

Original Research

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Factors Associated with Behavioral Health Outcomes in Veterinarians Involved in Disaster Responses

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Abstract

Objective: The objective of this study was to determine what factors are associated with behavioral health in veterinary disaster responders.

Methods: An online cross-sectional survey was distributed via snowball sampling. Results were analyzed using chi-square analyses.

Results: Responses from 237 veterinarians were analyzed. Being involved in more than 1 disaster event was associated with higher anxiety and/or depression (43.4% vs 28.6%, respectively), difficulty with relationships (28.1% vs 14.3%, respectively), and a greater prevalence of sleep problems (44.6% vs 28.0%, respectively) compared to only being involved in 1 event. Veterinarians that were deployed longer than 2 months had the highest prevalence of anxiety and/or depression (43.9%) and sleep problems (50.0%). Veterinarians that received behavioral health training before deployment had lower rates of anxiety and/or depression (27.8% vs 42.9%, respectively) compared to those who did not receive training. Respondents involved with depopulation had the highest rates of anxiety and/or depression (66.7%) and sleep problems (58.1%).

Conclusions: Factors associated with behavioral health outcomes included the number and length of deployments, receiving behavioral health training, and being involved in depopulation. To reduce the risk of behavioral health outcomes, interventions such as time-off and behavioral health support are needed.

Disasters of all types have profound impacts on human and animal health, the environment, economies and trade, and societies. In 2022, there were 387 natural hazards and disasters worldwide, resulting in the loss of 30 704 lives and affecting 185 million individuals. Economic losses totaled around US \$223.8 billion. These numbers do not include the extraordinary impacts of the COVID-19 pandemic or terrorism/armed conflict.¹

The economic losses from animals impacted by disaster events can be significant. The direct impact of disasters on animals was highlighted in the United Nations Office for Disaster Risk Reduction (UNDRR) Annual Report 2019 where an estimated 1.25 billion animals were killed during the Australian wildfires from October 2019 to March 2020.² The Food and Agriculture Organization of the United Nations (FAO) analyzed the post-disaster needs assessments undertaken in the aftermath of medium-to-large-scale disasters in Africa, Asia, and Latin America over the decade from 2003–2013. Livestock were the second most affected subsector after crops, accounting for US \$11 billion, or 36% of all damage and losses.³ Animals and animal-related issues are increasingly part of disaster management and risk reduction due to their economic, health and welfare, food security, and social aspects.

Veterinarians are involved in disaster preparedness and response due to the link between human and animal health and the economic and social impacts of animal loss or disease. The World Organisation for Animal Health (WOAH) has undertaken support for member states' National Veterinary Services through numerous pathways. WOAH has developed and published disaster guidelines for National Veterinary Services, developed veterinary emergency training, and conducted simulation exercises. WOAH accepted the technical item, World Organisation for Animal Health, Veterinary Services and Aquatic Animal Services Engagement in global, regional and national emergency management systems during the 89th General Session of World Assembly in May 2022 as a framework for future activities in this arena.⁴

Veterinarians have high rates of anxiety, depression, and suicide. In fact, a scoping review found that veterinarians have higher burnout, anxiety, and depressive disorders compared to the general population and other occupational groups.⁵ Compounding this underlying risk, the mental health of responders in disaster and emergency events is a significant issue. Medical

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responders in general are at risk of experiencing a wide range of negative psychological health conditions following a disaster.^{6,7} In the past, depression and post-traumatic stress disorder (PTSD) were the most studied outcomes in medical responders.⁷ Risk factors for adverse outcomes were found to be lack of social support and communication, maladaptive coping, and lack of training.⁷ However, studies focused on veterinary disaster responders are limited, and have focused on transboundary disease incursions such as foot and mouth disease⁸ or avian influenza.⁹ Recent research has also been focused on the mass depopulation of swine during the COVID-19 pandemic. In 1 of these studies, Baysinger and Kogan, 2022¹⁰ surveyed veterinarians involved in depopulation and reported nearly a third of participants had high levels of burnout. In addition, a qualitative study of swine veterinarians outlined the need for additional training and supportive services for veterinarians involved in future depopulation efforts.¹¹

Due to the lack of research in veterinary responders and the high rate of mental health disorders in this occupational group, the objective of this study was to determine if there are demographic, operational, or functional factors associated with reported behavioral health issues in veterinary disaster responders. By identifying risk factors for adverse behavioral health outcomes, interventions and policies can be better targeted towards those at highest risk. This study builds on results previously reported from the survey that ascertained the scale and scope of behavioral health issues in veterinary responders and found that 50% of veterinarians responding to the survey experienced behavioral health issues during the disaster event and 32% reported persistence of these issues 6 months after the disaster event.¹²

Methods

The Lincoln Memorial University Institutional Review Board (#875 V.0) reviewed and approved the study protocol. This anonymous 24-item online cross-sectional survey was developed to identify risk factors for behavioral health issues among veterinarians involved with disaster response. The survey instrument was evaluated for construct validity by multiple experts in the field, including veterinarians, disaster responders, and health practitioners, prior to use. The survey link was distributed via snowball sampling by email, starting with contact lists of the WOAHA headquarters and attendees from conferences related to disaster and emergency management. Two recruitment emails were sent to contact lists, 1 month apart. The survey was kept open 1 month after the second recruitment email was sent. Snowball sampling was implemented because this specific group (veterinary disaster responders) is hard to target and sample from and this method allowed participants to forward the survey invitation to other veterinary disaster responders.¹³ Data was collected and securely secured on the Qualtrics platform, where informed consent was obtained. The consent form stated that participation was voluntary, and participants could stop the survey at any time. More details about the survey methodology were presented in Vroegindewey and Kertis, 2021.¹²

Stata version 18.0 was used for all statistical analyses (StataCorp, College Station, TX). Observations from participants that completed less than 50% of the survey were dropped from the analysis. Small cell sizes in behavioral health outcome reporting were censored to protect against re-identification of study participants. Descriptive statistics were performed to assess factors (demographics, location and length of deployment, awareness of

current mental health policies, role while deployed, behavioral health training and support, and work history) associated with the following behavioral health outcomes *during* and *after* deployment:

1. Anxiety/restlessness/lack of concentration and/or depression (hereafter referred to as anxiety and/or depression),
2. Difficulty with personal and/or professional relationships (hereafter referred to as difficulty with relationships),
3. Trouble sleeping and/or dreaming/nightmares/flashbacks (hereafter referred to as sleep problems),
4. Mood swings, and
5. Suicidal thoughts

Statistical significance in quantitative analyses was tested using Chi-square tests or Fisher's exact tests (when expected counts were less than 5). Statistical significance was set at $P \leq 0.05$. Data on the helpfulness of behavioral health support *before* and *during* disaster events were summarized descriptively.

Results

A description of the study sample was reported in more detail in Vroegindewey and Kertis, 2021.¹² The final sample size for this analysis was 237 participants after dropping 28 observations due to these participants completing <50% of the survey (Table 1). When applicable, the results state when data were censored to protect re-identification of study participants.

Behavioral Health Outcomes During and/or After the Disaster Event

Participants that were involved in more than 1 disaster event were more likely to have anxiety and/or depression (43.4% versus 28.6%, respectively), difficulty with relationships (28.1% versus 14.3%, respectively), and sleep problems (44.6% versus 28.0%, respectively). In addition, those with longer deployments (3-4 weeks and longer) were more likely to report anxiety and/or depression and sleep problems (see Table 1 for details). Those who received behavioral health training before deployment were less likely to report anxiety and/or depression (27.8% versus 42.9%, respectively). Difficulty with relationships was reported more often among those who received support after the event (43.3% versus 21.2%, respectively). Lastly, those who were aware of behavioral health guidelines were less likely to report sleep problems (28.6% versus 48.0%, respectively). Awareness of behavioral health guidelines was not significantly different by disaster location (data not shown). There were no characteristics associated with mood swings or suicidal thoughts.

Supplementary Table 1 shows behavioral health outcomes stratified by during versus after the disaster response. Of note, those who did fieldwork were more likely to experience anxiety and/or depression (30.8% versus 16.0%, respectively), sleep problems (13.1% versus 5.0%, respectively), and mood swings (14.0% versus 5.0%, respectively) *after the event* compared to those who did not do fieldwork. There were no differences in behavioral health outcomes in those who did fieldwork versus those who did not *during the event*. Those who were aware of behavioral health guidelines were less likely to report anxiety/and or depression (10.1% versus 31.2%, respectively), difficulty with personal relationships (6.7% versus 18.8%, respectively), sleep problems (censored data), and mood swings (censored data) *after the event* compared to those who were unaware of guidelines.

Table 1. Questionnaire variables stratified by behavioral health outcomes that occurred during and/or after a disaster response in a sample of veterinarians ($n = 237$)¹

	Anxiety and/or depression ²		Difficulty with relationships ³		Sleep problems ⁴		Mood swings		Suicidal thoughts	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Demographics										
Gender										
Male ($n = 124$)	43	35.8	25	21	49	41	18	15.3	- ⁵	-
Female ($n = 113$)	48	43.2	31	27.9	44	39	17	15.3	-	-
Birth year										
Before 1960 ($n = 58$)	21	37.5	13	23.2	22	39	9	16.4	-	-
1960 to 1969 ($n = 75$)	23	31.1	17	22.7	25	34	9	12.2	-	-
1970 to 1979 ($n = 61$)	29	50	17	29.3	32	53	7	12.1	-	-
1980 and later ($n = 38$)	13	34.2	9	24.3	13	34	9	23.7	-	-
Years as a vet										
0–5 years ($n = 16$)	5	31.3	-	-	6	38	5	31.3	-	-
6–10 years ($n = 19$)	8	44.4	-	-	8	47	-	-	-	-
11–15 years ($n = 29$)	10	34.5	7	24.1	10	35	-	-	-	-
16–20 years ($n = 33$)	18	54.6	8	24.2	16	49	-	-	-	-
More than 20 years ($n = 139$)	50	37.3	35	25.9	53	39	17	12.8	-	-
Involved with more than 1 event										
Yes ($n = 172$)	73	43.4	47	28.1	75	44.6	26	15.8	6	4
No ($n = 65$)	18	28.6	9	14.3	18	28	9	14.1	-	-
Deployment characteristics										
Year										
Before 2000 ($n = 22$)	7	31.8	-	-	5	23	-	-	-	-
2000–2004 ($n = 32$)	15	50	6	20.7	15	48	-	-	-	-
2005–2009 ($n = 34$)	17	50	12	35.3	15	44	-	-	-	-
2010–2014 ($n = 37$)	9	25.7	9	25	11	31	5	14.3	-	-
2015 and later ($n = 108$)	42	39.6	27	25.5	47	44	18	16.8	-	-
Location										
Africa ($n = 26$)	7	26.9	5	20	12	48	-	-	-	-
Asia-Pacific ($n = 28$)	11	39.3	7	25.9	12	44	-	-	-	-
Canada/United States ($n = 94$)	32	34	27	29	42	45	17	18.5	-	-
Europe ($n = 73$)	20	27.8	11	15.9	22	31	9	13	-	-
Latin America ($n = 16$)	6	37.5	6	37.5	5	31	-	-	-	-
Type										
Animal disease outbreak ($n = 122$)	52	43.7	28	23.5	48	40	20	16.8	5	4
Other ($n = 114$)	39	35.1	28	25.4	45	41	15	13.8	-	-
Length of deployment										
<1 week ($n = 21$)	-	-	-	-	-	-	-	-	-	-
1–2 weeks ($n = 37$)	9	24.3	8	22.2	12	33	-	-	-	-
3–4 weeks ($n = 51$)	26	52	14	27.5	21	41	12	23.5	-	-
5–8 weeks ($n = 26$)	9	36	5	20	8	32	-	-	-	-
More than 2 months ($n = 101$)	43	43.9	28	29.2	49	50	17	17.5	-	-
Fieldwork										
Yes ($n = 113$)	49	45	31	28.4	47	42	20	18.5	5	5
No ($n = 122$)	42	45	25	21	46	39	14	11.8	-	-

(Continued)

Table 1. (Continued)

	Anxiety and/or depression ²		Difficulty with relationships ³		Sleep problems ⁴		Mood swings		Suicidal thoughts	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Behavioral health training and support										
Received training before										
Yes (<i>n</i> = 55)	15	27.8	15	28.3	18	33	6	11.1	-	-
No (<i>n</i> = 182)	76	42.9	41	23.2	75	42	29	16.6	7	4
Received support during										
Yes (<i>n</i> = 38)	12	31.6	10	27.8	13	35	5	13.5	-	-
No (<i>n</i> = 198)	79	40.9	46	23.7	80	41	30	15.6	6	3
Received support after										
Yes (<i>n</i> = 31)	13	41.9	13	43.3	16	53	7	23.3	-	-
No (<i>n</i> = 204)	78	39.2	42	21.2	76	38	27	13.7	6	3
Aware of behavioral health guidelines										
Yes (<i>n</i> = 93)	29	31.9	16	17.8	26	28.6	11	12.1	-	-
No (<i>n</i> = 143)	62	44.6	40	28.8	67	48	23	16.8	5	4

¹Missing data summary: Birth year (*n* = 5); Years as vet (*n* = 1); Disaster year (*n* = 4); Disaster type (*n* = 1); Length of deployment (*n* = 1); Fieldwork (*n* = 1); Received support during (*n* = 1); Received support after (*n* = 2); Aware of guidelines (*n* = 1); Anxiety and/or depression (*n* = 6); Difficulty with relationships (*n* = 7); Sleep problems (*n* = 5); Mood swings (*n* = 8); Suicidal thoughts (*n* = 10). Bolded values indicate statistical significance of an association between that variable (row) and behavioral health outcome (column) at $P \leq 0.05$. Comparisons of each variable with each behavioral health outcome were conducted using Chi-square analyses. Fisher's exact test was used when exact counts <5.

²Anxiety/restlessness/lack of concentration and/or depression.

³Difficulty with personal and/or professional relationships.

⁴Trouble sleeping and/or dreaming/nightmares/flashbacks.

⁵Indicates censored data due to small cell size.

Behavioral Health Outcomes During and/or After the Disaster Event by Type of Fieldwork

Among those who were involved with depopulation, anxiety and/or depression (66.7% versus 36.7%, respectively) and sleep problems (58.1% versus 36.0%, respectively) were higher compared to those who were not involved in depopulation (Table 2). Those who were involved with sheltering had lower rates of anxiety and/or depression (24.0% versus 51.2%, respectively), sleep problems (censored data), and mood swings (censored data) compared to those not involved with sheltering. Additionally, participants involved in treatment had lower rates of anxiety/depression (32.5% versus 52.2%, respectively) compared to those not involved in treatment.

Supplementary Table 2 shows behavioral health outcomes stratified by fieldwork type and time point (*during* and *after* the event). Anxiety and/or depression were higher among those involved with carcass management (50.0% versus 24.4%, respectively) and quarantine (50.0% versus 25.6%, respectively) *during the event* compared to those not involved in carcass management and quarantine, respectively. Conversely, participants involved in sheltering had lower rates of anxiety and/or depression *during the event* (censored data) compared to those not involved with sheltering. Those involved with depopulation were more likely to have anxiety and/or depression *after the event* (50.0% versus 23.4%, respectively) compared to those not involved in depopulation. In comparison, those involved with treatment had lower levels of anxiety and/or depression *after the event* (18.4% versus 37.7%, respectively).

Helpfulness of Behavioral Health Support During and After a Disaster Event

The most common support received during an event was recreation/leisure time (*n* = 70), followed by training (*n* = 61), and

getting more than 24 hours off (*n* = 60) (Table 3). The most helpful support received during an event was getting more than 24 hours off, with 51.7% reporting that this was extremely helpful and 36.7% reporting that this was somewhat helpful. Group counseling was also highly rated with 42.4% reporting that it was extremely helpful and 45.5% reporting that it was somewhat helpful. For help after the event, the most helpful support was not clear, although the average rating of individual counseling (1=Not helpful, 2=Somewhat helpful, 3=Extremely helpful) was slightly higher (mean[sd]; 2.14[0.8]) compared to group counseling (2.06[0.7]), online support (2.04[0.9]), and medication (1.95[0.9]).

Limitations

There are several limitations to the present study. The severity of behavioral health outcomes was not assessed, and clear definitions of each outcome in the survey were not described to the participants. Future studies should use validated survey instruments to evaluate behavioral and mental health in this population. In addition, the study may be subject to volunteer bias, meaning those who participated are different from the general population. For example, those who have experienced negative mental health outcomes may be more likely to respond. Lastly, the survey was cross-sectional in nature and survey responses may be subject to recall bias. Some of the disaster responses reported in the survey by participants occurred years earlier, so they may not have accurately recalled their behavioral health state during that time. Future studies could consider conducting longitudinal studies that span before, during, and after a disaster event to better ascertain causality and reduce the risk of recall bias. Still, this study addresses a gap in the literature as very few studies have assessed behavioral health risk factors in veterinarians. Future studies should consider a longitudinal study

Table 2. Behavioral health outcomes stratified by fieldwork type during and/or after a disaster response among veterinarians ($n = 113$)¹

	Anxiety and/or depression ¹		Difficulty with relationships ²		Sleep problems ³		Mood swings		Suicidal thoughts	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Assessment										
Yes ($n = 76$)	37	50	23	31.9	32	43	12	16.7	-. ⁵	-
No ($n = 37$)	12	34.3	8	21.6	15	42	8	22.2	-	-
Carcass management										
Yes ($n = 34$)	20	58.8	10	30.3	16	47	7	21.2	-	-
No ($n = 79$)	29	38.7	21	27.6	31	40	13	17.3	-	-
Depopulation										
Yes ($n = 32$)	20	66.7	10	34.5	18	58.1	8	27.6	-	-
No ($n = 81$)	29	36.7	21	26.3	29	36	12	15.2	-	-
Rescue										
Yes ($n = 21$)	9	42.9	6	28.6	8	38	-	-	-	-
No ($n = 92$)	40	45.5	25	28.4	39	43	18	20.5	-	-
Sheltering										
Yes ($n = 26$)	6	24.0	-	-	-	-	-	-	-	-
No ($n = 87$)	43	51.2	27	32.5	43	50	19	22.9	-	-
Treatment										
Yes ($n = 41$)	13	32.5	11	27.5	15	38	-	-	-	-
No ($n = 72$)	36	52.2	20	29	32	45	16	23.2	-	-
Quarantine										
Yes ($n = 30$)	16	57.1	8	28.6	12	41	7	25	-	-
No ($n = 83$)	33	40.7	23	28.4	35	43	13	16.3	-	-

¹Bolded values indicate statistical significance of an association between that variable (row) and behavioral health outcome (column) at $P \leq 0.05$. Comparisons of each variable with each behavioral health outcome were conducted using Chi-square analyses. Fisher's exact test was used when exact counts <5.

²Anxiety/restlessness/lack of concentration and/or depression.

³Difficulty with personal and/or professional relationships.

⁴Trouble sleeping and/or dreaming/nightmares/flashbacks.

⁵Indicates censored data due to small cell size.

Table 3. Helpfulness of behavioral health support during and after a disaster response in veterinarians

	Not helpful		Somewhat helpful		Extremely helpful	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
During the event						
Training ($n = 61$)	6	9.8	33	54.1	22	36
Recreation/leisure time ($n = 70$)	7	10	37	52.9	26	37
Change of duties ($n = 53$)	9	17	25	47.2	19	36
>24 hours off ($n = 60$)	7	11.7	22	36.7	31	52
Individual counseling ($n = 28$)	4	14.3	13	46.4	39	11
Group counseling ($n = 33$)	4	12.1	15	45.5	14	42
Medication ($n = 21$)	7	33.3	8	38.1	6	29
After the event						
Online support ($n = 23$)	9	39.1	4	17.4	10	43
Individual counseling ($n = 28$)	8	28.6	8	28.6	12	43
Group counseling ($n = 33$)	8	24.2	15	45.5	10	30
Medication ($n = 21$)	8	38.1	6	28.6	7	33

design that utilizes validated survey instruments to measure behavioral health.

Discussion

In this study, multiple risk factors for adverse behavioral health outcomes in veterinarians involved with disaster response were identified, including increased number of disaster events experienced, increased length of deployment, lack of pre-deployment training, being involved in depopulation, and lack of awareness of behavioral health guidelines. Additionally, the study identified types of behavioral health support the respondents viewed as most beneficial during the disaster event, including getting more than 24 hours off and group counseling.

Those deployed more than 1 time and deployed for a longer time (at least 3 weeks) were at higher risk of adverse behavioral health problems. In addition, respondents rated having more than 24 hours off as a very helpful form of support during a disaster event. Out of 198 free text responses to the question “What behavioral health support do you believe veterinarians need BEFORE, DURING, and/or AFTER participating in a disaster event?”, 29 mentioned time-off and breaks between deployments.¹² These findings are similar to studies among human medicine disaster respondents.¹⁴ In a simulated disaster-training exercise, sleep quantity and cognitive effectiveness were decreased after 3-5 days.¹⁵ Burgess, 2007¹⁶ created recommendations for 24-hour emergency coverage based on human physiology and the circadian rhythm, including avoiding scheduling key individuals on a 24-hour basis, shifting to 8-hour shifts instead of 12-hour shifts, and the inclusion of recuperative days. In addition, there is a need to increase the veterinary disaster workforce, starting with veterinary training in veterinary curricula and continuing education,¹⁷ so that deployment times and time off can be better managed.

Similar to findings in a systematic review in medical responders, lack of training prior to a disaster event was associated with adverse mental health events.⁷ In a study on hurricane response, the Florida Center for Public Health Preparedness (FCPHP) tested disaster mental health training and reported that the majority of respondents found that the training gave them more knowledge of mental health and provided them with useful mental health skills.¹⁸ In the current study, those who received behavioral health training before deployment were less likely to report anxiety and/or depression. Out of 198 free-text responses to the question “What behavioral health support do you believe veterinarians need BEFORE, DURING, and/or AFTER participating in a disaster event?”, 86 mentioned behavioral health training.¹² This supports the previous recommendation for WOA, with the United Nations Agency for Food and Agriculture (UNFAO), to develop guidelines and standards for behavioral health training.¹²

Depopulation was associated with adverse behavioral health outcomes, including anxiety, depression, and sleep problems. These findings are similar to findings in previous studies conducted among veterinarians, which found that veterinarians involved in de-population of swine during the COVID-19 pandemic had high levels of burnout and needed additional support.^{10,11} Of note, in the current study, those who were involved with depopulation tended to experience greater adverse behavioral health events after the event, indicating that continued support is necessary for these individuals. Conversely, those involved with sheltering and treatment had lower risk of behavioral health outcomes.

In agreement with qualitative findings from this survey previously reported,¹² participants thought counseling was an important aspect of behavioral health support. In the current study, participants tended to rate group and individual counseling higher than some other forms of support, including medication. Additionally, out of 198 free text responses for the question “What behavioral health support do you believe veterinarians need BEFORE, DURING, and/or AFTER participating in a disaster event?”, 68 mentioned counseling, 14 mentioned mentoring and peer support, 32 mentioned check-ins, and 36 mentioned de-briefing.¹² Winders et al. 2021¹⁹ performed a systematic review of interventions for first responders to treat mental health effects of a disaster response and found that psychological interventions likely positively impact mental health outcomes post-disaster. There is a need to develop and implement training programs for counseling psychologists to treat trauma related to disaster response.²⁰

Conclusions

Multiple risk factors for adverse behavioral health outcomes were identified, including responding to more than 1 event, longer deployments, being involved with depopulation, carcass management, or quarantine, and lack of behavioral health training prior to deployment. The majority of participants (51.7%) reported that adequate time-off was extremely helpful and 36.7% reported that it was somewhat helpful. Group counseling was rated as extremely helpful by 42.4% of respondents and somewhat helpful by 45.5% of respondents. These results can assist veterinary response leadership to evaluate their current standard operating procedures and response plans to incorporate behavioral health resilience training and support and adequate time-off across the entire spectrum of the disaster management cycle. Interventions to alleviate behavioral health outcomes should be developed to target those in high-risk roles, such as those involved in depopulation, carcass management, and quarantine. Future studies should consider longitudinal designs that use validated instruments to address limitations of the current design.

Supplementary material. The supplementary material for this article can be found at <http://doi.org/10.1017/dmp.2024.257>.

Author contribution. Gary Vroegindewey was involved in the conception and design of the study, acquisition of data, and drafting and revising the manuscript. Lauren Wisnieski was involved in designing and conducting the statistical analysis and revising the manuscript. J Lee Jenkins was involved as a subject matter expert and was involved in designing the statistical analysis and revising the manuscript.

Competing interest. The authors declare none.

References

1. **Centre for Research on the Epidemiology of Disasters (CRED)** Institute Health and Society (UCLouvain). 2022 *Disasters in numbers*. UCLouvain. Updated 2023. Accessed October 17, 2023. https://cred.be/sites/default/files/2022_EMDAT_report.pdf
2. **United Nations Office for Disaster Risk Reduction (UNDRR)**. Annual Report 2019. United Nations. Updated 2020. Accessed April 2, 2024. <https://www.undrr.org/media/47138/download>
3. **Food and Agriculture Organization of the United Nations (FAO)**. The Impact of Natural Hazards and Disasters on Agriculture and Food Security and Nutrition. Food and Agriculture Organization of the United Nations. Updated May, 2015. Accessed July 2, 2022. <https://www.fao.org/3/i4434e/i4434e.pdf>

4. **World Organisation for Animal Health (WOAH).** World Organisation for Animal Health, Veterinary Services and Aquatic Animal Health Services engagement in global, regional, and national Emergency Management Systems. World Assembly. Paris 23-26, May 2022.
5. **Pohl R, Botscharow J, Böckelmann I,** et al. Stress and strain among veterinarians: a scoping review. *Irish Vet J.* 2022;75:15. <https://doi.org/10.1186/s13620-022-00220-x>
6. **Brooks SK, Dunn R, Amlôt R,** et al. Social and occupational factors associated with psychological distress and disorder among disaster responders: a systematic review. *BMC Psych.* 2016;4:18. <http://doi.org/10.1186/s40359-016-0120-9>
7. **Naushad VA, Bierens JJ, Nishan KP,** et al. A systematic review of the impact of disaster on the mental health of medical responders. *Prehosp and Disaster Med.* 2019;34(6):632–643. <https://doi.org/10.1017/S1049023X19004874>
8. **Davies G.** The foot and mouth disease (FMD) epidemic in the United Kingdom 2001. *Comp Immunol Microbiol Infect Dis.* 2002;25(5–6):331–343. [https://doi.org/10.1016/s0147-9571\(02\)00030-9](https://doi.org/10.1016/s0147-9571(02)00030-9)
9. **Lee D-H, Torchetti MK, Killian ML,** et al. Highly Pathogenic Avian Influenza A (H7N9) Virus, Tennessee, USA, March 2017. *Emerg Infect Dis.* 2017; 23(11):1860–1863. <https://doi.org/10.3201/eid2311.171013>
10. **Baysinger A, Kogan LR.** Mental health impact of mass depopulation of swine on veterinarians during COVID-19 infrastructure breakdown. *Front in Vet Sci.* 2022;9:e842585. <https://doi.org/10.3389/fvets.2022.842585>
11. **Bussolari C, Packman W, Currin-McCulloch J,** et al. Mass depopulation of swine during COVID-19: an exploration of swine veterinarians' perspectives. *Vet Sci.* 2022;9,563. <https://doi.org/10.3390/vetsci9100563>
12. **Vroegindewey G, Kertis K.** Veterinary Behavioral health issues associated with disaster response. *Aust J Emer Man.* 2021:78–83. <https://doi.org/10.47389/36.3.78>
13. **Chambers M, Bliss K, Rambur B.** Recruiting research participants via traditional snowball vs Facebook advertisements and a website. *West J of Nurs Res.* 2020;42(10):846–851. <https://doi.org/10.1177/0193945920904445>
14. **Brooks SK, Dunn R, Sage CAM,** et al. Risk and resilience factors affecting the psychological wellbeing of individuals deployed in humanitarian relief roles after a disaster. *J Mental Heal.* 2015;24(6):385–436. <http://doi.org/10.3109/09638237.2015.1057334>
15. **James L, Smart D, Odom-Maryon T,** et al. Sleep deprivation in Air National Guard medical personnel responding to simulated disaster-training exercises. *Mil Psych.* 2019; 31(2):138–146. <https://doi.org/10.1080/08995605.2019.1565909>
16. **Burgess PA.** Optimal shift duration and sequence: Recommended Approach for short-term emergency response activations for public health and emergency management. *Amer J Pub H.* 2007;97(S1):S88–S92.
17. **Dunning D, Martin MP, Tickel JL,** et al. Preparedness and disaster response training for veterinary students: Literature review and description of the North Carolina State University Credentialed Veterinary Responder Program. *JVME.* 2009;36(3):317–330.
18. **Reid WM, Ruzycski S, Haney, ML,** et al. Disaster mental health training in Florida and the response to the 2004 hurricanes. *JPHMP.* 2005;11(6):S57–S62.
19. **Winders WT, Bustamante ND, Garbern SC,** et al. Establishing the effectiveness of interventions provided to first responders to prevent and/or treat mental health effects of response to a disaster: A systematic review. *DMPHP.* 2021;15(1):115–126. <https://doi.org/10.1017/dmp.2019.140>
20. **Bowman SL, Roysircar G.** Training and practice in trauma, catastrophes, and disaster counseling. *Couns Psych.* 2011;39(8):1160-1181. <https://doi.org/10.1177/0011000010397934>