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REVIEW ARTICLE

A One Health Perspective of Pet Birds Bacterial Zoonosis and Prevention

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ABSTRACT

One Health addresses the intricate relationship between humans, animals, and the environment, and pet or wild animal zoonosis is an important aspect in this regard. The pet bird ownership has grown in popularity, and owners frequently raise their birds close to their houses. They harbor the pathogens and are involved in disease transmission. They have relevance due to their lethality and zoonotic potential. Parrots, pigeons, passeriformes, and poultry birds are most frequently kept as pets. These birds are kept in housing that complies with industry standards for the care of pet birds. In addition to being kept as pets, these birds are possible transmitters or carriers of several infections thought to be the cause of zoonotic diseases. Bacterial, viral, parasitic, and fungal infections are all included in the list of zoonotic diseases. Understanding the method by which zoonotic illnesses spread requires an understanding of the mode of transmission. Companion birds typically harbor *Lactobacillus, Streptococcus, Corynebacterium, Staphylococcus epidermidis,* and *Micrococcus spp.,* among other germs as their normal flora. Most frequently reported Gram-negative bacterial pathogens of pet birds include *Klebsiella, Pseudomonas, Aeromonas, Proteus, Enterobacter, Campylobacter, Yersinia, Citrobacter* spp, *Chlamydia, Salmonella,* and *Escherichia coli*. Commonly reported Gram-positive bacterial pathogens of companion birds are *Clostridium, Mycobacterium, Staphylococcus aureus, Streptococcus,* and *Enterococcus.* In this review, bacteria of public health importance in pet birds have been covered with zoonotic disease categories, their transmission and spread of zoonoses, control and prevention recommendations are made for individual public health and biosafety.

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INTRODUCTION

The term "pet birds" refers to those who feed on different seeds, grains, and plants and are legally kept for some time or permanently in cages. Since the previous few decades, pet birds have become increasingly popular, this has brought attention to the importance of pet bird zoonoses globally (Nair *et al*., 2022). The practice of these birds increases globally because these birds are used as companions, for enjoyment, and psychological support (Macauley and Chur-Hansen, 2023). The connection between companion or pet birds, which are now regarded as family members in some parts of the world (Smith *et al.*, 2020). Canaries, finches, and other Passeriformes species make up the majority of pet birds i.e. parrots, budgerigars, parakeets, etc. (Hosseinian, 2022). In addition, pigeons were among the first domesticated birds, and they have historically been utilized as messenger pigeons, notably during battle (Zahoor *et al*., 2018).

Zoonotic pathogens are infectious organisms that can infect people through food, drink, contact with the environment, or direct contact with the disease-infected animal. Our close bond with pets makes them potentially dangerous for public health everywhere. Veterinary hospitals, for instance, have the potential to disseminate zoonotic illnesses like as *Staphylococcus aureus* and *Escherichia coli* (Jung *et al.*, 2020). The transcontinental migration of birds across large geographic distances may present chances for the spread of infections among populations and regions (Fair *et al.*, 2024).

Since the beginning of human history, pets have been a primary source of human infection with zoonotic diseases. According to the current study, the prevalence of pathogenic *S. aureus* was higher in pet pigeons (7.10%) than in budgerigars (3.57%) and cockatiels (1.79%), respectively (Royal *et al.*, 2024). As a result, pet birds may provide a substantial reservoir for diseases caused by pathogenic staphylococci, which can spread from animals to people through zoonotic transmission (Pontes *et al*., 2018). Therefore, it is possible to classify pet birds as a primary reservoir for pathogenic staphylococci infections, which can be transferred from animals to people through zoonotic contact transmission. Pet birds, on the other hand, may also be a significant source of staphylococci due to their frequent interactions with their owners and their surroundings (Sulikowska *et al.*, 2024).

Pet birds can lead to dangerous illnesses in humans including salmonellosis and chlamydia. Through direct or indirect contact, diseases from these animals can be spread (Hosseinian, 2022). The transfer could take place inside, outside, in pet stores, hospitals, or other places. Gram-negative and Gram-positive bacteria both can cause zoonoses (Muñoz-Ibarra *et al*., 2022). According to estimates, bacterial pathogens are the most common zoonotic pathogens with bovine origins (42%), followed by viral (22%), parasitic (29%), fungal (5%), and prion-like (2%) (McDaniel *et al.*, 2014). The birds can get infected with these pathogens and transfer the disease to humans. Most zoonotic illnesses are transmitted from animals to humans. According to certain claims, people can also infect animals (Adesokan *et al*., 2019). These illnesses are referred to as reverse zoonoses (Cerdà-Cuéllar *et al.*, 2019). MRSA, *Campylobacter* species, *Cryptosporidium parvum* (*C. parvum*), *Salmonella enterica* serovar Typhimurium (*S.* Typhimurium) are examples of such infections (Rahman *et al.*, 2020).

The understanding that human health is closely linked to the health of other species and the environment they live in has given rise to the idea of One Health. The One Health concept recognizes the interdependence of humans, animals, plants, and the environment in the study of infectious diseases (Pitt and Gunn, 2024). Calvin Schwabe, an American veterinary surgeon, proposed the idea of "One Medicine" in the middle of the 20th century by drawing comparisons between methods for addressing the health and welfare of humans and animals. He emphasized the multidisciplinary, integrated viewpoint that practitioners in his field might bring to general practice (Evans, 2011). Additionally, he promoted the use of social sciences and the development of communication skills to strengthen community cooperation in the fight against contagious diseases.

Gram-negative bacteria in pet birds are the pathogens that are most frequently reported: *Klebsiella, Aeromonas, Pseudomonas, Enterobacter, Proteus, Serratia marcescens, Citrobacter spp.,* and *Escherichia coli (E. coli)*. *Staphylococcus aureus* (*S. aureus*), *Streptococcus, S. intermedius, Enterococcus, Clostridium,* and other *Staphylococcus* spp. are the most prevalent Gram-positive bacterial pathogens found in pet birds.

The poultry population is continuing to spread out to effectively address the exponential rise in human consumption. According to statistics, there were over 22.70 billion chickens available worldwide on average in 2016. As a result, reports of sporadic outbreaks of numerous bird diseases have been made every year across the globe (Ayoola *et al.*, 2022). While this is going on, there are other illnesses with pathogenic significance, including Campylobacteriosis, Newcastle disease, and avian influenza (Nga *et al*., 2019). Similar to humans, numerous elements affect owners when choosing the right type of bird to keep as a pet, including the bird's size, color, average age, sound, and human interaction (Varela *et al.*, 2022).

Transmission frequently happens when birds are taken to exhibitions and competitions (Lal *et al*., 2022). Humans can sometimes contract the bacteria directly from birds, from bites or scratches, or from arthropod vectors such as fleas and ticks (Asaaga *et al.*, 2022). The balance between the environment, agent, and host may be upset at any time as a result of a variety of anthropogenic activities, such as population growth and natural processes that cause the emission of zoonoses (Morse *et al*., 2012).

The close bond between pet bird owners and their feathered companions enhances owners' obligations to provide enough shelter, sanitary food, and water, and this bond also increases the danger of zoonotic disease transmission and spread of chlamydophilosis, salmonellosis, and tuberculosis (Contreras *et al.*, 2016). Direct contact with carriers or sick pet birds serves as the primary method of transmission and dissemination (Lal *et al*., 2022). Possible septicemic agents have been identified as *Pasteurella* spp. in birds attacked by house cats or rats. *Chlamydia* and *Mycobacterium* are typical intracellular bacterial pathogens (O'Neil, 2018). Despite being uncommon, there is evidence of methicillin-resistant *S. aureus* (MRSA). Chronic sinusitis, which is frequently encountered in cockatiels, has been linked to *Mycoplasma* species.

When people come into contact with domestic or wild animals that have diseases that are communicable to one another, either directly or indirectly, zoonotic infections can result (Nupur *et al*., 2023). Therefore, understanding both the mechanisms underlying those interactions and the elements keeping those animals infected is essential to control. The One Health philosophy urges us to act with caution, exercise humility, and have an open mind about potential unforeseen repercussions (Wu *et al.*,2017). Ignored zoonotic diseases pose a challenging problem to the scientific community because of their complex biology, many mechanisms of transmission, and ability to infect a wide range of host species (Ehuwa *et al.*, 2021). Owners of pet birds' ought to be aware of the avian form of chlamydiosis, which can cause fatal, uncommon pneumonia in humans, and is one of the zoonotic illnesses that is frequently ignored. After infecting birds, the disease may then infect people. The importation of exotic pet birds led to a rapid expansion of avian chlamydiosis (Pitt and Gunn, 2024).

Examining the owners, facilities, avian exploitation, and health of pet birds should therefore be a worthwhile starting point for defining human health hazards and proposing financial and hygienic preventative actions to protect human health and enhance the economy. The impact of zoonoses can be measured using factors including illness prevalence, occurrence, illness, death,

and financial loss even if it is difficult to put a number on it. This paper briefly examines the most common zoonotic diseases transmitted by pet birds, their transmission routes, and suggestions for controlling and preventing transmission from birds to humans.

Zoonotic bacterial diseases of pet birds: Zoonoses are diseases that can spread naturally from vertebrate animals to humans. Zoonotic infections can spread to people by direct contact, with food, water, the environment, viral, bacterial, parasitic, or other unconventional agents (Filho *et al*., 2022). Due to our strong contact with birds in agriculture, as companions, and in the natural environment, they constitute a significant public health issue globally as described below in Table 1. The important bacterial diseases are:

Chlamydophilosis: *Chlamydia psittaci* (*C. psittaci*) is a Gram-negative, obligatory intracellular bacteria that goes through at least two phases in the course of its life cycle (Ravichandran *et al*., 2021). Elementary bodies attach to eukaryotic cells, most frequently respiratory epithelial cells, after being inhaled or swallowed by a host (Boroomand and Faryabi, 2020). The illness results in air sacculitis, pneumonia, hepatitis, and pericarditis, and systemic illness may eventually be fatal (Meyst *et al.*, 2022). The most dangerous zoonotic disease, commonly known as parrot fever, psittacosis, or ornithosis, is carried on by *C. psittaci* (Mia *et al.*, 2022). A recent outbreak of parrot fever has been linked to human casualties in northern and western Europe (WHO, 2024). Antibiotic resistance in humans is also exacerbated by the zoonotic *Chlamydophila* cloud (Santos *et al.*, 2014).

Salmonellosis: Salmonellosis is the most common zoonotic disease worldwide. It is the second most common gastrointestinal disorder resulting from the consumption of *Salmonella-contaminated* food. It infects more than 90 million people annually (Ame *et al*., 2022). Horizontal as well as vertical transmission of the disease may occur (Saleem *et al*., 2022). *Salmonella* is a possible zoonotic infection that can be transmitted to people, especially from passerine birds. Pet birds are more prone to this disease (Rahmani *et al.*, 2011). Human salmonellosis may occur often and present with severe clinical symptoms, such as vomiting and diarrhea (Cavallo *et al*., 2015).

Tuberculosis: *Mycobacterium tuberculosis* (*M. tuberculosis)* causes disease in wildlife, and livestock and zoonotic TB in humans (Rehman *et al*., 2022). *M. tuberculosis* causes this disease and is transmitted from pet birds, especially psittaciformes. *Mycobacterium genavense* (*M. genavense*) and *Mycobacterium avium* (M. *avium*) are the most often isolated species, respectively. *M. avium-infected* birds often exhibit no clinical symptoms, but they may grow lethargic and malnourished (Kumar *et al.*, 2023). However, *M. tuberculosis*, the main human infection, is rarely noted in birds as a potential zoonotic agent (Nair *et al.*, 2022).

Campylobacteriosis: *Campylobacter jejuni* (*C. jejuni*) is inhabited in the intestinal tract of birds with no or mild clinical signs in the host (Ehsannejad *et al.*, 2015). Bacteria can be zoonotic and spread from birds to humans through contaminated poultry products, close exposure to infected birds, and contact with their feces and areas contaminated with birds dropping (Mulder *et al.*, 2020). In humans, it causes gastroenteritis (vomiting and diarrhea), headaches, and depression, which can occasionally be fatal (De Luca *et al.*, 2018).

Yersiniosis: Yersiniosis is a zoonotic bacterial disease, also called pseudotuberculosis. *Yersinia* bacteria, primarily *Y. enterocolitica* and *Y. pseudotuberculosis* are responsible for the illness (Yue *et al.*, 2023). Pigeons and sparrows also had these bacteria. These bacteria can be transferred from birds to humans and cause food poisoning, enteritis, mesenteric and intestine lymphadenitis, etc. Additionally, urinary tract infections, pneumonia, meningitis, and pharyngitis may be brought on by the bacteria (Kozdruń *et al.*, 2015).

Table 1: Major bacterial zoonotic diseases, their etiological agents, major symptoms in humans and birds, risk factors.

Disease	Etiology	Clinical signs in birds	Clinical signs in humans	Risk Factors
Chlamydophilosis	*C. psittaci*	Pneumonia, air sacculitis, hepatitis and pericarditis, depression, anorexia, ruffled feathers	Myalgias, arthralgias, vomiting, headache, and abdominal pain Genital organ infections, conjunctivitis, arthritis, and diarrhea, mild respiratory symptoms, severe pneumonia	Prolonged transportation, overcrowding, nutritional deficiency, hygienic conditions, temperature changes and reproduction
Salmonellosis	*Salmonella*	Diarrhea in young birds and leads to mortality, no signs in adult birds	Gastroenteritis, fever	Poor sanitation, poor hygiene services, contaminated animal source foods
Tuberculosis	*M. tuberculosis*	Respiratory distress, white diarrhea with soiled feathers, weight loss, depression	weight loss, no appetite, chills, fever	Contaminated soil and water, infected birds, poor sanitation and hygienic condition
Campylobacteriosis	*C. jejuni*	Diarrhea and weight loss in young birds	Bloody diarrhea, fever, abdominal cramping	handling raw, contaminated turkey meat and chicken, non-chlorinated or contaminated surface water,
Yersiniosis	*Y. enterocolitis*	Lameness, diarrhea, ruffled feathers, weakness	Bloody stools or diarrhea, fever and abdominal pain	Untreated water, raw milk, food hygiene, contaminated hand
Colibacillosis	*E. coli*	Ruffled feathers, decreased appetite, depression, cough	Fever, diarrhea, stomach cramps, purpura	Contaminated food or water, farm situation, Management factors
Lyme disease	*B. burgdorferi*	Lack of appetite, depression, lameness due to inflamed joints, discomfort	Characteristic skin rash called erythema migraines. headache, fever, fatigue	Bacteria transfer from birds to humans through ticks
Other diseases	*K. pneumoniae, P. aeruginosa, S. aureus C. difficile*	Skin, respiratory tract, oral cavity and crop, Vesicular dermatitis	Diarrhea, dehydration, loss of appetite and weight loss, UTIs	Contaminated surfaces, contaminated food and water, spores or bacteria

Colibacillosis: Colibacillosis is the disease caused by *Escherichia coli* which is Gram-negative, facultative anaerobic bacteria. It is a normal inhabitant of warm-blooded animals but some strains cause disease (Nawaz *et al.*, 2021). Some strains of *E. coli* are responsible for coli septicemia, peritonitis, coli granulomatosis, and inflammation of the yolk sac in birds (Aparecida *et al.*, 2017). Avian pathogenic *E. coli* and Shiga toxin-producing *E. coli* can be transferred from birds to humans and cause various infections including hemolytic uremic syndrome (HUS), urinary tract infection (UTIs), diarrhea and inflammation of mammary glands in humans (Kozdruń *et al.*, 2015).

Lyme disease: The bacterium *Borrelia burgdorferi* is the source of the common tick-borne illness Lyme disease (also known as Lyme borreliosis). Wild birds, songbirds, sparrows, and canaries are the most frequent hosts for *Borrelia* species (Dumas *et al.*, 2022). Humans contract *Borrelia* species from infected ticks of the genus Ixodid (Ogden *et al.*, 2015). Although birds cannot directly transmit *Borrelia* spp. to people, they can transport ticks that do to a new place (Cohen *et al.*, 2015). Bacteria transfer from birds to humans by biting. Infected people displayed symptoms such as fever, exhaustion, headaches, skin rashes, and erythema migrans (Steere *et al.*, 2016). Therefore, both migratory and wild birds play a crucial part in the worldwide spread of *Borrelia* species (Hosseinian, 2022).

Other diseases: Many other possible zoonotic diseases have also been found in pet birds, including:

K. pneumoniae is Gram-negative bacteria, isolated from the droppings of seemingly healthy birds, and cause respiratory infection in passeriformes and psittaciformes is thought to be a pathogen. In clinically healthy parrots and passerines, *K. pneumoniae* may be isolated from stool samples and the oropharynx, although these enterobacteria frequently cause respiratory infections (El Fertas-Aissani *et al*., 2013). It's possible that keeping birds in captivity will change their intestinal and respiratory microbiota, favoring Gram-negative bacterial colonization. An important pathogen linked to nosocomial infections in humans is *K. pneumoniae* (Effah *et al.*, 2020).

A common opportunistic and nosocomial pathogen of humans and Animals is *P. aeruginosa* whose infection in birds is linked to septicemia, respiratory symptoms, diarrhea, and mortality as well as significant financial losses for the poultry sector (Sanches *et al*., 2017). The infection has been linked to both high mortality in young poultry and late death in the embryo's shell (Abd El-Ghani, 2021). Domestic pigeons have the potential to spread some Pseudomonas species to people and other animals through their feces. It may be associated with a variety of infectious diseases, including hemorrhagic enteritis, septicemia, laryngitis, and sinusitis (Badr *et al.*, 2022).

It has been documented that *S. aureus* is a pathogenic agent that infects pet birds. Birds that have been colonized by these organisms are thought to pose a danger to their human connections of contracting an endocarditis-causing MRSA infection (Peton and Le Loir, 2014). It is believed that workers' hands or *S. aureus* species frequently contaminate carcasses at poultry processing facilities (Boroomand and Faryabi, 2020).

Clostridium difficile is an anaerobic spore forming bacteria responsible for causing enteric disease in humans, can spread from chickens to humans through the consumption of poultry meat (Hernandez *et al.*, 2020). Watery feces in the small intestine and diffuse multifocal hemorrhages in the ceca and colon are the typical gross lesions of infected birds (Kachrimanidou *et al*., 2019). Thus, the literature review indicates that birds can transfer pathogens that can infect multiple systems of the human body resulting in severe disease.

Route of transmission: Direct or vector-borne transmissions are two methods by which zoonoses may be transmitted and spread among those who raise or own pet birds.

Direct transmission: An infectious agent passes from a reservoir to a susceptible host through direct contact or droplet dispersal indirect transmission. The fact that pet bird owners or breeders have such intimate contact with their birds enhances the likelihood of illness transmission (Mortimer, 2019). The practice of pet bird breeders or owners shedding zoonotic diseases into drinking water sources is another aspect of direct contact (Diren *et al.*, 2020). There are different routes of zoonotic transmission as summarized in Table 2. Zoonotic disease dissemination and transmission illnesses are also linked to interaction with the food and water of pet birds (Peng and Broom, 2021). The chance of spreading and transmitting various infections is further increased by different meets or groupings of domesticated birds by their owners at various displays or shows of pet birds (Boseret *et al.*, 2013). Consequently, it is advisable to avoid unusually close contact with pet birds to prevent the direct spread of contagious germs (Smith *et al.*, 2011).

Table 2: Zoonotic bacterial diseases in pet birds and their transmission

Zoonotic bacterial species	Disease	Transmission rout			References
		Direct	Indirect	Vector born	
Chlamydophila psittaci	Chlamydophilosis	Yes	yes	yes	(Knittler and Sachse, 2015)
Mycobacterium tuberculosis	Tuberculosis	yes	yes	no	(Dhama *et al.*, 2011)
Salmonella enterica	Salmonellosis	yes	yes	no	(Dróżdż *et al.*, 2021)
Borrelia burgdorferi	Lyme disease	no	no	yes	(Contreras *et al.*, 2016)
Escherichia coli	Colibacillosis	yes	yes	no	(Boroomand and Faryabi, 2020)
Campylobacter jejuni	Campylobacteriosis	yes	yes	yes	(Mughini-Gras *et al.*, 2021)
Yersinia pseudotuberculosis	Yersiniosis	yes	yes	yes	(Mani and Maguire, 2009)
Pseudomonas aeruginosa	Chronic wasting disease	yes	no	no	(Giacopello *et al.*, 2015)
Staphylococcus aureus	Arthritis, osteomyelitis	yes	yes	no	(Umaru *et al.*, 2011)
Clostridium difficile	Acute diarrhea and colitis	yes	yes	no	(Diab *et al.*, 2016)
Klebsiella pneumoniae	Encephalitis and lung infection	yes	yes	no	(Riwu *et al.*, 2020)

Indirect Transmission: When an infectious agent is transported from a reservoir to a host via a suspended air particle, Item, or an animated intermediary, it is called indirect transmission. Indirect transmission of zoonotic diseases can also take place through coming into touch with a surface or environment that has been polluted by avian feces, blood, saliva, secretions from the nose, bodily fluids, or by consuming contaminated foods and beverages by contaminating the places and objects used in food preparation or less frequently by contaminated vapors or drops (Varela *et al.*, 2022).

Vector-borne transmission: Mites, mosquitos, and ticks are mechanical vectors for some zoonotic infections, and infections are transmitted to humans by biting. Breeders and owners of pet birds are significantly affected by vector-borne zoonotic illnesses. Mosquito-borne diseases also lead to an outbreak forming in a specific area because the mosquitoes typically pick up an infection from eating pet birds or other animals that have the virus. Similarly, ticks (especially those of the genus Ixodes) aid in the spread of several infections including *B. burgdorferi*, the culprit responsible for Lyme disease (Medlock and Leach, 2015) (Ebani *et al*., 2016). Overall, routine cleaning of pet birds and their surroundings can effectively reduce zoonotic disease spread and transmission brought on either by ticks, mites, or mosquitoes (Rahman *et al.*, 2020). The routes of transmission are shown in Fig. 1.

In conclusion, humans may be exposed to zoonosis from birds either by close contact, or contamination of food, water, or by different insect vectors.

Public health importance: According to the US Centre for Disease Control and Prevention, there have been 935 human cases of psittacosis between 1988 and 2003 (Szymańska-Czerwińska and Niemczuk, 2016). The majority were linked to interaction with Psittaciformes. Annually, 100 instances of psittacosis are reported in the US, and the illness can cause 1 death (Liu *et al.*, 2023a). Between 2005 and 2009, 66 cases of *C. psittaci* infection were discovered by the Centre for Disease Control and Prevention in persons during research they conducted in the USA (Smith *et al.*, 2011). The National Institute of Public Health and the National Institute of Hygiene (NIPH-NIH) published a report stating that in 2013, there were two instances of ornithosis found in the vicinity of Lodz with one instance discovered in Silesia (Kozdruń *et al.*, 2015).

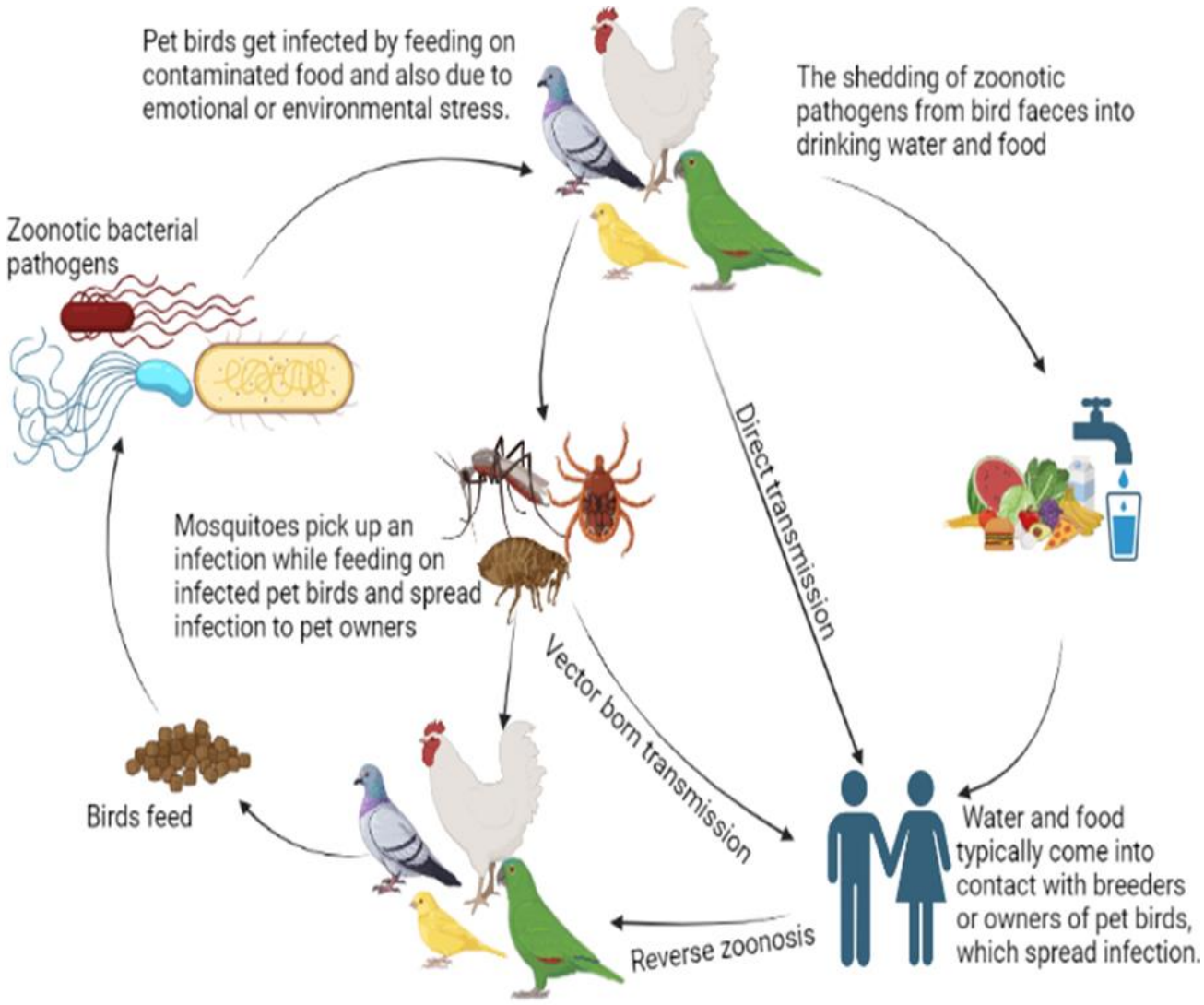

Fig. 1: Transmission of zoonotic bacterial pathogens in pet birds (Retrieved from Biorender).

According to NIPH-NIH data, 156 (41.6%) of the 375 campylobacteriosis patients detected in Poland in 2010 required hospitalization. In 2011, there were 354 cases, a lesser number than in 2010, yet 204 (57.6%) of those cases required hospital admission for the patient (40). The Institute reports that in 2012, 431 cases were diagnosed, and 247 (57.3%) of those were hospitalized. The numbers were 552 and 394 (71.4%) in 2013 and 654 and 487 (74.5%) in 2014 (Kozdruń *et al.*, 2015).

The widespread occurrence of CDI infections in people and the numerous Asian and Latin American countries were found to have high *C. difficile* prevalence. According to a different study conducted in Egypt, the prevalence of *C. difficile* in poultry was 11.5% (12 of 104), 14% (7 of 50), and 9.3% (5 of 54) in infected chickens (Abdel-Glil *et al.*, 2018). While stated Greater incidence levels up to 42%, were found. In North America and Canada, prevalence rates range from as low as 2% to as high as 44% (Kachrimanidou *et al*., 2019).

Common groups of avian species kept as pets are the psittacine, passerine, and columbiform birds. Both domestic pets and exotic pets are frequently kept in homes today. Fortunately, zoonotic disease transmission from these animals is rare, but there are some known risks (Meurens *et al.*, 2021). There is potential for zoonoses to spread more widely because 14-62% of pet owners allow their animals to sleep there (Tomori and Oluwayelu, 2023). The risk of developing a fresh zoonotic disease spread by exotic birds and animals, pets, and companion animals is extremely high (Rahman *et al.*, 2020). Most significantly, people can acquire *C. psittaci* from pet birds (Liu *et al.*, 2023b). *Salmonella* spp. can spread through pet birds, despite being more frequently a food-borne zoonotic agent (Harkinezhad *et al.*, 2009). There have also been reports of allergic reactions to pet birds, such as contact dermatitis and pneumonitis (Moira *et al.*, 2023).

Prevention and Control: Surveillance is crucial for the prevention and management of zoonotic diseases (Dhama *et al.*, 2013). This approach can identify early infection, sick people and animals, reservoirs, vectors, and endemic locations, including the "hotspots," (Loh *et al*., 2015). In aviaries and poultry production facilities, keeping young birds apart from older ones may help to lower the prevalence of avian chlamydiosis (Boseret *et al.*, 2013). Even though extensive avian testing might not be cost-effective, treatment could help lower human risk (Kulsum *et al.*, 2021).

It is not advisable to buy or sell sick birds. Birds from different origins shouldn't be mixed up without the appropriate quarantine and *C. psittaci* multimodal testing. To prevent the transfer of feces, tainted food, dander from feathers, and other contaminants between cages, food containers, and water bowls should be placed and cleaned. Every day waste materials including feces and food should be removed (Smith *et al*., 2011). To prevent the waste from becoming aerosolized before removal, it is advised that fecal excrement and contaminated cage components should be sprayed or wetted down. Before treating and handling diseased birds in multi-bird homes or facilities, healthy birds should be taken care of (Van der Giessen *et al.*, 2010). Cleaning cages should remove all trash and waste (Stull *et al.*, 2013). It is best to utilize cleaning techniques that prevent material aerosolization like cleaning cages and floors with a spray before sweeping and mopping (Rahman *et al.*, 2020). Pressure washers and Vacuum cleaners should not be used since they might cause aerosolization (Balsamo *et al.*, 2017). To prevent buildup and prevent the spread of aerosolized germs, there should be enough ventilation. The spread of zoonotic diseases between birds and people can be prevented by identifying and eliminating carriers as well as biological and mechanical vectors.

Conclusions: Diseases in pet birds having zoonotic potential should not be disregarded or undervalued due to the significant negative effects on the population's health, especially that of children. Zoonoses significantly affect both people's quality of life and means of subsistence. The affected people are sometimes kept apart from the rest of the population, which makes them more vulnerable to mental health problems. Surveillance is crucial for the prevention and management of zoonotic diseases. A well-equipped lab, enough diagnostic tools, experienced employees, and sufficient funding are required for effective and efficient surveillance. One Health approach is suggested to prevent pet zoonosis and mitigation of public health diseases shared at the animal-human-environment interface.

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