

# Management of Avian Chlamydiosis in Birds Guideline, 2018

Population and Public Health Division,  
Ministry of Health and Long-Term Care

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# TABLE OF CONTENTS

<b>1</b>	<b>Preamble</b> .....	<b>3</b>
<b>2</b>	<b>Purpose</b> .....	<b>3</b>
<b>3</b>	<b>Reference to the Standards</b> .....	<b>3</b>
<b>4</b>	<b>Reporting of Bird Cases to Boards of Health</b> .....	<b>4</b>
4.1	Reporting to the Ministry .....	4
<b>5</b>	<b>Response to Avian Chlamydiosis Cases</b> .....	<b>4</b>
5.1	Avian Case Follow-up .....	5
5.2	Management of Infected Birds .....	7
5.3	Determining the Extent of <i>C. psittaci</i> Infection Within Premises.....	10
<b>6</b>	<b>Management of Human Exposures</b> .....	<b>10</b>
6.1	Infection prevention and control for Caretakers of Birds .....	11
6.2	Reporting of Human Cases .....	11
<b>7</b>	<b>Management of Avian Contacts</b> .....	<b>11</b>
7.1	Management of Exposed Birds .....	12
<b>8</b>	<b>Cleaning and Disinfection</b> .....	<b>12</b>
<b>9</b>	<b>Other Agencies and Response Considerations</b> .....	<b>14</b>
	<b>References</b> .....	<b>14</b>
	<b>Appendix A: Background Information on <i>C. psittaci</i> Infections</b> .....	<b>16</b>
	<b>Appendix B: Avian Chlamydiosis In Birds</b> .....	<b>17</b>
	<b>Appendix C: Diagnostic Testing Modalities for Avian Chlamydiosis in Birds</b> .....	<b>19</b>
	<b>Appendix D: Psittacosis/Ornithosis in Humans</b> .....	<b>23</b>
	<b>Appendix E: Diagnostic Testing Modalities for Psittacosis/Ornithosis in Humans</b> .....	<b>25</b>

# 1 Preamble

The Ontario Public Health Standards: Requirements for Programs, Services, and Accountability (Standards) are published by the Minister of Health and Long-Term Care under the authority of section 7 of the *Health Protection and Promotion Act* (HPPA) to specify the mandatory health programs and services provided by boards of health.<sup>1,2</sup> The Standards identify the minimum expectations for public health programs and services. Boards of health are accountable for implementing the Standards including the protocols and guidelines that are referenced in the Standards. Guidelines are program and topic-specific documents which provide direction on how boards of health shall approach specific requirement(s) identified within the Standards.

# 2 Purpose

This guideline document was created to assist staff at boards of health with the management of suspected cases of avian chlamydiosis in captive birds or poultry flocks (due to infection with the causative agent of psittacosis). The document is a condensed version of the National Association of State Public Health Veterinarians' *Compendium of Measures to Control Chlamydia psittaci Infection Among Humans (Psittacosis) and Pet Birds (Avian Chlamydiosis)*, 2017, with some amendments made by the Ministry of Health and Long-Term Care (the ministry) in order to adapt the information to an Ontario-specific context.<sup>3</sup>

# 3 Reference to the Standards

## Infectious and Communicable Disease Prevention and Control

**Requirement 15.** The board of health shall receive and respond to all reported animal cases of avian chlamydiosis (infection of birds with the causative agent of psittacosis in humans), avian influenza, novel influenza and *Echinococcus multilocularis* infection, in accordance with the *Health Protection and Promotion Act*, the *Management of Avian Chlamydiosis in Birds Guideline, 2018* (or as current), the *Management of Avian Influenza or Novel Influenza in Birds or Animals Guideline, 2018* (or as current); and the *Management of Echinococcus Multilocularis Infections in Animals Guideline, 2018* (or as current).

**Requirement 21.** The board of health shall ensure 24/7 availability to receive reports of and respond to:

- a) Infectious diseases of public health importance in accordance with the *Health Protection and Promotion Act*; the *Mandatory Blood Testing Act, 2006*; the *Infectious Diseases Protocol, 2018* (or as current); and the *Institutional/ Facility Outbreak Management Protocol, 2018* (or as current);
- b) Potential rabies exposures in accordance with the *Health Protection and Promotion Act*; the *Management of Potential Rabies Exposures Guideline, 2018*

(or as current); and the *Rabies Prevention and Control Protocol, 2018* (or as current); and

- c) Animal cases of avian chlamydiosis, avian influenza, novel influenza, or *Echinococcus multilocularis* infection, in accordance with the *Health Protection and Promotion Act*, the *Management of Avian Chlamydiosis in Birds Guideline, 2018* (or as current); the *Management of Avian Influenza or Novel Influenza in Birds or Animals Guideline, 2018* (or as current); and the *Management of Echinococcus Multilocularis Infections in Animals Guideline, 2018* (or as current).

## 4 Reporting of Bird Cases to Boards of Health

In accordance with section 4 of the Communicable Diseases Regulation (Reg. 557), the director of a laboratory or veterinarian who knows or suspects that a bird or birds are infected with *Chlamydia psittaci*, the agent of psittacosis-ornithosis in humans, shall notify the Medical Officer of Health.<sup>4</sup>

On an annual basis, the board of health shall provide veterinarians within its jurisdiction with information on how cases of avian chlamydiosis are to be reported to the Medical Officer of Health.

### 4.1 Reporting to the Ministry

The board of health shall:

- Report all cases of avian chlamydiosis in birds to the ministry as soon as possible after receiving the report;
- Consult with the ministry with respect to managing all animal health aspects of the response, and
- Report to the ministry all actions taken in response to the case(s) of avian chlamydiosis.

## 5 Response to Avian Chlamydiosis Cases

The identification of a confirmed or suspect case of avian chlamydiosis in a bird or birds shall trigger an investigation by the PHU in order to evaluate potential disease transmission to both avian contacts of and human exposures to the infected bird(s). The results of the investigation assist in determining actions to be taken to prevent the spread of *C. psittaci* to humans.

See Appendices A and B for background information on *C. psittaci* infections and avian chlamydiosis in birds, including transmission, incubation period and clinical signs in birds.

## 5.1 Avian Case Follow-up

Cases of avian chlamydiosis can occur in a wide range of settings in Ontario, ranging from private households with only one bird, to large private aviaries, to breeding operations or commercial aviaries selling pet birds, to bird sanctuaries, to commercial poultry flocks. Required response actions will depend largely on the nature of the setting in which the case(s) of avian chlamydiosis has occurred.

The board of health shall interview the owner and/or caretaker(s) of the infected bird(s) as soon as possible and collect the following information:

- Number, species and individual descriptions (colour, age, sex, as well as band numbers or microchip numbers where applicable, etc.) of all infected birds;
- Date of onset and nature of clinical signs in all infected birds;
- Current health status of infected birds;
- Any veterinary treatment protocols already in place;
- Any previous *C. psittaci* testing results for the birds, if available;
- Length of time the owner has had the bird(s) in their possession;
- Source the bird(s) was/were obtained from;
- Location of all facilities where the bird(s) was/were housed for the 60 day period preceding the onset of clinical signs;
- Whether any new birds entered the household, aviary, facility or flock in the 60 day period prior to the onset of clinical signs, which may have been a source of infection for the infected bird(s);
- Any protocols in place related to quarantine of new birds prior to addition to the flock;
- Number, species and individual descriptions of other birds housed with the infected bird(s) within the 60 day period prior to the onset of clinical signs;
- Health status of all potentially exposed birds at the facility;
- Any relevant ventilation-related factors;
- Contact information for the attending veterinarian for the infected bird(s), or the veterinarian associated with the establishment; and
- Names and contact information for any human exposures to the birds during the 60-day period prior to the onset of clinical signs in the infected bird(s), including all caretakers, feeders and persons entering the room(s) or facility where birds are housed.

The Medical Officer of Health shall require the owner, at the owner's expense, to isolate or isolate and treat all infected and exposed birds on premises where *C. psittaci* infection has been identified. The purpose of doing so is to prevent further pathogen transmission to both birds and humans.

### 5.1.1 Response to Case(s) of Avian Chlamydiosis in Poultry Flock Settings

The diagnosis of avian chlamydiosis in poultry flocks (such as chickens, turkeys, ducks and geese) has been relatively rare in Ontario.

Under the federal *Health of Animals Act*, avian chlamydiosis is an immediately notifiable disease, requiring laboratory reporting of suspect or confirmed cases by veterinary diagnostic laboratories to the Canadian Food Inspection Agency (CFIA). The CFIA can undertake control measures for immediately notifiable diseases when notified of their presence in Canada.

Under trade regulations, a flock of origin must be certified as being free from avian chlamydiosis in order to meet import requirements of trading partners. As a result, diagnosis of avian chlamydiosis in a flock may result in depopulation of the entire poultry flock, particularly if the flock is destined for export out of Canada.

In cases where the owner of a flock opts for treatment rather than depopulation, in most circumstances where large numbers of birds are involved, it is not possible for the Medical Officer of Health to decide which individual birds are carrying the organism, and the entire flock may require treatment.

Where medication is elected, the flock must be clinically assessed by a veterinarian two weeks after a full course of treatment. If they appear well, the flock may be released for slaughter, adhering to antibiotic withdrawal times as specified by a licensed veterinarian.

If the flock is remaining in Ontario, the Medical Officer of Health may permit slaughter of an infected flock where slaughterhouse conditions are suitable and proper protection of personnel is available. The Health and Safety Committee at the receiving plant must agree to proceed with the slaughter. It should be noted that apparently healthy turkeys have caused disease among poultry plant workers in the United States.

### 5.1.2 Response to Case(s) of Avian Chlamydiosis in Private and Commercial Aviary Settings

The board of health shall require any breeding or commercial aviary operations (including pet stores) with infected birds to produce purchase and sales records for follow-up of other birds that had contact with the infected bird(s) or the environment where infected birds have been housed over the 60-day period prior to the onset of clinical signs.

Records for the 60-day period to be produced by the owner of the breeding operation, commercial aviary or pet store should include:

- The species and individual bird identification of all birds acquired;
- The date of purchase;
- The source of the acquired bird(s), including names and contact information for any breeders/sellers the birds were purchased or received from;

- Name, address and phone numbers for any intermediary handlers of the birds (e.g. hand-feeders for juvenile birds);
- Any identified illnesses or deaths among birds; and
- The name, address, and telephone number of all individuals who have purchased or otherwise obtained birds from the breeding operation, aviary or pet store, along with individual identifying information for the birds they purchased or obtained (e.g. band or microchip number).

The sale of pet and exotic birds is not a regulated industry in Ontario, and boards of health may encounter situations where bird breeding operations or commercial aviaries are operating out of private residences and/or function on the basis of internet purchases and sales through internet sites such as Kijiji or Craigslist. These circumstances are likely to render tracing the purchase and sale of birds difficult, and the board of health's ability to conduct a full investigation may be limited.

## 5.2 Management of Infected Birds

In accordance with the Communicable Diseases – General regulation (Reg. 557), a Medical Officer of Health who knows or suspects that a bird or birds are infected with *C. psittaci*, shall require the owner of the bird(s), at the owner's expense, to isolate or isolate and treat the bird(s).<sup>4</sup>

### 5.2.1 Treatment of Birds for Avian Chlamydiosis

The Medical Officer of Health shall require that treatment of birds with confirmed or probable avian chlamydiosis shall be supervised by a licensed veterinarian, after consultation with an experienced avian veterinarian. Subsequent to the diagnosis of infection in the bird or birds, and upon isolation of the bird(s), the owner or person in charge should enlist licensed veterinary services for any treatment and testing that may be required.

If a clinical evaluation of the bird(s) by a licensed veterinarian indicates that treatment would be worthwhile and the owner expresses a willingness to cooperate in the day-to-day administration of the antibiotic, the veterinary practitioner should establish an appropriate regimen of treatment.

Treatment of avian chlamydiosis can be challenging. Although treatment protocols are usually successful, knowledge is evolving and no single protocol ensures safe treatment or complete elimination of infection in every bird.

The location for treatment should be discussed with the attending veterinarian and is frequently conducted on an outpatient basis. Birds should be treated in a separate quarantine area, which may or may not be on the same premises, to prevent exposure to the public and other birds. If the birds are to be transported to an off-site location for treatment, a dedicated vehicle specifically designed for the transportation of birds should be used, and appropriate cleaning and disinfection protocols should be implemented for the vehicle.



Doxycycline is presently the drug of choice to treat birds with avian chlamydiosis, although the effective treatment period for avian chlamydiosis has not been scientifically established. Ultimate clearance of the organism likely depends on the host immune system as well as the effectiveness of antimicrobial treatment. Historically, a treatment period of 45 days has been recommended, except in budgerigars (budgies or parakeets), where 30 days of treatment can be effective. Recent studies have shown that shorter treatment periods of 21-30 days may also be effective. However, if shorter treatment periods are used, the birds should be retested using a PCR-based method 2-4 weeks after treatment.

Sick birds may consume inadequate amounts of medicated food or water, so they should initially be treated with medication delivered directly by mouth or parenterally.

Limited studies and clinical experience indicate that the treatment methods described for use in psittacine birds may be effective in other avian species. However, variability in drug metabolism and adverse drug effects make it impossible to make uniform recommendations for treatment. An avian veterinarian experienced in the care of the specific target bird species should be consulted to obtain treatment recommendations. As with psittacine birds, post-treatment testing is recommended.

The Medical Officer of Health shall consult with the ministry as well as the attending veterinarian to determine the appropriate treatment protocol for the infected bird(s) and require the owner to continue medication of the birds for the full treatment period to avoid incomplete resolution of the infection.

Birds may have reduced chlamydial shedding within days of treatment initiation. As a result, in commercial aviary settings, and where deemed appropriate, the Medical Officer of Health may consider allowing the owner to sell the birds after at least 7 days of treatment, provided that the new owner agrees in writing to continue the quarantine and treatment of the bird(s) and is informed of the potential human health risk to themselves, and risks to any other birds in their care.

Following a full treatment period, birds should be clinically monitored for a period of two weeks for clinical signs of relapse. Monitoring may be performed by the owner or the caretaker, or a veterinarian, as deemed appropriate. If they appear well, the detention order may be lifted after consultation with the ministry and any attending veterinarians. Post-treatment testing of the birds using a PCR-based method should be conducted no sooner than 2 weeks after treatment is concluded.

### 5.2.2 Isolation and Care of Infected Birds

In issuing a quarantine order, the Medical Officer of Health shall ensure that the conditions of the quarantine reduce the risk of further transmission of the infection.

For birds under a quarantine order, the place of isolation should be selected so as to minimize the risk of airborne infection to other birds or humans, either through ventilation systems or through positive air pressure. Depending on the size and set-up of a private



or commercial aviary, it may be appropriate to isolate and quarantine the entire aviary, or specific sections or rooms of the aviary.

The board of health shall ensure that caretakers are provided with simple, concise written treatment and bird care procedures to ensure treatment success and with information about preventing further disease transmission, including the following:

- Birds that are to be treated should be isolated in clean and uncrowded cages, and should be housed in a separate air space from other birds and non-caretakers;
- Cages should be positioned so as to prevent the transfer of fecal matter and other materials from one cage to another;
- Substrate/litter that will not produce dust (e.g. newspapers) should be used;
- Circulation of feathers and dust in the isolation area should be minimized by wet-mopping the floor frequently with disinfectants and preventing air currents and drafts within the area;
- Contamination from dust should be reduced by spraying the floor with a disinfectant or water before sweeping it;
- Use of vacuum cleaners or pressure washers may aerosolize infectious particles and are not recommended;
- Waste material should be removed from cages frequently (after misting the material with water);
- Birds should be protected from all undue stress (e.g. chilling, unnecessary relocation), poor husbandry, and malnutrition;
- Birds should be observed daily and weighed every 3-7 days. If the birds are not maintaining weight, they should be re-evaluated by the attending veterinarian;
- All calcium and mineral supplements such as oyster shell, mineral blocks, and cuttlebone should be removed from cages for the duration of the treatment period. High dietary concentrations of calcium and other minerals inhibit the absorption of tetracyclines. In hand-fed neonate birds, where dietary calcium is required, the calcium and tetracycline should be given at least 4-6 hours apart;
- Good husbandry practices should be followed to prevent opportunistic infections, including:
  - All spilled food in the aviary should be cleaned up promptly;
  - All cages should be cleaned daily. When a cage is being cleaned and disinfected, occupant birds should be transferred to another clean cage; and
  - All food and water containers should be cleaned daily. Soiled bowls should be emptied, cleaned with soap and water, rinsed, placed in a disinfectant solution and rinsed again before use.
- Birds should receive appropriate vitamins daily;
- Exhaust ventilation should be sufficient to prevent the accumulation of aerosols; and
- All waste should be burned or double-bagged for disposal.

Treated birds can be reinfected. Therefore, the Medical Officer of Health shall require a thorough cleaning and disinfection of contaminated aviaries several days before

treatment ends, in addition to the cleaning and disinfection to occur following completion of the treatment period.

### 5.2.3 Avian Case Management – Euthanasia

In accordance with the Communicable Diseases – General regulation (Reg. 557), in cases where the isolation and treatment of the bird(s) are not, or are unlikely to be effective in preventing the spread of infection, or the person having care or custody of the bird(s) has failed to isolate or treat the bird(s), a Medical Officer of Health shall require the owner, at the owner's expense, to humanely euthanize the bird(s) and disinfect the premises.

## 5.3 Determining the Extent of *C. psittaci* Infection Within Premises

In accordance with Reg. 557 (Communicable Diseases – General), the Medical Officer of Health shall require the owner, at the owner's expense, to have laboratory examinations performed on specimens of the bird(s) until the Medical Officer of Health is of the opinion that the bird(s) is/are free of the infective agent.<sup>4</sup> In cases where an infected bird has been housed with and has likely exposed other birds, testing should also be required for exposed birds.

In settings with large numbers of birds, a number of diagnostic testing strategies may be employed to determine the extent of the infection within the bird population, including batch testing of birds to minimize costs. If required, appropriate testing strategies should be determined on the basis of consultations with the ministry and any attending veterinarians.

As boards of health may receive a variety of laboratory test results for birds, please see the Appendix to this guideline document for an overview of diagnostic testing modalities for avian chlamydiosis in birds, and individual test characteristics.

The board of health shall also consult with the ministry with respect to environmental assessments of premises where infected birds have been housed, for infection prevention and control and disease transmission risks. The ministry may also assist with facilitating and coordinating on-site veterinary support for the board of health's investigation from the Ministry of Agriculture, Food and Rural Affairs with respect to site assessments, where appropriate.

## 6 Management of Human Exposures

The board of health shall inform all persons in contact with birds or bird-contaminated materials in the 60 day period prior to onset of clinical signs in the infected bird(s) about the associated potential health risks of this contact. In most cases, by the time infection is recognized in a group of birds, a critical period for pathogen accumulation and possible dissemination to humans and other birds has already occurred.

The board of health shall direct bird caretakers with respiratory or influenza-like symptoms to seek prompt medical attention and inform their healthcare providers about contact with infected birds. Seeking healthcare early in the course of illness may improve clinical outcomes.

### 6.1 Infection Prevention and Control for Caretakers of Birds

The number of people charged with the care of the bird or birds under a quarantine order should be limited to as few as possible.

The board of health shall inform these individuals about the nature of the disease and advise them to observe the following precautions throughout the quarantine period for the bird(s):

- When handling infected or exposed birds, caretakers should wear protective clothing such as a smock or coveralls, gloves, eyewear, designated footwear or shoe covers, and a disposable surgical cap;
- Disposable NIOSH-approved N95 masks should be worn when cleaning cages. Masks should be fit tested by a certified mask fitter, according to the manufacturer's recommendations. In addition, masks should be fit checked each time the mask is put on. To check test the mask, the wearer takes a quick, forceful inspiration to determine if the mask seals tightly to the face. For instructions on how to best use the N95 mask or equivalent, refer to the handout provided by the manufacturer, or follow your provincial regulations.<sup>1</sup> Surgical masks might not be effective in preventing transmission of *C. psittaci*; and
- Disposable surgical gloves should be used, especially when handling litter and when collecting fecal samples. Cage cleaning and feeding methods should minimize air circulation of feathers, dust and litter. Where possible, protective clothing should be worn and appropriately cleaned following use.

### 6.2 Reporting of Human Cases

Psittacosis in humans is designated as both a disease of public health significance and a communicable disease under Ontario Regulation 135/18.<sup>5</sup> Any identified human cases meeting the provincial case definition provided in the Appendices to the *Infectious Diseases Protocol, 2018* (or as current) shall be reported to the ministry by the board of health.

See also Appendix D for background information on psittacosis/ornithosis in humans.

## 7 Management of Avian Contacts

The investigation of the case(s) of avian chlamydiosis shall, to the extent possible, aim to identify all other birds that have been in contact with the infected bird(s) during a period of 60 days preceding the onset of clinical signs in the infected bird(s).

An epidemiologic investigation shall be initiated if a bird with confirmed or probable avian chlamydiosis was either:

- Procured from a pet store, breeder, or dealer within 60 days of the onset of signs of illness;
- Linked to a person with clinically compatible illness, or
- Associated with several other suspect avian cases from the same source.

Investigations involving recently purchased birds should include a visit to the site where the infected bird is located and identification of the location where the bird was originally procured (e.g. pet shop, dealer, breeder, etc.).

### 7.1 Management of Exposed Birds

Exposed birds not showing signs of illness should be subject to a separate quarantine order and isolated.

Routine prophylactic antibiotic treatment is highly discouraged as it may cause adverse effects and could generate resistant strains of *C. psittaci* and other bacteria. Although antibiotic-resistant *C. psittaci* has not yet been reported in birds, *Chlamydia suis*, a bacteria that belongs to the same genus as *C. psittaci*, has been documented in swine, and the potential development of resistant strains of *C. psittaci* is a concern.

Birds placed in isolation because of previous association with infected birds should be evaluated clinically by a veterinarian and screened for *C. psittaci* infection, as they may be asymptomatic carriers. If they appear well and remain so for a period of two weeks, and diagnostic screening is negative, the detention order may be lifted, after consultation with the ministry and the attending veterinarian. If one or more of the exposed birds develops clinical signs indicative of avian chlamydiosis, antibiotic treatment or euthanasia are the next precautionary alternatives.

Although there is no epidemiologic evidence of increased disease risk to young, elderly, pregnant or immunocompromised humans, the Medical Officer of Health shall consider requiring more rigorous testing for birds in contact with these individuals.

## 8 Cleaning and Disinfection

The Medical Officer of Health shall require the thorough cleaning and disinfection of the facility or premises where confirmed and suspect cases of avian chlamydiosis have been housed, as follows:

- If birds are undergoing treatment for avian chlamydiosis, cleaning and disinfection should occur twice:
  - The first cleaning and disinfection shall occur several days prior to the end of the treatment period, and
  - A second thorough cleaning and disinfection following completion of treatment;

## Management of Avian Chlamydiosis in Birds Guideline, 2018

- If birds are to be euthanised and no treatment will be administered, cleaning and disinfection of the facility or premises should occur once the birds have been euthanised and removed, prior to bringing in any new birds.

The Medical Officer of Health shall require the owner(s) of the bird(s) to comply with the following requirements related to cleaning and disinfection of the premises or facility where the bird(s) were housed and/or isolated:

- If cages to be disinfected currently house birds, the birds must be transferred to a clean cage during the cleaning and disinfection process;
- Soiled cages must be thoroughly scrubbed with a detergent to remove all fecal debris, then rinsed and disinfected, ensuring that the disinfectant has appropriate contact time with the surface being disinfected. Most disinfectants require 5–10 minutes of contact time. Cages must then be rinsed again to remove the disinfectant prior to moving birds back into the cages;
- All items that cannot be adequately disinfected (eg, wooden perches, ropes, nest material, substrate/litter) must be discarded;
- All waste must be burned or double-bagged for disposal;
- All surfaces must be thoroughly cleaned of organic debris before disinfection. *C. psittaci* is susceptible to many disinfectants and detergents as well as heat; however, it is resistant to acid and alkali. Examples of effective disinfectants which may be used include 1:1000 dilution of quaternary ammonium compounds (eg, Roccal, Zephiran, Pet Focus), 1% Lysol, and freshly prepared 1:32 dilution of household bleach (one-half cup/gallon) or other oxidizing agents (eg, accelerated hydrogen peroxide-based disinfectant); and
- Many disinfectants are respiratory irritants for both humans and birds and should be used in a well-ventilated area. Disinfectants should not be mixed with any other product.

The board of health shall ensure that disinfection is complete by having a health inspector inspect the premises or facility.

The Medical Officer of Health shall also order PCR-based environmental testing for *C. psittaci* following the completion of the final cleaning and disinfection of the facility or premises in order to evaluate the effectiveness of the cleaning and disinfection.

The organism is environmentally labile, but the elementary body of *C. psittaci* can remain infectious for over a month if protected by organic debris (e.g. litter and feces). It is reported to survive in bird feed for up to two months, on glass for 15 days, and in straw for 20 days. While persistence is longer at low temperatures, one study found that *C. psittaci* remained viable for at least 72 hours at temperatures between 4°C and 56°C in a crude suspension from infected eggs.

## 9 Other Agencies and Response Considerations

Depending on the setting in which cases of avian chlamydiosis in birds are identified, a number of other government agencies may be involved in the response from an animal health and welfare perspective, or may be able to provide additional support to the board of health.

As avian chlamydiosis is an immediately notifiable disease under the federal Health of Animals Act, the CFIA may be involved in responding to reports of avian chlamydiosis in commercial poultry flocks, where appropriate and warranted by the circumstances.

In private or commercial aviary settings, the Ontario Ministry of Agriculture, Food and Rural Affairs may be able to assist with site visits to assess environmental conditions related to how birds are being kept, and likelihood of disease transmission in settings with larger numbers of birds.

In aviary settings such as breeding operations, or commercial aviaries being run out of private residences, where there may be additional concerns about overcrowding of birds or other animal welfare concerns, the Ontario Society for the Prevention of Cruelty to Animals and/or municipal Animal Services agencies, where available, may be able to provide assistance or support, depending on availability.

In all cases where large numbers of birds are being kept in private residences, and particularly where this is being done for commercial purposes, municipal authorities should be advised of the situation, as this may be violating zoning by-laws and posing a risk to the community.

## References

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## Management of Avian Chlamydiosis in Birds Guideline, 2018

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## Appendix A: Background Information on *C. psittaci* Infections

Bacterial infections caused by *Chlamydia psittaci* (formerly known as *Chlamydophila psittaci*), a member of the genus *Chlamydia*, can cause severe pneumonia and other serious health problems in humans. In birds, *C. psittaci* infection is referred to as avian chlamydiosis.

Members of the genus *Chlamydia* are coccoid, obligate intracellular bacteria. They have a unique life cycle, alternating between two different forms called the elementary body and the reticulate body. The elementary body, which is smaller and relatively inert, is infectious, while the reticulate body, which is found only inside cells, is non-infectious. Chlamydiae can sometimes persist for long periods in unknown locations in the body.

At least 16 genotypes of *C. psittaci* have been recognized in birds or mammals. Some *C. psittaci* genotypes tend to be associated with certain avian hosts, but this is not absolute, and infections in other species (e.g. horses, cattle, dogs) are increasingly recognized. Humans can be infected with any genotype, but some (e.g. genotype A) seem to be associated with a higher incidence of serious illnesses than others.

*C. psittaci* can be found worldwide. There is no vaccine against avian chlamydiosis, and complete eradication appears impractical given the large number of potential hosts.

## Appendix B: Avian Chlamydiosis In Birds

### 1. Avian Chlamydiosis in Birds

Chlamydial organisms have been isolated from more than 460 bird species, but are most commonly identified in psittacine (parrot-type) birds, especially cockatiels and budgerigars (also called parakeets or budgies). Among non-psittacine birds, avian chlamydiosis occurs most frequently in poultry, pigeons and doves. It can also occur in species such as canaries and finches, but is less frequently diagnosed. Outbreaks have also been documented in many other species, such as ratites (e.g. ostriches), peacocks and game birds.

### 2. Transmission to Birds

*C. psittaci* may be excreted in the ocular and nasal discharges and/or feces of infected birds; shedding routes vary by species. The length of time a bird sheds the organism can also vary, depending on the strain and the host.

Birds can acquire *C. psittaci* when they inhale infectious dust or airborne particles (including feathers) or ingest infectious material (including carcasses). Large quantities of the organism are excreted in feces, and can become aerosolized when the fecal materials dries. Some birds carry *C. psittaci* asymptotically, and can shed it intermittently for long periods. Shedding can be precipitated or exacerbated by concurrent illness/infections, or stressors such as nutritional deficiencies, handling, overcrowding, egg laying, rearing of young birds, relocation, shipping, injury and temperature extremes.

Vertical transmission has been reported in various avian species, but appears to be infrequent. *C. psittaci* also occurs on the surface of eggs in infected flocks, and eggshell penetration of organisms was demonstrated under experimental conditions. However, most infected eggs will not hatch. More often, young birds may be infected in the nest via regurgitated food from the parents, by exposure to environmental contamination, or from ectoparasites such as biting flies, mites and lice. Nestlings that survive can become carriers.

*C. psittaci* can also be transmitted to birds via fomites, including contaminated feed or water.

### 3. Incubation Period in Birds

The usual incubation period of *C. psittaci* infection in birds ranges from 3 days to several weeks in pet birds and poultry. However, asymptomatic carriers can become ill at any time; in some cases, this occurs years after the birds were initially infected.

## 4. Clinical Signs of Avian Chlamydiosis in Birds

Some infected birds can appear entirely healthy or have subtle clinical signs while shedding the organism. Others become mildly to severely ill, either immediately or after they have been stressed.

Active disease can appear with no identifiable exposure or risk factor.

Infected psittacine birds often remain asymptomatic until they are stressed. Severity of illness can range from subtle upper respiratory disease or mild conjunctivitis to death and depends on the virulence of the bacterial strain and the immune status of the host bird. This organism generally causes systemic illness, but localized syndromes (e.g. conjunctivitis) are also reported. When clinical signs of avian chlamydiosis are apparent, they are nonspecific, may be subtle and can include any or all of the following: lethargy, anorexia, low body weight, ruffled feathers, conjunctivitis, serous or mucopurulent ocular or nasal discharge or other clinical signs consistent with upper respiratory disease (e.g. sneezing, increased respiratory signs, dyspnea), and signs of liver disease such as hepatomegaly. Severely affected birds can become emaciated and dehydrated. Swollen sinuses, diarrhea, and polyuria with excretion of green to yellow-green urates, may also be seen. Neurological signs have been described in some species of psittacine birds, especially in subacute to chronic cases. Reproductive loss and neonatal death may occur in breeding birds. Conjunctivitis can be a component of systemic chlamydiosis, but it can also occur without generalized signs of disease.

Clinical signs in other species of birds are generally similar to those in psittacine birds. Conjunctivitis, blepharitis and rhinitis are reported to be common signs in pigeons, and some birds may be transiently ataxic. Turkeys can become mildly to severely ill, with clinical signs that may include conjunctivitis, nonspecific signs of illness, respiratory signs and diarrhea. Mortality is high in some outbreaks among turkeys, but negligible in others. Egg production is decreased. Ducks can develop clinical signs, including trembling or gait abnormalities; however, some infected flocks have few or no signs of disease. Clinical cases are rarely reported in chickens.

Morbidity and mortality rates for avian chlamydiosis vary with the host species, health of the bird(s), and virulence of the *C. psittaci* strain. Concurrent infections, immunosuppression or stressors can increase the severity of disease. In psittacine birds that become ill, the mortality rate can reach 50% or more. Age can also be a factor; young birds tend to be more susceptible. In flocks where *C. psittaci* circulates, birds often become infected after they lose their protection from maternal antibodies. Whether a bird has acute or chronic signs of illness depends on the species of bird, virulence of the strain, infectious dose, stress factors, age, and extent of treatment or prophylaxis.

# Appendix C: Diagnostic Testing Modalities for Avian Chlamydiosis in Birds

## Diagnostic Testing of Birds for Avian Chlamydiosis

Bacteria are classified as *C. psittaci* based on shared biochemical characteristics and genome composition, but are undergoing continual evolution. Diversity in the organism, the level of exposure, and the host response may cause spurious test results in individual birds.

As a result, diagnosis of avian chlamydiosis can be difficult, especially in the absence of clinical signs, and a single testing method might not be adequate. Therefore, in Ontario, the use of a combination of antibody-detection, and antigen-detection methods is recommended, particularly when only one bird is tested. Bacterial culture for *C. psittaci*, which does not have the same limitations as the other diagnostic testing methodologies, is not available in Ontario as *C. psittaci* is classified as a Risk Group 3 pathogen.

Consultation with the ministry and an experienced avian veterinarian may help when interpreting results. Because proper sample collection techniques and handling are critical to obtaining accurate test results, clinical laboratories should be contacted for specifics on specimen submission.

Veterinarians in Ontario may submit avian specimens for avian chlamydiosis testing to a number of laboratories both within Ontario (e.g. the Animal Health Laboratory at the University of Guelph, as well as commercial laboratories such as IDEXX and Antech), and laboratories located in other provinces or in the United States. Different laboratories may have different testing modalities available.

### 1. Diagnostic Pathology (Post-mortem)

In birds with avian chlamydiosis, cloudy air sacs and enlargement of the liver and spleen may be observed, but no specific gross lesion is pathognomonic. Chromatic (acid-fast) or immunologic (immunohistochemistry) staining of tissue or impression smears can be used to identify organisms in necropsy and biopsy specimens.

When sending birds for post-mortem testing, whole carcasses should be submitted to the Animal Health Laboratory for full evaluation. Full post mortem evaluation allows collection of tissue impression smears and selection of multiple tissues for further testing. Post-mortem testing available for *C. psittaci* at the Animal Health Laboratory includes gross post mortem evaluation, histopathology, modified acid fast (MAF) staining of tissue impression smears (liver, spleen), and immunohistochemistry (IHC) on histologic

sections. IHC must be combined with other test results as the sensitivity and specificity of this test are unknown.

### **Diagnostic pathology facilities are available at the:**

Animal Health Laboratory  
Laboratory Service Division  
University of Guelph  
419 Gordon Street – Bldg 89  
Guelph ON N1G 2W1  
Tel: (519) 824-4120 Ext. 54530

Animal Health Laboratory  
Laboratory Services Division  
Univ of Guelph/Kemptville Campus  
79 Shearer Street  
Kemptville, Ontario K0G 1J0

AHL enquiry email: [ahinfo@uoguelph.ca](mailto:ahinfo@uoguelph.ca)

Carcasses, when submitted by a veterinary practitioner or Medical Officer of Health, should be prepared by dipping in a soapy or detergent germicide and bagging it in well-sealed plastic. It is recommended that the bird be triple-bagged. Delivery should be made as soon as possible (within 24 hours) and the specimen should not be frozen, but simply refrigerated and transported on ice – preferably gel freezer-packs. The bird should be shipped in either a corrugated cardboard box, or a styrofoam cooler, packed with newspaper. Standard laboratory fees will be charged.

Any specimens submitted for testing must have a submitting veterinarian on the requisition form. In cases where specimens are being submitted by the health unit directly, rather than through an attending veterinarian, the ministry's Public Health Veterinarian can assist with submission of the requisition form.

## **2. Tests for *C. psittaci* antibodies**

A positive serologic test result is evidence that the bird was infected by Chlamydiaceae at some point, but it might not indicate that the bird has an active infection. False-negative results can occur in birds that have acute infection when specimens are collected before seroconversion. Treatment with an antimicrobial agent can diminish the antibody response. However, IgG titers may persist following successful treatment.

When specimens are obtained from a single bird, serologic testing is most useful when signs of disease and the history of the flock or aviary are considered and serologic results are compared with white blood cell counts and serum liver enzymes. A fourfold or greater increase in the titer of paired samples or a combination of a titer and antigen identification is needed to confirm a diagnosis of avian chlamydiosis.

## 2.1 Elementary-body agglutination (EBA)

The elementary body is the infectious form of *C. psittaci*. Elementary-body agglutination is commercially available and detects IgM antibodies, an indication of early infection. Titers greater than 10 in budgerigars, cockatiels, and lovebirds and titers greater than 20 in larger birds are frequently detected in cases of recent infection. However, increased titers can persist after treatment is completed.

## 2.2 Indirect Fluorescent Antibody Test (IFA)

Polyclonal secondary antibody is used to detect host antibodies (primarily IgG). Sensitivity and specificity varies with the immunoreactivity of the polyclonal antibody to various avian species. Low titers may occur because of non-specific reactivity.

## 2.3 Complement fixation (CF)

Direct CF is more sensitive than agglutination methods. False-negative results are possible in specimens from parakeets, young African gray parrots, and lovebirds. High titers can persist after treatment and complicate interpretation of subsequent tests. Modified direct CF is more sensitive than direct CF.

# 3. Tests for *C. psittaci* antigen

Tests for antigen detect the organism. These tests give rapid results and do not require live, viable organisms; however, false-positive results from cross-reacting antigens can occur. False-negative results can occur if there is insufficient antigen or if shedding is intermittent. As with all nonculture tests, results must be evaluated in conjunction with clinical findings.

## 3.1 Enzyme-Linked Immunosorbent Assay (ELISA)

ELISA tests were originally developed for identification of *Chlamydia trachomatis* in humans. The exact sensitivity and specificity of these tests for identifying other Chlamydiaceae are not known. They are now occasionally used to identify suspected *C. psittaci* in birds. If a bird has a positive ELISA result but is healthy, the veterinarian should attempt to verify that the bird is shedding antigen via isolation of the organism. When a clinically ill bird has a negative ELISA result, a diagnosis of avian chlamydiosis cannot be excluded without further testing (e.g., culture, serologic testing, or polymerase chain reaction [PCR] assay).

## 3.2 Fluorescent Antibody Test (FA)

Monoclonal or polyclonal antibodies, fluorescein staining techniques and fluorescent microscopy are used to identify the organism in impression smears or other specimens. These tests have similar advantages and disadvantages to ELISA. This test is utilized by some state diagnostic laboratories in the United States.

## 4. Tests for DNA

Numerous laboratories offer DNA detection testing using polymerase chain reaction assay (PCR). PCR amplification can be sensitive and specific for detection of target DNA sequences in collected specimens (e.g., combined conjunctival, choanal and cloacal swab specimens, and blood). Results differ between laboratories because there are no standardized PCR primers, and laboratory techniques and sample handling may vary. Because of the sensitivity of the assay, samples for PCR must be collected using techniques to avoid contamination from the environment or other birds. PCR does not differentiate between viable and nonviable microorganisms. Test results must be interpreted in light of clinical presentation and other laboratory tests.



## Appendix D: Psittacosis/Ornithosis in Humans

### 1. Transmission to Humans

While many types of birds can be infected by *C. psittaci*, in general, the literature suggests that human cases most often occur after exposure to infected parrot-type birds kept as pets, especially cockatiels, parakeets, and conures. Infected birds shed the bacteria through feces and nasal discharges, and humans become infected from exposure to these materials. Human infection with *C. psittaci* usually occurs when a person inhales organisms that have been aerosolized from dried feces or respiratory tract secretions (which can end up in feather dust) of infected birds. Other means of exposure include mouth-to-beak contact and handling of infected birds' plumage (feathers) and tissues.

Although other types of exposure resulting in illness have been reported, contact with birds appears to be the primary risk factor for illness in humans. Persons at greatest risk include those exposed to birds via recreational or occupational exposure, such as pet bird owners and breeders, pet shop employees, zoo employees, poultry workers, veterinarians, diagnostic laboratory workers, and wildlife workers. In addition to transmission through direct contact with birds, particularly if the birds were ill or recently acquired, human infection can also result from indirect environmental exposure. Among poultry workers, psittacosis due to occupational exposure has been associated with turkeys in the United States and other countries, as well as chickens and ducks in Europe. Transmission has also been documented from free-ranging birds, including doves, pigeons, birds of prey, and shorebirds.

There is no documented transmission of *C. psittaci* via ventilation systems from pet bird aviaries or pet stores to humans.

Person-to-person transmission of psittacosis is possible, but thought to be rare.

### 2. Incubation Period in Humans

Onset of illness in humans typically follows an incubation period of 5-14 days, but longer periods have been reported based on the results of serologic testing.

### 3. Clinical Signs of Psittacosis/Ornithosis in Humans

The severity of illness in humans ranges from a mild, non-specific illness to a systemic illness with severe pneumonia and, rarely, death. Mortality has been extremely rare since the advent of antibiotics. Clinical cases in pregnant women may be especially severe, and can result in the death of the fetus.

Recent studies suggest that infections with *C. psittaci* may be underdiagnosed in some populations, such as poultry workers. Humans with symptomatic infections typically have an abrupt onset of fever, chills, headache, malaise, and myalgia. A non-productive cough is usually present and can be accompanied by breathing difficulty or chest tightness.

Infection with *C. psittaci* has been reported to affect organ systems other than the respiratory tract, including endocarditis, myocarditis, hepatitis, arthritis, keratoconjunctivitis, and encephalitis.

# Appendix E: Diagnostic Testing Modalities for Psittacosis/Ornithosis in Humans

## Diagnostic Testing of Humans for Psittacosis/Ornithosis

Specimens for human diagnostic testing for *C. psittaci* can be submitted to the Public Health Ontario Laboratory (PHOL), which will forward the specimens to the National Microbiology Laboratory (NML) in Winnipeg for testing. Specimens may only be submitted for patients who are symptomatic AND are either immunocompromised or have had contact with an infected or exotic bird. All fields of the PHOL General Test Requisition Form must be completed, including all patient history. Samples submitted without adequate patient history to justify testing are subject to rejection. Therefore, requisitions must describe patient contact with infected birds and patient symptoms consistent with the disease. Specimens submitted for *C. psittaci* testing are shipped to the NML every Wednesday, and turnaround time may be up to 28 days.

### 1. Serology

Whole clotted blood or serum from symptomatic suspect human cases can be submitted to the PHOL. Paired sera, acute and convalescent, are preferred. For further information on submitting human specimens for serological testing, please refer to the PHOL Laboratory Services Test Directory web page for *Chlamydophila psittaci* - Serology.

### 2. Polymerase Chain Reaction (PCR)

Nasopharyngeal swabs or bronchoalveolar lavages from symptomatic suspect human cases are the preferred specimens to be submitted to the PHOL for PCR testing. Sputum and cerebrospinal fluid are accepted, but are not optimal specimens. For further information on submitting human specimens for PCR testing, please refer to the PHOL Laboratory Services Test Directory web page for *Chlamydophila psittaci* – Polymerase Chain Reaction (PCR).

