



Original Research Paper

Bridging Veterinary and Dental Health: Veterinarians' Perspectives on the Oral Health Implications of Zoonotic Diseases

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ABSTRACT

Aim:

The aim of the present study was to evaluate veterinarians' awareness of zoonotic pathogens, their understanding of possible oral health implications, and their views on incorporating oral health considerations into zoonotic disease education and prevention strategies.

Methods:

The cross sectional study was conducted in the Department of Veterinary Science and Animal Husbandry, Government Veterinary Hospital, Hanumangarh, Rajasthan from 31 May 2026 to 2 June 2026. The included population was practicing veterinarians including clinical professionals, academic veterinarians and researchers.

Results:

More than half of the respondents (52.4%) were above 50 years of age, indicating that the study population was predominantly composed of senior veterinary professionals. Among 63 respondents, rabies virus was the most commonly encountered zoonotic pathogen (57.1%), followed by Salmonella spp. and fungal pathogens (47.6% each). Overall, 80.9% of respondents considered the impact of zoonotic diseases to be high or very high, highlighting widespread recognition of their significant public health and societal implications. Among the 63 respondents, 46.0% rated their knowledge regarding oral manifestations of zoonotic diseases as average, while 42.9% considered their knowledge good.

Conclusion:

The present study highlighted that veterinarians possess a strong understanding of zoonotic diseases and recognize their substantial impact on human health and society. Most participants demonstrated awareness of key preventive

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measures, including pet vaccination, hand hygiene, regular veterinary care, and maintenance of pet oral hygiene, reflecting their important role in zoonotic disease prevention and public health promotion.

Keywords: awareness, zoonotic pathogens, oral health implications, oral health considerations, zoonotic disease education, prevention strategies

INTRODUCTION

Microorganisms are the small microscopic organisms which cannot be seen from naked eyes. It includes bacteria, parasites, fungi which have the potential to cause infection in humans and animals, such diseases causing agents are called pathogens. It has been estimated that 64% of more than 1,400 recognized human pathogens are zoonotic and that 73% of 177 emerging or reemerging pathogens have originated in animals. Thus zoonotic infections are caused by wide variety of microorganisms and are transmitted naturally from animals to humans and vice versa. Nowadays there is increased animal to human interaction. Dogs and cats are not only considered as pets but are integral part of family. This results in frequent sharing of living environment, daily activities and physical contact which enhances the chances of transmitting microbes to their owners.

Despite the growing trend of zoonotic infections, their oral health implications remained unexplored. Though the systemic manifestations of zoonotic infections can be severe affecting the respiratory, cardiovascular, neurological, gastrointestinal and dermatological system. The oral health implications may go unnoticed as it may be secondary to systemic disease or less severe than systemic complications. Furthermore, limited interdisciplinary collaboration between veterinary and dental professionals has contributed to a lack of awareness regarding the potential oral effects of zoonotic pathogens. As a result, the oral health aspect of zoonotic diseases remains an emerging area of research that requires further investigation. Veterinarians play crucial role in identifying, preventing and managing the zoonotic infections as they are the first healthcare professionals who encounter such infections having potential to transmit to humans. Despite the increasing risk of zoonotic infections and interconnectedness of veterinarians and dentists there is still lack of awareness regarding veterinarian's knowledge about oral implications of zoonotic diseases. Assessing their perspective can help in bridging educational gaps and strengthening public health initiatives.

Therefore, a study was conducted to evaluate veterinarians' awareness of zoonotic pathogens, their understanding of possible oral health implications, and their views on incorporating oral health considerations into zoonotic disease education and prevention strategies.

METHODOLOGY

The cross sectional study was conducted in the Department of Veterinary Science and Animal Husbandry, Government Veterinary Hospital, Hanumangarh, Rajasthan from 31 May 2026 to 2 June 2026. The included population was practicing veterinarians including clinical professionals, academic veterinarians and researchers.

Inclusion criteria: Registered veterinary professionals who are actively engaging in clinical practices and academics that consented to participate.

Exclusion criteria: veterinary students, Retired professionals who are no longer in practice, people who submitted incomplete questionnaire and people who did not consented to participate.

A pre-structured questionnaire was developed in English based on review of existing studies about zoonotic infections and their systemic implications along with interdisciplinary healthcare. The questionnaire was validated and was distributed among the veterinarians. The questionnaire was divided into four sections.

- *Demographic profile:* age, gender, highest qualification, years of clinical experience and type of clinical practice.
- *Awareness of zoonotic infections:* questions assessing about the awareness of transmission of zoonotic infections, most common zoonotic pathogen encountered and the impact of zoonotic diseases on human health and society.
- *Awareness of oral health implications:* questions regarding their knowledge about oral implications of zoonotic infections, most common oral manifestations due to zoonotic pathogens.
- *Preventive practices:* Questions regarding importance of pet's oral hygiene and risks of transmission to their owners, educations of owners about pet's hygiene practices.

Data collection procedure

The study was conducted through Google form by posting a Google form through veterinary professional's network and on social media platform. Participation was completely voluntary and anonymity was carried out throughout the study. 70 Google forms were distributed and 63 responses came back. There was 90% response.

Ethical consideration

Prior to participation, all respondents were provided with the overview of study's objective and data handling. The personal data of the participants were kept confidential.

Statistical Analysis

Data collected through the structured questionnaire were entered into Microsoft Excel and analyzed using the Statistical Package for Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographic characteristics of the participants and their responses regarding awareness of zoonotic diseases, knowledge of oral manifestations, perceptions of the One Health approach, and attitudes toward interdisciplinary collaboration. Categorical variables were expressed as frequencies and percentages. Associations between demographic variables (such as age, gender, years of professional experience, and type of practice) and levels of awareness or knowledge regarding zoonotic diseases and their oral health implications were assessed using the Chi-square test or where appropriate. A p-value of less than 0.05 was considered statistically significant. The results were presented in the form of tables, graphs, and charts to facilitate interpretation and comparison of findings.

RESULTS

Table 1: Demographic data

Age groups	N	%	χ^2 Value	P value
21-30 years	6	9.5	27.22	<0.001
31-40 years	14	22.2		
41-50 years	10	15.9		
>50 years	33	52.4		
Gender				
Male	59	93.7	48.02	<0.001
Female	4	6.3		
Educational Qualification				
BVSc & AH	31	49.2	37.13	<0.001
MVSC	24	38.1		
Phd	6	9.5		
Others	2	3.2		
Years of experience				
<5 years	7	11.1	39.29	<0.001
5-10 years	7	11.1		

11-20 years	12	19		
>20 years	37	58.8		
Type of practice			87.76	<0.001
Companion animal practice	2	3.2		
Large animal practice	4	6.3		
Mixed animal practice	13	20.6		
Academic/Teaching	3	4.8		
Government services	37	58.7		
Others	4	6.3		

More than half of the respondents (52.4%) were above 50 years of age, indicating that the study population was predominantly composed of senior veterinary professionals. Respondents aged 31–40 years constituted 22.2% of the sample, while those between 41–50 years accounted for 15.9%. The youngest age group (21–30 years) represented only 9.5% of participants. A chi-square goodness-of-fit test indicated that the distribution of respondents across age groups differed significantly from an equal distribution, $\chi^2(3) = 27.22$, $p < 0.001$. The respondents were predominantly male, accounting for 93.7% of the total sample, while females represented only 6.3%. The gender distribution was significantly unequal, $\chi^2(1) = 48.02$, $p < 0.001$, with males comprising 93.7% of the study population. Nearly half of the respondents (49.2%) held a Bachelor of Veterinary Science and Animal Husbandry (BVSc & AH) degree as their highest qualification. A substantial proportion (38.1%) possessed a Master of Veterinary Science (MVSc) degree, while 9.5% had obtained a PhD. Only 3.2% fell under the "Others" category. A significant difference was observed in the distribution of educational qualifications, $\chi^2(3) = 37.13$, $p < 0.001$. Nearly half of the respondents held a BVSc & AH degree (49.2%). The majority of respondents (58.8%) reported more than 20 years of professional experience. Those with 11–20 years of experience comprised 19.0%, while veterinarians with less than 5 years and 5–10 years of experience each accounted for 11.1%. The distribution of years of professional experience differed significantly across categories, $\chi^2(3) = 39.29$, $p < 0.001$, with 58.8% having more than 20 years of experience. Government veterinary services constituted the largest professional category, representing 58.7% of respondents. Mixed animal practitioners accounted for 20.6%, while large animal practitioners represented 6.3%. Companion animal practitioners made up only 3.2% of the sample.

Academic and teaching professionals constituted 4.8%, and another 6.3% belonged to other categories. A highly significant difference was found in the type of veterinary practice, $\chi^2(5) = 87.76$, $p < 0.001$. Government service constituted the largest category (58.7%).

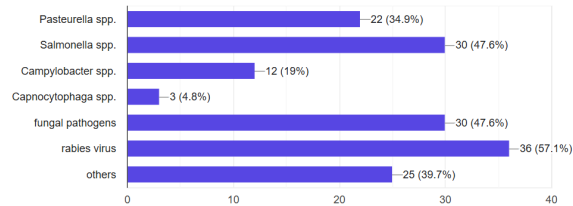


Diagram: 1 Bar graph showing common zoonotic pathogens encounters in practice

Among 63 respondents, rabies virus was the most commonly encountered zoonotic pathogen (57.1%), followed by Salmonella spp. and fungal pathogens (47.6% each). Pasteurella spp. was reported by 34.9% of respondents, while Campylobacter spp. and Capnocytophaga spp. were encountered less frequently (19.0% and 4.8%, respectively). Additionally, 39.7% of respondents reported encountering other zoonotic pathogens not listed in the survey, indicating substantial diversity in zoonotic disease exposure within clinical practice.

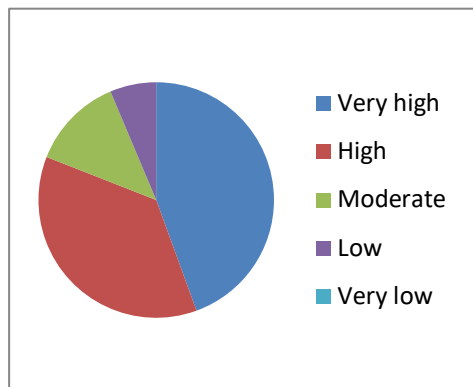


Diagram 2: pie chart showing the impact of zoonotic diseases on human health and society

The majority of respondents perceived zoonotic diseases as having a substantial impact on human health and society. Nearly half (44.4%) rated the impact as very high, while 36.5% rated it as high. Moderate, low, and very low ratings accounted for 12.7%, 6.3%, and 0% of responses, respectively. Overall, 80.9% of respondents considered the impact of zoonotic diseases to be high or very high, highlighting widespread recognition of their significant public health and societal implications.

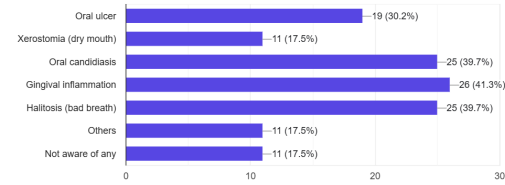


Diagram 3: Bar graph showing potential oral manifestations by zoonotic diseases

When participants were asked about oral manifestations that may potentially occur following zoonotic infections, gingival inflammation was the most commonly identified condition (41.3%), followed by oral candidiasis (39.7%) and halitosis (39.7%). Oral ulcers were recognized by 30.2% of respondents, while xerostomia was identified by only 17.5%. Additionally, 17.5% of participants reported being unaware of any oral manifestations associated with zoonotic infections. These findings suggest moderate awareness of certain oral manifestations, but also highlight notable gaps in knowledge among respondents.

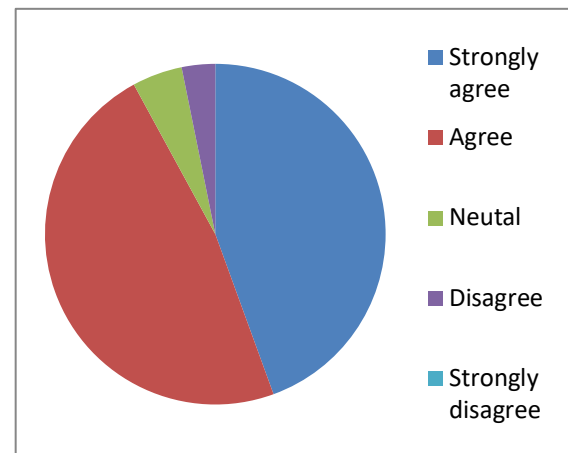


Diagram 4: pie chart showing veterinarians' response about oral manifestations in immunocompromised patients

The majority of participants (92.0%) agreed or strongly agreed that immunocompromised individuals are at greater risk of oral complications associated with zoonotic infections, reflecting a high level of awareness regarding the impact of immune status on susceptibility to oral manifestations of zoonotic diseases. Only 4.8% of respondents were neutral, while 3.2% strongly disagreed with the statement.



Diagram 5: pie chart showing knowledge of veterinarians regarding oral manifestations of zoonotic diseases

Among the 63 respondents, 46.0% rated their knowledge regarding oral manifestations of zoonotic diseases as average, while 42.9% considered their knowledge good. Only 6.3% reported excellent knowledge, and 4.8% rated their knowledge as poor. No participants selected the very poor category. These findings suggest that although most respondents possess a moderate level of awareness, there remains a need for further education to improve comprehensive understanding of oral manifestations associated with zoonotic diseases.

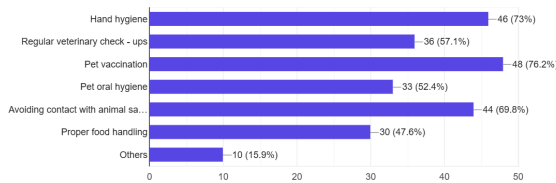


Diagram 6: bar graph showing preventive measures suggested by veterinarians to pet owners to avoid transmission of pathogens

Among the 63 respondents, pet vaccination was the most commonly recommended preventive measure against zoonotic diseases (76.2%), followed by hand hygiene (73.0%) and avoiding contact with animal saliva and secretions (69.8%). More than half of the participants also recommended regular veterinary check-ups (57.1%) and pet oral hygiene (52.4%), while 47.6% emphasized proper food handling. These findings indicate a strong awareness of preventive practices aimed at minimizing zoonotic disease transmission through both personal hygiene and responsible animal care.

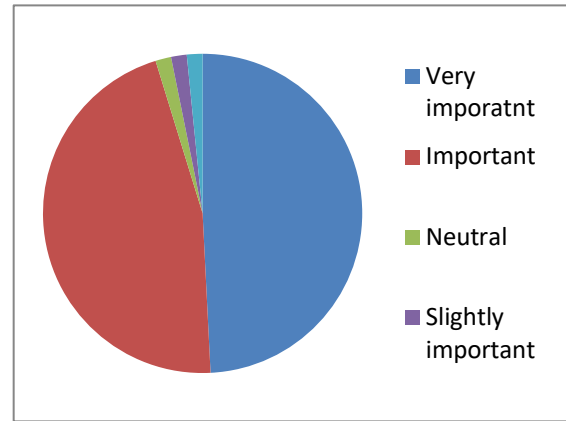


Diagram 7: Pie chart showing importance of pet hygiene in reducing the microbial transmission

The majority of respondents considered maintenance of pet oral hygiene to be important in reducing microbial transmission risks, with 49.2% rating it as very important and 46.0% as important. Overall, 95.2% of participants acknowledged the significance of pet oral hygiene in preventing microbial transmission, while only 4.8% expressed neutral or negative opinions. These findings reflect a high level of awareness regarding the role of pet oral health in zoonotic disease prevention and public health protection.

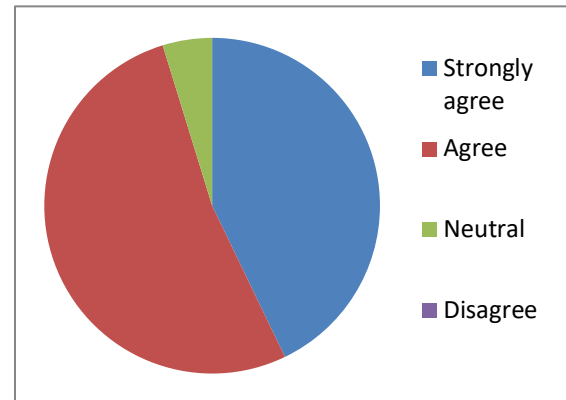


Diagram 8: pie chart showing veterinarians' response about collaboration of veterinarians and dentist regarding improved public awareness about zoonotic diseases

The majority of respondents supported greater interaction between veterinary and dental professionals to improve public awareness regarding zoonotic diseases. Overall, 52.4% agreed and 42.9% strongly agreed with the statement, representing a combined agreement rate of 95.3%. Only 4.8% of participants remained neutral, while no respondents expressed disagreement. These findings highlight strong support for interdisciplinary collaboration and underscore the perceived importance of integrating

veterinary and dental expertise in zoonotic disease education and public health initiatives.

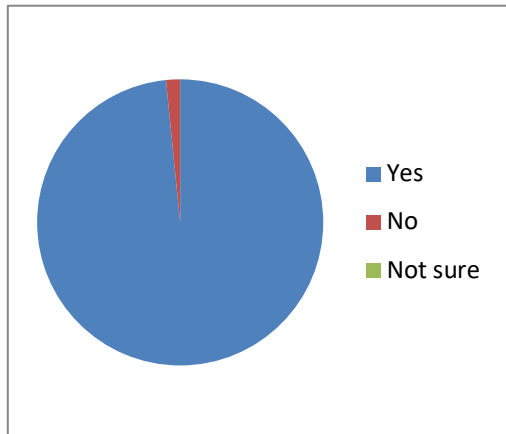


Diagram 9: Pie chart showing veterinarians response to need of educating people about oral spread of zoonotic diseases and their oral implications.

The survey revealed overwhelming support for integrating oral health into zoonotic disease education, with 98.4% of respondents endorsing its inclusion. This finding highlights a strong perceived need for interdisciplinary approaches that connect veterinary and dental health education. The near-universal agreement suggests that respondents recognize oral health as an important component of disease prevention and public health awareness in the context of zoonotic infections.

DISCUSSION

According to the Centers for Disease Control and Prevention (CDC), a collaborative, multisectoral, and transdisciplinary approach is essential to achieve optimal health outcomes by recognizing the interconnectedness of humans, animals, plants, and their shared environment. This framework emphasizes coordinated actions at local, regional, national, and global levels to prevent, detect, and control infectious diseases¹. Recent global policy frameworks further define One Health as an operational strategy that integrates surveillance, risk assessment, and response mechanisms across sectors to strengthen global health security^{2,3}. Veterinarians are no longer restricted to providing clinical animal care in the 21st century. They contribute significantly to food safety, antimicrobial stewardship, wildlife conservation, biosecurity and epidemiological surveillance, which encompass the core components of the One Health agenda⁴. Historically, the human health and veterinary sectors have often operated independently, with limited interdisciplinary communication. Despite its clear links to the development of infectious diseases, environmental health has received less attention and is

often addressed separately.⁵ However, recent global initiatives such as the One Health Joint Plan of Action (2022–2026) advocate stronger institutional collaboration among veterinary, medical, and environmental professionals to address complex health challenges⁶.

More than half of the respondents (52.4%) were above 50 years of age, indicating that the study population was predominantly composed of senior veterinary professionals. The respondents were predominantly male, accounting for 93.7% of the total sample, while females represented only 6.3%. In the study conducted by Steele et al. (2021), a total of 605 veterinarians participated in the survey. The majority of respondents were female (74.5%), while males constituted 25.0% of the study population. Participants were recruited from both urban and rural practice settings. Most respondents were graduates of Australian veterinary schools, and small-animal practitioners represented the largest professional group (65.6%)⁷. Nearly half of the respondents (49.2%) held a Bachelor of Veterinary Science and Animal Husbandry (BVSc & AH) degree as their highest qualification. The majority of respondents (58.8%) reported more than 20 years of professional experience. Those with 11–20 years of experience comprised 19.0%, while veterinarians with less than 5 years and 5–10 years of experience each accounted for 11.1%. Government veterinary services constituted the largest professional category, representing 58.7% of respondents. Information regarding year of graduation and professional experience was also collected to assess potential associations between demographic characteristics and perceptions of zoonotic diseases. The findings revealed that veterinarians demonstrated significantly greater confidence in diagnosing and managing zoonotic diseases compared with medical practitioners. A substantial proportion of participants (85.6%) expressed concern regarding zoonotic diseases and their impact on public health. The majority of respondents perceived zoonotic diseases as having a substantial impact on human health and society. Nearly half (44.4%) rated the impact as very high, while 36.5% rated it as high. Overall, 80.9% of respondents considered the impact of zoonotic diseases to be high or very high, highlighting widespread recognition of their significant public health and societal implications. Meslin (2006) highlighted that zoonotic diseases pose a significant threat to human health by contributing to morbidity, mortality, and the emergence of large-scale outbreaks. The study emphasized that diseases such as severe acute respiratory syndrome (SARS), avian influenza, and bovine spongiform encephalopathy have generated substantial public health concerns worldwide. In addition to their direct health

consequences, zoonotic diseases were reported to cause considerable economic losses and social disruption, thereby affecting both healthcare systems and societal well-being⁸

When participants were asked about oral manifestations that may potentially occur following zoonotic infections, gingival inflammation was the most commonly identified condition (41.3%), followed by oral candidiasis (39.7%) and halitosis (39.7%). Oral ulcers were recognized by 30.2% of respondents, while xerostomia was identified by only 17.5%. These findings suggest moderate awareness of certain oral manifestations, but also highlight notable gaps in knowledge among respondents. Joseph et al. (2023) provided a comprehensive overview of the oral manifestations associated with zoonotic diseases. The authors reported that several zoonotic infections may present with oral ulcers, mucosal lesions, lymphadenopathy, salivary gland involvement, and periodontal changes. The study emphasized the importance of early recognition of these manifestations by oral healthcare professionals to facilitate timely diagnosis and management⁹

The majority of participants (92.0%) agreed or strongly agreed that immunocompromised individuals are at greater risk of oral complications associated with zoonotic infections, reflecting a high level of awareness regarding the impact of immune status on susceptibility to oral manifestations of zoonotic diseases. Moosazadeh et al. (2021) conducted a systematic review and meta-analysis comprising 95 studies to evaluate the global prevalence of oral lesions among patients with HIV/AIDS. The analysis revealed that oral candidiasis was the most prevalent oral manifestation, affecting 35% of patients, followed by pseudomembranous candidiasis (19%) and erythematous candidiasis (18%). Other commonly reported lesions included oral hairy leukoplakia (12%) and Kaposi sarcoma (5%). The authors concluded that oral lesions are highly prevalent among immunocompromised individuals and may serve as important clinical indicators of immune suppression and disease progression. The findings underscore the significance of routine oral examinations for the early detection, monitoring, and management of HIV/AIDS-related complications¹⁰

Among the 63 respondents, 46.0% rated their knowledge regarding oral manifestations of zoonotic diseases as average. These findings suggested that although most respondents possess a moderate level of awareness, there remains a need for further education to improve comprehensive understanding of oral manifestations associated with zoonotic diseases. Huang et al. (2024) conducted a scoping review to explore the interrelationship between animal health, environmental health, and human oral health within

the framework of the One Health approach. The review identified a substantial gap in the existing literature regarding the integration of oral health into One Health research and practice. The authors highlighted the need for greater interdisciplinary collaboration among veterinarians, physicians, and dental professionals to address complex health challenges that transcend traditional disciplinary boundaries. Furthermore, the study emphasized that oral health remains an underexplored component of the One Health paradigm despite its significant implications for overall health and disease prevention. These findings underscore the importance of investigating veterinarians' knowledge and awareness of oral manifestations associated with zoonotic diseases, as such research may contribute to strengthening interdisciplinary collaboration and improving early disease detection and public health outcomes¹¹

Among the 63 respondents, pet vaccination was the most commonly recommended preventive measure against zoonotic diseases (76.2%), followed by hand hygiene (73.0%) and avoiding contact with animal saliva and secretions (69.8%). These findings indicate a strong awareness of preventive practices aimed at minimizing zoonotic disease transmission through both personal hygiene and responsible animal care. Lipton et al. (2008) conducted a cross-sectional survey to assess veterinarians' involvement in zoonotic disease prevention practices. The study found that 77% of veterinarians considered client education regarding zoonotic disease prevention to be highly important. Commonly recommended preventive measures included educating pet owners about zoonotic risks, providing informational materials, implementing effective infection-control practices, and encouraging high-risk individuals to seek appropriate medical advice. The authors concluded that veterinarians play a crucial role in reducing the transmission of pathogens between animals and humans through client education and preventive counseling¹²

The majority of respondents considered maintenance of pet oral hygiene to be important in reducing microbial transmission risks, with 49.2% rating it as very important and 46.0% as important. Overall, 95.2% of participants acknowledged the significance of pet oral hygiene in preventing microbial transmission. Damborg et al. (2016) reviewed the transmission of bacterial zoonotic diseases associated with household pets and highlighted the public health implications of close human-animal interactions. The authors reported that frequent and close contact between pets and their owners creates favorable conditions for the transmission of bacterial pathogens. Common pet-associated zoonotic diseases identified

in the review included cat-scratch disease, campylobacteriosis, salmonellosis, and leptospirosis. The study emphasized the importance of implementing preventive measures to minimize the risk of pathogen transmission. Recommended strategies included maintaining proper pet hygiene, practicing hand hygiene after animal contact, ensuring appropriate disposal of animal waste, and seeking routine veterinary care. The authors concluded that these preventive practices are essential for reducing the transmission of zoonotic bacteria and promoting the health of both companion animals and their owners¹³

Overall, 52.4% agreed and 42.9% strongly agreed with the statement, representing a combined agreement rate of 95.3%. These findings highlight strong support for interdisciplinary collaboration and underscore the perceived importance of integrating veterinary and dental expertise in zoonotic disease education and public health initiatives. Eroğlu Çakmakoglu and Çelebi (2022) evaluated the awareness of dental professionals regarding zoonotic diseases and the One Health concept. The study highlighted the important role of dentists in the prevention, early recognition, and management of zoonotic diseases that may present with oral manifestations. The authors emphasized the need to enhance awareness among dental professionals regarding their responsibilities in zoonotic disease surveillance and public health promotion. Furthermore, the study underscored the significance of interdisciplinary collaboration among veterinarians, physicians, and dentists in addressing zoonotic health challenges. The findings suggest that effective cooperation between these professional groups can contribute to improved disease prevention, early diagnosis, and increased public awareness of zoonotic diseases. Notably, this study represents one of the few investigations directly examining the relationship between dental professionals and zoonotic disease awareness within the framework of One Health.¹⁴

The survey revealed overwhelming support for integrating oral health into zoonotic disease education, with 98.4% of respondents endorsing its inclusion. This finding highlights a strong perceived need for interdisciplinary approaches that connect veterinary and dental health education. Joseph et al. (2023) reviewed the relationship between oral health and zoonotic diseases and reported that numerous zoonotic infections may present with oral manifestations, including oral ulcers, mucosal lesions, salivary gland involvement, and periodontal changes. The authors emphasized that increasing public awareness regarding these oral signs is essential for promoting early recognition and timely intervention. The study further highlighted the need for educational initiatives aimed at improving knowledge of the oral implications

of zoonotic diseases among both healthcare professionals and the general population.¹⁵

CONCLUSION

The present study highlighted that veterinarians possess a strong understanding of zoonotic diseases and recognize their substantial impact on human health and society. Most participants demonstrated awareness of key preventive measures, including pet vaccination, hand hygiene, regular veterinary care, and maintenance of pet oral hygiene, reflecting their important role in zoonotic disease prevention and public health promotion. Furthermore, respondents acknowledged the increased susceptibility of immunocompromised individuals to oral complications associated with zoonotic infections and recognized the significance of pet oral health in reducing microbial transmission risks.

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