

RESEARCH

Open Access



Investigation of the understanding on tropical infectious diseases and oral health among dental professionals in China

Yi Shuai^{1,2*†}, Wenyin Zhu^{3†}, Bingyao Liu^{1,2†}, Ping Li^{4*} and Lei Jin^{1,2*}

Abstract

Background: With the increasing exchange of domestic and international personnel, local infections of tropical infectious diseases are continuing in tropics and imported infections are emerging in non-tropics, some of which are accompanied by oral manifestations. Therefore, it is essential for dental professionals to identify the related oral manifestations, who are working for domestic medical service, international medical assistance, peace-keeping medical service or medical support of international joint military exercises. This study aims to investigate the attitude and knowledge of Chinese dental professionals on tropical infectious diseases and oral health, and to explore the difference between different genders, education backgrounds, professional identities, professional titles and tropics working experience.

Methods: Network questionnaire was used to evaluate the knowledge and attitude of 236 Chinese dental professionals towards tropical infectious diseases and oral health.

Results: The scores of the participants on tropical infectious diseases and oral health were quite low. Although working experience in the tropics partially affected the understanding, there was no difference between different genders, education backgrounds, professional identities and professional titles.

Conclusion: The understanding of dental professionals on tropical infectious diseases and oral health was insufficient. It is necessary to improve the clinical education and management specified with tropical infectious diseases and oral health.

Keywords: Tropical infectious diseases, Oral health, Dental professionals, Clinical management, Knowledge

Background

Nowadays, personnel exchange has been largely increased because of increasingly open domestic and international cooperation, such as tourism, business,

international assistance, peace-keeping action and international joint military exercises. As a result, sporadic and local epidemics of imported infectious diseases, being prevalent in tropics, have been reported in non-tropics [1–5]. Furthermore, the medical professionals might fight against tropical infectious diseases during their medical task of international assistance, peace-keeping action and international joint military exercises.

Oral-maxillofacial system has been reported to be affected by such infectious diseases, such as parasitic diseases [6, 7], viral diseases [8, 9], bacterial diseases [10, 11] and fungal diseases [10, 12]. In addition, oral

[†]Yi Shuai, Wenyin Zhu and Bingyao Liu contributed equally to this work

*Correspondence: handsy@126.com; leep2002@163.com; lejinnju@126.com

¹ Department of Stomatology, Jinling Hospital, Medical School of Nanjing University, Nanjing 210002, Jiangsu, People's Republic of China

⁴ Institute of Liver Disease, Qinhuai Medical District of Jinling Hospital, Medical School of Nanjing University, Nanjing 210002, Jiangsu, People's Republic of China

Full list of author information is available at the end of the article



adverse events of medications for tropical infectious diseases have been also reported [13]. Notably, some related oral manifestations occurred as the first sign of aforementioned infectious diseases [6–8, 14–16] and their drug associated adverse events [13]. Therefore, the dental professionals working for domestic medical service, international medical assistance, peace-keeping medical service or medical support of international joint military exercises might face a big challenge of managing tropical infectious diseases and oral health. Dental professionals should pay attention to identify the oral symptoms and infectious diseases, because some sufferers may firstly visit the dentists for their oral discomfort. Timely identification and appropriate management are particularly crucial for the management of infectious diseases in dental clinic, which largely depend on education and mastery of related knowledge. However, there are few studies concentrating on infectious diseases and oral health.

Therefore, the aim of current study is to uncover the attitude and knowledge of dental professionals on tropical infectious diseases and oral health, and to explore the difference between different genders, education backgrounds, professional identities, professional titles and tropics working experience. We expect that these findings will alert tropical doctors to improve clinical education and management of tropical medicine and oral health.

Methods

Questionnaire preparation

The network questionnaire (The Tencent Technology (Shenzhen) Co. Ltd, China), having been validated by a pilot study, was designed by three experts majoring in stomatology, infectious diseases and tropical medicine, respectively. Some changes were made based on the feedbacks of the pilot participants (21 participants from Department of Stomatology, Jinling Hospital, Medical School of Nanjing University), including linguistic errors and improper statements. The reliability and validity of the questionnaire were evaluated by Cronbach's α Coefficient (0.92) and Goodness of Fit Index (0.83). The final questionnaire consisted of 56 questions, concerning general information (6 items), attitude towards tropical infectious diseases and oral health (5 items), understanding of tropical infectious diseases (24 items), tropical infectious diseases related oral health (17 items) and management of tropical infectious diseases in dental clinic (4 items).

Study participants and analysis

By 2021, there were 278,000 registered dental professionals in China [17]. According to Doctor Law of The People's Republic of China, being registered in dental

society is mandatory to practice in China. Totally, 241 dental professionals with practicing qualifications from 25 provincial regions of China were recruited in the study. Among them, 236 dental professionals completed the questionnaires. The proportions of the respondent backgrounds were close to the previous report, which covered all dental professionals from seven economically developed and underdeveloped provinces of different regions in China [18]. The participants of the pilot study were excluded from the main study. Dental professionals in the main study were recruited from multiple provincial regions through delivering announcement in the online chat room of Dental Professional Society of China. The recruited participants were asked for joining in a new online chat room to complete the network questionnaire. The questionnaires were distributed on Feb 22nd, 2020, and were all responded on Feb 27th, 2020. All the questionnaires were valid.

The data were divided into two parts: attitude and knowledge on tropical infectious diseases and oral health. The data were statistically analyzed between different genders, education backgrounds, professional identities, professional titles and tropics working experience. The score of each part of knowledge was normalized to 10, thus the total score was 80.

Statistical methods

Descriptive statistics (number and percentage) was used to analyze general information of samples and attitude of the dental professionals towards tropical infectious diseases and oral health. Chi-square test or continuity correction was used to analyze the difference of ratio in different groups. Student's *t* test and One-way ANOVA were used to analyze the Mean between different groups. The statistical significance was $p < 0.05$.

Results

Sample characteristics

A total of 241 dental professionals from 25 provincial regions of China were recruited as participants. However, 236 participants completed the questionnaires (97.9%). There were 121 males and 115 females; 174 postgraduates, 54 graduates and 8 junior college graduates; 211 doctors and 25 nurses; 26 participants with senior titles, 126 participants with intermediate titles, and 84 participants with junior titles; 24 participants with tropics working experience, 212 participants without such experience. The average age was 35.7 years old (23–59 years old). (Additional file 1: Table S1).

The attitude of dental professionals towards tropical infectious diseases and oral health

Oral manifestations related to tropical infectious diseases have been displayed in Additional file 1: Table S2. The ratio of positive attention and systematical study experience of dental professionals on tropical infectious diseases and oral health were only 36.9% and 25.4%, respectively (Table 1). The positive ratio of participants who thought it was necessary to systematically learn about infectious diseases and oral health if working in non-tropics was 79.7%, while the ratio was statistically increased to 96.2% if working in tropics (Table 1). The positive ratio of participants, thinking identification of oral lesions was helpful to the management of tropical infectious diseases, was 85.6% (Table 1).

Compared to the participants with no tropics working experience, the participants with such experience showed statistically higher positive ratio on attention (58.3% vs 34.4%) and systematical study experience (41.7% vs 21.7%) of the dental professionals on tropical infectious diseases and oral health (Table 2). However, there was no difference between different genders, education backgrounds, professional identities and professional titles (Table 2).

The understanding of dental professionals on tropical infectious diseases and oral health

The average of total score was only 29.87 ± 0.60 (Fig. 1A). In the section of tropical infectious diseases, the average score of scope (Fig. 1B), prevalent subtype (Fig. 1C), transmission route (Fig. 1D), insect-borne type (Fig. 1E), associated pathogen (Fig. 1F) of tropical infectious diseases were 4.37 ± 0.11 , 6.33 ± 0.14 , 1.48 ± 0.12 , 2.49 ± 0.21 and 4.89 ± 0.22 , respectively. In the section of tropical infectious diseases related oral health, the average score of oral manifestations of tropical infectious diseases (Fig. 1G), oral adverse events of medications for tropical infectious diseases (Fig. 1H) were 2.99 ± 0.11 , 1.74 ± 0.17 , respectively. In the section of management of tropical infectious diseases in dental clinic, the average score was 5.57 ± 0.18 (Fig. 1I).

However, there was no difference of score between different genders, education backgrounds, professional identities and professional titles and tropics working experiences in aforementioned sections (Fig. 1).

Discussion

Dental clinics are at high risk of tropical infectious diseases because: (1) some infected patients or patients with drug-induced adverse events, need to be identified, may firstly visit the dentists for their accompanied oral discomfort [6–8, 13–16]; (2) the aerosols will be generated during the oral treatment, which is the crucial risk factor for infectious disease spread [19–21]; (3) the closed treatment environment is easy for infectious disease spread [19, 20]; (4) the blood exposure is another risk factor for infectious disease spread [22]; (5) some tropical infectious diseases have severe late-onset oral complications which need follow-up, such as Burkitt lymphoma related to malaria [7], oral cancer related to trichinosis [6] and jaw-bone osteonecrosis related to dengue fever [8]. Therefore, it is necessary for the dental professionals to focus on tropical infectious diseases and oral health. The understanding of dental professionals on this topic will directly influence the clinical management of infectious diseases in dental clinics.

The network questionnaire was formulated to evaluate the understanding of the dental professionals on tropical infectious diseases and oral health: (1) The attention and study experience of the dental professionals on tropical infectious diseases was insufficient. Tropics working experience positively improved the attention and study experience of the dental professionals on this topic, whereas gender, education backgrounds, professional identities and professional titles did not affect it. It is indicated that the participants with tropics working experience might have seen some suspected cases during their clinical practice to improve the attention and study experience. (2) Most dental professionals realized the importance of study on tropical infectious diseases and oral health. Additionally, most dental professionals realized that it was helpful for the management of tropical

Table 1 The attitude of the dental professionals towards tropical infectious diseases and oral health

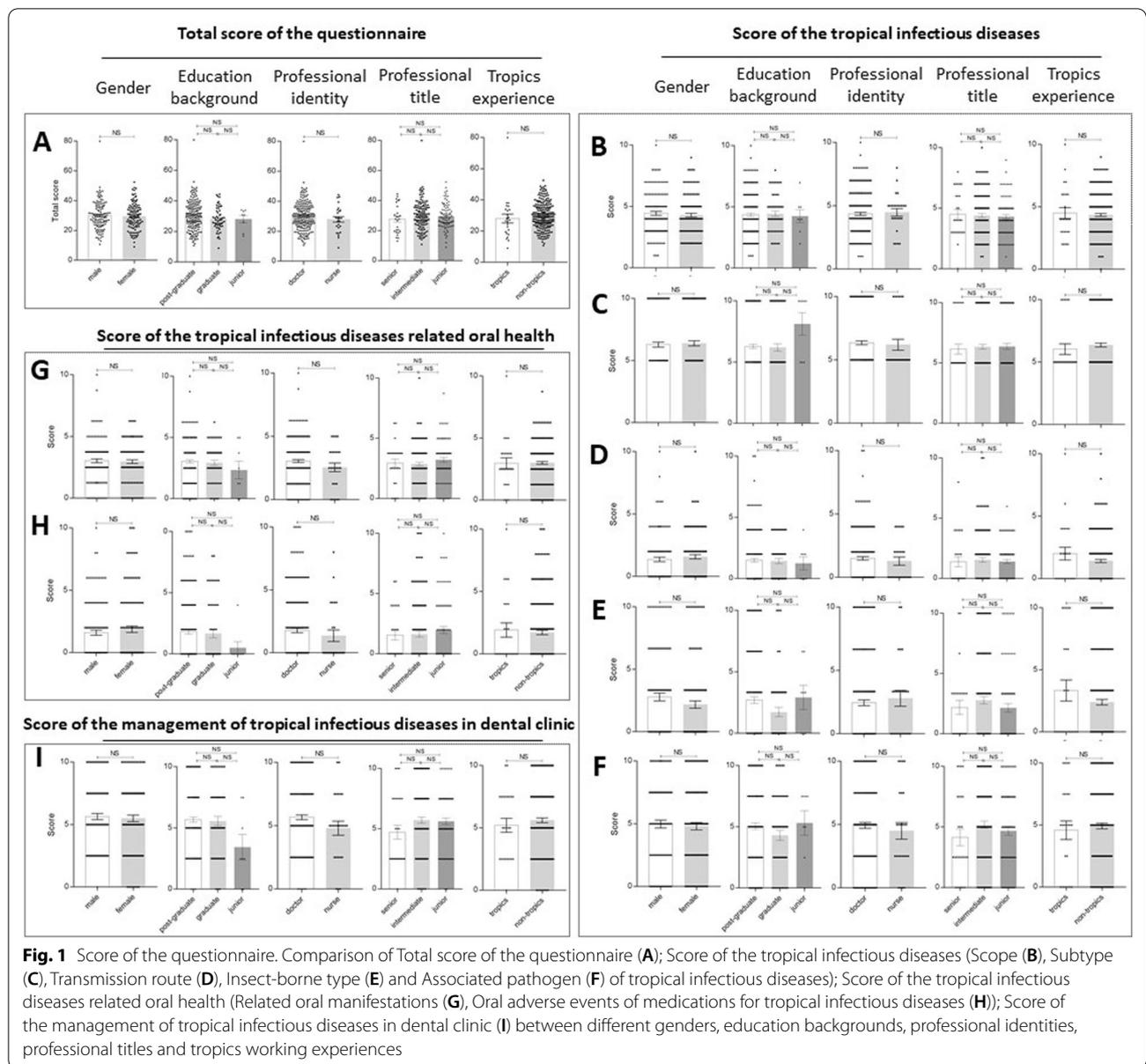
Content of questionnaire	Yes	No	Positive rate	Negative rate
Focus on tropical infectious diseases and oral health	87	149	36.9%	63.1%
Study on tropical infectious diseases and oral health systematically	60	176	25.4%	74.6%
If working in non-tropics, it is necessary to learn about infectious diseases and oral health systematically. [§]	188	48	79.7%	20.3%
If working in tropics, it is necessary to learn about infectious diseases and oral health systematically. [#]	227	9	96.2%	3.8%
Identification of oral lesions is helpful to the management of tropical infectious diseases	202	34	85.6%	14.4%

Item “#” compared with item “§”; $p < 0.05$

Table 2 The attitude of the dental professionals towards tropical infectious diseases and oral health (classification)

Content of questionnaire	Gender		Education background				Professional identity			Professional title				Tropics working experience		
	Male (121)	Female (115)	Post-graduate (174)	Graduate (54)	Junior (8)	Doctor (211)	Nurse (25)	Senior (26)	Intermediate (126)	Junior (84)	Yes (24)	No (212)	Yes (24)	No (212)	p value	
	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	p value	
Focus on tropical infectious diseases and oral health	51/70 42.1%	36/79 31.3%	63/111 36.2%	22/32 40.7%	2/6 25.0%	78/133 35.3%	9/16 36.0%	11/15 42.3%	44/82 34.9%	32/52 38.1%	14/10 58.3%	73/139 34.4%	0.02*			
Study on tropical infectious diseases and oral health systematically	34/87 28.1%	22/93 19.1%	44/130 25.3%	12/42 22.2%	0/8 0%	49/162 22.2%	7/18 28.0%	7/19 26.9%	32/94 25.4%	17/67 20.2%	10/14 41.7%	46/166 21.7%	0.03*			
If working in non-tropics, it is necessary to learn about infectious diseases and oral health systematically, ³	97/24 80.2%	94/21 81.7%	135/39 77.6%	48/6 88.9%	6/2 75.0%	169/42 76.5%	22/3 88.0%	23/3 88.5%	101/25 80.2%	67/17 79.8%	23/1 95.8%	168/44 79.2%	0.09			
If working in tropics, it is necessary to learn about infectious diseases and oral health systematically, ⁴	117/4 96.7%	110/5 95.7%	168/6 96.6%	52/2 96.3%	7/1 87.5%	204/7 92.3%	23/2 92.0%	25/1 96.2%	120/6 95.2%	82/2 97.6%	24/0 100%	203/9 95.8%	0.64			
Identification of oral lesions is helpful to the management of tropical infectious diseases	106/15 87.6%	96/19 83.5%	149/25 85.6%	47/7 87.0%	6/2 75.0%	179/32 81.0%	23/2 92.0%	23/3 88.5%	106/20 84.1%	73/11 86.9%	21/3 87.5%	181/31 85.4%	0.37			

Item “#”, $p < 0.05$; Item “ Δ ”: p value of three sub-groups comparison, there was no difference between any two sub-groups. Item “#” compared with item “\$”; $p < 0.05$



infectious diseases through oral manifestation identification. All these suggest that the dental professionals' attitude was positive on this topic. (3) The low score of the tropical infectious diseases and oral health suggested that mastery of the knowledge was poor among the dental professionals. In addition, gender, education backgrounds, professional identities, professional titles and tropics working experience could not ameliorate the understanding of knowledge, suggesting that (1) academic education, continuing education and clinical education are not satisfied on this topic; (2) some suspected cases might be misdiagnosed by some dental professionals; (3) learning and mastery of the knowledge was

insufficient among the participants with tropics working experiences, although they have seen some suspected cases and realized the importance of tropical infectious diseases and oral health.

With regard to the tropical infectious diseases and oral health, there were three types of surveys exploring knowledge mastery of medical and dental providers. Firstly, most research reported the knowledge and attitude of medical or dental professionals towards infectious diseases, such as AIDS [23, 24], hepatitis [25, 26], COVID [27, 28], leprosy [29, 30] and some other tropical diseases [31, 32]. However, few of them concentrated on their oral manifestations. Additionally, infectious diseases involved

in most of these surveys were not tropical infectious diseases. Secondly, several studies investigated the understanding of the medical and dental professionals on oral signs related to systemic diseases [33], whereas tropical infectious diseases were always ignored. Thirdly, although some oral disorders related to tropical infectious diseases have been found in clinic [8, 10, 11], the researchers did not investigate the understanding of this knowledge and importance among dental professionals. However, our study paid attention to such neglected aspect of tropical infectious diseases and oral health. In addition, most of the previous surveys included only one or two classes of medical or dental professionals, therefore the outcomes might not be representative of the overall professionals.

Lack of the knowledge and understanding of this topic might bring certain risks for the management of infectious diseases in dental clinics, such as misdiagnosis, missed diagnosis, delayed diagnosis and even leading to spread of infectious diseases. Therefore, it is urgent to develop an educational and training system for tropical infectious diseases and oral health: (1) Compile textbooks on tropical infectious diseases and oral health, including the knowledge about tropical infectious diseases; associated oral manifestations; oral adverse events of commonly used drugs for infectious diseases; clinical management; emergency treatment and follow-up treatment instructions, and so forth. (2) Offer public course of this topic in academic education, continuing education and clinical education. (3) Offer targeted guidance and training for the dental professionals who will be working in tropics, such as international medical assistance, peace-keeping medical service and medical support of international joint military exercises. (4) Establish a public communication platform to share popular scientific information, case report and discussion of this topic. We hope to raise concerns of this topic and improve the role of the dental professionals in the management of tropical infectious diseases through aforementioned measures.

Conclusion

Tropical infectious diseases are highly related to oral health, neglect of which might trigger the spread of infectious diseases. We first investigated the understanding of tropical infectious diseases and oral health among dental professionals, which was neglected by most medical professionals and researchers. The data of the investigation showed that the dental professionals were lacking in understanding on tropical infectious diseases and oral health, which might bring hidden danger to oral and public health. It is necessary to improve dental education and management specified with infectious diseases and oral health.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12903-022-02250-x>.

Additional file 1: Sample characteristics of the study.

Acknowledgements

We thank all participants in this study.

Author contributions

YS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology and Writing-original draft. WZ and BL: Conceptualization, Data curation, Formal analysis, Investigation and Methodology. PL: Conceptualization, Funding acquisition, Project administration, Writing-review & editing. LJ: Conceptualization, Funding acquisition, Project administration, Writing-review & editing. All authors read and approved the final manuscript.

Funding

Project of General Hospital of Eastern Theater Command (YYQN2021071, YYMS2021039), Military Medical Science and Technology Youth Cultivation Project (17QNP054).

Availability data and materials

All data generated or analyzed during this study are included in this published article and its Additional files.

Declarations

Ethics approval and consent to participate

This study was approved by The Institutional Review Board (IRB)/Ethics Committee of Jinling Hospital (2017NZKY-005-02). Informed consent, on the first page of the network questionnaire, was confirmed and obtained from all subjects. All the methods and experimental protocol were carried out in accordance with guidelines of Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Department of Stomatology, Jinling Hospital, Medical School of Nanjing University, Nanjing 210002, Jiangsu, People's Republic of China. ²Department of Stomatology, General Hospital of Eastern Theater Command, PLA, Nanjing 210002, Jiangsu, People's Republic of China. ³Department of The Third Outpatient, Nanjing Stomatological Hospital, Medical School of Nanjing University, Nanjing 210002, Jiangsu, People's Republic of China. ⁴Institute of Liver Disease, Qinhuai Medical District of Jinling Hospital, Medical School of Nanjing University, Nanjing 210002, Jiangsu, People's Republic of China.

Received: 3 January 2022 Accepted: 24 May 2022

Published online: 02 June 2022

References

- Xia J, Wu D, Sun L, Zhu H, Li K, Zhang J, Lin W, Wan L, Zhang H, Liu S. Characteristics of imported *Plasmodium ovale* spp. and *Plasmodium malariae* in Hubei Province China 2014–2018. *Malar J*. 2020;19(1):264.
- Yu T, Fu Y, Kong X, Liu X, Yan G, Wang Y. Epidemiological characteristics of imported malaria in Shandong Province, China, from 2012 to 2017. *Sci Rep*. 2020;10(1):7568.
- Hou J, Liu Q, Wang J, Wu Y, Li T, Gong Z. Insecticide resistance of *Aedes albopictus* in Zhejiang Province, China. *Biosci Trends*. 2020;14(4):248–54.
- Yao MX, Wu SZ, Wang GL, Wang XJ, Fan WJ, Zhang WG, Yang LL, Sun DP, Liu JY, Wu JL, et al. Imported dengue serotype 1 outbreak in a

- non-endemic region, China, 2017: a molecular and seroepidemiological study. *J Infect.* 2020;81(2):304–10.
5. Wang Y, Wang X, Liu X, Ren R, Zhou L, Li C, Tu W, Ni D, Li Q, Feng Z, et al. Epidemiology of Imported Infectious Diseases, China, 2005–2016. *Emerg Infect Dis.* 2018;25(1):33–41.
 6. Hassona Y, Scully C, Delgado-Azner W, de Almeida OP. Oral helminthic infestations. *J Investig Clin Dent.* 2015;6(2):99–107.
 7. Shuai Y, Liu B, Zhou G, Rong L, Niu C, Jin L. Oral manifestations related to malaria: a systematic review. *Oral Dis.* 2021;27(7):1616–20.
 8. Pedrosa MS, de Paiva M, Oliveira L, Pereira S, da Silva C, Pompeu J. Oral manifestations related to dengue fever: a systematic review of the literature. *Aust Dent J.* 2017;62(4):404–11.
 9. Katz J, Guelmann M, Stavropoulos F, Heft M. Gingival and other oral manifestations in measles virus infection. *J Clin Periodontol.* 2003;30(7):665–8.
 10. Zislis T, Adrian JC, Cutright DE. Oral manifestations of tropical infectious diseases of Central and South America. Part II: Bacterial and mycotic infections. *Mil Med.* 1980;145(8):529–34.
 11. Vohra P, Rahman MSU, Subhada B, Tiwari RVC, Nabeel Althaf MS, Gahlawat M. Oral manifestation in leprosy: a cross-sectional study of 100 cases with literature review. *J Fam Med Primary Care.* 2019;8(11):3689–94.
 12. Souza RL, Bonan PR, Pinto MB, Prado JD, de Castro JF, Carvalho EA, Perez DC. Oral paracoccidiodomycosis in a non-endemic region from Brazil: a short case series. *J Clin Exp Dent.* 2019;11(10):e865–70.
 13. Shuai Y, Wang J, Jiang H, Yu Y, Jin L. Oral-maxillofacial adverse events related to antimalarials. *Oral Dis.* 2021;27(6):1376–82.
 14. Mignogna MD, Celentano A, Leuci S, Cascone M, Adamo D, Ruoppo E, Favia G. Mucosal leishmaniasis with primary oral involvement: a case series and a review of the literature. *Oral Dis.* 2015;21(1):e70–78.
 15. Sinha S, Sardana K, Garg VK. Photoletter to the editor: Disseminated histoplasmosis with initial oral manifestations. *J Dermatol Case Rep.* 2013;7(1):25–6.
 16. Ferreira OG, Cardoso SV, Borges AS, Ferreira MS, Loyola AM. Oral histoplasmosis in Brazil. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2002;93(6):654–9.
 17. Ma X, Yu X. Statistical annals of China health. Peking Union Med College Press. 2021;2021:1–405.
 18. Gao B, Li G, Wang Y, Guo J, Hao Y, Ding X. The investigation on dentist structure in some provinces and a city of China. *J Pract Stomatol.* 2011;27(2):279–82.
 19. Leggat PA, Kedjarune U. Bacterial aerosols in the dental clinic: a review. *Int Dent J.* 2001;51(1):39–44.
 20. Zemouri C, Awad SF, Volgenant CMC, Crielaard W, Laheij A, de Soet JJ. Modeling of the Transmission of Coronaviruses, Measles Virus, Influenza Virus, Mycobacterium tuberculosis, and Legionella pneumophila in Dental Clinics. *J Dent Res.* 2020;99(10):1192–8.
 21. Khemasuwan D, Farver CF, Mehta AC. Parasites of the air passages. *Chest.* 2014;145(4):883–95.
 22. Wendel S, Leiby DA. Parasitic infections in the blood supply: assessing and countering the threat. *Dev Biol (Basel).* 2007;127:17–41.
 23. Jin CX, Meng YC, Du WZ, Pei DD, Li A. Knowledge of infection prevention and attitudes towards HIV/AIDS Among Chinese Dental Bachelor Interns: an appeal for educational intervention. *Oral Health Prev Dent.* 2020;18(1):485–92.
 24. Sufiawati I, Rafi MA, Putri FM. Evaluating knowledge, attitude, and behavior of dentists on HIV/AIDS in West Java, Indonesia, in the COVID-19 Era. *Int J Dent.* 2021;2021:1901887.
 25. Saquib S, Ibrahim W, Othman A, Assiri M, Al-Shari H, Al-Qarni A. Exploring the knowledge, attitude and practice regarding hepatitis B infection among dental students in Saudi Arabia: a cross-sectional study. *Open Access Maced J Med Sci.* 2019;7(5):805–9.
 26. Gambhir RS, Kumar M, Singh G, Singh A, Kaur A. Hepatitis C: Knowledge and awareness of private dental practitioners of a tricity in India. *J Educ Health Promot.* 2018;7:7.
 27. Izná VKSK, Khanna SS, Salokhe O, ChandraTiwari RV, Tiwari H. Knowledge and apprehension of dental health professionals pertaining to COVID in Southern India: a questionnaire study. *J Pharm Bioallied Sci.* 2021;13(1):448–51.
 28. Shariff S, Bente MM, Ahmed Al-Zabidi MK, Alshehri GM, Almeahmadi AA, Alhazmi ST, AlDara EW. Knowledge and attitude towards dental clinical practice related to COVID-19 pandemic among dental interns in Saudi Arabia. *J Pharm Bioallied Sci.* 2021;13(Suppl 1):S831–5.
 29. Kabir H, Hossain S. Knowledge on leprosy and its management among primary healthcare providers in two districts of Bangladesh. *BMC Health Serv Res.* 2019;19(1):787.
 30. Dellar R, Ali O, Kinfe M, Tesfaye A, Fekadu A, Davey G, Semrau M, Bremner S. Knowledge, attitudes and practices of health professionals towards people living with lymphoedema caused by lymphatic filariasis, podocorniosis and leprosy in northern Ethiopia. *Int Health* 2021.
 31. Tamiru HF, Mashalla YJ, Mohammed R, Tshweneagae GT. Cutaneous leishmaniasis a neglected tropical disease: community knowledge, attitude and practices in an endemic area, Northwest Ethiopia. *BMC Infect Dis.* 2019;19(1):855.
 32. Emeto DC, Salawu AT, Salawu MM, Fawole OI. Recognition and reporting of neglected tropical diseases by primary health care workers in Ibadan, Nigeria. *Pan African Med J.* 2021;38:224.
 33. Hassona Y, Salim NA, Tarboush N, Sartawi S, Alrashdan MS, Rajab L, Sawair F. Knowledge about oral manifestations of systemic diseases among medical and dental students from Jordan: An interdisciplinary educational gap. *Special care in dentistry : official publication of the American Association of Hospital Dentists, the Academy of Dentistry for the Handicapped, and the American Society for Geriatric Dentistry* 2022.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

