

Pet birds and risks of respiratory disease in Australia: a review

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Early in the new millennium, avian influenza (influenza A [H5N1]; 'bird flu') spread in poultry and waterfowl, initially in Asia, and then later to other parts of the world.¹ The virus crossed the species barrier to cause human fatalities, leading to widespread concern about a possible flu pandemic, as well as heightening awareness of the health risks associated with pet bird ownership.² There is, in fact, limited risk of avian influenza from pet birds because they have little or no contact with the principal reservoirs (poultry or waterfowl), but the concern raised by such epizootic events serves as an opportunity to reinforce robust diagnostic procedures and public health practice. Psittacosis, allergic alveolitis and asthma are the main respiratory diseases that can result from contact with pet birds in Australia, and are readily avoided by appropriate handling practices. The present review summarises information about these three (overlapping) diseases and makes recommendations for reducing the associated disease burden.

Numerous studies on the respiratory health hazards posed to people exposed to birds via their occupation (veterinarians, poultry farmers) have been conducted,³⁻⁸ but there is a scarcity of research on the relationship between respiratory health and those recreationally exposed to birds i.e. bird owners. Birds carry at least 22 zoonotic organisms, of which at least seven affect the human respiratory system. In Australia, the main threats to respiratory health from pet bird contact are psittacosis (*Chlamydophila psittaci*) and allergic alveolitis (AA). Other hypersensitivity disorders (such as asthma) are sometimes associated with bird-keeping in the literature,⁹ although the role played by avian contact in the aetiology of these diseases remains poorly characterised.¹⁰⁻¹² Pet bird ownership is common (estimated at 15% of the Australian population),¹³ and the opportunity for improved diagnostic procedures and public health interventions is therefore significant. The purpose of this article is to inform medical practitioners

Abstract

Objective: Exposure to birds has long been associated with disease in humans. Three respiratory diseases (psittacosis, allergic alveolitis and asthma) were reviewed in association with pet bird ownership with the aim to clarify the spectrum of avian-related respiratory illnesses.

Approach: Nineteen studies were selected for review based on recreational bird exposure in relation to psittacosis, allergic alveolitis and asthma.

Conclusion: Literature reveals little consensus on the relationship between pet bird ownership and respiratory illness. Implications: Future studies should aim to clarify the spectrum of avian-related illnesses, and to direct the dissemination of public health information to clinicians and members of the public who keep birds as pets.

Key words: Psittacosis, allergic alveolitis, asthma, recreational bird ownership.

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and bird owners that, although Australian birds do not presently transmit avian influenza, there are important respiratory health risks posed by keeping pet birds.

Method

Literature in the review was identified using a comprehensive Medline search (1990–2006) for articles that reported on avian-related illnesses, and articles that reported their results on atopic and asthmatic disorders by association with pet birds (key words: allergic alveolitis, asthma, atopy, avian illness, avian sickness, avian zoonoses, birds, bird fancier's disease, bird fancier's lung, bird illness, bird sickness, Chronic Obstructive Pulmonary Disease, extrinsic allergic alveolitis, hay fever, hypersensitivity pneumonitis, pets, respiratory illness, respiratory symptoms, zoonoses, zoonotic illness).

For articles to be included in the review, several selection criteria were used. It was a requirement that studies were to be focused on recreational exposure to birds, thus studies outside this area, such as in occupational settings, were excluded. Articles referring to avian influenza were excluded because this disease is considered exotic to Australia. To optimise the external validity of the selected studies, only those conducted in developed nations were included. Studies conducted on the asthma-pet exposure must have included birds and analysed results separately by pet ownership status i.e. not just by pets alone but with birds as a separate analysis category. Articles must also have dealt with the relationship between birds and humans, rather than simply be a clinical summary of the symptoms resulting from exposure.

Despite the long list of avian zoonoses, a search of the literature revealed psittacosis as the main threat to human respiratory health in Australia via birds. Of relevance to this study were the pathogens actually being transmitted to humans and causing respiratory illness in Australia. The literature identified psittacosis and allergic alveolitis (AA) as the main avian-associated respiratory illnesses, although Aspergillosis and *Cryptococcus neoformans* were also noted. Confirmation of psittacosis and AA as the major avian-related threats to human respiratory health in Australia was provided by John Jardine, a specialist veterinary pathologist in Perth, Western Australia. It was therefore decided to focus on psittacosis and AA in the literature as the main threats to human respiratory health from recreational avian interaction.

In addition to studies regarding psittacosis and AA, several studies were reviewed that looked at the more general association of birds and asthma. In total, 82 studies were identified, of which 19 studies met the selection criteria, 12 under the heading of avian illness and seven for the asthma-pet studies.

Results

The spectrum of diseases from avian contact in Australia:

i. Psittacosis (infection with *Chlamydophila psittaci*)

Chlamydophila psittaci is a bacterial infection which causes

Figure 1: Carnaby's cockatoo with signs of psittacosis.



Note: crusted eye and dullness evidenced by handler able to put finger in bird's mouth. (Photo: Dr Chris Hawkins, Department of Agriculture and Food, Western Australia [personal communication]).

psittacosis, an infection widely distributed among birds.¹⁴ The bacteria has a reservoir in native birds, particularly psittacines, and is transmissible to caged birds and humans.¹⁵ In birds, psittacosis manifests as anorexia, apathy, ocular and nasal discharge, diarrhoea and conjunctivitis (see Figure 1).¹⁶ *Chlamydophila psittaci* can be present in high concentrations in the droppings of infected birds and dust contaminated by infected droppings.¹⁷ Intestinal infections in birds commonly produce a carrier state and intermittent shedding, although the organisms may also be shed during periods of apparent good health.^{14,16} Avian psittacosis typically has a prevalence among domesticated birds of around 5%, although this may increase to 100% under conditions such as crowding and transport, which may increase the spread of the organism to other birds and humans.¹⁸ Infection in a bird colony must be treated promptly to prevent further avian infection and transmission to humans.³

Psittacosis is spread from birds by contaminated exudates, secretions and dried faecal matter or via direct contact with aerosols, usually of dried faeces or wing dust.^{3,19} Organisms can remain viable in the environment for long periods of time and human infection can occur when a person inhales aerosolised faeces and secretions infected with the bacterium.^{16,17} Infection may also occur as a result of bird bites, kissing birds or mouth to beak resuscitation.¹⁹ Person-to-person transmission of the illness occurs rarely.^{16,19}

The incubation period for human illness after contact with infected birds is from four to fourteen days.¹⁶ The presentation of psittacosis in humans ranges from asymptomatic infections to systemic illness with severe pneumonia and is potentially fatal.^{17,20} Symptoms include respiratory illness, conjunctivitis, severe headache and myalgia.³ Untreated psittacosis has a case-fatality rate of 15–20%.¹⁷

It is postulated that psittacosis is a relatively common cause of community acquired pneumonia in adults, but that the illness can often go unnoticed.¹⁹ Infection is likely to occur more often than

clinical case numbers reflect for the following reasons: a) persons infected with *C. psittaci* may only be mildly symptomatic and not seek medical attention; b) physicians may not elicit a history of bird exposure when evaluating patients because the diagnosis may not be suspected; or c) patients may not recall transient contacts with birds.¹⁸ Because of the non-specific and varying clinical presentation of psittacosis in humans, accurate epidemiological information is crucial for identifying patients who potentially have psittacosis.¹⁶ A careful history should be taken to elicit reports of any bird exposure, particularly to new or ill birds, and diagnosis should be confirmed with serologic testing.¹⁶ Minimising exposure to birds and observing hygienic practices when handling birds are important to limit the development of the disease.¹⁹

Notification rates of psittacosis are relatively low. In 2006, the number of notifications of psittacosis around Australia was 165, a rate of 0.5 cases per 100,000 population.²¹ In 2007 notification numbers decreased to 93 cases.²¹ There is a large variation in the notifications across states and territories in Australia.²² The majority of cases are reported in New South Wales and Victoria, a trend consistent over the many years of data collection.²² In 2006, 93% of cases were from NSW and Victoria and 91% of cases in 2007.²²

There has been no published study explaining this disparity across states. It is plausible that the environmental conditions (hot and dry) of WA are less conducive to the survival and spread of the organism than in other parts of Australia. There are no specific data on differential carriage rates of wild birds in WA, but the epidemiology of the disease in wild birds may impact the epidemiology of the disease in humans. Carriage rates in commercial birds may also be a significant issue. Psittacosis is rarely, if ever diagnosed in commercial poultry in WA, but has been diagnosed in a number of laying and meat bird flocks in NSW in the past few years. Infection was clinically apparent and confirmed by Fluorescent. Ab test (FAT). In addition, a number of broiler flocks were diagnosed by FAT with no clinical signs. Psittacosis may also be associated with the turkey industry. Turkeys are highly susceptible to psittacosis and are good carriers. NSW has the largest turkey industry in Australia but there is no commercial turkey industry in WA.

ii. Allergic Alveolitis

Allergic alveolitis (AA) (also termed extrinsic allergic alveolitis, hypersensitivity pneumonitis or bird fancier's lung) is an immunologically mediated lung disease caused by the inhalation of a variety of organic particulate antigens ~ 4-5 microns (μm) or less in diameter.²³⁻²⁵ Although AA is not classed as a zoonosis (because no infectious agent is being transmitted from bird to human), it is recognised as one of the major threats to human respiratory health from avian species.¹⁴ Inhalation of bird dander – which comprises bird droppings, feather bloom and skin scales – contains allergenic proteins that may stimulate an immune response^{9,23-25} and trigger inflammation of the terminal bronchioles and alveoli in susceptible individuals.⁹ Symptoms typically commence after close contact with birds such as when cleaning the cage.⁹

Avian AA can be caused by a variety of bird species, although it is particularly associated with the Psittaciforme bird family (parrots), most likely due to the structure and components of their plumage.²⁶ For example, the plumage of pigeons consists of around 5,800 feathers, all of which are coated with a very fine dust resembling talcum powder.²⁷ The majority of this powder is produced by special feathers called pulviplumes (powder down).²⁷ Powder down is clustered in specific anatomical areas known as powder down patches, whereas powder from other feathers is distributed more evenly around the body.²⁷ The secreted particles are approximately 1 μm in diameter and are granular, rod-shaped or splinter-shaped, and therefore easily inhaled and deposited in the airways. Pigeons and parrots have the largest number of pulviplumes, whereas chickens, singing birds, ducks and geese have far fewer. These differences in plumage constituents between species may explain why bird fancier's asthma and AA are predominantly reported from contact with parrots or pigeons.²⁷

Symptoms of AA include cough, fever, dyspnoea, lassitude, wheezing and rales in the lungs, which can occur as early as 4-6 hours after exposure, although the disease may have a latent period of several years.^{9,25} The disease is associated with restricted ventricular function, reduced lung compliance and very occasionally can lead to death.^{9,25} Similarities in symptom presentation with other diseases (such as asthma) may lead to misdiagnosis and hence further disease progression of AA. The prevalence of symptomatic AA is up to 16% among bird owners.⁹

Early diagnosis and intervention is essential to avoid progression of the disease.²³ Prevention of long-term exposure to the antigens is necessary – such as by limiting exposure times – to halt the progression of the disease to chronic status.²³ Fatal cases of the disease are unusual provided that diagnosis is timely, the causative allergen/environment is identified and appropriate treatment is initiated (including avoidance measures and corticosteroids).²⁴ Conversely, those that continue to be exposed to the antigen experience chronic symptoms and a decline in pulmonary function.²⁴ Although minimisation of contact with the allergen is the primary non-medicinal treatment for AA, complete avoidance may be difficult.²⁴ Bird antigens can persist in a home for up to 18 months after bird removal.²⁴ The environmental distribution of dander is related to its aerodynamic properties and passive transfer of the allergen.²⁴ Recently, it has been recognised that even a low degree of environmental exposure to bird antigens can stimulate an immune response and result in hypersensitive reactions.⁹

iii. Asthma from avian contact

The potential relationships between asthma and avian contact are defined in the next section.

Disease risks among domestic and recreational bird owners: a review of recent literature

The following review assesses the recent published evidence of disease arising in domestic and recreational bird owners. In Australia, ownership in the general community is a very common form of exposure given the widespread enthusiasm for birds as pets, including a wide range of both imported and native species.

Six outbreaks of psittacosis that occurred between 1990 and 2002 were reviewed. Three of the outbreaks were case studies; the others used a case-control design. The outbreaks occurred in the US and Australia. Both males and females were affected and ages ranged from five to 79 years. For all studies cases were identified and confirmed through the use of clinical pathology and serology such as antibody titre levels and symptom scores determined from blood samples and interviews respectively. Two of the six studies used active case searching.^{20,28}

Factors identified as increasing the risk of developing psittacosis were gardening and lawn-mowing, presumably stemming from inhalation of infectious particles disturbed by such activities;²⁰ living in a rural environment, particularly near bushlands harbouring native bird populations;^{17,20} being of an older age; and being male.²⁰ It was suggested that the latter associations could arise because men are traditionally more likely to undertake some outdoor activities such as lawn-mowing. Because cases identified in the outbreaks were those people who presented late for medical attention and with more severe systemic illness, the high rate of male cases also relate to delayed presentation patterns in men.²⁰ However, these risk factors conflict with the findings of Moroney et al. who found no significant differences between cases and controls in regards to age, sex or the existence of underlying medical conditions.²⁹

Six articles on allergic alveolitis (AA) were suitable for inclusion in this review. All six reports were case studies, conducted between the years of 1998 and 2005. Three studies were undertaken in the US; the others in Scotland, Japan and Malta. Ages of cases ranged from nine to 54 years. Ten cases were identified through hospital admissions^{23,24,30,31} and medical clinics.^{25,26} Cases were determined by reviewing symptoms typical of AA and by taking a detailed history. The most prevalent symptoms were cough and progressive dyspnoea, both occurring in 60% of cases.^{23-26,31} Two cases were fatal.^{23,24}

Fifty per cent of cases were originally misdiagnosed with illnesses ranging from asthma to tuberculous meningitis with psychosis.^{24,25} The latency period between exposure and disease was up to several years²⁶ and often patients did not remember or consider it important to mention exposure to birds.³¹ Exposure to feather dander and other avian allergens need not originate from a live bird: one study reported a patient whose bird had died two years prior to illness, but had kept a wreath woven from bird feathers in the living room.^{25,31} Exposure to sources such as feather pillows or feathers used in artificial fishing lures have also been linked to the development of AA.³⁰

Both adults and children as young as three years of age developed AA.³⁰ However, AA overall was uncommon in childhood and often confused with more common respiratory conditions such as asthma.²⁵ Boys experienced higher exposure levels, perhaps because they may be more involved in hobbies such as bird keeping, breeding and racing.²⁵ Identified risk factors for AA include the frequency of exposure to the antigen, duration of exposure and smoking status.^{25,26,32} The interaction between the host and antigen appears to be influenced by both genetic and environmental factors.²⁶

The most common diagnostic methods for identifying AA were spirometry tests, serum analysis for precipitating antibodies to bird sera, chest X-rays and history taking. Although a comprehensive patient history was performed in 100% of cases, it should be noted that this was usually undertaken only when other diagnostic tools had failed to identify the illness and when treatments for illnesses such as asthma and pneumonia had failed to curb the progress of the disease.^{25,26,30}

In relation to the asthma development or exacerbations, research that specifically explores avian contact is scarce. Some evidence of an association is suggested by studies examining pet ownership more generally as a risk factor of allergy and asthma. However, of 39 studies which assessed the impact of pet ownership overall on asthma, 32 studies were excluded from the review because they did not consider birds as a separate category for analysis. Of the remaining seven studies, five were cross-sectional and two were prospective cohort studies. Five of the studies were conducted only in children; the other two considered the association between pets and respiratory illness in adults. Studies were conducted in Germany, The Netherlands, US, the State of Qatar and an international study involving 16 countries.

Findings from the seven studies were conflicting. Two studies reported no significant association between bird ownership and respiratory symptoms.^{33,34} Behrens et al. found that the ownership of 'furry' and 'feathered' pets was not significantly associated with asthma-related respiratory symptoms, but when pet ownership was considered at different stages of life, results differed from those found for pet owners.³⁵ Elevated prevalence rates for asthma symptoms were observed when analyses were restricted to participants who owned a bird only during the first year of life.³⁵ Brunekreef et al. also reported a high prevalence of allergy for children who had birds previously but did not currently own them.³⁶ Svanes et al. found respiratory symptoms were more common in subjects who had kept birds in childhood, leading to the suggestion that adults with asthma avoided owning birds unless they had kept them during childhood.³⁷ Three studies found bird ownership was associated with increased rates of respiratory symptoms, regardless of when the bird was owned.^{11,12} In Bener et al., birds were both significantly associated with presence of asthma and were also the only pet associated with skin allergy.¹¹

Conclusion

Clarifying community health risks from avian contact

This review has highlighted the difficulties in defining the relationship between bird ownership and respiratory illness. Separating the clinical profiles for psittacosis, asthma and AA is made more challenging by their overlapping symptom complexes, summarised in Table 1. It is clear that allergic alveolitis, in particular, is a disease with a diverse range of clinical manifestations and several diagnostic tools may be required to confirm the disease. The case reports described above suggest that the understanding of avian-mediated illness in the medical community is limited, leading to misdiagnosis of the illness and possible fatal results. Enquiring about exposure to birds is imperative as the diagnosis of this spectrum of disorders may be missed or delayed.²⁵ Disorders such as allergic alveolitis should be considered as a possible diagnosis in any child with persistent and unexplained respiratory symptoms.²⁵ The case studies highlighted difficulties in detection of the sometimes unusual sources of antigen exposure.

Despite the range of studies, no clear consensus exists on the association between respiratory symptoms and bird ownership or duration of exposure. With the exception of Svanes et al.,³⁷ the studies provided no hypotheses to explain why birds in particular tend to cause a high prevalence of associated pet allergy.³⁸ Studies on the relationship between bird ownership and atopic illnesses

(such as asthma and hay-fever) are contradictory, inconclusive or provide little information regarding why birds may cause or exacerbate such illnesses.

Implications

From a community health perspective, eliciting a detailed avian exposure history may elucidate causative and preventable agents of respiratory problems. Identifying occupation and hobbies as well as bird ownership may assist in highlighting less obvious risk factors for psittacosis, such as gardening or lawn mowing.¹⁶ Skin testing is available to identify responsiveness to avian allergens that may exacerbate respiratory problems or allergies.³⁹

In the prevention of avian mediated illnesses there are various ways to reduce the disease burden. Exposure to birds and their products can be reduced to prevent disease and minimise the chronicity of illness. The prevention of avian-related asthma and allergies may be reduced by avoiding ownership of birds, especially when very young children may be exposed to the birds.³⁵⁻³⁷ Actions to reduce exposure include thorough house cleaning after removal of birds, habitation of birds away from the main residence, and hygienic practices when handling birds and cleaning cages.^{16,19} Further measures include the avoidance of feather pillows and duvets.³² The prompt treatment of ill birds can also reduce the transmission of infections to humans.³

In summary, a review of literature reveals little consensus on the relationship between bird ownership, respiratory symptoms and the precise mechanisms of disease initiation. Given the similarities in symptoms across the diseases mentioned, it is important that those in the medical profession enquire about any bird exposure when presented with a case of persistent and unexplained respiratory illness. Considering the high personal and social costs of diseases such as asthma, it is apparent that a preventative approach is highly desirable, with an emphasis on minimising contacts with avian-borne pathogens and allergens.

Table 1: Comparison of common symptoms of psittacosis, allergic alveolitis and asthma.

Disease	Psittacosis	Allergic alveolitis	Asthma
Symptoms			
Bronchospasm			X
Chills	X	X	
Cough (sporadic or persistent)	X	X	X
Diarrhoea	X		
Dyspnoea	X	X	X
Episodes of dizziness	X	X	
Fever	X	X	
Generalised fatigue	X	X	
Hallucinations		X	
Headache	X	X	
Insomnia		X	
Intermittent hoarseness		X	
Itchy / scratchy throat			X
Loss of appetite	X	X	
Nausea / vomiting	X	X	
Nightmares		X	
Night sweats		X	
Panic attacks		X	
"Pressure" in the chest	X	X	X
Shortness of breath (at rest or on exertion)	X	X	X
Sputum production	X	X	X
Sweating	X	X	
Wheeze		X	X
Fatality	X	X	X

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