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To cite this article: Nienke Endenburg, Shane Ryan & Hein A. van Lith (2022) A global survey of companion animal veterinary practitioners on animal welfare teaching – *Focus on undergraduate and continuing education, and clients' sources of information*, Journal of Applied Animal Welfare Science, 27:1, 57-104, DOI: [10.1080/10888705.2022.2047681](https://doi.org/10.1080/10888705.2022.2047681)

To link to this article: <https://doi.org/10.1080/10888705.2022.2047681>



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A global survey of companion animal veterinary practitioners on animal welfare teaching – *Focus on undergraduate and continuing education, and clients' sources of information*

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ABSTRACT



As part of a wider research on animal welfare, a global survey was developed to gain insight into the opinion of companion animal veterinarians about animal welfare education, namely to investigate *i*) their exposure to animal welfare teaching during their undergraduate education, *ii*) their access to continuing professional education on animal welfare, and *iii*) their opinions on clients' sources of information on animal welfare. The survey was distributed to companion animal veterinarians around the world. The results were highly influenced by the large numbers of respondents who trained in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland, or the United States of America. Worldwide, 58.4% of the respondents thought that animal welfare was poorly covered or not taught at all when they were students. The best coverage of animal welfare was in the Netherlands and the United Kingdom of Great Britain and Northern Ireland. Most companion animal veterinarians (65.3%) had access to continuing education on animal welfare, but there were small differences between the six above-mentioned countries. Companion animal veterinarians get information on animal welfare mainly from the internet and veterinary conferences/meetings, and thought that their clients obtained animal welfare information from various sources. The findings show that there is a need to improve education on animal welfare in veterinary curricula and the provision of relevant continuing education, so that companion animal practitioners can keep abreast of developments and societal expectations.


KEYWORDS

Animal welfare; clients; companion animal veterinarians; education; sources of information

Introduction

Veterinarians are expected to keep the animals in their care healthy, to treat and prevent disease, and to monitor and promote animal welfare (Dolby & Litster, 2015; Siegford, Cottee, & Widowski, 2010). Professional and societal expectations require veterinarians to be leaders in promoting animal welfare (Federation of Veterinarians of Europe, 2021), and to make informed medical and ethical choices regarding their animal patients. Veterinary choices may depend on a variety of factors including local legislative requirements, drug and equipment availability, and cultural expectations.

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 Supplemental data for this article can be accessed [here](#)

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While animal welfare is a fundamental component of veterinary science (Main, 2010) and should be part of the veterinary curriculum, studies have shown that the time devoted to animal welfare in veterinary curricula differs substantially worldwide (De Briyne, Vidović, Morton, & Magalhães-Sant'Ana, 2020; Hewson et al., 2005; Lord et al., 2017; Rayner et al., 2020; Tadich, Molento, & Gallo, 2010).

In 2016, only 6 of 30 (American Veterinary Medical Association (AVMA) – Council on Education accredited) veterinary schools in the United States of America (USA) had a formal course with the term animal welfare or animal well-being in the title (Shivley, Garry, Kogan, & Grandin, 2016). In contrast, formal education in veterinary medicine is standardized at a national level in Italy, so that all veterinary students receive similar training in animal welfare (Pirrone et al., 2019). Although significant advances have been made in the inclusion of animal welfare in veterinary training programs in Latin American countries, much remains to be done (Mota-Rojas et al., 2018).

Veterinary medicine is rapidly evolving (Boutet, 2006; Morgan & McDonald, 2007), and this is especially true for the discipline animal welfare (Phillips & Molento, 2020). Veterinarians can access the newest (evidenced-based) information on animal welfare in veterinary journals, the internet (e.g., via the website of Universities Federation for Animal Welfare: <https://www.ufaw.org.uk/animal-welfare-information/introduction/>), or online interactive courses (Siegford, Bernardo, Malinowski, Laughlin, & Zanella, 2005), but the resources available may vary by country (Huntley, Dean, Massey, & Brennan, 2016). A study by Vandeweerd et al. (2012) found that in a French speaking part of Belgium veterinarians preferred to gain information from their colleagues, internet, and textbooks rather than peer-reviewed journals and literature searches. Something similar was found in the USA (McKenzie, 2011). The choice of information source depends on the situation; for example, when treating an animal patient, it is quicker and easier to consult a colleague than read the scientific literature.

The owners of companion animals see their veterinarian for (preventive) medical reasons and to gain information about animal welfare, how to care for their animal, which food they should give it, etc. But they can also consult other sources of information, such as internet fora, breeders, journals for companion animal owners, (e)books, etc. In a study of anesthesia in dogs, Hofmeister, Watson, Snyder, and Love (2008) found that veterinary clients listed their sources of information as veterinary general practitioners in the first instance, followed by veterinary specialists, the internet, family/friends, and other media sources. Companion animal veterinarians could help their clients by providing them with internet links with reliable information (Kogan, Schoenfeld-Tacher, & Viera, 2012).

To gain more insight into companion animal veterinarians' opinions about animal welfare education, a global, questionnaire-based-survey (see appendix **WSAVA Animal Welfare Survey**) was developed by the Animal Welfare Guidelines Group (AWGG) of the World Small Animal Veterinary Association (WSAVA); a sub-committee of WSAVA's Animal Welfare and Wellness Committee (AWWC). The information obtained was used, among other things, to develop animal welfare guidelines for companion animal practitioners for use in daily clinical practice and as an aid when interacting with clients, the public, and non-veterinary bodies (Ryan et al., 2019). Companion animal veterinarians from various countries worldwide were asked whether they had been taught about animal welfare during their veterinary training, which resources on animal welfare they currently used to gain relevant information, and which resources they thought their clients used. In veterinary medicine, three dimensions are often considered regarding animal welfare: welfare science, welfare ethics, and welfare legislation and policy (Main, 2010; Morton et al., 2013). However, for this study we did not distinguish between these three dimensions nor did we define animal welfare in the questionnaire.

Materials and methods

Development of questions

The survey questions (see appendix **WSAVA Animal Welfare Survey**) were developed by the AWGG of WSAVA to assess various issues that may affect companion animal welfare. The AWGG consists of private veterinary practitioners, veterinary specialists in animal welfare, and a clinical psychologist. The survey was divided into three parts. The first part (**Demographic information; questions 1–5**) included respondents' demographic information, i.e., gender (**question 1**), age (**question 2**), place of practice (**question 3**), the country and institution where they obtained their veterinary degree (**question 4**), and whether they currently worked as veterinary practitioners (**question 5**).

The second part (**Animal welfare issues in practice in your country/region; questions 6–11**) consisted of twenty Likert-style questions on animal welfare, scored 1–5 (1 = Very important, 2 = Important, 3 = Variable importance, 4 = Not very important, and 5 = Not important). These questions were divided into animal health-related (**question 6**), potential behavioral-related (**question 7**), owner-related (**question 8**) and social-related (**question 9**) issues; there were five issues for each question. The respondents could indicate the top three animal welfare issues in their veterinary practice (**question 10**). They could also provide additional information e.g., what their most important animal welfare-related issue was if not included in the list (**question 11**). The findings regarding **questions 6–11** were recently reported in this journal (Endenburg et al., 2021). Briefly, the results were: *i*) The main animal welfare concern reported worldwide was obesity, although there were differences across regions, possibly due to cultural and socioeconomic factors; *ii*) Anthropomorphism was an issue in western countries but less so in Asia, Africa, and Oceania; *iii*) There were significant differences between Asia and Europe, Africa, or Oceania in the importance and prevalence of convenience euthanasia; *iv*) There were also age and sex differences in participant responses, with older veterinarians reporting fewer welfare problems than younger veterinarians, and female veterinarians reporting more welfare issues than their male counterparts.

The third part (**Animal welfare education; questions 12–16**) asked about whether respondents thought they had been taught about various topics – including animal welfare – when they were students, what resources they used for information on these topics, what resources on animal welfare they thought their clients used, whether they had access to continuing education on animal welfare, and whether continuing education was necessary for renewal of their veterinary license. A definition or concept of “animal welfare” was not provided. We let respondents use their own ideas.

Question 12 asked respondents to indicate how well certain topics were covered during their undergraduate training. For this question we used a 4-point Likert-type scale because we wanted to have an ipsative (forced choice) scale that did not have a “neutral” answer option. A weighted score for each topic was calculated by assigning numeric values from 1 to 4 to the scale categories and taking the weighted mean: Not taught = 1, Poorly covered = 2, Adequate coverage = 3, and Well-covered = 4. Given the aims of the *Journal of Applied Animal Welfare Science*, we only present the results for **animal welfare** here; the results for other aspects of veterinary training will be presented elsewhere. **Question 13** investigated where respondents obtained information on a number of topics – including animal welfare – with possible options “Local continuing education”, “Veterinary journals”, “Veterinary conferences/meetings”, “Internet”, “I don't search for information on this topic”. In principle, up to four answers could be ticked. Only the information on **animal welfare** will be reported here; the results concerning sources of other, non-animal welfare, information will be presented elsewhere. Preliminary results for this question have been presented in abstract and poster form (Endenburg & van Lith, 2021). **Question 14** asked respondents where they thought their clients got information about animal welfare. Again, more than one answer was possible. **Question 15** investigated whether respondents had access to adequate continuing education on animal welfare (yes or no) and, if not, how access could be improved. In **question 16** the

respondents were asked whether continuing education is required for renewal of their veterinary license (yes or no).

Recruiting respondents to the study

The Ethics Review Board of the Faculty of Social and Behavioral Sciences of Utrecht University approved the study (approval number: FETC16-057). The survey was available in English, French, Chinese (standard Mandarin), Spanish, and Russian, and distributed through the SurveyMonkey® (San Mateo, CA, USA) platform (available at URL: <https://www.surveymonkey.com/>; for English version see appendix **WSAVA Animal Welfare Survey**) in 2016. The target audience was companion animal veterinarians worldwide. They could choose which language version of the survey they preferred to use. The English version of the survey was piloted (not included in this study) with companion animal practitioners in the practices of some of the members of the AWWG. Only minor differences in wording were made and pre-testing showed that it was not necessary to further adjust the survey questions. The survey was advertised on the WSAVA website, and regional contacts of WSAVA (member associations) were asked to publish the link to the survey on their regional veterinary website. The text of the advertisement is as follows:

"The WSAVA Animal Wellness & Welfare Committee (AWWC) is conducting a survey on the status of companion animal welfare globally. Information obtained will be used in development of animal welfare guidelines designed for the veterinary practitioner to use with the clinic setting & also aid in dealing with clients, the public & non-veterinary bodies. The survey questionnaire should only take 5 or fewer minutes to complete. Responses are anonymous and all information will be treated confidentially."

As the number of companion animal veterinarians who read the advertisement is not known, it was not possible to determine the response rate. Based on the returned surveys, it is obvious that certain representatives of the member associations (for instance, the representatives from Saint Petersburg Veterinary Society and Russian Small Animal Veterinary Association; Russian Federation) were very active in recruiting respondents in their country. Respondents were recruited using the snowball method through Facebook (<https://www.facebook.com/WSAVA>). The questionnaires were returned from March 24 to June 18, 2016. The results were obtained and processed anonymously. Some respondents did not answer all the questions.

Grouping of respondents

There are several ways to divide the respondents of this global, opinion-questionnaire-based survey into groups. First, based on where they worked (**question 3**) the respondents were divided into six geographic regions (with number of countries per sub-region in parentheses): Europe (Northern Europe, 6 countries; Eastern Europe, including Northern Asia = Siberia, 4 countries; Southern Europe, 5 countries; Western Europe, 5 countries), Asia (Central Asia, 1 country; Eastern Asia, 2 countries; South-eastern Asia, 8 countries; Southern Asia, 5 countries; Western Asia, 4 countries), North America (Northern America, 2 countries; Central America, 2 countries; Caribbean, 2 countries), South America (Central America, 1 country; South America, 6 countries), Africa (Northern Africa, 3 countries; Eastern Africa, 2 countries; Southern Africa, 2 countries; Western Africa, 4 countries), and Oceania (Australia and New Zealand, 2 countries; Melanesia, 1 country). In addition and only for Europe and Asia, four sub-regions were compared: *i*) Northern, Eastern (including Northern Asia), Southern, and Western Europe; *ii*) Eastern, South-eastern, Southern, and Western Asia. Appendix **Figure A1** shows the 67 countries where the respondents work.

Given the large numbers of respondents who trained in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or the USA (**Figure 1**), these six countries were compared to each other. Further, we previously found that almost one third (32.6%) of the respondents had trained at five institutions, namely, the Hebrew

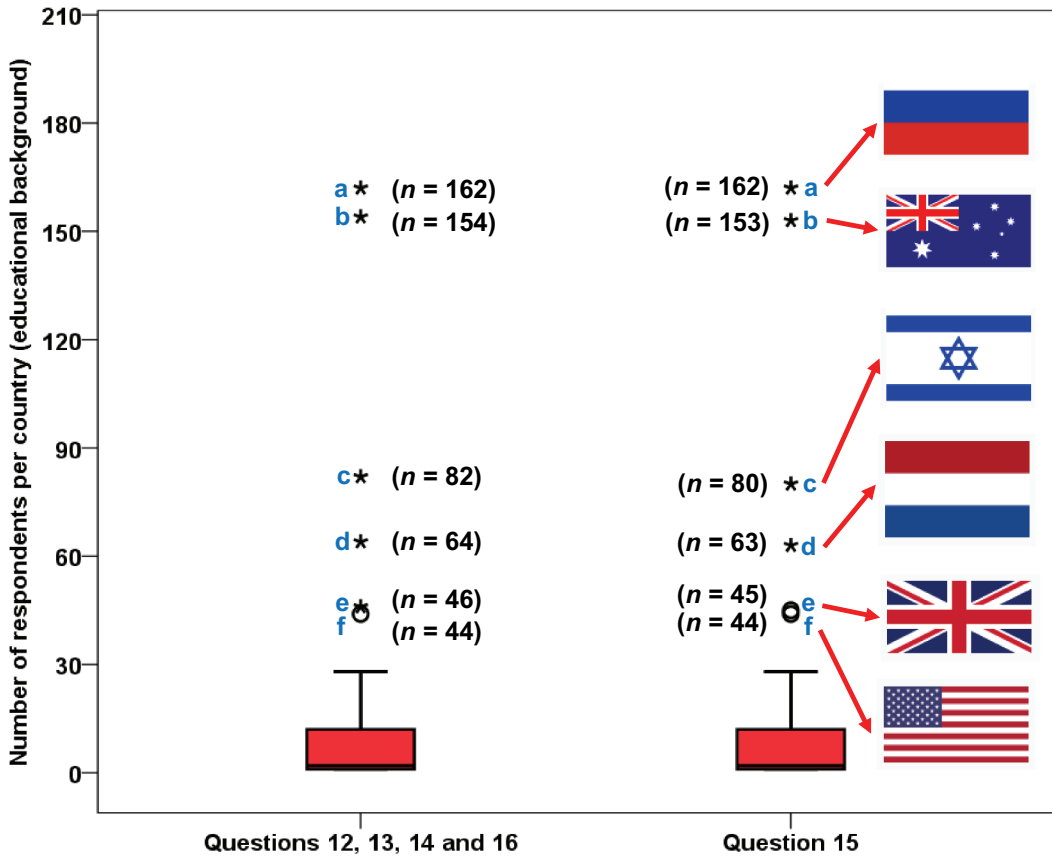


Figure 1. Number of respondents per country, i.e., the country where the respondents obtained their primary veterinary degree (question 4, see appendix **WSAVA Animal Welfare Survey**). Results are presented as box-and-whisker plots. Outliers and extreme cases are indicated with "o" and "x", respectively. Countries: **a** = Russian Federation; **b** = Australia; **c** = Israel; **d** = Netherlands; **e** = United Kingdom of Great Britain and Northern Ireland (UK); **f** = United States of America (USA).

University of Jerusalem – Koret School of Veterinary Medicine, Saint Petersburg State Academy of Veterinary Medicine, Utrecht University – Faculty of Veterinary Medicine, University of Sydney – Faculty of Veterinary Science, and Moscow State Academy of Veterinary Medicine and Biotechnology (Endenburg et al., 2021). These five institutions were also compared to each other. In Australia several institutions offer a veterinary degree, but the majority of the respondents had trained at the University of Sydney – Faculty of Veterinary Science, University of Melbourne – Faculty of Veterinary Science, University of Queensland – School of Veterinary Science and Murdoch University – School of Veterinary and Biometrical Sciences (Endenburg et al., 2021). Therefore, these four Australian institutions were also compared to each other. In addition, gender (question 1) differences were statistically analyzed globally as well as by geographic region, geographic sub-region, country and educational background.

Presentation of data and statistical analyses

All statistical analyses were carried out using IBM® SPSS® Statistics for Windows (version 24.0) computer program (IBM Corp., Armonk, NY, USA) and according to Field (2009). Two-sided probabilities were estimated throughout.

The significance of the difference between the six geographic regions in the age of the respondents was calculated with the Kruskal-Wallis test. *Post hoc* comparisons for the age data were performed with the Wilcoxon-Mann-Whitney test (i.e., the pairwise comparisons of the geographic regions and the pairwise comparisons of the educational backgrounds). These age data, the number of respondents per country, as well as the number of respondents who trained at a certain veterinary institution are presented as box-and-whisker plots showing median values with interquartile range, highest and lowest non-outlying values (i.e., values up to 1.5 box lengths from the upper or lower edge of the box). (Mild) outliers (i.e., cases with values between 1.5 and 3 box lengths from the upper or lower edge of the box) and extreme cases (i.e., cases with values more than 3 box lengths from the upper or lower edge of the box) are also indicated. The world map of the countries where the respondents worked was generated using the Heatmapper online software (Babicki et al., 2016) available at <http://www.heatmapper.ca/geomap/>.

The ordinal (Likert type; **question 12**), multiple response categorical (**questions 13 and 14**), or dichotomous (**questions 15 and 16**) data from the survey are presented as scores (i.e., number of respondents or number of answers, #) with the relative frequency (%) in parentheses in tables. In figures these data are presented as solid colored stacked bar charts without (= #) or with (= %) black diagonal lines and borders. The hypothesis that the probability of choosing the categories of the questions was the same for the various groups (six geographic regions, four geographic sub-regions, six countries, four or five educational backgrounds, two genders) was tested using the Likelihood ratio test (G-test of goodness-of-fit; *omnibus* test). *Post hoc* comparisons for these data were performed also with the Likelihood ratio test (*post hoc* test).

To account for the greater probability of a Type I error because of multiple comparisons and/or multiple topics, a more stringent criterion was used for statistical significance (i.e., for the Likelihood ratio tests). A so-called Dunn-Šidák correction ($\alpha_{adjusted} = 1 - [1 - 0.05]^{1/\gamma}$) was calculated, where γ is the number of hypotheses tested. Supplementary **Table S1** presents an overview of the adjusted α -value for the various *omnibus* and *post hoc* tests concerning **questions 12–16**. Further, the threshold of significance (α) for the Kruskal-Wallis test was 0.05 and for the *post hoc* Wilcoxon-Mann-Whitney tests 0.003414 (geographic regions: Dunn-Šidák correction, $\gamma = 15$) or 0.016952 (three educational backgrounds: Dunn-Šidák correction, $\gamma = 3$).

Significant *P* values are marked with an asterisk (*) and are reported with six (e.g., $P = 0.001273^*$) or seven ($P < 0.000005^*$) decimal places, whereas non-significant *P* values are reported with two (e.g., $P = 0.20$) to four (e.g., $P = 0.0074$) decimal places. As statistical significance represented by *P* values may not necessarily reflect practical importance, the size of the observed effects is perhaps more relevant. Effect sizes (*w*) reported for the contingency tables were derived from Cramer's *V* using the formula:

$$w = V \times \sqrt{(r - 1)}$$

where *w* = effect size *w*, *V* = Cramer's *V*, and *r* = the number of rows or columns (whichever is the smaller of the two). The following standard cutoffs for *w* were used (Cohen, 1988, pp. 224–227): zero or nearly zero effect, $0 \leq w < 0.1$; *small* effect, $0.1 \leq w < 0.3$; *moderate* effect, $0.3 \leq w < 0.5$; and *large* effect, $w \geq 0.5$. To estimate the relative magnitude of differences in the age of the respondents in the *post hoc* comparisons, Cohen's *d* effect size coefficients were calculated as the difference between the two means divided by the pooled standard deviation (SD). A commonly used interpretation – based on benchmarks suggested by Cohen (1988, pp. 24–27) is to refer to effect sizes as: zero or nearly zero effect, $0 \leq |d| < 0.2$; *small* effect, $0.2 \leq |d| < 0.5$; *moderate* effect, $0.5 \leq |d| < 0.8$; and *large* effect, $|d| \geq 0.8$.

Results

Demographics (Figures 2 and 3)

Overall, 1167 surveys were returned; 1052 respondents reported where they had trained (appendix Table A1). The English, French, Chinese, Spanish, and Russian questionnaires were completed by 857, 13, 23, 40 and 234 respondents, respectively. Contrary to what was suggested in the advertisement, it took the respondents an average of 15 minutes to complete the questionnaire. Veterinary and allied degrees were awarded by 201 different universities, institutes, academies, colleges, and schools in 63 different countries. As can be seen from appendix Table A1 and Figure 2, the results are skewed by the large number of responses from the graduates of eleven institutions: *Europe* (Saint Petersburg State Academy of Veterinary Medicine, $n = 81$; Utrecht University, Faculty of Veterinary Medicine, $n = 66$; Moscow State Academy of Veterinary Medicine and Biotechnology, $n = 43$; University of Veterinary Medicine, Košice, $n = 22$; University of London, Royal Veterinary College, $n = 14$), *Asia* (Hebrew University of Jerusalem, Koret School of Veterinary Medicine, $n = 92$; Putra University Malaysia, Faculty of Veterinary Medicine, $n = 21$; Bogor Agricultural

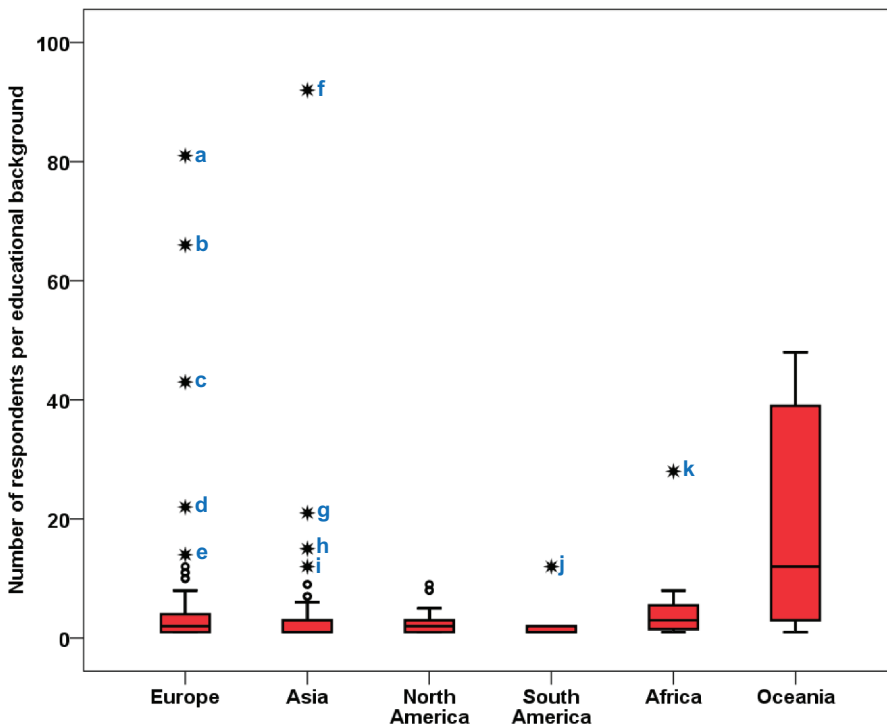


Figure 2. Number of respondents per educational background (question 4, see appendix **WSAVA Animal Welfare Survey**) in the geographic regions of Europe, Asia, North America, South America, Africa and Oceania. Results are presented as box-and-whisker plots. Outliers and extreme cases are indicated with "o" and "*", respectively. Educational backgrounds: **a** = Saint Petersburg State Academy of Veterinary Medicine; **b** = Utrecht University – Faculty of Veterinary Medicine; **c** = Moscow State Academy of Veterinary Medicine and Biotechnology; **d** = University of Veterinary Medicine in Košice; **e** = University of London – Royal Veterinary College; **f** = Hebrew University of Jerusalem – Koret School of Veterinary Medicine; **g** = Putra University Malaysia – Faculty of Veterinary Medicine; **h** = Bogor Agricultural University – Faculty of Veterinary Medicine; **i** = Ho Chi Minh City University of Agriculture and Forestry – Faculty of Veterinary Breeding; **j** = University of Buenos Aires – Faculty of Veterinary Sciences; **k** = University of Pretoria – Faculty of Veterinary Science.

University, Faculty of Veterinary Medicine, $n = 15$; Ho Chi Minh City University of Agriculture and Forestry, Faculty of Veterinary Breeding, $n = 12$), *South America* (University of Buenos Aires, Faculty of Veterinary Sciences, $n = 12$), and *Africa* (University of Pretoria, Faculty of Veterinary Science, $n = 28$).

964 respondents answered **questions 12, 13, 14, and 16**, and 955 respondents answered **question 15**. Appendix **Table A2** shows the number of respondents per geographic region (as well as worldwide), country, and gender. For each country, the geographic sub-region to which it belongs is also given in parentheses. Of the respondents (from 67 different countries; see appendix **Figure A1**) who completed **questions 12–16**, 35.6% were male and 64.4% were female. About 87% of the respondents were practicing veterinarians; 13% were non-practitioners. **Table 1** shows the top ten institutions with the most respondents/graduates regarding **questions 12–16** of the questionnaire. Except for the University of Veterinary Medicine in Košice (*Slovakia*) and the University of Pretoria – Faculty of Veterinary Science (*South Africa*), these (eight) veterinary institutions were part of the comparison of five and/or four educational backgrounds (See section **Materials and methods – Grouping of respondents**).

The mean age of the respondents was 38 years (SD = 12 years) and differed significantly by geographic region (Kruskall-Wallis test, Chi-square = 156.053, $df = 5$, $P < 0.0000005^*$). The mean \pm SD age of respondents was: Europe, 35 ± 10 years; Asia (mainly represented by a high response rate from Israel), 39 ± 10 years; North America, 48 ± 11 years; South America, 45 ± 14 years; Africa, 49 ± 13 years; and Oceania (mainly represented by a high response rate from Australia), 46 ± 13 years. The respondents in Europe were significantly (Wilcoxon-Mann-Whitney test) younger than those in Asia (mainly represented by a high response rate from Israel) ($P < 0.0000005^*$, **moderate** effect, $|d| = 0.581$), North America ($P < 0.0000005^*$, **large** effect, $|d| = 1.318$), South America ($P = 0.000288^*$, **large** effect, $|d| = 1.010$), Africa ($P < 0.0000005^*$, **large** effect, $|d| = 1.344$), and Oceania (mainly represented by a high response rate from Australia) ($P < 0.0000005^*$, **large** effect, $|d| = 0.971$). The respondents in Asia (mainly represented by a high response rate from Israel) were significantly younger than those in North America ($P < 0.0000005^*$, **moderate** effect, $|d| = 0.735$), Africa ($P = 0.000124^*$, **moderate** effect, $|d| = 0.768$), and Oceania (mainly represented by a high response rate from Australia) ($P = 0.000127^*$, **small** effect, $|d| = 0.438$) (**Figure 3**). Further details on demographics can be found in Endenburg et al. (2021).

Animal welfare in the veterinary curriculum (**Figure 4**)

Geographic regions

58.4% of the respondents thought animal welfare was poorly covered/not taught in the veterinary curriculum when they were students (**question 12**, see appendix **WSAVA Animal Welfare Survey**), but there was a significant difference between Asia (mainly represented by a high response rate from Israel) and Europe ($P = 0.000149^*$, **small** effect, $w = 0.172$). Asian veterinary curricula (weighted score = 2.46) appeared to cover animal welfare issues somewhat better than European veterinary curricula (weighted score = 2.20) (supplementary **Table S2-I** and **Figure 4**, panel A).

Geographic sub-regions

For Europe (supplementary **Table S2-II** and **Figure 4**, panel B), but not for Asia (supplementary **Table S2-III** and **Figure 4**, panel C), there was a significant difference between the four sub-regions. Companion animal veterinarians from Western Europe (weighted score = 2.54) when compared to those of Eastern Europe (weighted score = 2.01) thought they have had a better coverage of animal welfare during undergraduate veterinary training ($P = 0.000003^*$, **moderate** effect, $w = 0.300$).

Table 1. The top ten institutions (= veterinary educational background) with regard to the number of respondents to questions 12–16 of the questionnaire.

Geographic region		Being part of the comparison of ... ³	
• Country (United Nations geoscheme) ¹	Number of respondents ²	... 5 educational backgrounds?	... 4 educational backgrounds?
Europe			
• Russian Federation (Eastern Europe + Northern Asia)			
✓ Saint Petersburg State Academy of Veterinary Medicine	69 (69)	Yes	No
✓ Moscow State Academy of Veterinary Medicine and Biotechnology	38 (38)	Yes	No
• Netherlands (Western Europe)			
✓ Utrecht University – Faculty of Veterinary Medicine	61 (60)	Yes	No
• Slovakia (Eastern Europe)			
✓ University of Veterinary Medicine in Košice	18 (18)	No	No
Asia			
• Israel (Western Asia)			
✓ Hebrew University of Jerusalem – Koret School of Veterinary Medicine	76 (74)	Yes	No
Africa			
• South Africa (Southern Africa)			
✓ University of Pretoria – Faculty of Veterinary Science	23 (22)	No	No
Oceania			
• Australia (Australia and New Zealand)			
✓ University of Sydney – Faculty of Veterinary Science	43 (43)	Yes	Yes
✓ University of Melbourne – Faculty of Veterinary Science	36 (36)	No	Yes
✓ University of Queensland – School of Veterinary Science	36 (36)	No	Yes
✓ Murdoch University – School of Veterinary and Biometrical Sciences	22 (22)	No	Yes

¹The United Nations geoscheme is a system, defined by the United Nations Statistics Division, that divides the countries in the world into groups and it is based on the M49 coding classification (<https://unstats.un.org/unsd/methodology/m49/>).

²Number of respondents to **questions 12, 13, 14 and 16** with in parentheses the number of respondents to **question 15**.

³See section **Materials and methods – Grouping of respondents**.

Six countries

Table 2 and panel **D** from **Figure 4** show the results for the six countries. On the basis of responses, the veterinary curricula of the Russian Federation (weighted score = 2.04) covered animal welfare less well than those of Australia (weighted score = 2.47, $P = 0.000005^*$, *small* effect, $w = 0.286$), the Netherlands (weighted score = 2.67, $P < 0.0000005^*$, **moderate** effect, $w = 0.347$), and the UK (weighted score = 2.80, $P = 0.000009^*$, **moderate** effect, $w = 0.358$). Moreover animal welfare issues were covered less well in the veterinary curricula of the USA (weighted score = 2.07) than in the curricula of the Netherlands ($P = 0.000025^*$, **moderate** effect, $w = 0.451$) and the UK ($P = 0.000116^*$, **moderate** effect, $w = 0.470$).

Five veterinary institutions

Comparison of the responses to **question 12** suggested that the veterinary curriculum of Utrecht University (weighted score = 2.70) covered animal welfare better than the curricula of the Moscow State Academy of Veterinary Medicine and Biotechnology (weighted score = 1.89, $P < 0.0000005^*$,

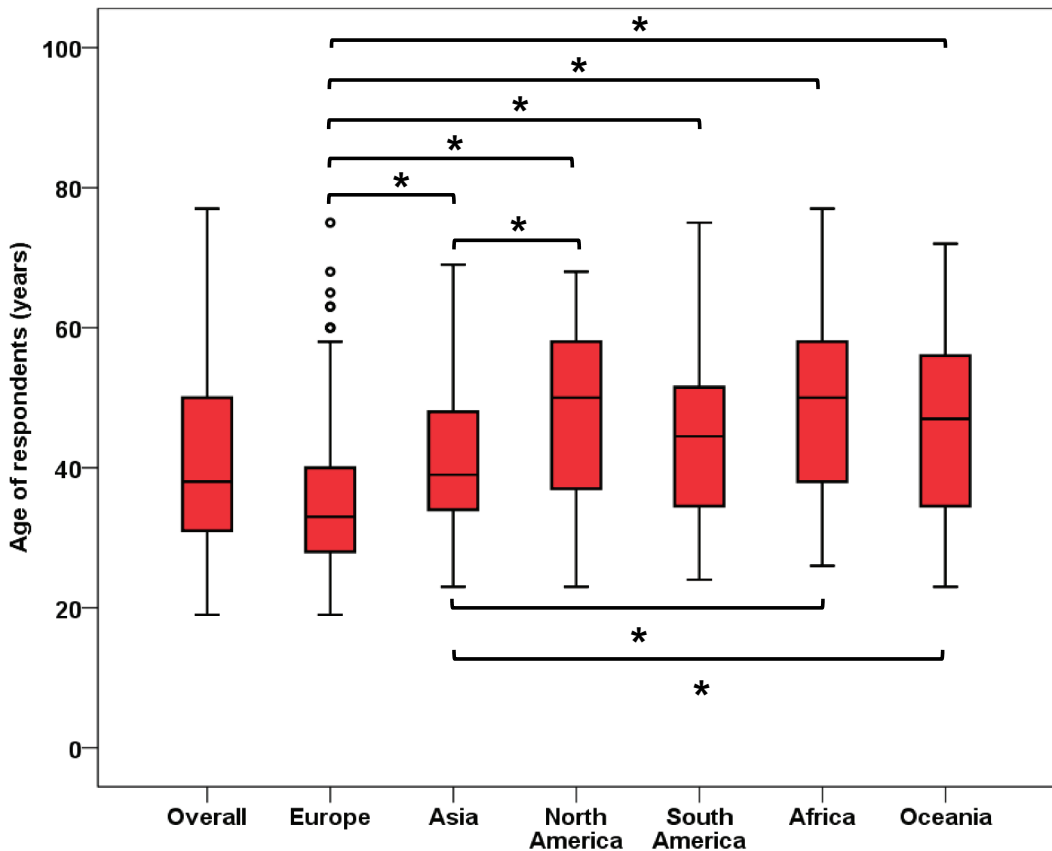


Figure 3. Age of respondents (in years; **question 2**, see appendix **WSAVA Animal Welfare Survey**) in the geographic regions of Europe, Asia, North America, South America, Africa and Oceania, as well as worldwide. Results are presented as box-and-whisker plots. Outliers are indicated with “o.”, * = significant difference ($P < 0.003414$) in *post hoc* comparison.

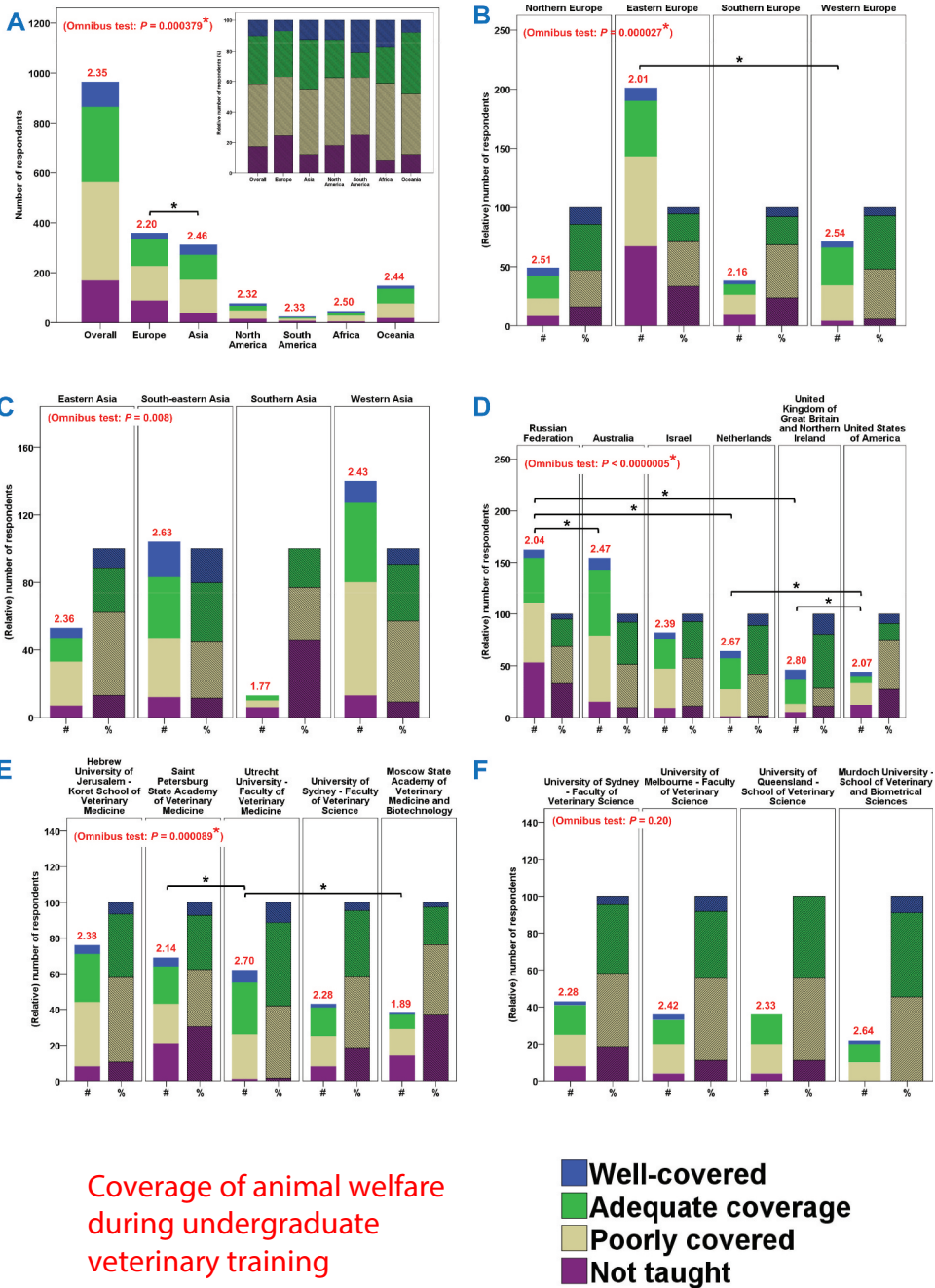
moderate effect, $w = 0.330$) and the Saint Petersburg State Academy of Veterinary Medicine (weighted score = 2.14, $P = 0.000001^*$, **moderate** effect, $w = 0.415$) (supplementary **Table S2-IV** and **Figure 4**, panel E).

Four Australian veterinary institutions

Between the four Australian veterinary institutions there were no significant differences ($P = 0.20$) in the responses to **question 12**; most respondents thought that animal welfare was poorly (39.5–45.5%) to adequately (36.1–45.5%) covered during their undergraduate training (supplementary **Table S2-V** and **Figure 4**, panel F).

Gender

There was no significant difference (worldwide, per geographic (sub-)region, country, or veterinary institution) between men and women with regard to how well they thought that animal welfare was taught during their veterinary training (**results not shown**).



Coverage of animal welfare during undergraduate veterinary training

Figure 4. Coverage of animal welfare during undergraduate veterinary training according to companion animal veterinarians (question 12, see appendix **WSAVA Animal Welfare Survey**). **Panel A:** Respondents working in geographic regions of Europe, Asia, North America, South America, Africa or Oceania, as well as worldwide. **Panel B:** Respondents working in Northern Europe, Eastern Europe (including Northern Asia), Southern Europe or Western Europe. **Panel C:** Respondents working in Eastern Asia, South-Eastern Asia, Southern Asia or Western Asia. **Panel D:** Respondents with their educational background in Russian Federation, Australia, Israel, Netherlands, United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA). **Panel E:** Respondents with their educational background in different veterinary institutions. **Panel F:** Respondents with their educational background in different Australian veterinary institutions. **Panel A:** In the main diagram results are presented as scores (number of respondents, #), whereas in the inserted diagram results are shown as relative scores (%). **Panels B-F:** Left and right bars represent scores (number of respondents, #) and relative scores (%), respectively. Solid colored stacked bars = #; solid colored stacked bars with black diagonal lines and borders = %. The numbers above the bars in the main diagram of **panel A** and above the left bars in the **panels B-F** are weighted scores. * = significant difference ($P < 0.007301$) in omnibus test. * = significant difference (**panels A and D**, $P < 0.000488$; **panel E**, $P < 0.000732$; **panels B, C and F**, $P < 0.001221$) in *post hoc* comparison.



Table 2. Coverage of animal welfare during the undergraduate training according to companion animal veterinarians with their educational background in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or the United States of America (USA)¹.

● Topic - Answer category	Country						Significance ^a /(Effect Size <i>w</i>) ⁶
	Russian Federation (162) ²	Australia (154)	Israel (82)	Netherlands (64)	United Kingdom of Great Britain and Northern Ireland (46)	United States of America (44)	
● Animal welfare							
- Well-covered	8 (4.9%) ³ <i>abc</i> ⁵	12 (7.8%) <i>a</i>	6 (7.3%) <i>bd</i>	7 (10.9%) <i>bd</i>	9 (19.6%) <i>ce</i>	4 (9.1%) <i>de</i>	C (<i>P</i> < 0.0000005*) (<i>w</i> = 0.371)
- Adequate coverage	43 (26.5%)	63 (40.9%)	29 (35.4%)	30 (46.9%)	24 (52.2%)	7 (15.9%)	
- Poorly covered	58 (35.8%)	64 (41.6%)	38 (46.3%)	26 (40.6%)	8 (17.4%)	21 (47.7%)	
- Not taught	53 (32.7%)	15 (9.7%)	9 (11.0%)	1 (1.6%)	5 (10.9%)	12 (27.3%)	
Weighted score: ⁷	2.20	2.46	2.32	2.33	2.50	2.44	

¹ This table is based on **question 12** (Please indicate how well the following topics were covered during your undergraduate veterinary training) and topic animal welfare of the questionnaire (see appendix **WSAVA Animal Welfare Survey**).

² Total number of respondents per country is given in parentheses and in **bold**.

³ Results are presented as scores (number of respondents) with in parentheses the relative frequency (%).

⁴ Significance (*P* < 0.007301) based on the Likelihood ratio test (G-test of goodness-of-fit). **C** indicates significant difference between **countries**; the significant *P* value is indicated with an asterisk.

⁵ Contrast significance (*post hoc* comparisons, *P* < 0.000488). *Post hoc* testing was done by the Likelihood ratio test (G-test of goodness-of-fit). Countries with the same lowercase letter were significantly different.

⁶ Effect size *w* was derived from Cramer's *V*. The (moderate) effect is indicated in **bold**.

⁷ Weighted score = calculated as weighted mean where Not taught = 1, Poorly covered = 2, Adequate coverage = 3, and Well-covered = 4.

Access to continuing education on animal welfare (Figure 5)

Geographic regions

Almost two-thirds (65.3%) of the respondents had access to continuing education on animal welfare (**question 15**, see appendix **WSAVA Animal Welfare Survey**), but there were significant differences between the geographic regions ($P = 0.000008^*$, *small* effect, $w = 0.180$; supplementary **Table S3-I**). More companion animal veterinarians in Oceania (mainly represented by a high response rate from Australia) had access to continuing education on animal welfare than did companion animal veterinarians in Europe ($P = 0.001499^*$, *small* effect, $w = 0.139$), Asia (mainly represented by a high response rate from Israel) ($P = 0.000464^*$, *small* effect, $w = 0.161$), and Africa ($P = 0.000008^*$, **moderate** effect, $w = 0.332$), as was also the case for North America compared with Africa ($P = 0.000072^*$, **moderate** effect, $w = 0.361$)(**Figure 5**, panel A).

Geographic sub-regions

Fewer companion animal veterinarians working in Southern Europe had access to continuing education on animal welfare than did companion animal veterinarians working in Northern Europe ($P = 0.001114^*$, **moderate** effect, $w = 0.351$; supplementary **Table S3-II** and **Figure 5**, panel B). There was a significant difference in access to adequate continuing education between respondents who worked in South-eastern Asia and those who worked in Western Asia ($P = 0.000476^*$, *small* effect, $w = 0.223$). Access to adequate continuing education was better in Eastern Asia than in Western Asia (supplementary **Table S3-III** and **Figure 5**, panel C).

Six countries

Relatively fewer companion animal veterinarians who trained in Israel had access to continuing education on animal welfare than did companion animal veterinarians who studied in Russian Federation ($P = 0.003178^*$, *small* effect, $w = 0.191$), Australia ($P = 0.000002^*$, **moderate** effect, $w = 0.314$), or the USA ($P = 0.002571^*$, *small* effect, $w = 0.266$) (**Table 3** and **Figure 5**, panel D).

Five veterinary institutions

There was a significant difference in access to continuing education on animal welfare between respondents who trained at the University of Sydney – Faculty of Veterinary Science and the Hebrew University of Jerusalem – Koret School of Veterinary Medicine ($P = 0.003659^*$, *small* effect, $w = 0.264$), with relatively more Sydney respondents than Jerusalem respondents having access to this information (supplementary **Table S3-IV** and **Figure 5**, panel E).

Four Australian veterinary institutions

There was no difference in access to adequate continuing education between respondents who trained at the various Australian institutions ($P = 0.79$) (supplementary **Table S3-V** and **Figure 5**, panel F).

Gender

There was a significant gender effect in Oceania (mainly represented by a high response rate from Australia) ($P = 0.004214^*$, *small* effect, $w = 0.224$) that was not seen in the other five geographic regions or overall. More male than female respondents in Oceania (mainly represented by a high response rate from Australia) reported having access to adequate continuing education on animal welfare (**results not shown**). This was also the case for the respondents who trained at the University of Sydney – Faculty of Veterinary Science ($P = 0.009033^*$, *small* effect, $w = 0.224$; **results not shown**).

Ways to improve continuing education

About 20% of the respondents suggested ways to improve continuing education (**question 15**, see appendix **WSAVA Animal Welfare Survey**). The most mentioned suggestions were webinars or



Table 3. Opportunity of companion animal veterinarians – with their educational background in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA) – to access adequate continuing education content on animal welfare¹.

● Topic - Answer category	Country						Significance ⁴ /(Effect size <i>w</i>) ⁶
	Russian Federation (162) ²	Australia (153)	Israel (80)	Netherlands (63)	United Kingdom of Great Britain and Northern Ireland (45)	United States of America (44)	
● Animal welfare	<i>a</i> ⁵	<i>b</i>	<i>abc</i>			<i>c</i>	C (<i>P</i> = 0.000115*) (<i>w</i> = 0.217)
- Yes	109 (67.3%) ³	120 (78.4%)	38 (47.2%)	38 (60.3%)	32 (71.1%)	33 (75.0%)	
- No	53 (32.7%)	33 (21.6%)	42 (52.5%)	25 (39.7%)	13 (28.9%)	11 (25.0%)	

¹ This table is based on **question 15** (*Do you have the opportunity to access adequate continuing education content on animal welfare?*) of the questionnaire (see appendix **WSAVA Animal Welfare Survey**).

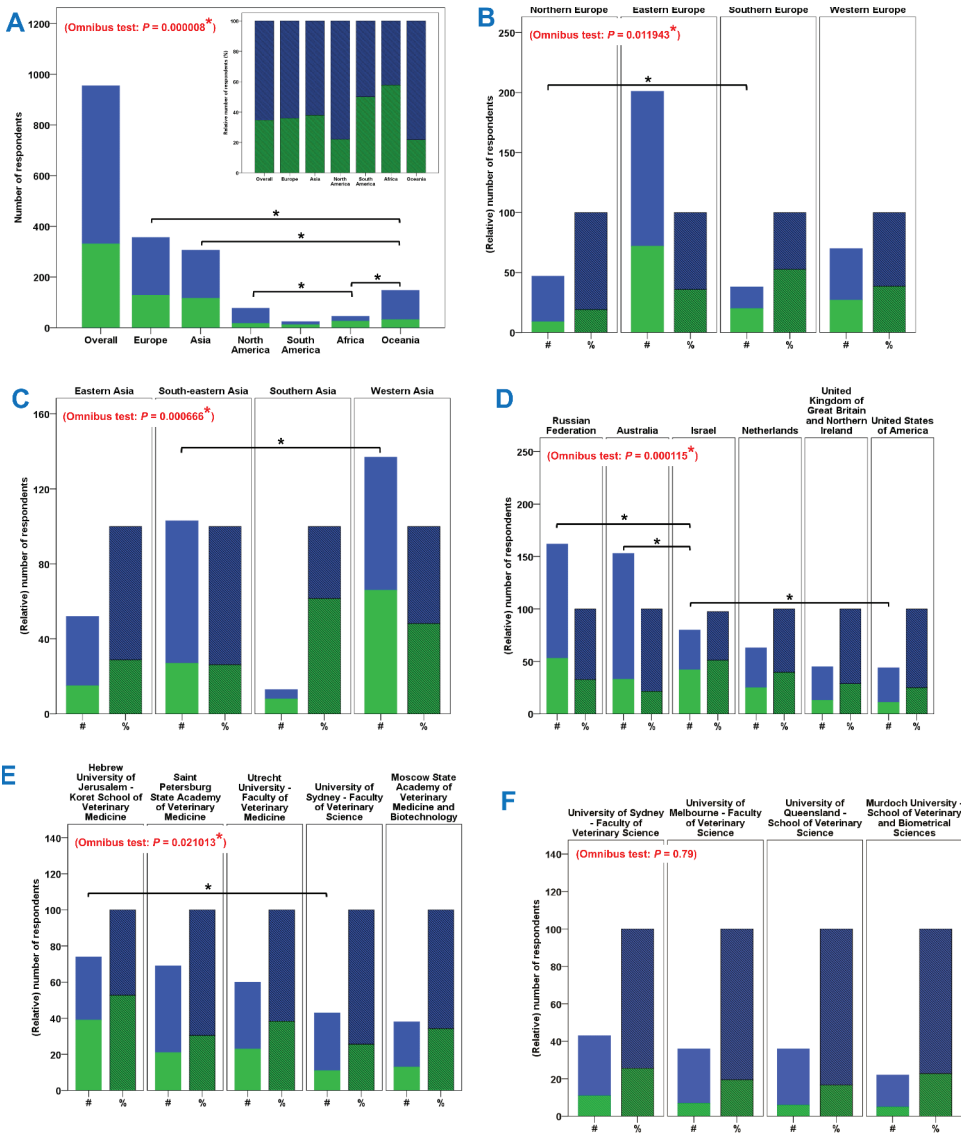
² Total number of respondents per country is given in parentheses and in **bold**.

³ Results are presented as scores (number of respondents) with in parentheses the relative frequency (%).

⁴ Significance (*P* < 0.05) based on the Likelihood ratio test (G-test of goodness-of-fit). **C** indicates significant difference between **countries**; the significant *P* value is indicated with an asterisk.

⁵ Contrast significance (*post hoc* comparisons, *P* < 0.003414). *Post hoc* testing was done by the Likelihood ratio test (G-test of goodness-of-fit). Countries with the same lowercase letter were significantly different.

⁶ Effect size *w* was derived from Cramer's *V*. The (small) effect is indicated in *italics*.



Opportunity to access adequate continuing education content on animal welfare

■ Yes
■ No

Figure 5. Opportunity of companion animal veterinarians to access adequate continuing education content on animal welfare (question 15, see appendix **WSAVA Animal Welfare Survey**). **Panel A:** Respondents working in geographic regions of Europe, Asia, North America, South America, Africa or Oceania, as well as worldwide. **Panel B:** Respondents working in Northern Europe, Eastern Europe (including Northern Asia), Southern Europe or Western Europe. **Panel C:** Respondents working in Eastern Asia, South-Eastern Asia, Southern Asia or Western Asia. **Panel D:** Respondents with their educational background in Russian Federation, Australia, Israel, Netherlands, United Kingdom of Great Britain and Northern Ireland, or United States of America (USA). **Panel E:** Respondents with their educational background in different veterinary institutions. **Panel F:** Respondents with their educational background in different Australian veterinary institutions. **Panel A:** In the main diagram results are presented as scores (number of respondents, #), whereas in the inserted diagram results are shown as relative scores (%). **Panels B-F:** Left and right bars represent scores (number of respondents, #) and relative scores (%), respectively. Solid colored stacked bars = #; solid colored stacked bars with black diagonal lines and borders = %; * = significant difference ($P < 0.05$) in omnibus test. * = significant difference (panels A and D, $P < 0.003414$; panel E, $P < 0.005116$; panels B, C and F, $P < 0.008512$) in post hoc comparison.

online courses, more animal welfare streams during conferences, more local continuing education, and newsletters with special articles about animal welfare.

Sources of information on animal welfare (Figure 6)

Geographic regions

With regard to the source of information on animal welfare (**question 13**, see appendix **WSAVA Animal Welfare Survey**), worldwide companion animal veterinarians typically reported obtaining information from the internet (29.4%), at veterinary conferences/meetings (28.4%) or from veterinary journals (23.7%) (supplementary **Table S4-I**). There were no significant differences between the six geographic regions ($P = 0.017$; supplementary **Table S4-I** and **Figure 6**, panel **A**).

Geographic sub-regions

There was a significant difference ($P = 0.005474^*$, *small* effect, $w = 0.201$) in where companion animal veterinarians obtained information on animal welfare between the four sub-regions of Europe (supplementary **Table S4-II** and **Figure 6**, panel **B**). Companion animal veterinarians working in Northern and Southern Europe reported obtaining information on animal welfare primarily at veterinary conferences/meetings (28.0% and 31.9%, respectively), secondarily from veterinary journals (26.9% and 27.7%, respectively) and thirdly from the internet (22.6% and 21.3%, respectively). In contrast companion animal veterinarians in Eastern Europe reported obtaining information primarily from the internet (34.9%), secondarily from veterinary journals (27.3%) and thirdly at veterinary conferences/meetings (25.5%). For companion animal veterinarians working in Western Europe this top three was: obtaining information from the internet (34.2%), at veterinary conferences/meetings (23.3%) and from veterinary journals (21.7%). However, none of the six *post hoc* comparisons was statistically significant ($P > 0.003$). Between the four Asian sub-regions (supplementary **Table S4-III** and **Figure 6**, panel **C**) there was no significant difference ($P = 0.047$).

Six countries

There was a significant difference ($P = 0.003192^*$, *small* effect, $w = 0.202$) between the six countries with regard to which resources on animal welfare companion animal veterinarians used to gain relevant information, but none of the fifteen *post hoc* comparisons was statistically significant ($P > 0.008$) (supplementary **Table 4** and **Figure 6**, panel **D**).

Five veterinary institutions

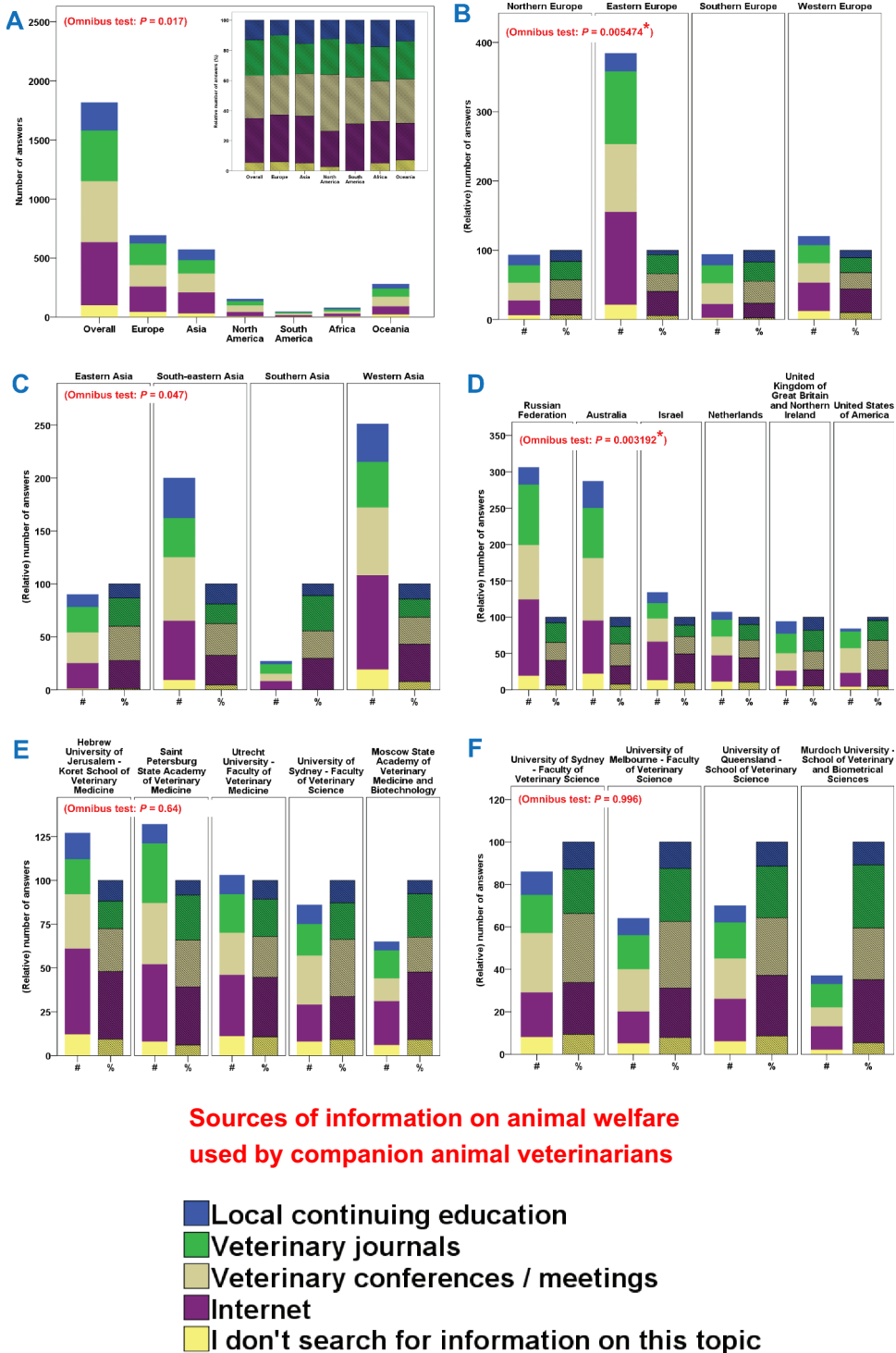
There was no significant difference between the five veterinary institutions ($P = 0.64$; supplementary **Table S4-IV** and **Figure 6**, panel **E**) with regard to the source of information on animal welfare.

Four Australian veterinary institutions

There was no significant difference in resources on animal welfare used by companion animal veterinarians between the four Australian veterinary institutions ($P = 0.996$; supplementary **Table S4-V** and **Figure 6**, panel **F**).

Gender

There was no significant difference (worldwide, per geographic (sub-)region, country, or veterinary institution) between men and women with regard to the source of information on animal welfare (**results not shown**).



Sources of information on animal welfare used by companion animal veterinarians

Figure 6. Sources of information on animal welfare used by companion animal veterinarians (question 13, see Appendix **WSAVA Animal Welfare Survey**). **Panel A:** Respondents working in geographic regions of Europe, Asia, North America, South America, Africa or Oceania, as well as worldwide. **Panel B:** Respondents working in Northern Europe, Eastern Europe (including Northern Asia), Southern Europe or Western Europe. **Panel C:** Respondents working in Eastern Asia, South-Eastern Asia, Southern Asia or

Is continuing education needed for renewal of veterinary license? (Figure 7)

Geographic regions

There were a number of significant differences between the geographic regions about whether continuing education was a prerequisite for license renewal (**question 16**, see appendix **WSAVA Animal Welfare Survey**). For example, more respondents in North America and Oceania (mainly represented by a high response rate from Australia) than in Europe or South America thought that continuing education was needed for license renewal ($P < 0.0000005^*$): Europe *versus* North America, **moderate** effect, $w = 0.350$; North America *versus* South America, **large** effect, $w = 0.758$; Europe *versus* Oceania (mainly represented by a high response rate from Australia), **small** effect, $w = 0.265$; South America *versus* Oceania (mainly represented by a high response rate from Australia), **moderate** effect, $w = 0.450$. Furthermore, more respondents in Oceania (mainly represented by a high response rate from Australia) than in Asia (mainly represented by a high response rate from Israel) considered continuing education to be necessary for license renewal ($P < 0.0000005^*$, **moderate** effect, $w = 0.325$), as did more respondents in Africa than in Asia (mainly represented by a high response rate from Israel) ($P = 0.001273^*$, **small** effect, $w = 0.170$)(**Table S5-I** and **Figure 7**, panel **A**).

Geographic sub-regions

All the four European sub-regions differed significantly ($P < 0.008512^*$) from each other concerning **question 16**. For example, in Northern Europe 85.7% of the respondents considered continuing education to be necessary for license renewal, whereas in Southern Europe only 10.5% thought that this was the case (**Table S5-II** and **Figure 7**, panel **B**). The four Asian sub-regions also differed about whether continuing education was a prerequisite for license renewal. Except for the Eastern Asia *versus* Southern Asia comparison ($P = 0.496$), the *post hoc* comparisons were significant ($P < 0.008512^*$). In South-eastern Asia, 88.5% of the respondents considered continuing education to be necessary for license renewal, whereas in Western Asia only 9.3% thought that this was the case (**Table S5-III** and **Figure 7**, panel **C**).

Six countries

There were also a number of significant differences between the six countries about whether continuing education was necessary for license renewal. For example, significantly ($P \leq 0.000003^*$) more respondents who trained at institutions in Australia, the UK, or the USA than respondents who trained at institutions in the Russian Federation, Israel, or the Netherlands thought that continuing education was needed for license renewal: Australia *versus* Russian Federation, **moderate** effect, $w = 0.337$; Australia *versus* Israel, **large** effect, $w = 0.697$; Australia *versus* the Netherlands, **moderate** effect, $w = 0.471$; UK *versus* Russian Federation, **moderate** effect, $w = 0.312$; UK *versus* Israel, **large** effect, $w = 0.794$; UK *versus* the Netherlands, **large** effect, $w = 0.538$; USA *versus* Russian Federation, **moderate** effect, $w = 0.359$; USA *versus* Israel, **large** effect, $w = 0.842$; USA *versus* the Netherlands, **large** effect, $w = 0.596$ (**Table 5** and **Figure 7**, panel **D**).

Western Asia. **Panel D:** Respondents with their educational background in Russian Federation, Australia, Israel, Netherlands, United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA). **Panel E:** Respondents with their educational background in different veterinary institutions. **Panel F:** Respondents with their educational background in different Australian veterinary institutions. **Panel A:** In the main diagram results are presented as scores (number of answers, #), whereas in the inserted diagram results are shown as relative scores (%). **Panels B-F:** Left and right bars represent scores (number of answers, #) and relative scores (%), respectively. Solid colored stacked bars = #; solid colored stacked bars with black diagonal lines and borders = %. * = significant difference ($P < 0.007301$) in *omnibus* test. There were no significant differences (**panels A and D**, $P \geq 0.000488$; **panels B, C and F**, $P \geq 0.001221$; **panel E**, $P \geq 0.000732$) in the *post hoc* comparisons.

Table 4. Sources of information on animal welfare used by companion animal veterinarians with their educational background in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or the United States of America (USA)¹.

Topic - Answer category	Country						Significance ⁴ /(Effect size <i>w</i>) ⁵
	Russian Federation (306) ²	Australia (287)	Israel (134)	Netherlands (107)	United Kingdom of Great Britain and Northern Ireland (94)	United States of America (84)	
● Animal welfare							
- Local continuing education	24 (7.8%) ³	37 (12.9%)	15 (11.2%)	11 (10.3%)	17 (18.1%)	4 (4.8%)	C (<i>P</i> = 0.003192*)
- Veterinary journals	83 (27.1%)	69 (24.0%)	21 (15.7%)	23 (21.5%)	27 (28.7%)	23 (27.4%)	(<i>w</i> = 0.202)
- Veterinary conferences/meetings	75 (24.5%)	86 (30.0%)	32 (23.9%)	26 (24.3%)	24 (25.5%)	34 (40.5%)	
- Internet	105 (34.3%)	73 (25.4%)	53 (39.6%)	36 (33.6%)	21 (22.3%)	19 (22.6%)	
- I don't search for information on this topic	19 (6.2%)	22 (7.7%)	13 (9.7%)	11 (10.3%)	5 (5.3%)	4 (4.8%)	

¹ This table is based on **question 13** (Where do you source information on the following topics? (more than one answer is possible)) and topic *animal welfare* of the questionnaire (see appendix **WSAVA Animal Welfare Survey**).

² Total number of answers per country is given in parentheses and in **bold**.

³ Results are presented as scores (number of answers) with in parentheses the relative frequency (%).

⁴ Significance (*P* < 0.007301) based on the Likelihood ratio test (G-test of goodness-of-fit). **C** indicates significant difference between **countries**; the significant *P* value is indicated with an asterisk. Contrast significance (post hoc comparisons, *P* < 0.000488) was tested too, but there were no significant differences. Post hoc testing was done by the Likelihood ratio test (G-test of goodness-of-fit).

⁵ Effect size *w* was derived from Cramer's *V*. The (small) effect is indicated in *italics*.



Table 5. Continuing education requirement of practicing companion animal veterinarians – with their educational background in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or the United States of America (USA) – for renewal of their veterinary license ¹.

Topic - Answer category	Country						Significance ⁴ /(Effect size <i>w</i>) ⁶
	Russian Federation (162) ²	Australia (154)	Israel (82)	Netherlands (64)	United Kingdom of Great Britain and Northern Ireland (46)	United States of America (44)	
• Animal welfare							
- Yes	73 (45.1%) ³	120 (77.9%)	4 (4.9%)	18 (28.1%)	38 (82.6%)	39 (88.6%)	C (<i>P</i> = 0.014230*)
- No	89 (54.9%)	34 (22.1%)	78 (95.1%)	46 (71.9%)	8 (17.4%)	5 (11.4%)	(<i>w</i> = 0.560)

¹ This table is based on **question 16** (*Is continuing education required for renewal your veterinary license?*) of the questionnaire (see appendix **WSAVA Animal Welfare Survey**).

² Total number of respondents per country is given in parentheses and in **bold**.

³ Results are presented as scores (number of respondents) with in parentheses the relative frequency (%).

⁴ Significance (*P* < 0.05) based on the Likelihood ratio test (G-test of goodness-of-fit). **C** indicates significant difference between **countries**; the significant *P* value is indicated with an asterisk.

⁵ Contrast significance (*post hoc* comparisons, *P* < 0.003414). *Post hoc* testing was done by the Likelihood ratio test (G-test of goodness-of-fit). Countries with the same lowercase letter were significantly different.

⁶ Effect size *w* was derived from Cramer's *V*. The (large) effect is indicated in **bold**.

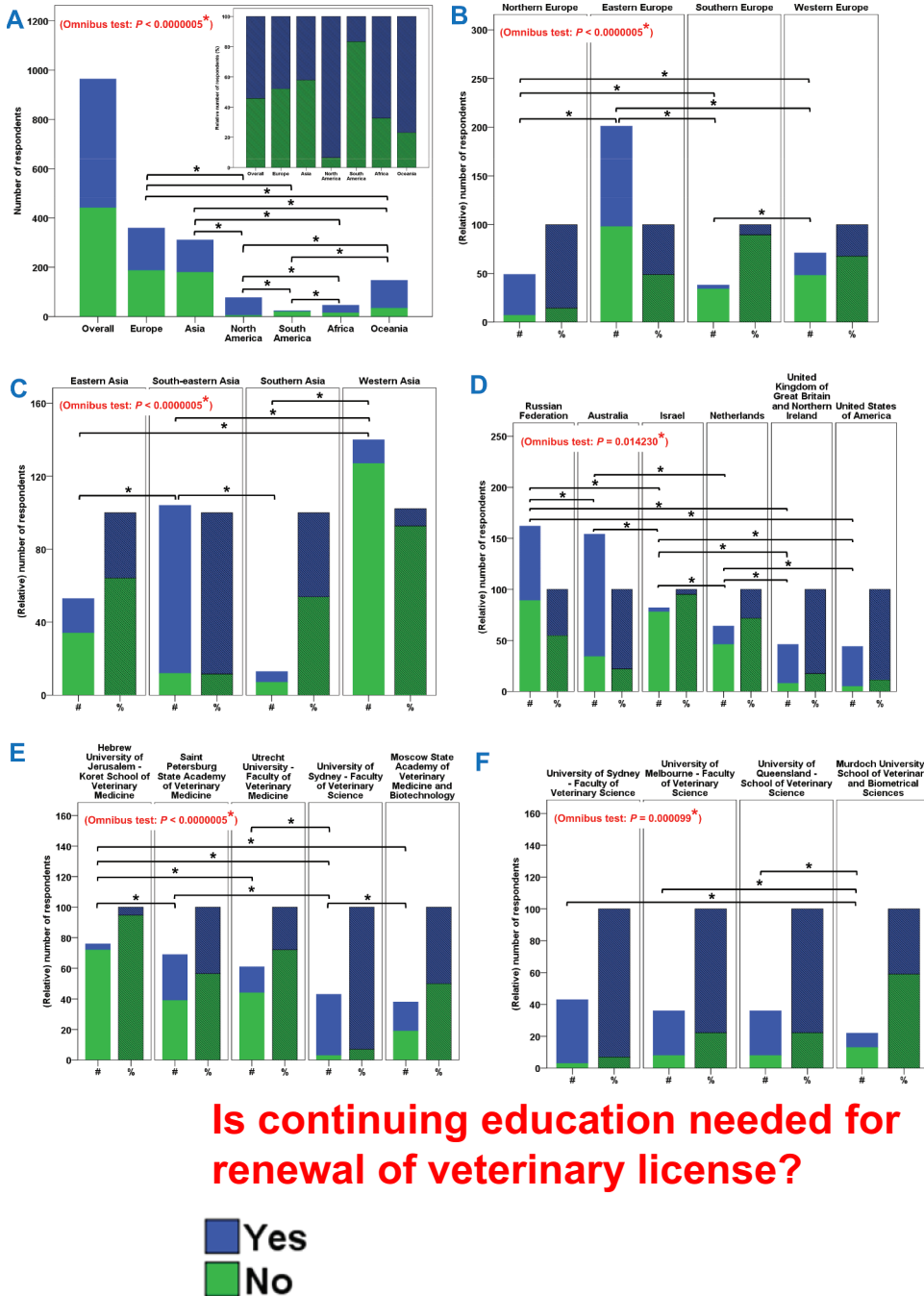


Figure 7. Continuing education requirement of practicing companion animal veterinarians for renewal of their veterinary license (**question 16**, see appendix **WSAVA Animal Welfare Survey**). **Panel A:** Respondents working in geographic regions of Europe, Asia, North America, South America, Africa or Oceania, as well as worldwide. **Panel B:** Respondents working in Northern Europe, Eastern Europe (including Northern Asia), Southern Europe or Western Europe. **Panel C:** Respondents working in Eastern Asia, South-Eastern Asia, Southern Asia or Western Asia. **Panel D:** Respondents with their educational background in Russian Federation, Australia, Israel, Netherlands, United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA). **Panel E:** Respondents with their educational background in different veterinary institutions. **Panel F:** Respondents with their educational background in different Australian veterinary institutions. **Panel A:** In the main diagram results are presented as scores (number of respondents, #), whereas in the inserted diagram results are shown as relative scores (%). **Panels B-F:** Left and right bars represent scores (number of respondents, #) and relative scores (%), respectively. Solid colored stacked bars = #; solid colored stacked bars with black diagonal lines and borders = %. * = significant difference ($P < 0.05$) in omnibus test. * = significant difference (**panels A and D**, $P < 0.003414$; **panel E**, $P < 0.005116$; **panels B, C and F**, $P < 0.008512$) in *post hoc* comparison.

Five veterinary institutions

Fewer respondents who trained at Koret School of Veterinary Medicine, the Hebrew University of Jerusalem, thought that continuing education was a requirement for license renewal compared with the respondents who trained at the Saint Petersburg State Academy of Veterinary Medicine ($P < 0.0000005^*$, **moderate** effect, $w = 0.450$), the Moscow State Academy of Veterinary Medicine and Biotechnology ($P < 0.0000005^*$, **large** effect, $w = 0.526$), the Faculty of Veterinary Medicine, Utrecht University ($P = 0.000199^*$, **moderate** effect, $w = 0.312$), or the Faculty of Veterinary Science, University of Sydney ($P < 0.0000005^*$, **large** effect, $w = 0.873$). Respondents who trained at the Faculty of Veterinary Science, University of Sydney thought that continuing education was more important for license renewal than did respondents who trained at the Saint Petersburg State Academy of Veterinary Medicine ($P < 0.0000005^*$, **moderate** effect, $w = 0.498$), the Moscow State Academy of Veterinary Medicine and Biotechnology ($P = 0.000007^*$, **moderate** effect, $w = 0.483$), and the Faculty of Veterinary Medicine, Utrecht University ($P < 0.0000005^*$, **large** effect, $w = 0.645$) (supplementary Table S5-IV and Figure 7, panel E).

Four Australian veterinary institutions

Of the Australian respondents, fewer respondents who trained at the School of Veterinary and Biometrical Sciences, Murdoch University thought that continuing education was important for veterinary license renewal compared with respondents who trained at the Faculty of Veterinary Science, University of Sydney ($P = 0.000005^*$, **large** effect, $w = 0.572$), Faculty of Veterinary Science, University of Melbourne ($P = 0.004607^*$, **moderate** effect, $w = 0.372$), or School of Veterinary Science, University of Queensland ($P = 0.004607^*$, **moderate** effect, $w = 0.372$) (supplementary Table S5-V and Figure 7, panel F).

Gender

There was no significant difference (worldwide, per geographic (sub-)region, country, or veterinary institution) between male and female companion animal veterinarians about whether continuing education was necessary for license renewal (**results not shown**).

Where do companion animal veterinarians think their clients find information regarding animal welfare? (Figure 8)

Geographic regions

There was a significant difference between Europe on the one hand and Asia (mainly represented by a high response rate from Israel) ($P < 0.0000005^*$, **small** effect, $w = 0.191$), North America ($P = 0.000047^*$, **small** effect, $w = 0.175$), Africa ($P = 0.000015^*$, **small** effect, $w = 0.187$), and Oceania (mainly represented by a high response rate from Australia) ($P < 0.0000005^*$, **small** effect, $w = 0.188$) on the other about the resources companion animal veterinarians thought their clients consulted to obtain information about animal welfare (**question 14**, see appendix **WSAVA Animal Welfare Survey**). The respondents in Europe thought that only 12% of their clients got information from animal welfare groups, whereas the respondents from the other geographic regions thought that 24.5–29.2% used this resource (supplementary Table S6-I and Figure 8, panel A).

Geographic sub-regions

For Europe ($P = 0.000266^*$, **small** effect, $w = 0.217$; supplementary Table S6-II and Figure 8, panel B), but not for Asia ($P = 0.38$; supplementary Table S6-III and Figure 8, panel C), there was a significant difference between the four sub-regions. The respondents in Eastern Europe thought that 85.0% of their clients got information from the veterinarians and internet, whereas the respondents from Northern Europe or Western Europe thought that 65.4% and 70.2%, respectively, used these resources: Eastern Europe *versus* Northern Europe, ($P = 0.000241^*$,

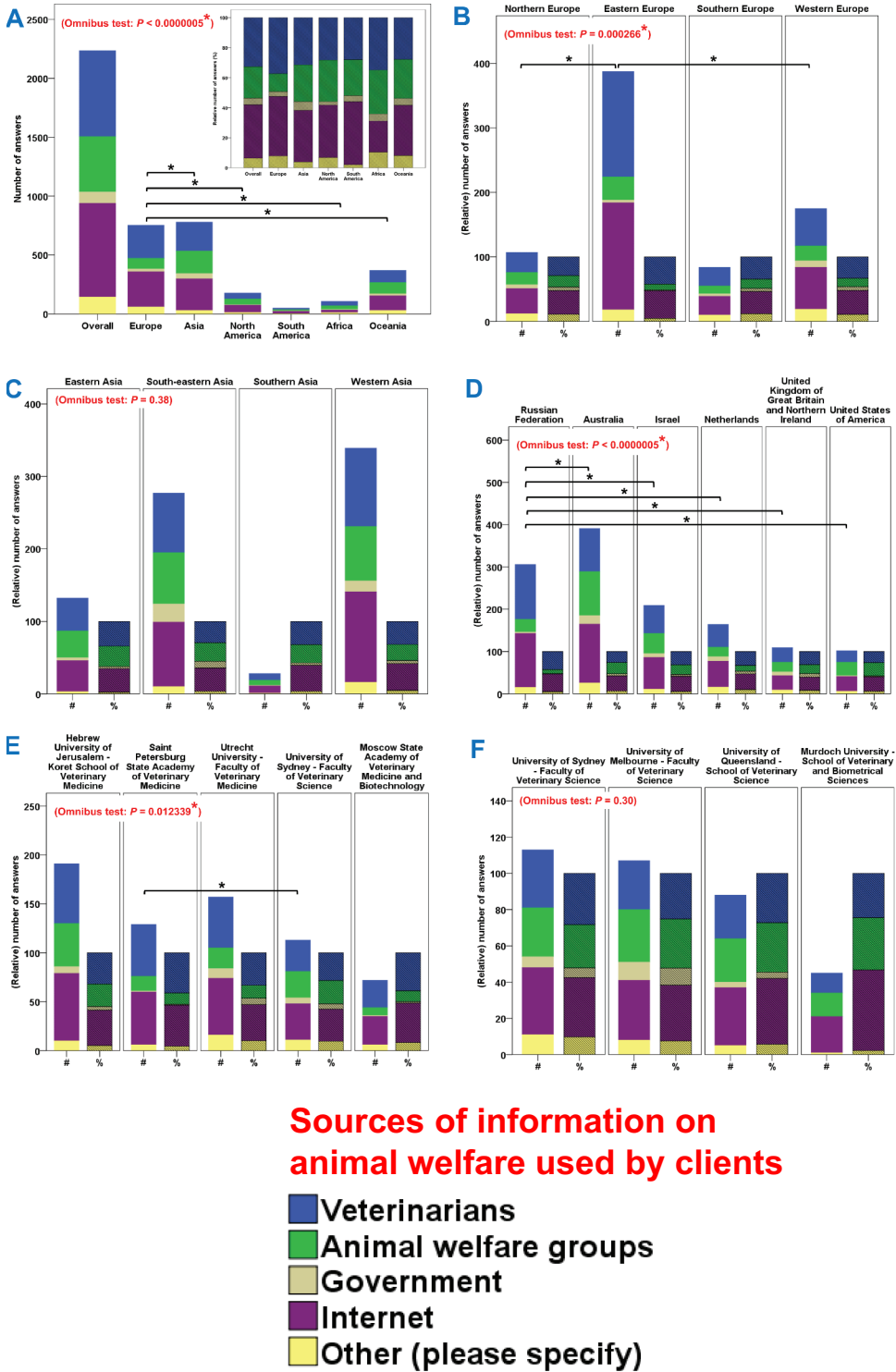


Figure 8. Sources of information on animal welfare used by clients according to their companion animal veterinarian (question 14, see appendix **WSAVA Animal Welfare Survey**). **Panel A:** Respondents working in geographic regions of Europe, Asia, North America, South America, Africa or Oceania, as well as worldwide. **Panel B:** Respondents working in Northern Europe, Eastern Europe (including Northern Asia), Southern Europe or Western Europe. **Panel C:** Respondents working in Eastern Asia, South-

small effect, $w = 0.223$); Eastern Europe *versus* Western Europe, ($P = 0.000285^*$, *small effect*, $w = 0.201$).

Six countries

With regard to the responses to **question 14** there was a significant difference between the respondents who trained in the Russian Federation and those who trained in Australia ($P < 0.0000005^*$, *small effect*, $w = 0.269$), Israel ($P = 0.000054^*$, *small effect*, $w = 0.221$), the Netherlands ($P = 0.000726^*$, *small effect*, $w = 0.206$), the UK ($P = 0.000028^*$, *small effect*, $w = 0.265$), and the USA ($P = 0.000016^*$, *small effect*, $w = 0.273$). The respondents who trained in the Russian Federation thought that 10.8% of their clients got information from animal welfare groups and the government, whereas the respondents who trained in the other countries thought that this percentage was higher: Australia, 31.7%; Israel, 27.3%; the Netherlands, 20.1%; the UK, 29.4%; the USA, 33.4% (Table 6 and Figure 8, panel D).

Five veterinary institutions

There was a significant difference between the respondents who trained at the Saint Petersburg State Academy of Veterinary Medicine and the respondents who trained at the Faculty of Veterinary Science, University of Sydney, in where they thought that their clients got information about animal welfare ($P = 0.002630^*$; *small effect*, $w = 0.256$): the veterinarian (41.1% *versus* 28.3%, respectively), the internet (41.9% *versus* 32.7%, respectively), and animal welfare groups (11.6% *versus* 23.9%, respectively) (supplementary Table S6-IV and Figure 8, panel E).

Four Australian veterinary institutions

The Australian respondents thought that their clients got information on animal welfare from internet (30.8–44.4%) and their veterinarian (24.4–28.3%). Where the respondents trained did not affect these findings ($P = 0.30$) (supplementary Table S6-V and Figure 8, panel F).

Discussion

Animal welfare in the veterinary curriculum

The importance of animal welfare continues to evolve in response to society's increasing awareness of its relevance (Main, 2010). Even so, it was rather disappointing to find that most of our respondents (58.4%) considered that animal welfare was poorly covered or not taught at all during their veterinary training (Figure 4, panel A). Earlier studies had also found that animal welfare was not taught in veterinary schools in a standardized manner (Main, 2010), and that it was not taught in most veterinary schools in Latin America (Tadich et al., 2010). This is why non-governmental organizations have addressed animal welfare issues, even though veterinarians should be the main actors in promoting animal welfare in different scenarios (Tadich et al., 2010). However most of our respondents graduated years ago (based on the age of the respondents; see Figure 3), but in the last couple of years there has been a substantial increase in animal welfare teaching in European

Eastern Asia, Southern Asia or Western Asia. **Panel D:** Respondents with their educational background in Russian Federation, Australia, Israel, Netherlands, United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA). **Panel E:** Respondents with their educational background in different veterinary institutions. **Panel F:** Respondents with their educational background in different Australian veterinary institutions. **Panel A:** In the main diagram results are presented as scores (number of answers, #), whereas in the inserted diagram results are shown as relative scores (%). **Panels B-F:** Left and right bars represent scores (number of answers, #) and relative scores (%), respectively. Solid colored stacked bars = #; solid colored stacked bars with black diagonal lines and borders = %. * = significant difference ($P < 0.05$) in *omnibus* test. * = significant difference (**panels A and D**, $P < 0.003414$; **panel E**, $P < 0.005116$; **panels B, C and F**, $P < 0.008512$) in *post hoc* comparison.

Table 6. Sources of information on animal welfare used by clients according to their companion animal veterinarian who had the educational background in the Russian Federation, Australia, Israel, the Netherlands, the United Kingdom of Great Britain and Northern Ireland (UK), or United States of America (USA)¹.

● Topic - Answer category	Country						Significance ⁴ / (Effect size <i>w</i>) ⁶
	Russian Federation (306) ²	Australia (391)	Israel (209)	Netherlands (164)	United Kingdom of Great Britain and Northern Ireland (109)	United States of America (102)	
● Animal welfare							
- Veterinarians	130 (42.5%) ³	102 (26.1%)	66 (31.6%)	54 (32.9%)	34 (31.2%)	27 (26.5%)	C (<i>P</i> < 0.0000005*)
- Animal welfare groups	30 (9.8%)	104 (26.6%)	48 (23.0%)	22 (13.4%)	23 (21.1%)	32 (31.4%)	(<i>w</i> = 0.242)
- Government	3 (1.0%)	20 (5.1%)	9 (4.3%)	11 (6.7%)	9 (8.3%)	2 (2.0%)	
- Internet	128 (41.8%)	139 (35.5%)	75 (35.9%)	61 (37.2%)	34 (31.2%)	35 (34.3%)	
- Other (please specify)	15 (4.9%)	26 (6.6%)	11 (5.3%)	16 (9.8%)	9 (8.3%)	6 (5.9%)	

¹ This table is based on **question 14** (Where do your clients get information about animal welfare? (more than one answer is possible)) of the questionnaire (see appendix **WSAVA Animal Welfare Survey**).

² Total number of answers per country is given in parentheses and in **bold**.

³ Results are presented as scores (number of answers) with in parentheses the relative frequency (%).

⁴ Significance (*P* < 0.05) based on the Likelihood ratio test (G-test of goodness-of-fit). **C** indicates significant difference between **countries**; the significant *P* value is indicated with an asterisk.

⁵ Contrast significance (post hoc comparisons, *P* < 0.003414). Post hoc testing was done by the Likelihood ratio test (G-test of goodness-of-fit). Countries with the same lowercase letter were significantly different.

⁶ Effect size *w* was derived from Cramer's *V*. The (small) effect is indicated in *italics*.

veterinary schools and colleges (De Briyne et al., 2020); Mota-Rojas et al. (2018) found the same in Latin America. Similar changes may be happening in the rest of the world.

The reason why animal welfare appears to be taught significantly ($P = 0.000149^*$) better in Asia (mainly represented by a high response rate from Israel) ($n = 311$, weighted score = 2.46) than in Europe ($n = 359$, weighted score = 2.20) is unclear (Figure 4, panel A), but we should bear in mind that the effect size was *small* ($w = 0.172$). However, it is good to realize that about 50% of the respondents (180 out of 359) from Europe worked in the Russian Federation (appendix Table A2) and that their opinions would have a strong influence on overall findings. If one compares the European respondents without those from the Russian Federation with the Asian respondents the results are as follows: Europe, $n = 179$, weighted score = 2.37; Asia (mainly represented by a high response rate from Israel), $n = 311$, weighted score = 2.46; $P = 0.31$, zero or nearly zero effect, $w = 0.086$). In IBM® SPSS® Statistics for Windows, weighting cases allows one to assign “importance” or “weight” to the cases in a dataset. In a weighted statistical analysis the results are: Europe, $n_{adjusted} = 358$, weighted score = 2.37; Asia (mainly represented by a high response rate from Israel), $n = 311$, weighted score = 2.46; $P = 0.15$, zero or nearly zero effect, $w = 0.088$). Thus the *small* effect might be explained by the contribution of the Russian Federation.

Companion animal veterinarians who trained in institutions in Australia, the UK, or the Netherlands had the highest scores on this question (question 12, see appendix WSAVA Animal Welfare Survey), whereas those who trained in the Russian Federation had significantly lower scores (Table 2 and Figure 4, panel D). A possible explanation is that animal welfare has been included in veterinary education from 1986 onward in the UK, the Netherlands, and Australia (Broom, 2005), but as far as we know not in the Russian Federation. Although the Russian Federation had a long history of animal welfare, with the Russian Society for the Protection of Animals being founded in 1865 (Anisimov & Ryzhenkov, 2016; Frölich & Jacobsson, 2017), at the current time the Russian Federation lacks an Animal Protection Act, and animals are treated as private property (Anisimov & Ryzhenkov, 2016; Frölich & Jacobsson, 2017). Animal welfare regulations have existed in the rest of Europe since 1975, although there are differences between member countries. Sweden, Norway, and the UK (all part of Northern Europe) have the most stringent legislation regarding animal welfare (Veissier, Butterworth, Bock, & Roe, 2008).

“World Animal Protection” is an international nonprofit animal welfare organization which has developed the Animal Protection Index (available at <https://api.worldanimalprotection.org/>; second edition released in 2020) and ranked 50 countries according to their animal welfare legislation and policy with ten indicators. The ranks are indicated with seven capital letters, ranging from A (the highest welfare) to G (the lowest welfare). Israel is not included in the list of 50 countries but the Russian Federation, Australia, the Netherlands, the UK, and the USA are. For the indicator “Presence of animal welfare – protecting companion animals,” the five countries are ranked as follows: Russian Federation, C; Australia, D; the Netherlands, C; the UK, B; the USA, F. Thus, even though the Russian Federation lacks a specific Animal Protection Act, it has the same rank as the Netherlands regarding “Presence of animal welfare – protecting companion animals.”

Animal welfare was covered less well during the undergraduate training of companion animal practitioners in the USA than in the UK or the Netherlands. An explanation for this might be the number of memberships of a veterinary institution for accreditation authorities regarding veterinary education establishment. In Europe and the USA the accreditation authorities are the European Association of Establishments for Veterinary Education (EAEVE) and the American Association of Veterinary Medical Colleges (AAVMC), respectively. The Faculty of Veterinary Medicine, Utrecht University, in the Netherlands and veterinary institutions in the UK are members of EAEVE. Furthermore, the veterinary school in the Netherlands and five veterinary schools in the UK are also member institutions of AAVMC. In contrast, the colleges or schools of veterinary medicine in the USA are members of AAVMC, but not of EAEVE or VSANZ (Veterinary Schools of Australia and New Zealand) (supplementary Table S7). It is interesting to note that the EAEVE (in collaboration with FVE, Federation of Veterinarians of Europe; Morton et al., 2013), AAVMC (Lord et al.,

2017), and VSANZ (Johnson et al., 2015) have developed model curricula for the study of animal welfare in the undergraduate veterinary program in the last decade. Similar initiatives should be taken by veterinary schools in the other geographic regions of the world (Asia, South America, and Africa).

There are several books on (companion) animal welfare available for practicing companion animal veterinarians to improve continuing education on this topic; for example Rochlitz (2007), Stafford (2007), Yeates (2019), Broom (2022), Rendle and Hinde (2022). However, an online course could provide uniform animal welfare education worldwide (Colonius & Swoboda, 2010; Siegford et al., 2005, 2010), and would be appropriate for practicing companion animal veterinarians who do not have the time to attend traditional classroom-taught courses. We found that the respondents would value online courses (= the suggestions of respondents regarding ways to improve continuing education; open-ended part of **question 15**, see appendix **WSAVA Animal Welfare Survey**). “*World Animal Protection*” and “*University of Bristol – Bristol Veterinary School*” have developed a welfare and ethics syllabus and teaching resource, designed for worldwide use (<https://www.worldanimalprotection.org/animal-welfare-training-resources>). This resource has proved successful in many middle- and low-income countries (de Boo & Knight, 2005). It is of interest to note that of the eight alumni from the Bristol Veterinary School who answered to **question 12** (see appendix **WSAVA Animal Welfare Survey**), two thought animal welfare was “well-covered” in the veterinary curriculum when they were students and six thought there was “adequate coverage.” Such courses should take local cultural, ethical, and legal differences into account (Cao, 2020; Szűcs, Geers, Jezierski, Sossidou, & Broom, 2012), because what is considered acceptable animal welfare may differ in different regions because it is determined in part by societal values (Ohl & Van der Staij, 2012). Special Eurobarometers (the European Union’s official instrument for measuring public opinion) on Animal Welfare (European Commission, 2007, 2016) illustrate the diversity of attitudes regarding animal welfare across European Member States (Magalhães-Sant’Ana, Moore, Morton, Osborne, & Hanlon, 2015). Magalhães-Sant’Ana (2014) presented a conceptual model for veterinary ethics teaching in European veterinary schools, which includes animal welfare science, laws/regulations, professionalism, and theories and concepts. This framework may also prove useful for veterinary schools in other geographic regions of the world, as long as the curricula are adapted to local, cultural, religious and other societal aspects.

Findings (Figure 4, panel E) showed that animal welfare appeared to be taught better at the Faculty of Veterinary Medicine, Utrecht University (respondent age: mean \pm SD, 36 \pm 13 years) than at the two veterinary schools in the Russian Federation, the Moscow State Academy of Veterinary Medicine and Biotechnology (respondent age: 31 \pm 8 years), and the Saint Petersburg State Academy of Veterinary Medicine (respondent age: 34 \pm 9 years). Given that the age of the respondents was not significantly different (Wilcoxon-Mann-Whitney tests, $P > 0.05$), we can assume that the respondents graduated at roughly the same time. The Dutch veterinary school has a full-time chair in animal welfare (from 1995 on; at the moment the chair is held by Prof. Dr. Ir. T.B. (Bas) Rodenburg; <https://www.uu.nl/staff/TBRodenburg>), which is indicative of the importance that the Utrecht University attaches to this topic. As far we know, this is not the case in the Russian Federation (Broom, 2005).

Access to continuing education on animal welfare

There were significant between-region differences in access to adequate continuing education on animal welfare (Figure 5, panel A). More respondents in Oceania (mainly represented by a high response rate from Australia) than in Africa, Asia (mainly represented by a high response rate from Israel), and Europe had access to this information. Significantly fewer respondents who trained in Israel (38 out of 80) had access to continuing education on animal welfare than the respondents educated in the Russian Federation (109 out of 162), Australia (120 out of 153), or the USA (33 out of 44) (Table 3 and Figure 5, panel D). As to the reason for this difference we can only speculate. The

Koret School of Veterinary Medicine, Hebrew University of Jerusalem is the only veterinary school in Israel (see appendix [Table A1](#)) and was established fairly recently, in 1985 (Shahar & Bark, 2006). In contrast, the two veterinary institutions in the Russian Federation (see appendix [Table A1](#)) where most of the respondents from this country studied were founded earlier: Saint Petersburg State Academy of Veterinary Medicine in 1808, and Moscow State Academy of Veterinary Medicine and Biotechnology in 1919 (International association of Universities, 2019). This is also true for Australia (see appendix [Table A1](#)): most respondents trained at the University of Sydney, Faculty of Veterinary Science, which was founded in 1910; University of Melbourne, Faculty of Veterinary Science founded in 1909; University of Queensland, School of Veterinary Science founded in 1936; and Murdoch University, School of Veterinary and Biometrical Sciences founded in 1975 (Caple, 2011). All but one of the veterinary institutions of the USA (see appendix [Table A1](#)) were founded before 1980 (Smith & Fenn, 2011). Older veterinary institutions may have a good (inter)national professional network for continuing professional education on animal welfare. Indeed, the network of veterinary associations for companion animal practitioners in Israel seems to be less extensive than those in Russian Federation, Australia, or the USA ([Table S8](#)). The various national, regional, and international veterinary associations could and should play an important role in promoting continuing education on animal welfare.

More companion animal veterinarians who graduated from the Faculty of Veterinary Science, University of Sydney, had access to continuing education on animal welfare relative to the respondents who graduated from the Koret School of Veterinary Medicine, Hebrew University of Jerusalem ([Figure 5](#), panel E). The same explanation as above (old versus young veterinary institution, as well as a larger professional network) could apply to this difference. In addition, animal welfare is an important topic in the curricula of Australian and New Zealand veterinary schools (Freire et al., 2017), which could explain why these schools offer more continuing education.

Sources of information used by companion animal veterinarians

Most respondents reported that they got information on animal welfare from the internet (including access to scientific journals) and veterinary conferences/meetings, whereas local continuing education seems to be the least used source of information ([Figure 6](#), panel A). While most respondents had access to adequate continuing education on animal welfare, only half or fewer of the respondents from South America and Africa had access to this information ([Figure 5](#), panel A). While programs for continuing education on animal welfare are widely available, busy companion animal practitioners may not have time to use these programs and prefer other sources of information. Online continuing education via webinars and similar technologies might be a solution for this, as indicated by the answers of the respondents to the open-ended question (Please indicate how access could be improved) in **question 15** (see appendix **WSAVA Animal Welfare Survey**). Furthermore, these forms of online continuing education allow a higher number of companion animal veterinarians to be reached at lower cost. It is important that suitable courses are available at accessible locations and times (Dale, Pierce, & May, 2013) and that these courses match the unique employment situation, learning style, and professional goals of users (Gates, McLachlan, Butter, & Weston, 2021b).

In another study of veterinarians worldwide, but mainly in high-income countries, Huntley et al. (2016) found that veterinarians get their information from veterinary journals, but that they mainly read the abstract and conclusions of the articles on internet. They also read bulletins or newsletters on internet. Busy veterinarians do not have the time to do a literature search on a specific topic, but need a quick answer for a problem occurring in veterinary practice (Vandeweerd et al., 2012). Veterinary conferences/meetings and networking are important for keeping knowledge up to date (Fakunle, Dollinger, Alla-Mensah, & Izard, 2019), not only for practicing companion animal veterinarians but also for veterinary students. However, for a quick answer to a problem occurring in veterinary practice, this source is not very useful and companion animal veterinarians tend to contact their colleagues.

Veterinary license

North America differed significantly from all the other regions with regard to the perceived importance of continuing education to license renewal (Figure 7, panel A). There was also a significant difference between the six countries about whether respondents thought continuing education was necessary for license renewal (Table 5 and Figure 7, panel D). In Australia, the UK, and the USA continuing professional development is obligatory for practicing veterinarians (Wieland, Daborn, Debnath, & Silva-Fletcher, 2021). Without continuing education, it is hardly possible to keep a veterinary license in the USA. The American Veterinary Medical Association (AVMA) and the Canadian Veterinary Medical Association (CVMA) play an important role in organizing continuing education. However, training is not uniform across Australia or the USA and differs by state. In the UK, veterinary practitioners have to spend 35 hours a year on continuing education (Wieland et al., 2021). In the Netherlands continuing professional development is voluntary for practicing veterinarians (Favier, Ten Cate, Duijn, & Bok, 2021). Despite this, 28.1% of the Dutch respondents thought that continuing education is required for veterinary license renewal (Table 5 and Figure 7, panel D). This is lower than the percentage mentioned in the 2018/2019 Federation of Veterinarians in Europe (FVE) Survey of the Veterinary Profession in Europe: 57% of the veterinarians in the Netherlands believed that continuing professional development was compulsory to keep their jobs (Federation of Veterinarians in Europe, 2019). In Israel there is no continuing education requirement for practicing veterinarians in any sector, private or public (see <https://www.nbn.org.il/life-in-israel/employment/professions-index/licensed-medical-professions/veterinary-medicine/>). Thus it is not a surprise that most respondents (78 out of 82) answered “No” to question 16 (see appendix WSAVA Animal Welfare Survey). However, this does not imply that there is no continuing education for practicing veterinarians in Israel. For instance the Koret School of Veterinary Medicine, Hebrew University of Jerusalem offers continuing education programs for local and new immigrant veterinarians (Shahar & Bark, 2006). 490 veterinarians from *European Russia* participated in the 2018/2019 FVE Survey of the Veterinary Profession in Europe and 95% of them worked with small animals (Federation of Veterinarians in Europe, 2019). This survey indicated that 81% of the veterinarians in *European Russia* believed that continuing professional development is compulsory to keep their jobs. However, we found that 45.1% of the respondents in the *Russian Federation* thought that continuing education is required for veterinary license renewal (Table 5 and Figure 7, panel D). The discrepancy between our findings and those of the FVE survey might be because we included respondents who trained in federal districts outside *European Russia* (appendix Table A1).

Respondents who trained at Koret School of Veterinary Medicine, Hebrew University of Jerusalem, Israel (Figure 7, panel E) thought that they had less need to take continuing education to keep their license than did other respondents. Indeed, as indicated above, in Israel there is no continuing education requirement for practicing veterinarians within any sector, private or public (see <https://www.nbn.org.il/life-in-israel/employment/professions-index/licensed-medical-professions/veterinary-medicine/>). Interestingly, the respondents who trained at the four Australian veterinary schools differed significantly in whether they thought companion animal veterinarians needed continuing education to keep their license (Figure 7, panel F). These veterinary institutions are located in four of the six Australian states. While the states have legislative power over the welfare of animals and legislation differs between each state (and territory) (Morton, Hebart, & Whittaker, 2020), all registered veterinarians, regardless of which state or territory they practice, are expected to follow continuing professional development (Caple, 2005) and obtain minimally 60 continuing professional development points over a consecutive 3-year cycle (Wieland et al., 2021). Thus, despite the perceptions of some of the respondents, all veterinarians in Australia have to follow continuing education in order to keep their veterinary license (Wieland et al., 2021). While continuing education is necessary for license renewal in some countries (Wieland et al., 2021), it is also essential for keeping abreast of the latest developments in veterinary science (Boutet, 2006; Dale et al., 2013; Gates, McLachlan, Butter, & Weston, 2021a, 2021b).

Sources of information used by clients

Veterinarians can play a significant role in educating their clients, as well as the general public, about animal welfare (Dolby & Litster, 2015). That the owners of companion animals in Europe were thought to get information regarding animal welfare from their veterinarian, whereas owners in Asia (mainly represented by a high response rate from Israel), Africa, and Oceania (mainly represented by a high response rate from Australia) were thought to also consult animal welfare groups (Figure 8, panel A), might be because there are more companion animal veterinarians per capita in Europe than in these geographic regions (assuming that a wealthier society has a greater number of practicing companion animal veterinarians per capita). Hofmeister et al. (2008) found that veterinary clients ranked veterinary general practitioners, veterinary specialists, the internet, family/friends, and other media as sources of information on anesthesia in dogs. However, in the last five years internet has become a more important source of information than it was in 2008.

The respondents who trained in the Russian Federation thought that 9.8% of their clients got information from animal welfare groups, whereas the respondents who trained in the other countries (i.e., Australia, Israel, the Netherlands, the UK, or the USA) thought a higher percentage did (Table 6 and Figure 8, panel D). An explanation for this might be that there are fewer animal welfare/protection/rights organizations in the Russian Federation than in the five other countries (see World Animal Net: <https://worldanimal.net/directory/search-wan-directory>).

More than 30% of the companion animal practitioners, regardless of country, reported that owners use the internet to get information about animal welfare (Table 6 and Figure 8, panel D). Kogan, Hazel, and Oxley (2019) reported that, in Australia, the owners of companion animals often get information from the internet and that the role of the companion animal veterinarian is to point out which internet sources are reliable (Kogan et al., 2019, 2012). In another study, Kogan, Oxley, Hellyer, Schoenfeld, and Rishniw (2018) found that, in the UK, the owners of companion animals rated the veterinarian as the most reliable source of information, but also that their veterinarian almost 50% of the time never indicated which websites were reliable, even though 90% of the respondents said they would visit the websites advised by their veterinarian. Kogan, Oxley, Hellyer, and Schoenfeld-Tacher (2017) also found that companion animal owners often do not understand what they read on the internet. This means that companion animal veterinarians have a very important role to play, not only by telling their clients where they can find reliable information, but also by ensuring that they understand what they read.

Limitations of the study

Veterinarians and their practices may be specialized in certain areas of veterinary medicine, but the majority of them focus on companion animals. For instance in Europe (Federations of Veterinarians in Europe, 2019) and the USA (American Veterinary Medical Association, 2021) almost two thirds of veterinarians work mainly as companion animal practitioners. Of course, ensuring good animal welfare is a core mandate for all veterinarians (De Paula Vieira & Anthony, 2020), but because the majority of the practicing veterinarians have a primary focus on companion animals and the survey questions (see appendix **WSAVA Animal Welfare Survey**) were developed by the AWGG of the WSAVA, the target audience was companion animal veterinarians. Nevertheless, it would be interesting to distribute this survey to the other species-specialized veterinarians (for example food-animal veterinarians, equine veterinarians, avian veterinarians, etc.) around the world.

Animal welfare is not taught in a standardized manner in veterinary schools. There is a diversity in content and method of delivery between various veterinary schools worldwide. Although animal welfare should address the impact of humans on animals (welfare science), analysis of our moral obligations (welfare ethics), and knowledge of minimum welfare standards (welfare legislation and policy) (Main, 2010; Morton et al., 2013), we used the general term “animal welfare” in our questionnaire. In 2016, when the questionnaire was launched, the AWGG of the WSAVA had not yet formulated a useful

definition of animal welfare that could be used in our survey. Since then, the AWGG of the WSAVA has published the following definition: “the physical and psychological, social, and environmental well-being of animals” (Ryan et al., 2019). The lack of definition in our study means that respondents may have had very different ideas about what constitutes animal welfare and may also have confused animal welfare with animal rights (Dolby & Litster, 2019). Tzioumis et al. (2018) found that educators at veterinary schools focus on practical aspects of veterinary medicine, which clashes with a perceived need for veterinarians to be educated about ethics.

One aim of this survey was to find out whether companion animal veterinarians thought that animal welfare was taught during their veterinary training (historical recall of content), but we did not verify whether this was actually the case. As animal welfare includes behavioral medicine and animal health (for a definition of animal welfare see Ryan et al., 2019), it might have been included in the curriculum without being termed as such, so that respondents might not have realized that the topic was taught. Furthermore, every definition of animal welfare is influenced by the moral or ethical standards of society (Ohl & Van der Staaij, 2012). It might be relevant to survey the participating institutions (appendix Table A1) about the content of their curricula, as was done by De Briyne et al. (2020) among 57 European veterinary schools.

We also investigated what resources practicing companion animal veterinarians used for information and which resources they thought their clients used. While some studies have investigated this (Hewson et al., 2005; Huntley et al., 2016), this is the first study to investigate this worldwide (appendix Figure A1 and Table A1). However, the respondents were not uniformly distributed over the six geographic regions, with most countries having fewer than five respondents (appendix Table A2). This makes statistical comparisons between most countries underpowered and necessitated grouping countries by geographic region. Some countries, namely, the Russian Federation, Israel, and Australia, had more than a hundred respondents each (appendix Table A2), so that these countries had a substantial influence on the findings for their region. Moreover, eleven institutions had a substantial influence on the results for the geographic regions (Figure 2).

Of course, our global survey is not representative of the opinions of companion animal veterinarians worldwide. For instance, in Europe there were an estimated 309,114 active veterinarians in 2018, of which 67% had specialized in companion animals (Federation of Veterinarians in Europe, 2019). In the present survey, only 356–359 European companion animal veterinarians responded to the survey (appendix Table A2), 68% of whom worked in the Russian Federation or the Netherlands (appendix Table A2). The responses from the Russian Federation were dominated by respondents who trained at two institutions: the State Academy of Veterinary Medicine in Saint Petersburg and the State Academy of Veterinary Medicine and Biotechnology in Moscow. There is only one veterinary school in the Netherlands, at Utrecht University. Together, these three institutions accounted for 47% ($n = 69 + 61 + 38 = 168$, see supplementary Table S2-IV) of the European respondents, which would have skewed the results for Europe. Two other European institutions (University of Veterinary Medicine in Košice, $n = 22$; University of London – Royal Veterinary College, $n = 14$) were also influential (Figure 2).

There are more than 56,000 companion animal practitioners in the USA (American Veterinary Medical Association, 2021) and yet there were only 46 respondents (appendix Table A2). Although the country has more than 30 veterinary colleges (i.e., accredited by the AVMA) (Cooney, Dickinson, & Hoffmann, 2021), the respondents came from 20 veterinary colleges (appendix Table A1). This means that our findings do not represent the views of the USA or, indeed, of North America.

Veterinarians are typically poor responders to questionnaires, and thus the respondents may have been especially interested in animal welfare, which might have introduced bias (Arhant, Hörschläger, & Troxler, 2019; Dawson, Dewey, Stone, Guerin, & Niel, 2016) and resulted in our findings not being truly representative of the profession (Arhant et al., 2019). For practical reasons, the questionnaire was distributed electronically through the website of WSAVA and member organizations.

However, electronic surveys have lower response rates and have a higher percentage of item non-response than traditional paper surveys (Menachemi, 2011).

Conclusions

This was the first worldwide study of animal welfare education in the veterinary curriculum, the availability of continuing education on animal welfare, and where companion animal veterinarians think their clients get information about this topic.

58.4% of the respondents were of the opinion that animal welfare was poorly covered or not taught at all when they were students, although Asia (mainly represented by a high response rate from Israel) fared better than Europe on this. The best coverage of animal welfare was in the Netherlands and the UK. It was covered significantly better in the Netherlands or the UK than in the Russian Federation or the USA. Of the five selected veterinary schools, animal welfare was covered significantly better in Utrecht University than in the two veterinary schools in the Russian Federation.

More companion animal veterinarians in Oceania (mainly represented by a high response rate from Australia) had access to continuing education on animal welfare than did companion animal veterinarians in Africa, Asia (mainly represented by a high response rate from Israel), and Europe. Fewer companion animal practitioners who trained in Israel had access to continuing education on this topic than did practicing companion animal veterinarians who studied in the Russian Federation, Australia, or the USA. The difference between Australia and Israel is also reflected when the University of Sydney is compared to the Hebrew University of Jerusalem.

Practicing companion animal veterinarians get information on animal welfare mainly from the internet and veterinary conferences/meetings, but in daily practice – due to time constraints – they tend to consult their colleagues.

More companion animal veterinarians in North America thought that continuing education was required for veterinary license renewal than did veterinarians in the other geographic regions of the world. More companion animal practitioners educated in the three English-speaking countries (Australia, the UK, and the USA) considered continuing education to be necessary for license renewal than did those studied in the Russian Federation, Israel or the Netherlands.

The companion animal veterinarians thought that their clients would obtain animal welfare information from their veterinarian, animal welfare groups, and the internet, with emphasis on the veterinarian and internet in Europe and relatively more emphasis on animal welfare groups in Asia (mainly represented by a high response rate from Israel), Africa, and Oceania (mainly represented by a high response rate from Australia).

In conclusion, our findings show that there is a need to improve education on animal welfare in veterinary curricula and the provision of relevant continuing education, so that companion animal practitioners can keep abreast of developments and societal expectations.

Acknowledgments

The authors acknowledge the financial support of the AWWC by Waltham[®]. The authors are greatly indebted to the companion animal veterinary alumni who took the time to complete and return the WSAVA Animal Welfare Survey. N. Endenburg and S. Ryan take the opportunity to thank H.J. Bacon, S.J. Hazel, R. Jouppi, N.Y.P. Lee, K. Seksel, and G. Takashima (all members of the WSAVA's AWGG) for the stimulating collaboration they have had on this global, opinion-questionnaire-based survey on animal welfare. The authors are also grateful to the anonymous reviewers for their valuable comments on the manuscript, which has undoubtedly helped the authors to improve the article. We thank J. Sykes for checking the English.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The work was supported by Waltham®.

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Appendix

WSAVA Animal Welfare Survey

Demographic information

(1) Are you male or female?

0 Male

0 Female

(2) What is your age?

..... years

(3) In what country do you work?

.....

(4) Where did you obtain your primary veterinary degree?

.....

Name of veterinary school, institution or university?

.....

(5) What is your primary veterinary role?

0 Veterinary practitioner

0 Non-Practitioner (please describe)

.....

WSAVA Animal Welfare Survey

Animal welfare issues in practice in your country/region

(6) Following are 6 questions about potential animal welfare issues seen at your veterinary practice. Firstly, animal health-related issues – please indicate degree of importance:

	Very important (1)	Important (2)	Variable importance (3)	Not very important (4)	Not important (5)
(a) Incorrect (over/under feeding) or inappropriate nutrition	0	0	0	0	0
(b) Genetic or breed-related health issues	0	0	0	0	0
(c) Lack of routine prophylaxis (e.g., vaccinations, anti-parasiticsides)	0	0	0	0	0
(d) Obesity	0	0	0	0	0
(e) Age-related issues (e.g., osteoarthritis)	0	0	0	0	0

(7) Secondly, potential behavioral-related issues – please indicate degree of importance:

	Very important (1)	Important (2)	Variable importance (3)	Not very important (4)	Not important (5)
(a) Aggression	0	0	0	0	0
(b) Separation related behavior (e.g., separation anxiety)	0	0	0	0	0
(c) Lack of socialization/poor social skills	0	0	0	0	0
(d) Disobedience	0	0	0	0	0
(e) Inappropriate elimination (soiling)	0	0	0	0	0

(8) Third, owner-related issues – please indicate degree of importance:

	Very important (1)	Important (2)	Variable importance (3)	Not very important (4)	Not important (5)
(a) Delay or refusal to euthanize	0	0	0	0	0
(b) Lack of knowledge	0	0	0	0	0
(c) Animal abuse	0	0	0	0	0
(d) Noncompliance	0	0	0	0	0
(e) Anthropomorphizing	0	0	0	0	0

(9) Fourth, social-related issues – please indicate degree of importance:

	Very important (1)	Important (2)	Variable importance (3)	Not very important (4)	Not important (5)
(a) Confinement/lack of exercise	0	0	0	0	0
(b) Refusal of treatment	0	0	0	0	0
(c) Treatment by non-qualified persons	0	0	0	0	0
(d) Convenience euthanasia	0	0	0	0	0
(e) Uncontrolled or over-breeding	0	0	0	0	0

(10) Of all issues mentioned above which are the top **three** of all animal welfare issues in your veterinary practice?

- | | |
|---|---|
| 0 Lack of knowledge | 0 Confinement/lack of exercise |
| 0 Aggression | 0 Disobedience |
| 0 Uncontrolled or over-breeding | 0 Inappropriate elimination (soiling) |
| 0 Animal abuse | 0 Incorrect (over/under feeding) or inappropriate nutrition |
| 0 Obesity | 0 Refusal of treatment |
| 0 Delay or refusal to euthanize | 0 Genetic or breed-related health issues |
| 0 Separation related behavior (e.g., separation anxiety) | 0 Lack of socialization/poor social skills |
| 0 Lack of routine prophylaxis (e.g., vaccinations, anti-parasiticsides) | 0 Anthropomorphizing |
| 0 Convenience euthanasia | 0 Treatment by non-qualified persons |
| 0 Non-compliance | 0 Age-related issues |

(11) Are there other animal welfare issues in your veterinary practice that are not mentioned above?

.....

WSAVA Animal Welfare Survey
Animal welfare education

(12) Please indicate how well the following topics were covered during your undergraduate veterinary training

	Well-covered (4)	Adequate coverage (3)	Poorly covered (2)	Not taught (1)
(a) Client communication	0	0	0	0
(b) Animal welfare	0	0	0	0
(c) Surgical techniques	0	0	0	0
(d) Human animal bond	0	0	0	0
(e) Dentistry	0	0	0	0
(f) Animal behavior	0	0	0	0
(g) Zoonotic disease/epidemiology	0	0	0	0

(13) Where do you source information on the following? (more than one answer is possible)

	Local continuing education	Veterinary journals	Veterinary conferences/ meetings	Internet	I don't search for information on this topic
(a) Client communication	0	0	0	0	0
(b) Animal welfare	0	0	0	0	0
(c) Surgical techniques	0	0	0	0	0
(d) Human animal bond	0	0	0	0	0
(e) Dentistry	0	0	0	0	0
(f) Animal behavior	0	0	0	0	0
(g) Zoonotic disease/epidemiology	0	0	0	0	0

(14) Where do your clients get information about animal welfare? (more than one answer is possible)

- 0 Veterinarians
 - 0 Animal welfare groups
 - 0 Government
 - 0 Internet
 - 0 Other (please specify)
-

(15) Do you have the opportunity to access adequate Continuing Education content on animal welfare? (if no how could access be improved?)

- 0 Yes
- 0 No

Please indicate how access could be improved

.....

(16) Is Continuing Education required for renewal your veterinary license?

- 0 Yes
- 0 No

(17) In your opinion which animal welfare issues are most pressing in your area(city, state&/ or country)

.....

Table A1. Educational background of respondents per geographic region and country.

Geographic region	Number of respondents
<ul style="list-style-type: none"> ● <i>Country (United Nations geoscheme)</i>¹ <ul style="list-style-type: none"> ✓ Universities, institutes, academies, colleges and schools awarding veterinary and allied degrees 	
Europe	
<ul style="list-style-type: none"> ● <i>Russian Federation (Eastern Europe + Northern Asia)</i> <ul style="list-style-type: none"> ✓ Saint Petersburg State Academy of Veterinary Medicine 81 ✓ Moscow State Academy of Veterinary Medicine and Biotechnology 43 ✓ Peoples' Friendship University of Russia Moscow 6 ✓ Omsk State Agrarian University – Institute of Veterinary Medicine 4 ✓ South Ural State University 4 ✓ Ural Federal University 4 ✓ Voronezh State Agrarian University 4 ✓ Donskoy State Agrarian University 3 ✓ Kuban State Agrarian University 3 ✓ Moscow State University of Food Production 3 ✓ Novgorod State Agricultural Academy 3 ✓ Novosibirsk State Agricultural University 3 ✓ Ogarev Mordovia State University 3 ✓ Perm State Agricultural Academy 3 ✓ Vitebsk State Academy of Veterinary Medicine 3 ✓ Volgograd State Agricultural University 3 ✓ Crimean Agrotechnological University 2 ✓ Irkutsk State Agricultural Academy 2 ✓ Bashkir State Agrarian University 1 ✓ Ivanovo State University 1 ✓ Krasnoyarsk State Agrarian University 1 ✓ Kursk State Agricultural Academy 1 ✓ Orel State Agrarian University 1 ✓ Orenburg State Agrarian University 1 ✓ Samara National Research University 1 ✓ Saratov State Agrarian University 1 ✓ Stavropol State Agrarian University 1 ✓ Tomsk Agricultural Institute 1 ✓ Tyumen State Agriculture Academy 1 ● <i>Netherlands (Western Europe)</i> 	

(Continued)

Table A1. (Continued).

Geographic region	
✓ Utrecht University – Faculty of Veterinary Medicine	66
✓ Leiden Educational Institutions	1
✓ Van Hall Larenstein University of Applied Sciences	1
● <i>Slovakia (Eastern Europe)</i>	
✓ University of Veterinary Medicine in Košice	22
● <i>United Kingdom of Great Britain and Northern Ireland (UK) (Northern Europe)</i>	
✓ University of London – Royal Veterinary College	14
✓ University of Edinburgh – Royal (Dick) School of Veterinary Studies	12
✓ University of Bristol – Bristol Veterinary School	11
✓ University of Glasgow – School of Veterinary Medicine	11
✓ University of Liverpool – School of Veterinary Science	6
✓ University of Cambridge – Veterinary School	5
✓ University of Nottingham – School of Veterinary Medicine and Science	2
✓ Lite Limited	1
✓ Myerscough School of Veterinary Nursing	1
✓ Scotland's Rural College – Scottish Agricultural College	1
● <i>Belgium (Western Europe)</i>	
✓ University of Ghent – Faculty of Veterinary Medicine	10
✓ University of Liège – Faculty of Veterinary Medicine	3
● <i>Spain (Southern Europe)</i>	
✓ Autonomous University of Barcelona – Veterinary Faculty	10
✓ University of Santiago de Compostela – Faculty of Veterinary Medicine	7
✓ Complutense University of Madrid – Veterinary Faculty	6
✓ University of Zaragoza – Veterinary Faculty	4
✓ University of Las Palmas de Gran Canaria – Veterinary Faculty	2
✓ University of León – Veterinary Faculty	1
✓ University of Murcia – Veterinary Faculty	1
● <i>Greece (Southern Europe)</i>	
✓ Aristotle University of Thessaloniki – Faculty of Veterinary Medicine	8
● <i>Ukraine (Eastern Europe)</i>	
✓ Kharkiv State Zootechnical-Veterinary Academy	7
✓ National Agricultural University of Ukraine – Faculty of Veterinary Science	3
✓ Lviv National Agrarian University	2
✓ National University of Bioresources and Nature Kiev	2
✓ Bilotserkivska National Agrarian University	1
✓ Lugansk National Agrarian University	1
✓ Zhytomyr National Agroecological University	1
● <i>Estonia (Eastern Europe)</i>	
✓ Estonian University of Life Sciences – Institute of Veterinary Medicine and Animal Sciences	6
● <i>Hungary (Eastern Europe)</i>	

(Continued)

Table A1. (Continued).

Geographic region	
✓ Szent Istvan University, Budapest – Faculty of Veterinary Science	6
● <i>Italy (Southern Europe)</i>	
✓ University of Parma – Faculty of Veterinary Medicine	6
✓ University of Milan – Faculty of Veterinary Medicine	3
✓ University of Bologna – Faculty of Veterinary Medicine	2
✓ University of Pisa – Faculty of Veterinary Medicine	2
✓ University of Padua – Faculty of Veterinary Medicine	1
✓ University of Teramo – Faculty of Veterinary Medicine	1
✓ University of Turin – Faculty of Veterinary Medicine	1
● <i>Germany (Western Europe)</i>	
✓ Justus Liebig University Giessen – Faculty of Veterinary Medicine	4
✓ University of Veterinary Medicine Hanover	3
✓ Free University of Berlin – Department of Veterinary Medicine	2
✓ Ludwig Maximilian University of Munich – Faculty of Veterinary Medicine	2
● <i>Ireland (Northern Europe)</i>	
✓ University College Dublin – School of Veterinary Medicine	3
● <i>Slovenia (Southern Europe)</i>	
✓ University of Ljubljana – Faculty of Veterinary Medicine	3
● <i>Belarus (Eastern Europe)</i>	
✓ Grodno State Agrarian University – Faculty of Veterinary Medicine	2
● <i>Czech Republic (Eastern Europe)</i>	
✓ University of Veterinary and Pharmaceutical Sciences, Brno	2
● <i>France (Western Europe)</i>	
✓ National Veterinary School of Alfort	2
● <i>Moldova (Eastern Europe)</i>	
✓ Agricultural State University of Moldova – Faculty of Veterinary Medicine	2
● <i>Poland (Eastern Europe)</i>	
✓ Warsaw University of Life Sciences – Faculty of Veterinary Medicine	2
✓ University of Warmia and Mazury – Faculty of Veterinary Medicine	1
✓ Wroclaw University of Environmental and Life Sciences – Faculty of Veterinary Medicine	1
● <i>Portugal (Southern Europe)</i>	
✓ Technical University of Lisbon – Faculty of Veterinary Medicine	2
● <i>Romania (Eastern Europe)</i>	
✓ Bucharest Spiru Haret University – Faculty of Veterinary Medicine	2
✓ Banat University of Agricultural Sciences and Veterinary Medicine	1
✓ Carol Davila University of Medicine and Pharmacy	1
✓ University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca – Faculty of Veterinary Medicine	1
● <i>Albania (Southern Europe)</i>	

(Continued)

Table A1. (Continued).

Geographic region	
✓ Agricultural University of Tirana – Faculty of Veterinary Medicine	1
● <i>Austria (Western Europe)</i>	
✓ University of Veterinary Medicine Vienna	1
● <i>Croatia (Southern Europe)</i>	
✓ University of Zagreb – Faculty of Veterinary Medicine	1
● <i>Denmark (Northern Europe)</i>	
✓ University of Copenhagen – Faculty of Health and Medical Sciences	1
● <i>Latvia (Northern Europe)</i>	
✓ Latvia University of Life Sciences and Technologies – Faculty of Veterinary Medicine	1
Asia	
● <i>Israel (Western Asia)</i>	
✓ Hebrew University of Jerusalem – Koret School of Veterinary Medicine	92
● <i>China (People's Republic of) (Eastern Asia)</i>	
✓ China Agricultural University – College of Veterinary Medicine	9
✓ Nanjing Agricultural University – College of Veterinary Medicine	6
✓ Northwest Agriculture and Forestry University – College of Veterinary Medicine	5
✓ Northeast Agricultural University – College of Veterinary Medicine	3
✓ Sichuan Agriculture University – Veterinary Medicine College	3
✓ South China Agricultural University – College of Veterinary Medicine	3
✓ Jilin University – College of Animal Science and Veterinary Medicine	2
✓ Shanxi Agricultural University – Faculty of Veterinary Medicine	2
✓ Agricultural University of Hebei – College of Veterinary Medicine	1
✓ Huazhong Agricultural University – College of Veterinary Medicine	1
✓ National Chung Hsinhg University – College of Veterinary Medicine	1
✓ Qinghai University – Academy of Animal Science and Veterinary Medicine	1
✓ Yangzhou University – School of Veterinary Science	1
● <i>Malaysia (South-eastern Asia)</i>	
✓ Putra University Malaysia – Faculty of Veterinary Medicine	21
✓ University Malaysia Kelantan – Malaysia Faculty of Veterinary Medicine	3
● <i>Indonesia (South-eastern Asia)</i>	
✓ Bogor Agricultural University – Faculty of Veterinary Medicine	15
✓ Airlangga University – Faculty of Veterinary Medicine	7
✓ Syiah Kuala University – Faculty of Veterinary Medicine	1
✓ Udayana University – Faculty of Veterinary Medicine	1
● <i>Viet Nam (South-eastern Asia)</i>	
✓ Ho Chi Minh City University of Agriculture and Forestry – Faculty of Veterinary Breeding	12
✓ Can Tho University	2
✓ Tay Nguyen University – Faculty of Animal Science and Veterinary Medicine	2
✓ Quang Ninh University of Industry	1
● <i>Philippines (South-eastern Asia)</i>	
✓ University of the Philippines Los Baños – College of Veterinary Medicine	9
✓ Central Luzon State University – College of Veterinary Science and Medicine	2
✓ De La Salle-Araneta University – College of Veterinary Medicine and Agricultural Sciences	2
✓ Aklan State University – School of Veterinary Medicine	1

(Continued)

Table A1. (Continued).

Geographic region	
✓ Southwestern University PHINMA – School of Veterinary Medicine	1
● <i>Sri Lanka (Southern Asia)</i>	
✓ University of Peradeniya – Faculty of Veterinary Medicine and Animal Science	7
● <i>India (Southern Asia)</i>	
✓ G. B. Pant University of Agriculture and Technology – College of Veterinary and Animal Sciences	2
✓ Tamil Nadu Veterinary and Animal Sciences University – Madras Veterinary College	2
✓ Assam Agricultural University – College of Veterinary Science	1
✓ College of Veterinary and Animal Science Navania, Vallabh Nagar, Udaipur	1
✓ College of Veterinary Science & Animal Husbandry Mathura, Uttar Pradesh	1
✓ Karnataka Veterinary, Animal and Fisheries Sciences University – Veterinary College, Bangalore	1
✓ Maharashtra Animal and Fishery Sciences University – Bombay Veterinary College	1
✓ Punjab Agricultural University	1
✓ West Bengal University of Animal and Fishery Sciences – Faculty of Veterinary Science	1
● <i>Iran (Islamic Republic of) (Southern Asia)</i>	
✓ Karaj Islamic Azad University – Faculty of Veterinary Science	1
✓ University of Teheran – Faculty of Veterinary Medicine	1
● <i>Thailand (South-eastern Asia)</i>	
✓ Chiang Mai University – Faculty of Veterinary Medicine	1
✓ Kasetsart University – Faculty of Veterinary Medicine	1
● <i>Mongolia (Eastern Asia)</i>	
✓ Mongolian State University of Agriculture	1
● <i>Myanmar (South-eastern Asia)</i>	
✓ University of Veterinary Science, Yezin, Pyin Ommatseikyi – Institute of Animal Husbandry and Veterinary Science	1
● <i>Nepal (Southern Asia)</i>	
✓ Tribhuvan University's Institute of Agriculture and Animal Science	1
● <i>Taiwan (Southern Asia)</i>	
✓ National Pingtung University of Science and Technology – College of Veterinary Medicine	1
● <i>Uzbekistan (Central Asia)</i>	
✓ Tashkent State Agrarian University	1
North America	
● <i>Canada (Northern America)</i>	
✓ University of Saskatchewan – Western College of Veterinary Medicine	9
✓ University of Guelph – Ontario Veterinary College	8
✓ Olds College	3
✓ Lakeland College – Animal Health Technology	2
✓ Northern Alberta Institute of Technology	2
✓ University of Prince Edward Island – Atlantic Veterinary College	2
✓ Centralia College of Agricultural Technology	1
✓ Thompson Rivers University – Animal Health Technology	1

(Continued)

Table A1. (Continued).

Geographic region	
• <i>United States of America (USA) (Northern America)</i>	
✓ University of California – Davis School of Veterinary Medicine	8
✓ Cornell University – College of Veterinary Medicine	5
✓ University of Florida – College of Veterinary Medicine	4
✓ University of Pennsylvania – School of Veterinary Medicine	4
✓ Michigan State University – College of Veterinary Medicine	3
✓ Texas A&M College of Veterinary Medicine & Biomedical Sciences	3
✓ Tuskegee University – School of Veterinary Medicine	3
✓ University of Illinois at Urbana-Champaign – College of Veterinary Medicine	3
✓ University of Minnesota – College of Veterinary Medicine	3
✓ Louisiana State University – School of Veterinary Medicine	2
✓ North Carolina State University – College of Veterinary Medicine	2
✓ Ohio State University – College of Veterinary Medicine	2
✓ Tufts University Cummings School of Veterinary Medicine	2
✓ University of Missouri – College of Veterinary Medicine	2
✓ Washington State University – College of Veterinary Medicine	2
✓ Auburn University – College of Veterinary Medicine	1
✓ Mississippi State University – College of Veterinary Medicine	1
✓ University of Tennessee – College of Veterinary Medicine	1
✓ University of Wisconsin-Madison – School of Veterinary Medicine	1
✓ Western University of Health Sciences – College of Veterinary Medicine	1
• <i>Saint Kitts and Nevis (Caribbean)</i>	
✓ Ross University – School of Veterinary Medicine	2
• <i>Cuba (Caribbean)</i>	
✓ University of Granma	1
• <i>Trinidad and Tobago (Republic of) (Caribbean)</i>	
✓ University of the West Indies, St. Augustine Campus – School of Veterinary Medicine	1
• <i>Mexico (Central America)</i>	
✓ Chapingo Autonomous University	1
South America	
• <i>Argentina (South America)</i>	
✓ University of Buenos Aires – Faculty of Veterinary Sciences	12
✓ University of El Salvador – Veterinary Medicine Course	1
• <i>Brazil (South America)</i>	
✓ University of São Paulo – Faculty of Veterinary Medicine	2
✓ Federal University of Goiás – Veterinary and Husbandry School	1
✓ Paulista Júlio State University of Mesquita Filho, Botucatu campus Faculty of Veterinary Medicine and Husbandry	1
✓ Rural Federal University of Rio de Janeiro – College of Agriculture and Veterinary Medicine	1
• <i>Chile (South America)</i>	
✓ University of Chile – Faculty of Veterinary Sciences and Livestock	2
• <i>Colombia (South America)</i>	
✓ Saint Martin University – Faculty of Veterinary Medicine	2
✓ University of Caldas – School of Veterinary Sciences	1

(Continued)

Table A1. (Continued).

Geographic region	
● <i>Ecuador (South America)</i>	
✓ Central University of Ecuador – Faculty of Veterinary Medicine and Husbandry	2
✓ Agricultural University of Ecuador – Faculty of Veterinary Medicine and Husbandry	1
● <i>Honduras (Central America)</i>	
✓ National Autonomous University of Honduras – School of Veterinary Medicine	1
● <i>Venezuela (Bolivarian Republic of) (South America)</i>	
✓ Central University of Venezuela – Faculty of Veterinary Science	1
Africa	
● <i>South Africa (Southern Africa)</i>	
✓ University of Pretoria – Faculty of Veterinary Science	28
● <i>United Republic of Tanzania (Eastern Africa)</i>	
✓ Sokoine University of Agriculture – Faculty of Veterinary Medicine	8
● <i>Nigeria (Western Africa)</i>	
✓ University of Ibadan – Faculty of Veterinary Medicine	3
● <i>Zambia (Eastern Africa)</i>	
✓ University of Zambia – Samora Machel School of Veterinary Medicine	3
● <i>Tunisia (Northern Africa)</i>	
✓ National School of Veterinary Medicine of Sidi Thabet	2
● <i>Morocco (Northern Africa)</i>	
✓ Agronomic and Veterinary Institute of Hassan II Polytechnic Center of Earth and Life Sciences	1
● <i>Senegal (Western Africa)</i>	
✓ Inter-State School of Veterinary Sciences and Medicine of Dakar	1
Oceania	
● <i>Australia (Australia and New Zealand)</i>	
✓ University of Sydney – Faculty of Veterinary Science	48
✓ University of Melbourne – Faculty of Veterinary Science	40
✓ University of Queensland – School of Veterinary Science	39
✓ Murdoch University – School of Veterinary and Biometrical Sciences	27
✓ Charles Sturt University – School of Animal and Veterinary Sciences	3
✓ University of Adelaide – School of Animal and Veterinary Sciences	3
✓ James Cook University – School of Veterinary and Biomedical Sciences	2
✓ Monash University – Faculty of Medicine, Nursing and Health Sciences	1
● <i>New Zealand (Australia and New Zealand)</i>	
✓ Massey University – Faculty of Veterinary Science	12
Total	1052

¹The United Nations geoscheme is a system, defined by the United Nations Statistics Division, that divides the countries in the world into groups and it is based on the M49 coding classification (<https://unstats.un.org/unsd/methodology/m49/>).

Table A2. Number of respondents to questions 12–16 of the questionnaire per geographic region, country and gender.

Geographic region • Country (<i>United Nations geoscheme</i>) ¹	Number of respondents (Males/Females)	
	Questions 12, 13, 14 and 16	Question 15
Europe	359 (90/269) (25.1%/74.9%)	356 (89/267) (25.0%/75.0%)
• <i>Russian Federation (Eastern Europe + Northern Asia)</i>	180 (46/134)	180 (46/134)
• <i>Netherlands (Western Europe)</i>	64 (8/56)	63 (7/56)
• <i>United Kingdom of Great Britain and Northern Ireland (UK) (Northern Europe)</i>	36 (7/29)	34 (7/27)
• <i>Spain (Southern Europe)</i>	27 (8/19)	27 (8/19)
• <i>Ukraine (Eastern Europe)</i>	18 (10/8)	18 (10/8)
• <i>Estonia (Northern Europe)</i>	7 (1/6)	7 (1/6)
• <i>Greece (Southern Europe)</i>	6 (2/4)	6 (2/4)
• <i>Belgium (Western Europe)</i>	3 (2/1)	3 (2/1)
• <i>Norway (Northern Europe)</i>	3 (1/2)	3 (1/2)
• <i>Slovenia (Southern Europe)</i>	3 (0/3)	3 (0/3)
• <i>Luxembourg (Western Europe)</i>	2 (0/2)	2 (0/2)
• <i>Slovakia (Eastern Europe)</i>	2 (1/1)	2 (1/1)
• <i>Albania (Southern Europe)</i>	1 (1/0)	1 (1/0)
• <i>Croatia (Southern Europe)</i>	1 (1/0)	1 (1/0)
• <i>Denmark (Northern Europe)</i>	1 (0/1)	1 (0/1)
• <i>Germany (Western Europe)</i>	1 (0/1)	1 (0/1)
• <i>Ireland (Northern Europe)</i>	1 (1/0)	1 (1/0)
• <i>Latvia (Northern Europe)</i>	1 (0/1)	1 (0/1)
• <i>Poland (Eastern Europe)</i>	1 (1/0)	1 (1/0)
• <i>Switzerland (Western Europe)</i>	1 (0/1)	1 (0/1)
Asia	311 (133/178) (42.8%/57.2%)	306 (132/174) (43.1%/56.9%)
• <i>Israel (Western Asia)</i>	136 (55/81)	133 (54/79)
• <i>China (People's Republic of) (Eastern Asia)</i>	52 (28/24)	51 (28/23)
• <i>Singapore (South-eastern Asia)</i>	33 (9/24)	33 (9/24)
• <i>Malaysia (South-eastern Asia)</i>	26 (12/14)	25 (12/13)
• <i>Indonesia (South-eastern Asia)</i>	17 (9/8)	17 (9/8)
• <i>Viet Nam (South-eastern Asia)</i>	15 (4/11)	15 (4/11)
• <i>Philippines (South-eastern Asia)</i>	10 (2/8)	10 (2/8)
• <i>Sri Lanka (Southern Asia)</i>	6 (1/5)	6 (1/5)
• <i>India (Southern Asia)</i>	3 (3/0)	3 (3/0)
• <i>Cyprus (Western Asia)</i>	2 (2/0)	2 (2/0)

(Continued)

Table A2. (Continued).

Geographic region	Number of respondents (Males/Females)	
• <i>Iran (Islamic Republic of) (Southern Asia)</i>	2 (2/0)	2 (2/0)
• <i>Azerbaijan (Western Asia)</i>	1 (1/0)	1 (1/0)
• <i>Bahrain (Western Asia)</i>	1 (1/0)	1 (1/0)
• <i>Cambodia (South-eastern Asia)</i>	1 (1/0)	1 (1/0)
• <i>Mongolia (Eastern Asia)</i>	1 (0/1)	1 (0/1)
• <i>Myanmar (South-eastern Asia)</i>	1 (0/1)	1 (0/1)
• <i>Nepal (Southern Asia)</i>	1 (1/0)	1 (1/0)
• <i>Taiwan (Southern Asia)</i>	1 (1/0)	1 (1/0)
• <i>Thailand (South-eastern Asia)</i>	1 (0/1)	1 (0/1)
• <i>Uzbekistan (Central Asia)</i>	1 (1/0)	1 (1/0)
North America	77 (22/55) (28.6%/71.4%)	77 (22/55) (28.6%/71.4%)
• <i>United States of America (USA) (Northern America)</i>	46 (13/33)	46 (13/33)
• <i>Canada (Northern America)</i>	25 (7/18)	25 (7/18)
• <i>Jamaica (Caribbean)</i>	3 (1/2)	3 (1/2)
• <i>Belize (Central America)</i>	1 (0/1)	1 (0/1)
• <i>Mexico (Central America)</i>	1 (0/1)	1 (0/1)
• <i>Saint Kitts and Nevis (Caribbean)</i>	1 (1/0)	1 (1/0)
South America	24 (13/11) (54.2%/45.8%)	24 (13/11) (54.2%/45.8%)
• <i>Argentina (South America)</i>	10 (4/6)	10 (4/6)
• <i>Colombia (South America)</i>	4 (3/1)	4 (3/1)
• <i>Ecuador (South America)</i>	4 (2/2)	4 (2/2)
• <i>Chili (South America)</i>	2 (1/1)	2 (1/1)
• <i>Venezuela (Bolivarian Republic of) (South America)</i>	2 (1/1)	2 (1F/1)
• <i>Brazil (South America)</i>	1 (1/0)	1 (1/0)
• <i>Nicaragua (Central America)</i>	1 (1/0)	1 (1/0)
Africa	46 (32/14) (69.6%/30.4%)	45 (31/14) (68.9%/31.1%)
• <i>South Africa (Southern Africa)</i>	23 (10/13)	22 (9/14)
• <i>United Republic of Tanzania (Eastern Africa)</i>	7 (7/0)	7 (7/0)
• <i>Mali (Western Africa)</i>	4 (3/1)	4 (3/1)
• <i>Nigeria (Western Africa)</i>	2 (2/0)	2 (2/0)
• <i>Sudan (Northern Africa)</i>	2 (2/0)	2 (2/0)
• <i>Tunisia (Northern Africa)</i>	2 (2/0)	2 (2/0)
• <i>Zambia (Eastern Africa)</i>	2 (2/0)	2 (2/0)

(Continued)

Table A2. (Continued).

Geographic region	Number of respondents (Males/Females)	
• <i>Mauritania (Western Africa)</i>	1 (1/0)	1 (1/0)
• <i>Morocco (Northern Africa)</i>	1 (1/0)	1 (1/0)
• <i>Namibia (Southern Africa)</i>	1 (1/0)	1 (1/0)
• <i>Niger (Western Africa)</i>	1 (1/0)	1 (1/0)
Oceania	147 (53/94)	147 (53/94)
	(36.1%/63.9%)	(36.1%/65.1%)
• <i>Australia (Australia and New Zealand)</i>	133 (47/86)	133 (47/86)
• <i>New Zealand (Australia and New Zealand)</i>	13 (5/8)	13 (5/8)
• <i>Fiji (Melanesia)</i>	1 (1/0)	1 (1/0)
Total	964 (343/621)	955 (340/615)
	(35.6%/64.4%)	(35.6%/64.4%)
Veterinary practitioners and associated professions		
• <i>Non-practitioners</i>	126 (42/84)	124 (41/83)
• <i>Veterinary practitioners</i>	838 (301/537)	831 (299/532)

¹The United Nations geoscheme is a system, defined by the United Nations Statistics Division, that divides the countries in the world into groups and it is based on the M49 coding classification (<https://unstats.un.org/unsd/methodology/m49/>).

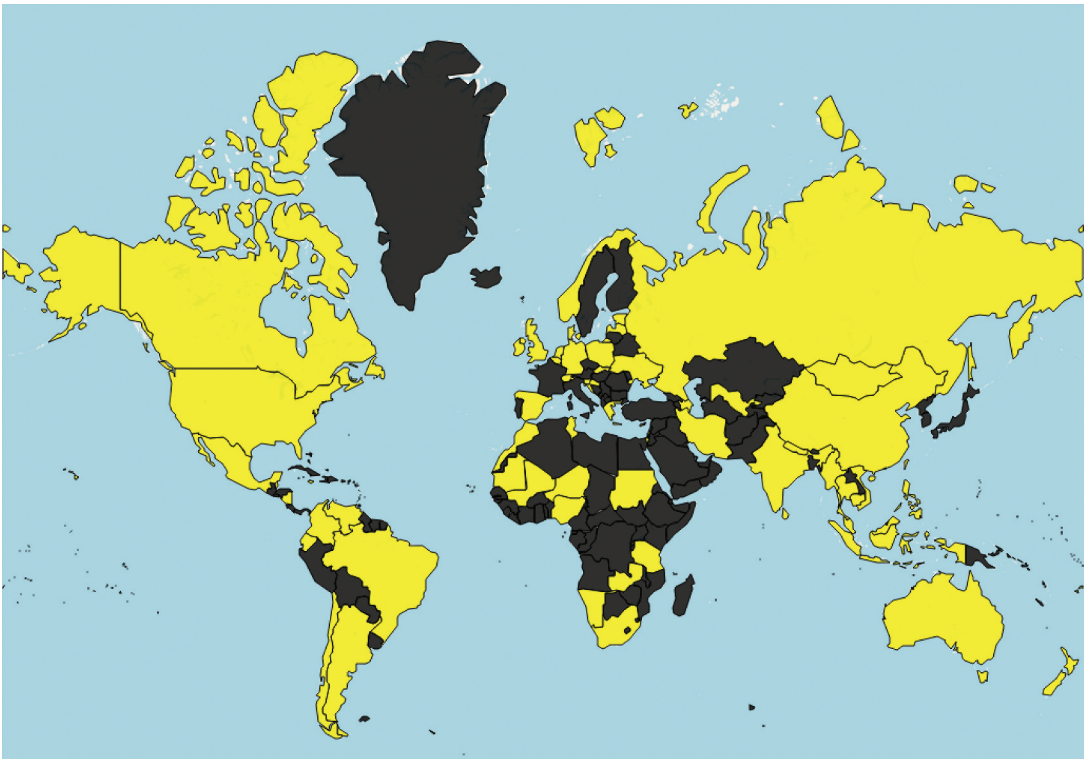


Figure A1. Worldwide map of the countries (colored yellow) where the respondents work. For countries colored black there were no respondents.