

Veterinary Students worldwide: Mental Health, Causes of Stress and Coping Mechanisms

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Introduction

Many veterinary students experience mental health related issues in the course of their studies. Studies in the United Kingdom and United States have found that stress and depression are more common in veterinary students than in the general population (Cardwell et al., 2013; Hafen et al., 2006, 2008; Karaffa & Hancock., 2019a; Nahar et al., 2019; Reisbig et al., 2012; Strand et al., 2005)

Stress can manifest itself in many different ways, both behavioral and physical. Behavioral and cognitive symptoms can include procrastination, concentration problems, memory problems substance abuse and withdrawal; emotional symptoms can include irritability, restlessness and a quick temper. Physical symptoms can vary and are usually based on activation of the sympathetic nervous system. These can include sleep disturbance, headaches, muscular stiffness, gastric disorders and hypertension (Gelberg & Gelberg, 2005; Williams et al., 2005).

The main causes of stress can be divided into academic and non-academic stressors. Academic stressors can include long working days, competitiveness with peers, balancing animal and human interests, dealing with the death of animals and dealing with clients. Non-academic stressors can include financial problems, relational issues, work life disbalance and a bad sleeping schedule (Collins & Foote, 2005; Hafen et al., 2008; Kogan et al., 2005; Strand et al., 2005; Weston et al., 2017; Williams et al., 2005).

Students faced with stress can develop various coping mechanisms (Figure 1) to deal with stress. Coping mechanisms are defined as 'an adaptation to environmental stress that is based on conscious or unconscious choice and that enhances control over behavior or gives psychological comfort'. Coping strategies can be divided in multiple ways. An important one is adaptive and maladaptive coping (Williams et al., 2005). Both reduce stress in the short term, but maladaptive coping mechanisms will increase stress in the long term, hence adaptive coping mechanisms are preferred. Maladaptive coping mechanisms can include substance abuse. Over half of US veterinary students were found to use over the counter medication and energy-boosting products (Hofmeister et al., 2010).

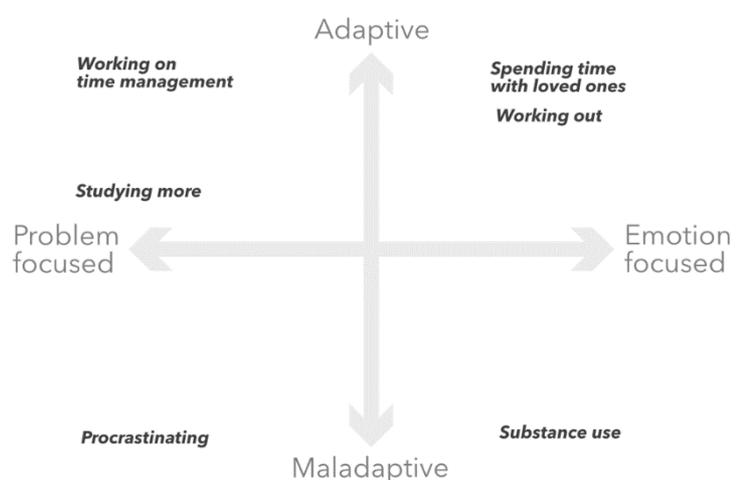


Figure 1: Coping Mechanisms

Another way of dividing coping mechanisms is through the way they achieve this coping. Problem focused coping focusses on changing the environment or the self to avoid stressors, while emotion focused coping focusses to regulate the emotions associated with the stressor, while still dealing with the stressor. This can for example be done using humor or comedy to alter someone's mood (Williams et al., 2005).

There is still a stigma on mental health issues in many parts of the world. Veterinary students and professionals can feel inadequate if they're faced with mental wellbeing issues themselves: as if it's their own fault that they are having these issues (A. W. Y. Tran & Lumley, 2019). This can lead to underreporting which can keep this cycle of underestimation of mental health issues going.

The presence of a pluralistic ignorance effect could give an insight into the possible underestimation of the prevalence of mental health issues. Veterinary students have been found to show this pluralistic ignorance effect when it comes to willingness to seek mental health services (Karaffa & Hancock, 2019b). This effect could heighten self-stigma when it comes to mental health issues and in turn make these issues worse.

Counseling services that many universities offer can be underused because of the aforementioned stigma on mental health problems. Besides counseling services not many tools to improve mental health are promoted by universities (Cardwell et al., 2013; Gelberg & Gelberg, 2005; Hafen et al., 2008; Kogan et al., 2005). Experiments that have employed mental health improvement programs seem to have positive effects on the mental health of participants (Liu & van Gelderen, 2020).

As mentioned before, multiple studies to these topics have been conducted in the United Kingdom, United States, New Zealand and Australia. The participants in these studies usually come from a single veterinary school. A worldwide assessment and comparison into the mental health of veterinary students has never been done before. Since the mental health of students, the causes of mental health problems and possible solutions to help lessen mental health issues can all differ between different countries and cultures, it is important to have research comparing students from around the world on these variables. This is also important since to the author's knowledge all studies conducted on veterinary student mental health so far have been done in western countries. By comparing the students in a worldwide study, direct comparisons can be made between students from different continents.

This study focuses on the mental health of veterinary students worldwide. The main research question is: What are the differences in the mental health of students on different continents?

Other research questions are:

- What is the mental health of veterinary students worldwide at the time of this study?
- What are the main causes of wellbeing issues in students and what are the differences between continents?
- What coping mechanisms are used by students to deal with mental health issues and what are the differences between continents?
- What is the perception of the prevalence of mental wellbeing issues of the peers of veterinary students, and what are the differences between continents?
- What is the availability and efficacy of mental wellbeing tools provided by universities and how do they relate to the prevalence of wellbeing issues?

Methods

Survey administration:

An online anonymous survey was conducted between February 1st 2020 and May 1st 2020 and disseminated worldwide through the network of the International Veterinary Students' Association (IVSA, www.ivsa.org). This is a veterinary student organization representing over 35000 veterinary students in 73 countries. It was disseminated through the Facebook group of members of the IVSA and also included in the mailing list to all member countries. It was shared with local students who were not all members of IVSA by the member organizations in France, Germany and South Africa.

Qualtrics software was used as the online platform and measures to ensure anonymity of the students surveyed were taken. The survey consisted of the following questions (for full list of questions see Appendix 1):

- Demographic questions
- Kessler 6 psychological distress scale. As the survey is voluntary for students worldwide, a tool was used that did not consist of many questions. The Kessler 6 is a validated tool for measuring psychological distress in multiple countries around the world in the World Mental Health (WMH) Survey (Kessler et al., 2010) that was also used in a survey by the World Small Animal Veterinary Association. The Kessler 6 consists of six questions about psychological distress, which are accompanied by three questions on disfunction because of psychological factors. The six questions on psychological distress are each graded on a 0-4 Likert scale. These scores are then added up to produce a score between 0 and 24. Final scores were divided into 4 categories, low (0-6), medium (7-12), high (13-18) and very high (19-24) based on the cutoff of >12 advised for detecting serious mental illness (SMI) with the highest sensitivity and specificity.
- From a list of nine different causes respondents picked a top three causes of psychological distress. The options were: bad sleeping schedule, balancing animal and human interests, competitiveness with peers, dealing with clients, dealing with the death of animals, financial problems, long working days, relational issues, and work life disbalance. These specific causes were chosen as they were common causes used in previous research into the mental health of veterinary students.
- Used coping mechanisms out of a list of eight coping mechanisms (multiple selections were possible): substances (alcohol, drugs), medicine (prescription or over the counter), energy drinks, procrastinating, working out, studying even more, spending time with family/friends or romantic relationships. These specific causes were chosen as they were common coping mechanisms used in previous research into the mental health of veterinary students.
- What percentage of their peers they think have mental health issues on a scale from 0-100% in 5% increments.
- Information on the mental health tools available in the respective universities and a rating of the availability and quality of the tools on a 1-5 Likert scale.

The survey was made available in English, Spanish, French, Mandarin and Russian. It was kept short (<5 minutes to complete the full survey) to ensure as many students as possible would complete the survey, since it was spread online and on a voluntary basis.

Data analysis

Analysis was performed using open-source R software (version 4.0.3).

Cronbach's Alpha was used to assess the internal validity of the used tool (Kessler 6 Psychological Distress Scale) for this study population.

Descriptive analysis was performed for Kessler 6 psychological distress scale, possible related factors, the perception of mental health of peers, the top three most frequently chosen perceived causes of psychological distress, and the used coping mechanisms.

Kruskall Wallis Tests were performed to test for significant differences between related variables. This test was chosen since the data is not following a normal distribution pattern. Pairwise Wilcoxon tests were performed to look at significant differences between pairs within variables while correcting for multiple testing (type 1 error). Kruskal Wallis Tests were also performed for the usage of individual coping mechanisms by using the options from the multiple select question as individual binary response variables.

Ordinal logistic regression was performed for relating factors which had a $p < 0.05$ in the Kruskal Wallis Test. Ordinal logistic regression was also performed for coping mechanisms which had a $p < 0.05$ in the Kruskal Wallis Test to assess what the influence of each variable on the K6 score could be.

Quantitative analysis of the top three causes of psychological distress was not possible due to the dependent nature of the way they were integrated in this survey, as making a top three means that the variables in this top three have an influence on all the other variables, making it impossible to look at the separate variables.

Results

The total response was 1804. After eliminating entries without complete Kessler 6 tests the used dataset had 1484 responses. 10 students responded as studying in North Korea, which was changed to South Korea since the survey tool used is not available in North Korea and confusion was probably caused by the way North and South Korea were listed in the survey, North Korea being the 'Democratic People's Republic of Korea' and South Korea being the 'Republic of Korea', the former being first alphabetically and thus the first option that shows when searching for 'Korea'.

Demographics

Students from 52 countries participated in the survey. A list of countries with total response can be found in Appendix 2. Cronbach's Alpha gave an internal validity for the Kessler-6 of 0.73, which is a good internal validity score (generally a value above 0.7 is considered acceptable for early research (Nunnally & Bernstein, 1994)).

Table 1: Gender demographics (response numbers and percentages) in the study population

	Male	Female	Would rather not say
Number	197	1286	11
Percentage	13,3%	86,0%	0,7%

Table 2: Continent demographics (response numbers and percentages) in the study population

Africa	Asia	Europe	North America	South America
223	94	1127	25	15
15,0%	6,3%	75,9%	1,7%	1,0%

Table 3: The amount of students in the study population that either study in their country of birth or do not

Studies in country of birth	Doesn't study in country of birth
1257	227
84,7%	15,3%

Table 4: The amount of students in each year of study in the study population

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6+
273	304	302	245	245	115
18,4%	20,5%	20,4%	16,5%	16,5%	7,7%

The median age of respondents was 22 years, with the mean being 22,8 years.

Psychological distress

Respondents' K6 scores compared to demographic and other relating factors can be found in Table 5 .

Table 5: Relating factors compared to the stress level of respondents. The letters in the significant difference column indicate that there is a significant difference between that row and the indicated row.

Characteristic	Kessler 6 score Low (0-6)		Moderate (7-13)		High (13-18)		Very high (13-24)		Total	Kruskall Wallis p-value	Significant Differences
	n	%	n	%	n	%	n	%			
Total	469	31,6%	606	40,8%	360	24,3%	49	3,3%	1484		p<0,05
Gender										0,028	
A Male	79	40,1%	70	35,5%	42	21,3%	6	3,0%	197		-
B Female	389	30,5%	530	41,5%	315	24,7%	42	3,3%	1276		-
C Prefer not to say	1	9,1%	6	54,5%	3	27,3%	1	9,1%	11		-
Continent										<0,001	
D Africa	69	30,9%	96	43,0%	48	21,5%	10	4,5%	223		E,H
E Asia	38	40,4%	42	44,7%	12	12,8%	2	2,1%	94		D,F,G,H
F Europe	356	31,6%	453	40,2%	284	25,2%	34	3,0%	1127		E,G
G North America	5	20,0%	10	40,0%	10	40,0%	0	0,0%	25		E,F
H South America	1	6,7%	5	33,3%	6	40,0%	3	20,0%	15		D,E,F
Studying in country of birth										0,688	
I Yes	403	32,1%	498	39,6%	311	24,7%	45	3,6%	1257		-
J No	66	29,1%	108	47,6%	49	21,6%	4	1,8%	227		-
Study year										0,015	
K 1	95	34,8%	125	45,8%	49	17,9%	4	1,5%	273		O,P
L 2	110	36,2%	114	37,5%	71	23,4%	9	3,0%	304		-
M 3	91	30,1%	123	40,7%	78	25,8%	10	3,3%	302		-
N 4	71	29,0%	105	42,9%	57	23,3%	12	4,9%	245		-
O 5	72	29,4%	94	38,4%	70	28,6%	9	3,7%	245		K
P 6+	30	26,1%	45	39,1%	35	30,4%	5	4,3%	115		K
University Services										<0,001	
Q Yes	306	33,9%	376	41,7%	192	21,3%	28	3,1%	902		-
R No	30	18,0%	58	34,7%	63	37,7%	16	9,6%	167		-
University Services Availability										<0,001	
S Very poorly available	27	12,9%	74	35,4%	90	43,1%	18	8,6%	209		T,U,V,W
T Poorly available	84	23,2%	160	44,2%	103	28,5%	15	4,1%	362		S,U,V,W
U Medium availability	184	35,4%	224	43,1%	103	19,8%	9	1,7%	520		S,T,W
V Well available	108	42,7%	95	37,5%	44	17,4%	6	2,4%	253		S,T,W
W Very well available	32	64,0%	14	28,0%	3	6,0%	1	2,0%	50		S,T,U,V
University Services Quality										<0,001	
X Very Poor Quality	16	10,7%	52	34,9%	66	44,3%	15	10,1%	149		Y,Z,AA,AB
Y Poor Quality	47	21,3%	93	42,1%	69	31,2%	12	5,4%	221		X,Z,AA,AB
Z Medium Quality	201	32,6%	261	42,3%	140	22,7%	15	2,4%	617		X,Y,AA,AB
AA Good Quality	115	40,9%	113	40,2%	47	16,7%	6	2,1%	281		X,Y,Z,AB
AB Excellent Quality	21	60,0%	10	28,6%	4	11,4%	0	0,0%	35		X,Y,Z,AA

The was no significant difference ($p>0,05$) between the genders using the pairwise Wilcox test after a Kruskal Wallis test, which did give a significant difference between all the groups ($p<0,05$). Asian student scored significantly lower than all other continents ($p<0,05$ compared to Europe and North America, $p>0,01$ compared to South America), while South American students scored significantly higher than all except for North America ($p<0,01$). European and African students scored similarly. First year students scored significantly lower than 5th and 6th year students ($p<0,01$), and there seems to be a light (but insignificant) upwards trend in scores the higher the year of study.

Ordinal logistic regression was performed with the factors that gave $p<0,05$ in the Kruskal Wallis test, which were: gender, continent, study year and if university services were available. The results can be seen in Table 6.

In this model, gender male was related to lower stress levels than gender female (B -0,56, $p=0,002$). Asia was related to lower stress levels compared to Africa (B -0,65, $p=0,022$), whereas South America was related to higher stress levels compared to Africa (B 1,53, $p=0,003$). Study year five was related to higher stress levels compared to year one (B 0,45, $p=0,027$) and Having University services available was related to lower stress levels compared to not having university services (B -1,06, $p=1,52e-10$).

Table 6: Ordinal Logistic Regression Model. The variables are compared to: 'Female' (Gender), 'Africa' (Continent), Study Year 1 (Study Year) and 'Not having university services'. The columns contain, in order from left to right: the beta coefficient, the standard deviation of the beta coefficient, the t-value, the p-value and the odds ratio. Intercepts are given below all variables.

Source	B	SE B	t	p	OR
Gender Male	-0,556	0,180	-3,086	0,002	0,574
Gender Prefer not to say	0,477	0,597	0,798	0,425	1,611
Continent Asia	-0,648	0,283	-2,287	0,022	0,523
Continent Europe	0,033	0,149	0,220	0,826	1,033
Continent North America	0,260	0,416	0,626	0,532	1,297
Continent South America	1,526	0,522	2,924	0,003	4,601
Study Year 2	0,011	0,191	0,056	0,955	1,011
Study Year 3	0,278	0,191	1,457	0,145	1,321
Study Year 4	0,199	0,195	1,020	0,308	1,220
Study Year 5	0,452	0,205	2,205	0,027	1,571
Study Year 6	0,345	0,249	1,386	0,166	1,412
University Services Yes	-1,061	0,166	-6,402	1,54E-10	0,346
<i>Intercept Low/Moderate Stress</i>	-1,58				
<i>Intercept Moderate/High Stress</i>	0,238				
<i>Intercept High/Very High Stress</i>	2,53				

Perceived mental health of peers

The perceived mental health of respondents' peers compared to relating factors used before are visualized in Figure 2. There was a low, but insignificant ($p > 0,1$) positive correlation (0.35) between the total Kessler score and the percentage of peers a student thinks has mental health issues using Spearman test for correlation. In Asia and Europe students thought a significantly lower number of their peers had mental health issues than other continents ($p < 0,001$), whereas in North and South America this was significantly higher than all other continents ($p < 0,05$ compared to Africa, $p < 0,001$ compared to Europe and Asia). There were no significant differences between Asia and Europe, and between North and South America. First year students thought a significantly lower amount of their peers had mental health issues than higher year students ($p < 0,05$ compared to 2nd year students, $p < 0,001$ compared to other years). Second year students also thought a significantly lower amount of their peers had mental health issues than 4th, 5th and 6th year students ($p < 0,05$ compared to 4th and 6th year students, $p < 0,01$ compared to 5th year students). Students that had mental health services available to them at their universities thought a significantly lower number of people had mental health problems than students without university mental health services ($p < 0,01$).

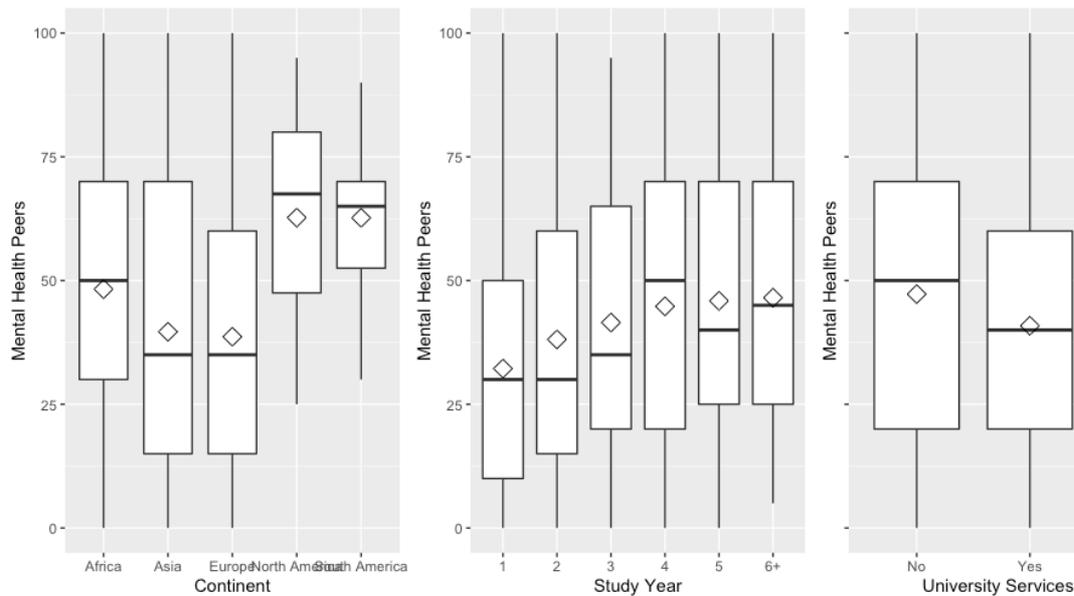


Figure 2: Percentage of peers students think have mental health issues compared to factors that had significant differences

Stress Causes

Responses to the top three stress causes can be found in Table 7. Work-life disbalance, long working days and a bad sleeping schedule are the top three most chosen. The weighted sum was acquired through giving each category a weight (1st x3, 2nd x2 and 3rd x1) and multiplying and adding the sum of responses in each category.

Table 7: The prevalence of each stress cause in the top 3 of the respondents, the sum of these and the weighted sum

	First	Second	Third	Sum	Weighted Sum
Bad sleeping schedule	201	299	331	831	766
Balancing animal and human interests	52	52	91	195	176
Competitiveness with peers	112	122	130	364	355
Dealing with clients	18	30	39	87	77
Dealing with the death of animals	20	25	29	74	70
Financial problems	101	150	168	419	386
Long working days	340	370	245	955	1003
Relational issues	149	119	176	444	431
Work life disbalance	484	293	233	1010	1136
NA's	7	24	42	73	

Academic stressors (balancing human and animal interests, competitiveness with peers, dealing with clients, dealing with the death of animals and long working days) made up 1679 or 38,2% of the weighted sum responses, whereas non-academic stressors (bad sleeping schedule, financial problems, relational issues and work-life disbalance) made up 2718 or 61,8 of the weighted sum responses.

The weighted sum was also compared to gender, continent, study year and the availability of university services. In all study years the top stress cause was work life disbalance, followed by long working days and bad sleeping schedule. This was also the case for respondents that did and did not have university services available, and males and females, and students from Africa and Europe. Students that did not specify their gender had work life disbalance as the top stress cause followed by a tie between financial problems and long working days. Students from Asia

gave a bad sleeping schedule as the top stress cause, followed by work life disbalance and long working days. Students from North America gave long working days as the top stress cause, followed by work life disbalance and a bad sleeping schedule. Students from South America gave long working days as the top stress cause, followed a bad sleeping schedule and a tie between relational issues and work life disbalance.

Students in lower years gave a bad sleeping schedule more often as a top 3 cause of stress, whereas 5th year students gave balancing human animal interests more often. Students in year 4-6 gave dealing with clients as a reason for stress more often. All of these and the following results are not significant, since quantitative analysis was not possible. This was due to the dependent nature of the variables to one another, which resulted from the way they were asked in a survey (as a top 3 of causes).

Men gave work life disbalance and long working days as a reason for stress less often than women and gave financial problems and relational issues as a problem slightly more than Women.

Students from Asia and South America (and in a lesser extent Africa) gave competitiveness with peers as a cause of stress more often than students from Europe and North America. Students from North America gave financial problems as a main cause of stress more often than other continents. Students from Asia and South America gave work life disbalance as a cause of stress less often than students from other continents.

Coping mechanisms

Table 8: The percentage of the respondents that use a certain coping mechanism

	Substances	Medicines	Energy Drinks	Procrastination	Studying even more	Working Out	Spending time with family/friends	Romantic Relationships
Yes	23,2%	18,8%	16,6%	60,0%	37,9%	58,5%	68,6%	34,0%
No	76,8%	81,2%	83,4%	40,0%	62,1%	41,5%	31,4%	66,0%

The percentage of respondents that used a certain coping mechanism are summarized in Table 8. 27,9% of the respondents used none of the maladaptive physical coping mechanisms (substances, medicines or energy drinks), 53,2% one, 16,0% two, and 2,9% of respondents used all three as a coping mechanism.

Kruskall Wallis tests comparing coping mechanisms to K6 categories gave significantly lower stress levels when ‘working out’ and ‘spending time with family and friends’ were used as coping mechanisms ($p < 0,01$). They also gave significantly higher stress levels when ‘substances (alcohol, drugs)’, ‘medicine (prescription or over the counter)’, ‘energy drinks’, ‘procrastinating’, and ‘studying even more’ were used as coping mechanisms ($p < 0,01$). There as no significant difference in the group that said they used romantic relationships as a coping mechanism and the group that said they did not ($p > 0,05$).

Ordinal logistic regression results are summarized in Table 9. Maladaptive coping mechanisms are associated with higher stress levels (substances, medicines, energy drinks, procrastinating), whereas one adaptive coping mechanism is associated with a higher stress level (studying even more) and two were related to lower stress levels (working out and spending time with family/friends). Romantic relationships was not included in the regression as it did not give a significant result in the Kruskal Wallis test.

Table 9: Regression model of the coping mechanisms with stress levels as the dependent variable. All variables are compared to NOT using the specified coping mechanism. The columns contain, in order from left to right: the beta coefficient, the standard deviation of the beta coefficient, the t-value, the p-value and the odds ratio.

Source	B	SE B	t	p
Substances (alcohol, drugs) TRUE	0,536	0,116	4,605	<0,001
Medicine (prescription or over the counter) TRUE	0,765	0,127	6,016	<0,001
Energy drinks TRUE	0,308	0,134	2,303	0,021
Procrastinating TRUE	0,279	0,101	2,758	0,006
Studying even more TRUE	0,482	0,101	4,768	<0,001
Working out TRUE	-0,293	0,100	-2,934	0,003
Spending time with family/friends TRUE	-0,571	0,106	-5,366	<0,001
Intercept Low/Moderate Stress	-0,737			
Intercept Moderate/High Stress	1,159			
Intercept High/Very High Stress	3,680			

University Services

902 (60,8%) of respondents replied they have some sort of mental health services available at their university. Most available were psychologists (655), counseling (603) and student mentors (552). Followed by mental health awareness campaigns (409) and teacher mentors (369).

The most popular services that students didn't have available yet at their university were psychologists (457) and mental health awareness campaigns (444), a bit less popular were counseling (306), teacher mentors (294), and student mentors (243).

African students are most content with the quality of their university mental health services, with 45,3% giving a good or excellent score. Less students from Asia (13,5%), Europe (20,7%), North America (29,2%) and South America (0%) give their university mental health services a good or excellent score.

A similar pattern is seen in the availability of students' university mental health students. 41,9% of African students rate this as either good or very good, whereas in Asia (15,5%), Europe (18,0%), North America (28,0%) and South America (6,7%) this percentage is again lower.

Discussion

General

The main aim of this study was to assess the mental health of veterinary students worldwide and if there are significant differences between different continents. Other aims were:

- Assessing veterinary students' mental wellbeing at that point in time.
- Assessing causes of mental wellbeing issues in students.
- Assessing coping mechanisms used by students to deal with mental wellbeing issues.
- Assessing the perception of mental wellbeing issues in veterinary students worldwide.
- Assessing the availability and efficacy of mental wellbeing tools provided by universities.

All of these points were also compared between different continents.

Studies in the general public that used Kessler 6 score have only been done in a couple of countries, so it's difficult to compare this to a worldwide student population. This study found 27,6% of respondents scored either high (score 13-18, 24,3%) or very high (score 19-24, 3,3%), which is related to SMI using the advised optimal cutoff point of >12. This is very high compared to the studies into the general population that have been performed. A Canadian study estimated a prevalence of SMI of 3,53% in the general population (Cairney et al., 2007). An Australian study estimated an SMI prevalence of 2,6% (Slade et al., 2011). A study in California found a SMI prevalence of 8,5% (Prochaska et al., 2012).

One study done in Australian veterinarians using the K10 scale (similar to the K6) found similar scores to the scores found in this study (Hatch et al., 2011), whereas another study conducted in the US using the K6 found scores that were lower than found in this study, at 6,8% of male and 10,9% of female respondents that could be classified as having SMI (Nett et al., 2015).

Other studies using different methodologies for measuring stress found that anxiety, stress and depression were on average high in veterinary students (Cardwell et al., 2013; Hafen et al., 2006, 2008; Karaffa & Hancock., 2019a; Knipe et al., 2018; Nahar et al., 2019; Reisbig et al., 2012; Siqueira Drake et al., 2012; Strand et al., 2005). This study is in line with other studies with a very high prevalence of SMI in veterinary students.

Demographic Factors

Men were found to have a lower (not significant, $p > 0,05$) K6 score than women. Three studies conducted in the United States also found higher (significant) stress and anxiety scores for female students than for male students (Karaffa & Hancock., 2019a; Nahar et al., 2019; Reisbig et al., 2012; Strand et al., 2005). One study in the United States found no significant gender differences (Hafen et al., 2008). One study in Australian veterinarians found higher K10 scores in female veterinarians as well (Hatch et al., 2011) Other studies in veterinary students found no significant gender differences or higher anxiety scores for women (Cardwell et al., 2013; Hafen et al., 2008). A large international study also found a higher prevalence of mental issues in women than in men with about a 2:1 ratio (Bromet et al., 2011). This is consistent with the odds ratio of 0,57 in the ordinal logistical regression model when comparing men to women in this study. Gender differences in the general population in the prevalence of depression are largest in adolescence, but haven't been studied in the age group that this study largely consists of (18-25) (Salk et al., 2017). A model to explain the gender differences in depression called the ABC (Affective, Biological, and Cognitive Vulnerability) model could also be partially applicable in this study population It is a model made for gender difference in age 13-15, but

could also explain for some of the gender differences at later ages. Social structure and gender inequality could be factors, but also biological and cognitive factors could play a role in the gender difference found in this study.

South American students scored significantly higher on the K6 than students from other continents, however this could be attributed to a very low response on this continent (15 in total). Asian students scored significantly lower than other countries with a higher response (94 in total), with an estimated SMI prevalence of 14,9%. This is still higher than SMI prevalence found in a Chinese undergraduate student population, which was 3,97% and in Japanese employees, which was 10,8% (Fushimi et al., 2012). Large international studies also found a lower prevalence of mental disorders in Asian countries (Bromet et al., 2011; Weissman et al., 1996). A study in the US population also found a lower prevalence of SMI in Asian-Americans using the K6 (Prochaska et al., 2012). One study in Indonesia advised a lower cutoff of >11 for detecting SMI, as they on average received lower K6 scores with similar mental problems when measured through alternative methods. This is also in line with the lower K6 scores found in this study (T. D. Tran et al., 2019). One explanation for the lower prevalence of SMI found in Asian students could be cultural differences, since people from different cultures can express different symptoms when they are experiencing mental health issues, and the stricter social rules in some cultures can also lead to underreporting of symptoms (Hofmann & Hinton, 2014). Another explanation could be that due to stigma on mental health issues, which is higher in Asia than in Western cultures (Lauber & Rössler, 2007) (although still present all over the world), Asian students experience more stress. Depressive symptoms in Asia show in more somatic symptoms as opposed to Western cultures, which could also be because of the beforementioned stigmatization of mental health issues and symptoms (Lauber & Rössler, 2007).

Stress scores were significantly lower in students in the first year of study than in students in 5th and 6th year, with a positive but not significant trend to higher stress scores in higher years also visible. A study in the United Kingdom found wellbeing to be significantly lower in the 4th year compared to the 2nd and 5th (Cardwell et al., 2013). One study in the United States found higher depression and anxiety scores in the 2nd and 3rd year compared to the 1st and 4th year (Siqueira Drake et al., 2012). Contrary to this, another study in the United States found that stress scores were significantly higher in first year students (Strand et al., 2005). More research is needed to find the cause of this disparity between different years of study. Since the curriculum and the pressure of the curriculum is different per university this should be done on a per-university basis. Universities should also assess this issue, as burn-out in the final years of study or the first years after graduation is an issue in the veterinary community (Hatch et al., 2011).

Significantly higher stress scores were found in students that had no university mental health services available. This could be an indication that the availability of university mental health services have a positive impact on student stress. Multiple studies have reported mental health benefits from introducing programs aimed at improving mental health at universities, although these studies all had their limitations, such as a lack of control groups and small sample sizes (Liu & van Gelderen, 2020). More research is needed in the future to see what the effect is of mental health interventions at universities and what intervention works best in which country, as cultural differences are likely to play a large role in the efficacy of programs.

Perceived mental health of peers

The average percentage of peers that respondents thought had mental health issues was 41,9%, which is higher than the percentage of respondents with a K6 score >12, which was 27,6%. However 48,1% of respondents had a K6 score 6-12, which could be indicative for moderate mental distress (Prochaska et al., 2012). The total percentage of respondents with a K6>5,

which can be indicative of moderate to severe distress is 75,7%. This is a much higher percentage than the average of 41,9% reported, which could be attributed to vagueness in the question, as the line between being healthy and having mental health issues was not clearly defined in the questionnaire. Another explanation for the lower percentage is the stigma on mental health issues that is still present worldwide when compared to for example physical health issues (Alonso et al., 2008) and could thus be demonstrative of a pluralistic ignorance effect.

There are significant differences between continents in the perception of mental health of their peers. Asian and European students thought a significantly lower percentage of their peers had mental health issues than other continents. The lower percentage that Asian students responded could be explained by the same cultural differences that explained the lower reporting of stress levels in Asian students, however this was compared to western cultures, so that does not explain why Asia and Europe are significantly lower.

Students in the first two years of study thought a significantly lower percentage of their peers had mental health issues than higher years, with an upwards trend visible the higher the year. This corresponds to the K6 score findings in this study, which were also lower in the first year and had an upward trend the higher the year. As mentioned before this could be explained by the curriculum getting harder throughout the years.

Causes of stress

Quantitative analysis of the causes of stress was not possible due to the nature of the questionnaire, which was chosen to keep the time to complete the survey to a minimum. Therefore, only trends can be analyzed, but nothing can be deemed either statistically significant or not.

At a first glance non-academic stressors seem to be more prevalent than academic stressors, with 61,8% being non-academic stressors. However, the top three most prevalent stressors, which together make up 63,8% of the total are: bad sleeping schedule, long working days and work life disbalance. These three are all three similar in that they are about the amount of time studying takes up, which is an academic stressor which can also express itself in non-academic stressors such as a bad sleeping schedule and work life disbalance. The other non-academic stressors make up only 18,6% of the total, so it could be argued that academic stressors are still the most prominent here, but that the cause of stress overall is multifactorial, which would be in line with other studies (Hafen et al., 2006, 2008; Reisbig et al., 2012; Siqueira Drake et al., 2012; Strand et al., 2005; Weston et al., 2017). A physiological reason for work life disbalance and a bad sleeping schedule causing stress symptoms is the overactivation of the sympathetic nervous system, which is responsible for our fight-or-flight response and can cause issues like headaches, muscular stiffness, and gastric disorders if over-activated.

Competitiveness with peers was lower in Europe and North America and highest in Asia. One explanation for this could be the competitive work environment that exists in Asian countries (Baumann et al., 2016). In addition to this one study found that Japanese and Chinese students studying in the United States enjoyed competition less than their American peers, which would be in line with Asian students perceiving this as a more important cause of stress for them (Houston et al., 2005).

Students from North America put financial issues in their top 3 causes of stress more often than students from other continents. A study in the United States also found financial problems as one of the main causes for stress (Hafen et al., 2008). Anecdotally tuition and other study costs

in the United States are also known to be being very high compared to other countries, so this could explain why American students have more stress about financial issues.

Long working days and work life disbalance were put as a top 3 cause of stress less by Asian students. This is in line with other results found with Asian students scoring lower on the K6 and thinking that a lower percentage of their peers have mental health issues. This could again be attributed to cultural differences and how mental issues present themselves in different cultures.

Future research focusing on the causes of stress could add more possible causes of stress and implement Likert scales for measuring each factor individually for quantitative analysis.

Coping mechanisms

For this study respondents could select any coping mechanisms they use to combat stress.

The four maladaptive coping mechanisms (substances, medicines, energy drinks and procrastinating) were all related to higher stress levels, whereas one of the adaptive coping mechanisms did (studying even more). It could be argued that studying even more is not an adaptive coping mechanism in this specific situation as it is a problem focused coping mechanism. In this case the problem cannot be altered through studying more, making it a maladaptive coping mechanism. Multiple studies also found that maladaptive coping was related to higher levels of anxiety or stress in students (Mahmoud et al., 2012; A. W. Y. Tran & Lumley, 2019).

Two other adaptive coping mechanisms (working out and spending time with family/friends) were correlated with lower stress levels. These are emotion focused coping mechanisms, which in this case seem to have a more positive effect on stress levels than the problem focused coping mechanism (studying more). Adaptive coping was significantly related to better psychological wellbeing in one study in students (A. W. Y. Tran & Lumley, 2019), where another didn't find any significant effect (Mahmoud et al., 2012).

These two findings suggest that being able to use adaptive coping mechanisms and avoid maladaptive coping mechanisms could have a positive effect on student mental health. One way to help students learning adaptive coping mechanisms is through university programs. One example could be giving students time to do sports, or to offer mental health awareness campaigns where students can learn the importance of using effective coping strategies and taking care of their mental health (Liu & van Gelderen, 2020). One study also found that positive appraisal predicts for adaptive coping and thus better mental health (Kohler Giancola et al., 2009). This is an intervention that, if not implemented yet, could relatively easily be implemented in teachers' instructions.

Future research focusing on coping mechanisms could include more possible coping mechanisms and implement Likert scales for measuring each factor individually for more precise analysis.

University Services

More than 50% of students responded that they had university mental health services available to them. These services were rated best in Africa, followed by North America. On average the availability and quality ratings were not very high, which means there is still room for improvement. Most respondents would like to see more mental health awareness campaigns and psychologists. The benefit of mental health awareness campaigns has been shown in some studies (Liu & van Gelderen, 2020), so this is something universities could implement to improve

the mental health of their students. One study in the United States also found that the majority of their study population that scored high in depression and anxiety were receiving mental health services and had positive associations with these services (Karaffa & Hancock., 2019a), which is in contrast to other studies that found a minority of students used these services or did not have them available (Cardwell et al., 2013; Gelberg & Gelberg, 2005; Hafen et al., 2008; Kogan et al., 2005; Knipe et al., 2018).

Limitations

The largest potential source for errors in this study is the non-response bias, which can occur when the response is low, and the subsample is not necessarily representative. Since this study uses a survey that was distributed through the International Veterinary Students' association students that completed the survey are likely to not be a representative random sample of the student population. It is also not possible to say if the demographic ratios in this study are representative for the worldwide student body, as this data is not available.

There are also large differences in the size of different groups in this study, with 86% being female and over 75% being European, which is a potential source for inaccuracies when comparing between groups.

As this study is a cross-sectional survey, it's not possible to say if any correlations found here are also causative effects.

The response on the questions about university services was lower than other questions, which could be because they were situated at the end of the survey.

This study compares groups by continent, which for an explorative study like this one is fine. However, when doing follow-up research comparing individual countries would be preferable as there are also large cultural differences between countries within continents.

Another limitation of comparing between continents is that the tools used might not be well tailored to students from a variety of countries and cultures. As discussed before using the Kessler 6 scale might cause an under reporting of students from certain areas, since they show mental distress differently from the western world, for which the scale was calibrated.

Comparing between different years in an international study can be difficult because of the variation in length and content of the curricula between different universities. For example, the curriculum in the United States comprises 4 years, whereas other schools are usually 5-6, and the year in which students start their clinical rotations also varies between faculties.

A last source of potential bias is the outbreak of the COVID-19 pandemic, which could have impacted stress levels of respondents. A large majority of responses was received before restrictive measures were put into place, so the change of this having a large impact on the results is low.

Conclusion

Mental health issues continue to negatively impact veterinary students worldwide.

This exploratory study shows that even groups that scored relatively low stress scores still scored very high compared to the general population. This study also found that 48,1% of respondents could be classified as having moderate mental distress, whereas 27,6% could be classified as having severe mental distress. It is therefore important for all veterinary faculties in the world

to acknowledge this issue and start or continue working towards implementing measures to improve mental health. In this process it is important to consider the cultural differences and that measures that could be effective in one part of the world might not necessarily work in another.

The main causes of stress seem to be academic, and more specifically to be the workload and long hours that the veterinary curriculum has. This impacts students not only academically, but also in their personal lives as they have less time for personal activities or even sleep.

This study also highlights the importance of teaching students to use adaptive coping mechanisms instead of maladaptive coping mechanisms. Even though the prevalence of adaptive coping mechanisms being used was still higher, a significant number of students used maladaptive coping mechanisms, which in the long term leads to more stress.

Further research into the causes of stress in veterinary students worldwide, and locally in diverse locations, is needed to properly assess what causes stress, and also to develop further ideas and plans to lessen these causes of stress and improve the mental health of veterinary students.

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Appendices

Appendix 1: Full survey questions:

PhraseID	EN
QID1_ QuestionText	Where do you study?
QID2_ QuestionText	Do you study in your country of birth?
QID2_ Choice1	Yes
QID2_ Choice2	No
QID5_ QuestionText	What year of your studies are you in?
QID4_ QuestionText	What is your age?
QID6_ QuestionText	What is your gender?
QID6_ Choice1	Male
QID6_ Choice2	Female
QID6_ Choice3	Prefer not to say
QID7_ QuestionText	During the past 30 days, about how often did you feel:
QID7_ Choice1	Nervous
QID7_ Choice2	Hopeless
QID7_ Choice3	Restless or fidgety
QID7_ Choice4	So depressed that nothing could cheer you up
QID7_ Choice5	That everything was an effort
QID7_ Choice6	Worthless
QID7_ Answer1	All of the time
QID7_ Answer2	Most of the time
QID7_ Answer3	Some of the time
QID7_ Answer4	A little of the time
QID7_ Answer5	None of the time
QID8_ QuestionText	The last six questions asked about feelings that might have occurred during the past 30 days. Taking them altogether, did these feelings occur More often in the past 30 days than is usual for you, about the same as usual, or less often than usual? (If you never have any of these feelings, circle response option "4.")
QID8_ Choice1	A lot more often than usual
QID8_ Choice2	Some more often than usual
QID8_ Choice3	A little more often than usual
QID8_ Choice4	About the same as usual
QID8_ Choice5	A little less often than usual
QID8_ Choice6	Some less often than usual
QID8_ Choice7	A lot less often than usual
QID22_ QuestionText	During the past 30 days, how many out of these 30 were you totally unable to work or carry out your normal activities because of these feelings?
QID23_ QuestionText	During the past 30 days, how many out of these 30 were you able to do only half or less of what you would normally have been able to do, because of these feelings?
QID24_ QuestionText	During the past 30 days, how many out of these 30 did you see a doctor or other health professional about these feelings?
QID10_ QuestionText	During the past 30 days, how often have physical health problems been the main cause of these feelings?
QID11_ QuestionText	Which of these would you say is the FIRST most important cause of stress for you?
QID11_ Choice1	Long working days

QID11_Choice2	Competitiveness with peers
QID11_Choice3	Balancing animal and human interests
QID11_Choice4	Dealing with the death of animals
QID11_Choice5	Dealing with clients
QID11_Choice6	Financial problems
QID11_Choice7	Relational issues
QID11_Choice8	Work life disbalance
QID11_Choice9	Bad sleeping schedule
QID12_QuestionText	Which of these would you say is the SECOND most important cause of stress for you?
QID13_QuestionText	Which of these would you say is the THIRD most important cause of stress for you?
QID15_QuestionText	Which of the following mechanisms have you used to try and lessen stress? (pick all that apply)
QID15_Choice1	Substances (alcohol, drugs)
QID15_Choice2	Medicine (prescription or over the counter)
QID15_Choice3	Energy drinks
QID15_Choice4	Procrastinating
QID15_Choice5	Working out
QID15_Choice6	Studying even more
QID15_Choice7	Spending time with family/friends
QID15_Choice8	Romantic relationships
QID15_Choice9	Other
QID16_QuestionText	What percentage of your peers do you think have mental health issues?
QID16_Choice1	Percentage
QID17_QuestionText	Does your university offer any mental health services?
QID18_QuestionText	What services do they offer? (pick all that apply)
QID18_Choice1	Counselling
QID18_Choice2	Psychologists
QID18_Choice3	Student mentors
QID18_Choice4	Teacher mentors
QID18_Choice5	Mental health awareness campaigns
QID18_Choice6	Other
QID20_QuestionText	What would you like to see that your university currently doesn't offer? (pick all that apply)
QID19_QuestionText	How would you rate the availability of mental health tools in your university?
QID19_Choice1	Very poorly available
QID19_Choice2	Poorly available
QID19_Choice3	Medium availability
QID19_Choice4	Well available
QID19_Choice5	Very well available
QID21_QuestionText	How would you rate the quality of the mental health tools in your university?
QID21_Choice1	Very poor quality
QID21_Choice2	Poor quality
QID21_Choice3	Medium quality
QID21_Choice4	Good quality
QID21_Choice5	Excellent quality

Appendix 2: Responses per country:

Algeria	1
Argentina	1

Austria	5
Bangladesh	2
Belgium	7
Bulgaria	1
Canada	2
China	5
Colombia	12
Croatia	2
Cyprus	3
Czechia	3
Denmark	3
Egypt	3
Estonia	35
Finland	2
France	317
Germany	501
Ghana	1
Greece	2
Grenada	2
Hungary	3
India	2
Indonesia	1
Ireland	20
Italy	6
Japan	9
Latvia	10
Lithuania	1
Malaysia	8
Mexico	10
Morocco	10
The Netherlands	2
Nigeria	2
Norway	1
Peru	2
The Philippines	8
Poland	22
Portugal	38
The Republic of Korea	54
Romania	12
Rwanda	1
Senegal	1
South Africa	200
Spain	64

Sweden	5
Switzerland	25
Taiwan	2
Tunisia	4
Turkey	2
The United Kingdom of Great Britain and Northern Ireland	38
The United States of America	11