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Attitudes towards zoonotic disease risk vary across sociodemographic, communication and health-related factors: A general population survey on literacy about zoonoses in the Netherlands

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ABSTRACT

Introduction: Literacy about zoonoses can contribute people adapt their behaviour to minimize zoonotic risks. In this study, associations between sociodemographic factors and zoonotic risk-averse attitudes were explored.
Objective: To determine factors significantly associated with literacy about zoonoses across sociodemographic groups to inform targeted interventions aiming at improving awareness and zoonotic risk-avoidance behaviours.
Method: Data was collected in 2022 using an online survey of a nationally representative sample of residents in the Netherlands. A multivariable logistic regression analysis, accounting for multiple hypothesis testing, was applied to assess whether there were significant associations between socio-demographic factors and attitudes towards zoonosis prevention.
Results: A total of 2039 respondents completed the survey. People who were female, older, highly educated and those who searched for information about zoonoses, were relatively more likely to report behaviours favourable to the prevention of zoonoses. However, people with limited language and computer skills and immunocompromised people were significantly more likely to report risky behaviours. There were no significant associations found for pregnant women, dog and cat owners, those with an intermediate level of education and those who do have contact with farm animals.
Conclusion: Certain sociodemographic groups display significantly riskier attitudes towards zoonoses. These groups provide targets where to improve literacy about zoonoses. This also implies that there is room for improvement in literacy about zoonoses, particularly among immunocompromised people and people with limited language and limited computer skills.

1. Introduction

Zoonoses are infectious diseases caused by pathogens that can be transmitted between animals and humans. They represent a major threat to public health, as an estimated 61% of all known infectious diseases originated from animals, including livestock, pets and wildlife [1,2]. Transmission of zoonoses can occur via direct contact with animals through biting, licking, scratching, and sneezing, as well as contact with animal excreta, secreta and other body fluids, or indirect contact with contaminated bedding, food, water, or via arthropod vectors [3,4].

Besides the exposure and severity, people's health literacy also affects the risk of infection [5–7]. Health literacy entails people's knowledge, motivation and competencies to access, understand, appraise, and apply health information to make judgments and decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life [8]. In 2021, Bekedam et al. introduced the concept of literacy about zoonoses or 'zoonotic literacy' (by analogy with health literacy), which emphasises the need to enhance knowledge and awareness about zoonotic diseases so that people can adapt their behaviour to avoid risks [5].

Hygiene measures, such as hand washing and forbidding pets to sleep in bed are considered important behaviours to minimize zoonotic infection risks [9–12]. However, non-compliance with these measures is relatively common. In the Netherlands, 18–30% of dogs and cats sleep with their owner in bed [12], and studies from other countries present similar percentages [4,13]. Research among pet owners in Australia

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showed that about 63% of households took action to prevent acquiring an infection from their pets [10]. However, about 10% of pet owners in Australia who were bitten or scratched by their pets did not wash their hands or take other actions to prevent infections [10].

Studies reported in Canada show that knowledge about zoonoses among pet owners and non-pet owners is almost equal [9]. The respondents had a good awareness of severe zoonotic diseases, such as rabies, which are not common in the country, but they had poor knowledge of more common zoonoses [9]. This indicates the need to improve awareness about more common zoonoses, such as cryptosporidiosis, dermatophytosis, salmonellosis, psittacosis, toxocariasis, and toxoplasmosis, among others [12,14].

In the current study, we investigated factors, associated with literacy about zoonoses among residents in the Netherlands, namely age, gender, general health status, educational attainment, computer and language skills and amount of contact with companion, farm and wild animals and factors related with different transmission routes, such as direct contact with pet and farm animals, indirect transmission via the environment from ticks, natural water and wildlife, but excluding foodborne transmission. The main aim was to provide more insights into factors associated with literacy about zoonoses across sociodemographic groups. With this information, we will get evidence-based information to improve potential targeted interventions related to awareness and zoonotic risk avoidance behaviours.

2. Method

2.1. Population based survey and data collection

The data used in this study were collected from a representative sample of the Dutch general population through a survey conducted by the company MarketResponse under the commission of the Dutch National Institute for Public Health and the Environment (RIVM). The purpose of this survey was to determine what respondents know about zoonotic transmission and their attitudes regarding the prevention of zoonotic infections. An expert elicitation workshop was held at the RIVM to formulate the survey questions provided by MarketResponse. This latter edited the questions to remove ambiguities and ensure a B1 language level according to the Common European Framework of Reference (CEFR) [15]. The resulting draft questionnaire was reviewed by RIVM experts, with a total of two rounds of feedback. The survey was released with a 'soft launch': once the questionnaire was completed by 30 to 50 respondents, a quality check was conducted. At the end of the questionnaire, an open question was asked where respondents could report any unclarities, doubts, issues or suggestions regarding the questionnaire. Based on this feedback, it was clear that no changes were needed. The survey was launched on September 22nd, 2022, and closed on October 3rd, 2022. The questionnaire was distributed on the panel of a first-party data company called Dynata. After completing the survey, people were remunerated to increase the number of respondents.

2.2. Survey questions

The survey contained a total of 119 questions and sub-questions. The questions on attitudes to prevent zoonotic diseases were grouped into themes based on transmission routes. As not all questions were asked to all respondents, a question for each theme was used to determine whether the theme applied to a respondent's specific situation. For example, respondents indicating to never swim in natural waters were not asked further questions about the risks of swimming in natural waters. For the current study, 13 questions were selected for analysis (see Appendix 1). These questions consisted of statements in which the respondents were asked to indicate, with a Likert scale, to what degree the statements applied to them. The respondents were not able to skip questions.

The selection criteria for the questions were:

1. Questions were in multiple-choice format, and answers could be divided into 3 categories: a) attitudes that are supposed to enhance the risk of zoonotic transmission; b) attitudes that are supposed to reduce the risk of zoonotic transmission; c) 'I don't know' or 'not applicable' answers. The analysis focused on answers implying negative and positive effects on zoonotic infection prevention (i.e., a and b).
2. Questions needed to have >20% variation in answers (i.e., at least 20% of participants selected answers a or b), to have a contrast to study in the analysis.
3. Questions should reveal attitudes towards prevention. For example, when asked about whether people wear clothes that completely cover arms and legs in nature, it is not clear whether this is done for aesthetic reasons or to prevent tick bites. Such a question may produce a biased overview of a person's literacy about zoonoses and is therefore not included in the analysis.
4. Questions needed to be relevant for policymakers in terms of concrete opportunities for prospective implementation of prevention strategies.

The answers to the 13 questions represented the dependent binary outcome variables of the analysis. For each outcome variable, 10 factors were assessed: 1) gender (men, pregnant women and non-pregnant women); 2) age (generation Y 18–39 years, X 40–59 years or W $\geq$ 60 years); 3) residence location (living in the large cities of Amsterdam, Rotterdam or The Hague and neighbouring municipalities, or peripheral residents, as people living in more rural areas might have different lifestyles and exposures to animals); 4) immune status (being immunocompromised due to illness or medication use, or not, based on respondent's self-reported information); 5) level of education (according to standard categorization used by Statistics Netherlands [CBS]; low education includes primary education and pre-vocational secondary education [VMBO], intermediate education includes completing pre-university education (VWO), senior general secondary education [HAVO] or secondary vocational education [MBO], high education includes higher professional education [HBO] or University education [WO]); 6) parenting (having children younger than 13 years, as children aged 13 years in the Netherlands go to secondary school where they usually develop a more independent lifestyle); 7) current pet ownership (cats or dogs, as these are the most common pets in Dutch households), 8) contact with farm animals (more than once a year, or less frequently); 9) having ever searched for information on zoonoses; (10) limited computer or language skills. Six statements were about establishing whether an individual was considered to have limited computer or language skills in this survey: 1) 'I can quickly find my way around a website'; 2) 'I arrange many personal matters online myself'; 3) 'I can easily look up information online'; 4) 'If I read a letter from my bank, I know exactly what to do'; 5) 'If I want to make an appointment, I prefer to call'; 6) 'If I get an email from the government, I ask for help to read it'. Regarding statements 1–4, the answers 'does not apply to my situation' or 'does not at all apply to my situation' were considered an indicator of having low computer or language skills. Regarding statements 5–6 the answers describing their situation 'well' or 'very well', were considered as an indication of impaired computer or language skills. Respondents were considered to have low computer and language skills when at least three out of six answers indicated impaired computer or language skills.

2.3. Data analysis

A multivariable logistic regression analysis was applied to assess whether there were significant associations between the factors and the attitudes towards the prevention of zoonoses. A stepwise backward elimination procedure was used to retain in the model only those variables with $p < 0.05$, which was the level of statistical significance used in this study. Collinearity between independent variables was examined by

looking at the correlation matrix and variance inflation factor (VIF); no signs of collinearity were detected. Age, gender, educational level and residence were considered a priori confounders and were always included in the models. Interactions were not investigated. Associations were expressed as Beta coefficients (β) and 95% Confidence Intervals (CI). To compensate for multiple hypothesis testing, Bonferroni correction of *p*-values was applied. All final regression models showed an overall statistical significance (likelihood ratio $\chi 2$ test, $p < 0.05$) and goodness-of-fit (Hosmer-Lemeshow test, $p > 0.05$). The descriptive statistics and data analysis were performed with SPSS Statistics version 28 and figures were made in R version 4.3.0.

3. Results

3.1. Population survey

A total of 2039 respondents completed the survey. The average completion time was 16 min. There were 299 people who did not finish the survey. Descriptive statistics for respondents by independent sociodemographic factors are presented in Table 1. The proportions of covariates are shown in Appendixes 2 and 3.

Table 1.

3.2. Logistic regression

The Beta coefficients and 95% Confidence Intervals between the studied factors and attitudes of respondents are shown in Fig. 1 and Fig. 2. The results of dog and cat owners, parents of children younger than 13 years and those who do have contact with farm animals were not reported because no significant associations were found.

Men were significantly less likely than women to report washing their hands after cleaning their pets' baskets or cages (β = −0.481), washing hands after petting or feeding farm animals (β = −0.489), checking their bodies for ticks after going out in nature (β = −0.297), monitoring tick bite spots for three months (β = −0.530), and washing their hands after touching a sick or dead animal (β = −0.464).

Respondents aged 60 years or older were significantly more likely than people aged 18–39 and 40–59 years to report not eating in a barn or near farm animals (β = 1.498 and β = 1.083), washing hands after touching a sick or dead animal (β = 0.1.666 and β = 0.880), clean and disinfect a bite or scratch wound of an animal (β = 1.510 and β = 0.817) and monitor a tick bite spot for 3 months (β = 1.356 and β = 0.652). Furthermore, those aged 60 years or older were significantly more likely than those aged 18–39 years to report washing their hands after cleaning their pets' baskets or cages (β = 0.727), letting their pets sleep in or on the bed (β = 0.613) and to be informed about rabies when travelling to endemic countries (β = 0.707).

Respondents who indicated to be immunocompromised were less likely to abstain from eating in stalls or places with farm animals (β = −0.132).

Lowly educated people were significantly less likely than highly educated people to wash their hands after petting or feeding farm animals (β = −629), to examine their bodies for ticks after being exposed to nature (β = −0.367) and to clean and disinfect an animal bite or scratch wound (β = −0.609).

People with low computer or language skills were significantly less likely to report washing their hands after cleaning their pet's basket or cage (β = −1.432), letting their pets sometimes or more often sleep in bed (β = −0.936), washing hands after touching a sick or dead animal (β = −1.295), being informed about rabies when travelling to endemic countries (β = −0.857), cleaning an animal bite or scratch wound (β = −0.816) and monitor a tick bite spot for 3 months (β = −1.029).

Respondents who indicated that they had searched for information on zoonoses were significantly more likely to report that they wash their hands after cuddling or stroking pets (β = 0.799), wash their hands after being licked or if pets eat from their hands (β = 0.603), washing their hands after petting or feeding their farm animals (0.695), check their bodies for ticks after they have been in nature (β = 0.834), swim in outdoor water only if the water quality has been checked (β = 0.493), get informed about rabies when travelling to endemic countries (β = 0.522), clean and disinfect a bite or scratch wound from an animal (β = 0.453), monitor tick bite spots for 3 months (β = 0.568).

Table 1
Distribution of the sociodemographic factors.

	N	%
Gender		
Pregnant female	39	1.9%
Male	988	48.5%
Female (not pregnant)	1012	49.6%
Residence		
Big cities	310	15.2
Periphery	1729	84.8
Age		
18–39 years	521	25.6%
40–59 years	627	30.8%
60+ years	891	43.7%
Level of education		
Low	575	28.2%
Intermediate	781	38.3%
High	683	33.5%
Immunocompromised		
No	1629	79.9%
Yes	382	18.7%
Do not want to tell	28	1.4%
Parents with children below 13 years old		
No	1677	82.2%
Yes	362	17.8%
Contact with farm animals		
No	1053	51.6%
Yes	986	48.4%
Dog/cat ownership		
No	992	48.7%
Yes	1047	51.3%
Limited computer or language skills		
No	1949	95.6%
Yes	90	4.4%
Searched information on zoonoses		
No	1451	71.2%
Yes	497	24.4%
Do not know	91	4.5%

4. Discussion

This study provides insights into factors associated with literacy about zoonoses across sociodemographic groups. We found that women were significantly more likely to report attitudes that mitigate the risk of zoonotic infections, such as washing their hands. This is consistent with previous studies that suggest that women wash their hands more often than men [16]. Women were also more likely to report checking their bodies for ticks after outdoor activities, whereas, in previous studies on Lyme disease in the Netherlands, France and Canada, no difference was observed before between men and women in the intention to check their bodies [17–19].

It is of particular importance for immunocompromised to behave in a risk-averse way due to their increased risk of infection and the severity thereof. Yet, we found that immunocompromised people were significantly more likely to report eating or drinking in the barn or near farm animals. However, this result may be biased because this question was only asked to people who have contact with farm animals. Immunocompromised individuals who exhibit risk-avoidance attitudes by avoiding all contact with farm animals because of infection risks are not represented. The exclusion of immunocompromised people with risk-averse attitudes could have influenced the results.

A low educational level and limited language or computer skills are significantly correlated with risky attitudes. For people with limited language and computer skills, it is known that they could misunderstand

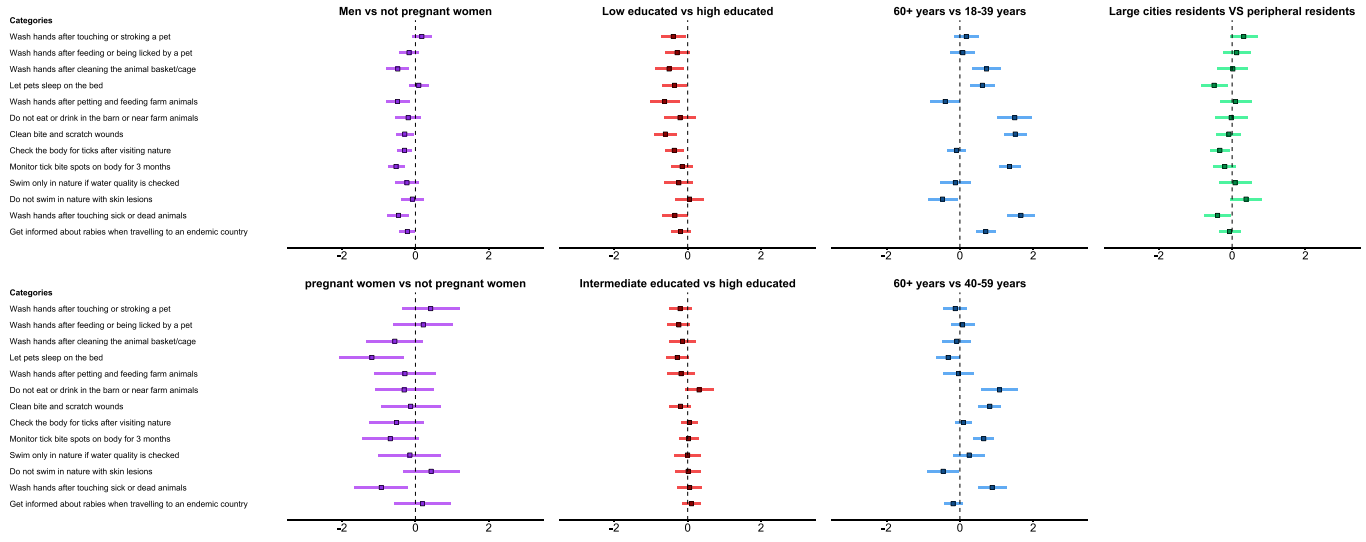

Fig. 1. Beta coefficients and 95% Confidence Intervals between the studied confounders and attitudes.

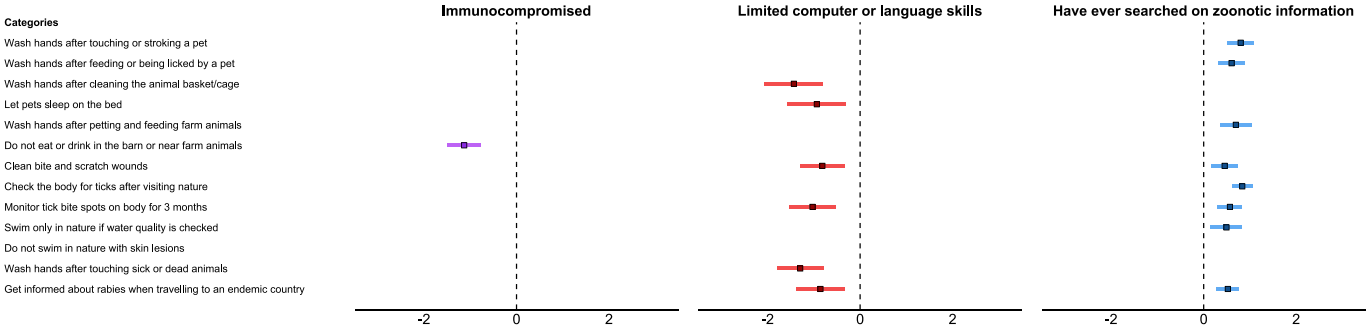

Fig. 2. Beta coefficients and 95% Confidence Intervals between factors related to literacy about zoonoses and attitudes.

questions more often [20]. The significant associations among respondents with low language and computer skills should therefore be interpreted with caution.

The finding that young adults have high-risk attitudes could be related to the fact that risk perception increases with age [21], but it could also be caused by more often using social media as a source of medical information [22]. Social media are known to often lack reliability and can provide medical misinformation [23].

There were no significant differences in attitudes found between owners of dogs and cats and people without dogs and cats. However, because of the intensity of contacts between pet owners and their pets, it is important that pet owners are aware of zoonotic risks. Research conducted in the United States shows that many pet owners do not realise that pets can transmit diseases [24].

Respondents who searched for information on zoonoses reported to wash their hands more often after touching or petting pets, as well as to check more often their bodies for ticks, monitor tick bite spots for 3 months, check the quality of outdoor water, get information about rabies when travelling, and clean a bite or scratch wound. Possibly the content of available information on zoonoses could influence the risk-averse behaviours, but their interest in zoonoses could explain their attitudes too.

In general, the proportions of the 2039 respondents in terms of gender, residence, age and level of education are nationally representative based on the Golden Standard of Market Research Association MOA for the Netherlands. Moreover, not all demographic groups were reached by the survey. For example, no respondents indicated that they did not identify as male or female and the study does also not represent people who cannot read or use computers at all. Another critical point of the present study is that it is mainly focused on attitudes, whereas knowledge and practices are not covered. They are all related, but the gap between knowledge, attitudes and performing behaviour should be considered [25,26]. It is also possible for respondents to give socially desirable answers which do not reflect their behaviour. Finally, the use of Bonferroni correction can be seen as too conservative, as Type II error can increase when the *p*-value is increased due to such correction. This means that false negative results become more likely to occur [27,28]. The likelihood of false-positive correlations would be very high when many different hypotheses are tested without any prior reasoned assumption. Using a correcting method such as the Bonferroni correction is therefore indicated [29].

The sociodemographic groups that are associated with risky attitudes could be a target group for policymakers to improve literacy about zoonoses so that they are better able to implement actions that reduce zoonotic risks. Besides people with high-risk attitudes, the so-called ‘yopi’s’ (young, old, pregnant women, people with reduced immunity) are also high-risk groups for zoonoses because of the impact these infections can have on them. Especially among people with reduced immunity and parents of young children, the results of the present study suggest there seems to be room for improving literacy about zoonoses. Pet owners and people having intensive contact with farm animals could also be considered as a risk group, as they are more often exposed to zoonoses.

A follow-up study could help investigate the motivations of the attitudes observed in these groups and how people could be facilitated to change them in favour of more risk-averse behaviours. For example,

regarding immunocompromised people and pet owners, studies from The United States have found that about 38–57% of veterinarians have brochures on zoonotic risks and only 4.2% of general practitioners do [24,30]. Other sources where people could obtain more information about zoonoses are specialist physicians, nursing staff, public health personnel, pet stores, animal breeders, friends/relatives, media (television, books newspapers internet), among others.

5. Conclusions

This study indicates that people who are female, older, highly educated or those who searched for information about zoonoses, are relatively more likely to report behaviours favourable to the prevention of zoonoses. Results also show that there is room for improvement in literacy about zoonoses among immunocompromised people. Moreover, also people with limited language and computer skills are significantly more likely to report risk behaviours. The limited accessibility of those people to information could be a barrier to acquiring the necessary knowledge.

CRediT authorship contribution statement

Frits Vlaanderen: Writing – original draft. **Lapo Mughini-Gras:** Supervision. **Chantal Bourgonje:** Data curation. **Joke van der Giessen:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.onehlt.2024.100721.

References

[1] L.H. Taylor, S.M. Latham, M.E. Woolhouse, Risk factors for human disease emergence, Philos. Trans. R. Soc. Lond. Ser. B Biol. Sci. 356 (1411) (2001 Jul 29) 983–989, https://doi.org/10.1098/rstb.2001.0888. PMID: 11516376; PMCID: PMC1088493.

[2] WHO, WHO Factsheets, available from, https://www.who.int/news-room/fact-sheets/detail/zoonoses, 2020. Accessed at 7-5-2023.

[3] R.A. Robinson, R.N. Pugh, Dogs, zoonoses and immunosuppression, J. R. Soc. Promot. Heal. 122 (2) (2002 Jun) 95–98, https://doi.org/10.1177/146642400212200210 (PMID: 12134775).

[4] C. Westgarth, G.L. Pinchbeck, J.W. Bradshaw, S. Dawson, R.M. Gaskell, R. M. Christley, Dog-human and dog-dog interactions of 260 dog-owning households in a community in Cheshire, Vet. Rec. 162 (14) (2008 Apr 5) 436–442, https://doi.org/10.1136/vr.162.14.436 (PMID: 18390853).

[5] H. Bekedam, A. Stegeman, F. De Boer, R. Fouchier, J. Kluytmans, S. Koenraadt, T. Kuiken, W. van der Poel, R. Reis, G. van Schaik, Zoönosen in het vizier. Rapport van de expertgroep zoönosen, 2021 Jun.

[6] M.A. Coman, A. Marcu, R.M. Chereches, J. Leppälä, S. Van Den Broucke, Educational interventions to improve safety and health literacy among agricultural workers: a systematic review, Int. J. Environ. Res. Public Health 17 (3) (2020 Feb 10) 1114, https://doi.org/10.3390/ijerph17031114. PMID: 32050565; PMCID: PMC7037762.

[7] S.C. Ratzan, R.M. Parker, Health Literacy. National Library of Medicine Current Bibliographies in Medicine, National Institutes of Health, US Department of Health and Human Services, Bethesda, 2000 Feb.

[8] K. Sørensen, S. Van den Broucke, J. Fullam, G. Doyle, J. Pelikan, Z. Slonska, H. Brand, (HLS-EU) Consortium Health Literacy Project European. Health literacy and public health: a systematic review and integration of definitions and models, BMC Public Health 12 (2012 Jan 25) 80, https://doi.org/10.1186/1471-2458-12-80 (PMID: 22276600; PMCID: PMC3292515).

[9] J.W. Stull, A.S. Peregrine, J.M. Sargeant, J.S. Weese, Household knowledge, attitudes and practices related to pet contact and associated zoonoses in Ontario, Canada, BMC Public Health (12) (2012 Jul 25) 553, https://doi.org/10.1186/1471-2458-12-553. PMID: 22831165; PMCID: PMC3489606.

[10] S.G. Steele, S.M. Mor, Client knowledge, attitudes and practices regarding zoonoses: a metropolitan experience, Aust. Vet. J. 93 (12) (2015 Dec) 439–444, https://doi.org/10.1111/avj.12380. Epub 2015 Oct 9. PMID: 26769069.

[11] P.A.M. Overgaauw, C.M. Vinke, M.A.E.V. Hagen, L.J.A. Lipman, A one health perspective on the human-companion animal relationship with emphasis on zoonotic aspects, Int. J. Environ. Res. Public Health 17 (11) (2020 May 27) 3789, https://doi.org/10.3390/ijerph17113789. PMID: 32471058; PMCID: PMC7312520.

[12] P.A. Overgaauw, L. van Zutphen, D. Hoek, F.O. Yaya, J. Roelfsema, E. Pinelli, F. van Knapen, L.M. Kortbeek, Zoonotic parasites in fecal samples and fur from dogs and cats in the Netherlands, Vet. Parasitol. 163 (1–2) (2009 Jul 7) 115–122, https://doi.org/10.1016/j.vetpar.2009.03.044. Epub 2009 Apr 5. PMID: 19398275.

[13] B.B. Chomel, B. Sun, Zoonoses in the bedroom, Emerg. Infect. Dis. 17 (2) (2011 Feb) 167–172, https://doi.org/10.3201/eid1702.101070. PMID: 21291584; PMCID: PMC3298380.

[14] S. Grant, C.W. Olsen, Preventing zoonotic diseases in immunocompromised persons: the role of physicians and veterinarians, Emerg. Infect. Dis. Jan-Feb;5(1): 159-63 (1999), https://doi.org/10.3201/eid0501.990121 (PMID: 10081686; PMCID: PMC2627689).

[15] Council of Europe. Council for Cultural Co-operation. Education Committee, Modern Languages Division. Common European Framework of Reference for Languages: Learning, Teaching, Assessment, Cambridge University Press, 2001.

[16] A. Kantele, M. Kanerva, M. Seppänen, J. Sutinen, K. Skogberg, L. Pakarinen, I. H. Jääskeläinen, I. Aho, A. Järvinen, T. Finnilä, J. Ollgren, Do as I say, not as I do: handwashing compliance of infectious diseases experts during influenza pandemic, Am. J. Infect. Control 38 (7) (2010 Sep) 579–580, https://doi.org/10.1016/j.ajic.2010.03.001 (PMID: 20736115).

[17] C. Aenishaenslin, C. Bouchard, J.K. Koffi, N.H. Ogden, Exposure and preventive behaviours toward ticks and Lyme disease in Canada: results from a first national survey, Ticks Tick Borne Dis. 8 (1) (2017 Jan) 112–118, https://doi.org/10.1016/j.ttbdis.2016.10.006. Epub 2016 Oct 13. PMID: 27771334.

[18] A. Septfons, J. Figoni, A. Gautier, N. Soullier, H. de Valk, J.C. Desenclos, Increased awareness and knowledge of Lyme Borreliosis and tick bite prevention among the general population in France: 2016 and 2019 health barometer survey, BMC Public Health 21 (1) (2021 Oct 8) 1808, https://doi.org/10.1186/s12889-021-11850-1. PMID: 34620144; PMCID: PMC8499535.

[19] D.J. Beaujean, M. Bults, J.E. van Steenbergen, H.A. Voeten, Study on public perceptions and protective behaviors regarding Lyme disease among the general public in the Netherlands: implications for prevention programs, BMC Public Health (13) (2013 Mar 15) 225, https://doi.org/10.1186/1471-2458-13-225. PMID: 23497311; PMCID: PMC3602656.

[20] M. Buisman, J. Allen, D. Fouarge, PIAAC: Kernvaardigheden voor werk en leven, J. Health Econ. 31 (3) (2013) 490–501.

[21] S. Tagini, A. Brugnera, R. Ferrucci, K. Mazzocco, A. Compare, V. Silani, G. Pravettoni, B. Poletti, It won't happen to me! Psychosocial factors influencing risk perception for respiratory infectious diseases: a scoping review, Appl. Psychol. Health Well Being 13 (4) (2021 Nov) 835–852, https://doi.org/10.1111/aphw.12274 (Epub 2021 Apr 15. PMID: 33855817; PMCID: PMC8250503).

[22] H. Marsh, M.H. Almekdash, S. Rossettie, A. John, K. Pelham, B. Magers, Implications of age on social media utilization in health care practice development: cross-sectional survey study, JMIR Hum. Factors 8 (3) (2021 Jul 15) e27528, https://doi.org/10.2196/27528. PMID: 34010138; PMCID: PMC8323016.

[23] Y. Wang, M. McKee, A. Torbica, D. Stuckler, Systematic literature review on the spread of health-related misinformation on social media, Soc. Sci. Med. 240 (2019 Nov) 112552, https://doi.org/10.1016/j.socscimed.2019.112552. Epub 2019 Sep 18. PMID: 31561111; PMCID: PMC7117034.

[24] B.A. Lipton, S.G. Hopkins, J.E. Koehler, R.F. DiGiacomo, A survey of veterinarian involvement in zoonotic disease prevention practices, J. Am. Vet. Med. Assoc. 233 (8) (2008 Oct 15) 1242–1249, https://doi.org/10.2460/javma.233.8.1242 (PMID: 19180714).

[25] E.L. Gollub, V. Leroy, R. Gilbert, G. Chêne, M. Wallon, European Toxoprevention Study Group (EUROTOXO), Effectiveness of health education on toxoplasma-related knowledge, behaviour, and risk of seroconversion in pregnancy, Eur. J. Obstet. Gynecol. Reprod. Biol. 136 (2) (2008 Feb) 137–145, https://doi.org/10.1016/j.ejogrb.2007.09.010. Epub 2007 Oct 30. PMID: 17977641.

[26] P. Sheeran, T.L. Webb, The intention–behavior gap, Soc. Personal. Psychol. Compass 10 (9) (2016 Sep) 503–518.

[27] T.V. Perneger, What's wrong with Bonferroni adjustments, BMJ. 316 (7139) (1998 Apr 18) 1236–1238, https://doi.org/10.1136/bmj.316.7139.1236. PMID: 9553006; PMCID: PMC1112991.

[28] S. Nakagawa, A farewell to Bonferroni: the problems of low statistical power and publication bias, Behav. Ecol. 15 (6) (2004 Nov 1) 1044–1045.
[29] R.A. Armstrong, When to use the Bonferroni correction, Ophthalmic Physiol. Opt. 34 (5) (2014 Sep) 502–508, https://doi.org/10.1111/opo.12131. Epub 2014 Apr 2. PMID: 24697967.
[30] P.W. von Matthiessen, R.A. Sansone, B.P. Meier, G.A. Gaither, J. Shrader, Zoonotic diseases and at-risk patients: a survey of veterinarians and physicians, AIDS. 17 (9) (2003 Jun 13) 1404–1406, https://doi.org/10.1097/00002030-200306130-00021 (PMID: 12799568).