of Georgia College of Veterinary Medicine, Athens, GA: (706) 542-8092; https://vet.uga.edu/diagnostic-service-labs/infectious-diseases-lab/
- Texas A&M Veterinary Medical Diagnostic Laboratory, College Station, TX: (979) 845-3414; https://tvmdl.tamu.edu/
- Diagnostic Virology Lab, National Veterinary Services Laboratories (NVSL), VS, APHIS, USDA, Ames IA: (515) 337-7551, https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/ct_laboratory_information_services
    - Note: Samples must be sent through the California Animal Health and Food Safety Laboratory (CAHFS). https://cahfs.vetmed.ucdavis.edu/

IV. MANAGEMENT AND CONTROL MEASURES

Psittacosis

A. Management of Human Cases

See Sections **I-D-iv *Description and Epidemiology*** and **III-B-i *Case Surveillance, Investigation, and Reporting***. Patients should be advised of the risk of transmission of *C. psittaci* from birds.

B. Management of Avian Contacts (Possible Sources of Infection)

See Section **III-B-i *Case Surveillance, Investigation, and Reporting***, as well as Section **I-E-iv *Description and Epidemiology*** if the bird is diagnosed with chlamydiosis.

Avian Chlamydiosis

A. Management of Avian Cases

See Sections **I-E-iv *Description and Epidemiology*** and **III-B-ii *Case Surveillance, Investigation, and Reporting***.

B. Management of Avian Contacts

See Section **III-B-ii *Case Surveillance, Investigation, and Reporting***, as well as Section **I-E-iv *Description and Epidemiology*** if the bird is diagnosed with chlamydiosis.

C. Management of Human Contacts

See Section **III-B-ii *Case Surveillance, Investigation, and Reporting***.

D. Infection Control Measures

- Refer to the CDPH document "Cleaning and Disinfection for Avian Chlamydiosis" (**Appendix B**) for details on decontamination of areas that have housed infected or exposed birds. This information can be provided to bird owners to implement in coordination with their veterinarian. The Disinfection document lists appropriate personal protective equipment (PPE) that should be worn by owners, a list of effective disinfectants, and instructions for cleaning and disinfection of areas during and after the isolation or quarantine period.
- Necropsies of potentially infected birds should be performed in a biological safety cabinet and the carcass should first be moistened with a detergent and water to reduce aerosol potential.

E. Special Considerations

C. psittaci is classified by the U.S. Centers for Disease Control and Prevention (CDC) as a Category B bioterrorism agent. The organism could be intentionally disseminated via aerosolization. CDPH should be immediately notified should bioterrorism be suspected.

V. APPLICABLE STATE STATUTES

California Code of Regulations, Title 17, §2500, §2502, §2603 (Public Health)

- §2500: Health care providers are required to report a case or suspected case of psittacosis to the Local Health Officer within one working day.
- §2502: The Local Health Officer is required to report a case of psittacosis to CDPH within seven days.

- §2505: Laboratories must report findings of *C. psittaci* to the Local Health Officer of the local health jurisdiction where the patient resides.
- §2603: CDPH or Local Health Officers can quarantine a pet bird or birds that are infected with a zoonotic disease or are suspected to be a source of human disease.

California Code of Regulations, Title 3, §797 (Food and Agriculture)

- Any licensed veterinarian, any person operating a diagnostic laboratory, or any person who has been informed, recognizes or should recognize by virtue of education, experience, or occupation, a case of chlamydiosis in any avian species should report it to the California Department of Food and Agriculture within two working days.

VI. ADDITIONAL RESOURCES

- CDPH Psittacosis webpage: https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Psittacosis.aspx
- U.S. Centers for Disease Control and Prevention Psittacosis webpage: https://www.cdc.gov/pneumonia/atypical/psittacosis/index.html
- Iowa State University Center for Food Safety & Public Health, Psittacosis/Avian Chlamydiosis, 2017: https://www.cfsph.iastate.edu/Factsheets/pdfs/psittacosis.pdf
- National Association of State Public Health Veterinarians, Psittacosis and Chlamydiosis Compendium and Resources: http://nasphv.org/documentsCompendiaPsittacosis.html
- Ontario Ministry of Health and Long-Term Care, Management of Avian Chlamydiosis in Birds Guideline, 2019: https://www.rcdhu.com/wp-content/uploads/2019/04/Mgmt-of-Avian-Chlamydiosis-Guideline_2019.pdf
- Sukon P, Nam NH, Kittipreeya P, Sara-In A, Wawilai P, Inchuai R, Weerakhun S. Global prevalence of chlamydial infections in birds: A systematic review and meta-analysis. Prev Vet Med. 2021 Jul;192:105370. doi: 10.1016/j.prevetmed.2021.105370. Epub 2021 May 5. PMID: 33984601.

Appendix A: Local Health Department Response to Case of Psittacosis or Avian Chlamydiosis

LHD receives report of confirmed or probable *C. psittaci* infection in a **person** (psittacosis)

LHD provides recommendations for management of patient.

No known contact with bird(s)

Known contact with bird(s)

Bird owner consults with veterinarian to determine the bird's infection status.

LHD receives report of confirmed or suspect *C. psittaci* infection in a **bird** (avian chlamydiosis). Investigate if the bird was:

- Procured from a pet store, breeder, or dealer within 60 days of onset of signs, or
- Linked to a confirmed or probable human case of psittacosis, or
- Associated with other confirmed or suspect avian cases from the same source.

Follow up on infected bird:

- LHD advises owner to consult with veterinarian on treatment and management.
- LHD provides recommendations for environmental hygiene and infection prevention.

Report case to CDPH-VPHS.

Identify bird contacts: LHD conducts trace-back and trace-forward to identify any bird(s) that had contact with infected bird.[1]

Assess bird contacts: LHD works with veterinarian to assess risk and determine follow-up plan for contact bird(s).

Manage bird contacts: LHD provides recommendations for management of bird contacts, environmental hygiene, and infection prevention.

Identify human contacts: LHD conducts trace-back and trace-forward to identify any people who had contact with infected bird(s).[1]

Assess human contacts: LHD determines exposure risk of human contact(s).

Manage human contacts: LHD refers person(s) to health care provider.

[1] *"Contact" is defined as sharing air space.*

Appendix B

Cleaning and Disinfection for Avian Chlamydiosis

This document provides instructions for owners and breeders of birds to decontaminate isolation areas that have housed birds with chlamydiosis (infected with *Chlamydia psittaci*) and quarantine areas for birds exposed to infected birds (contact birds).

- When working with infected or contact birds or cleaning known or potentially infected areas, personal protective equipment (PPE) should include all of the following:
  - Disposable Tyvek coveralls or freshly laundered coveralls,
  - Shoe coverings or rubber boots that can be disinfected,
  - Latex or nitrile gloves,
  - Eye protection,
  - Disposable surgical cap, and
  - Fit tested respirator with an N95 rating or higher.
- Effective disinfectants for *C. psittaci* include:
  - Quaternary ammonium compounds (chemicals typically ending with "ammonium chloride" or "ammonium saccharinate"),
  - 1% Lysol®, and
  - 1:32 dilution of household bleach.
- For infected birds and contact birds:
  - Remove feces from cages daily by first moistening the waste material, then double bagging and disposing of it.
  - Clean and disinfect daily feed and water containers. Soiled containers should be cleaned and disinfected before reuse.
  - Mop floors frequently with a disinfectant.
  - Avoid the use of vacuum cleaners or pressure washers.
  - Ensure that ventilation systems are clean and well maintained.
  - Do not eat or drink in the isolation/quarantine area.
  - Maintain all cleaning and disinfection materials and PPE attire within the isolation/quarantine area. Wastes should be double-bagged and the bag exterior disinfected prior to removal from the quarantine/isolation area.
  - Limit access to the isolation/quarantine area to the minimum persons necessary to tend to the feeding and care of the birds.
- Clean and disinfect the rooms and cages that have housed the birds after they are released from isolation or quarantine.
- Rooms and cages that have housed infected birds should be cleaned and disinfected after they are released from isolation and one week prior to completion of isolation to prevent reinfection from a contaminated environment.
  - This includes the room and cage where treated birds have been housed during isolation, as well as temporary holding cages used while areas have been cleaned and disinfected.