

ORIGINAL RESEARCH

Top-down animal welfare crisis communication during the COVID-19 pandemic: Animal care worker information sources, self-perceived knowledge and welfare concerns

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Abstract

Background: Experts communicating reliable and timely information are critical during public health crises. While assessments of human health crisis communication and preparedness have received attention, population animal welfare assessments are limited. This study assessed animal care worker (ACW) survey responses to identify factors potentially valuable for preparedness and intervention design for future crises that affect companion animals.

Methods: Our team took a subset of data from a US survey (conducted between July and October 2020) to investigate small animal veterinary (SAV; $N = 1209$) and animal shelter, rescue and control (SRC; $N = 132$) COVID-19 pandemic concerns pertinent to animal welfare, self-perceived knowledge of pandemic impacts, and update frequency and information sources.

Results: Compared with SAV workers, SRC workers more often reported frequent communication ($p < 0.001$), self-perceived expert knowledge ($p = 0.012$) and having welfare concerns ($p = 0.012$). The same was true for clinical SRC workers, more so than non-clinical SRC. Frequent updates correlated with greater self-perceived knowledge ($p < 0.001$). Information sources were primarily animal welfare focused for SRC workers and veterinary health focused for SAV.

Limitations: Community socioeconomic status and update contents are unknown. Furthermore, sample diversity was low, which may limit the generalisability of the findings.

Conclusion: There is a potential need for increased, more harmonised crisis communication from leading public and animal health entities to better support SAV and clinical SRC workers.

KEYWORDS

animal care workers, animal shelter workers, animal welfare, COVID-19 pandemic, public health, small animal veterinary workers

INTRODUCTION

The COVID-19 pandemic exerted numerous, multi-faceted stressors on societal welfare, including mass infections and deaths, and detrimental repercussions on the US and global economy.^{1–5} During crises like these, a concerted and strategic effort to provide reliable and timely communication is crucial to alleviate the spread of disease.^{6,7} For example, to address public health crises, key public health entities, such as the

Centers for Disease Control (CDC), employ the Public Health Emergency Preparedness System, a methodical framework to prepare for and alleviate public health crises.⁸

While analyses of COVID-19 public health crisis communication relevant to human welfare are abundant,^{9–11} similar analyses relevant to animal population welfare remain sparse.¹² In addition to the ethical need to assess factors pertinent to safeguarding animal health and wellbeing, evaluating crisis

communication specifically pertaining to animal welfare may also hold value within the context of disease transmission.

Compromised pet welfare could indirectly hinder disease transmission control efforts.¹³ For example, if a pet owner loses their job, the resulting emotional strain and financial hardship may reduce their ability to access veterinary care for their pet. Or, if a pet owner loses their home, the resulting housing instability could heighten stress for both the owner and pet, and experiencing chronic stress can weaken both pet and owner immune responses to disease-causing pathogens.^{14–16} During the pandemic, animal care worker (ACW) groups, including shelter, rescue and control (SRC) workers and small animal veterinary (SAV) workers, were among targeted personnel to receive top-down emergency messaging, that is, communication delivered from leading public health and animal welfare organisations or experts to local community public and animal healthcare workers. SRC and SAV workers indirectly work together to improve and protect companion animal welfare.^{17–19}

This study aimed to inform the enhancement of top-down One Health crisis communication and preparedness planning for future zoonotic crises that impact pets, their owners and their community's ACWs. The objectives of this study were to investigate factors that likely influence the effectiveness of a top-down animal welfare crisis communication dynamic and gather insights from ACWs on potential key topics that should potentially be prioritised within future disseminated information during relevant crises. For this study, we assessed the frequency of updates received from 'top' expert stakeholders, the identity of these information sources, and ACW self-perceived knowledge and concerns pertaining to the impacts of the COVID-19 pandemic on animal welfare.

The identified ACW concerns may aid in the refinement of current zoonotic emergency preparedness guidelines and training, especially for crises that affect companion animal welfare. Meanwhile, the frequency of updates and identified information sources could aid in forming collaborative relationships between identified human public health agencies and leaders in animal physical health and wellbeing or welfare. Assessing ACW self-perceived knowledge may be a simple, yet effective, measure of understanding if relevant and needed information pertaining to animal welfare during the pandemic was relayed.

METHODS

This study was a secondary data analysis nested within the survey study 'Assessing COVID-19 pandemic risk perception and response preparedness in veterinary and animal care workers' (CoVET).²⁰

Participant eligibility and methods of selection

Participants eligible to participate in the parent study needed to be ACWs who were over 18 years old and

lived within the US or US territories, such as Guam or Puerto Rico.²⁰ Participants recruited worked across different animal care industries, including small animal, equine, food, zoo, wildlife, exotic and laboratory veterinary medicine and animal shelter and control services, or were involved in government, advocacy efforts or academia.²⁰ Individuals held a variety of positions, including veterinarians, veterinary technicians, hospital support staff, animal control officers, laboratory and zoological facility workers, and academic professors.

Participants included in our secondary analysis were 18 years or older and employed as SRC or SAV animal care personnel.

Data collection and cleaning

Participants from the parent study completed an online, anonymous survey through the Hopkins RED-Cap platform^{21,22} between 6 July and 25 October 2020. Five questions from the study survey pertaining to COVID-19 impacts on animal welfare were assessed in this secondary analysis.²⁰ In these questions, ACW participants were asked:

- To rank their knowledge of animal health and welfare impacts due to the pandemic using a Likert scale, ranging from 1 (not knowledgeable) to 5 (having expert knowledge);
- How often they received updates or support from professional organisations, government agencies (local, state or federal) or any source regarding animal health and welfare during the COVID-19 pandemic, ranging from 1 (not often) to 5 (extremely often). They were also asked to name the sources that had contacted them;
- If they had concerns about animal health and welfare impacts during and after the pandemic (yes/no), and to describe their concerns within an open-ended question.

Based on the parent study's purpose, animal welfare questions were located within different sections of the survey.

Quantitative data analysis

Scale responses and concern were analysed in a binary manner, and potential differences between SRC and SAV groups were assessed. For Likert scale questions, aggregated ACW responses were dichotomised at the median (given the likelihood of a non-normal distribution). For example, when pooling all ACW responses, it was determined that frequency of updates had a median of 3; this outcome was then coded as above median (1), that is, reporting updates to be very to extremely often, compared to the median and below (0), that is, moderately to less often. For pooled ACW self-perceived knowledge, a median of 4 was identified.

Covariates consisted of the month of survey completion and participant demographics, such as age and

race. Job region had no significant unadjusted results (Table S4); however, update frequency and concern had probability values of less than 20%; consequently, job region was still included in the final adjusted analyses. To compare responses between ACW groups, unadjusted and adjusted logistic regression models of outcomes and covariates were performed, with SAV workers as the reference group.

Follow-up analyses were also conducted to aid in the interpretation of the results, including an assessment of self-perceived knowledge dichotomised at a median of 3, that is, the scale mid-point (moderate knowledge) (Table S3). Furthermore, the SAV worker group was predominantly composed of clinical workers, so, to account for any potential bias due to work experience, exploratory analyses were conducted to compare results between clinical and non-clinical SRC and SAV workers. Participants who identified as a veterinarian, veterinary technician or assistant were designated to the clinical group for analyses, whereas participants who were, for example, office managers, support staff, animal care technicians, adoption or administrative staff, were coded as non-clinical workers.

Lastly, sensitivity analyses were conducted using Cohen's kappa and chi-squared analyses to assess potential associations between study outcomes or among covariate variables. All analyses were conducted using the statistical analysis program STATA 17.0 (STATA Corp.).

Open-ended response analysis

Open-ended text questions for names of update sources and pandemic-related animal welfare concerns were compared between SAV and SRC workers. For both questions, participants could list multiple update sources or concerns within a single response. Drawing on close to a decade of past experience working and volunteering in veterinary and animal shelter organisations, the first author thematically labelled the reported concerns based on the main topics identified. For example, 'We rely on donations, and animals will unfortunately be the ones that suffer if we have to cut back' (SRC Worker, ID 480) was coded as 'Funding issues.'

Percentages of reported update sources and concerns were calculated by dividing the numerical frequency of a reported source or concern by the total number of update sources or concerns reported. Reported percentages for update sources and concerns are not mutually exclusive, that is, a respondent could report multiple update sources or concerns within a single response. The percentage and frequency of responses were calculated using QDA Miner Lite (version 2.0.9, Provalis Research). All text responses of participants who provided update sources and detailed concerns are included in the [Supporting Information](#).

RESULTS

Participant demographics

Of the parent study's 2415 survey participants,²⁰ 1341 (55%) were eligible for inclusion in this secondary analysis (Table S1). Of this sample, 1209 (90%) were SAV workers, and 132 (10%) were SRC workers. Details on participant demographics are supplied in Table S1, and participant job titles can be found in Table S2.

Frequency of crisis communication

Compared with SAV workers, SRC workers had greater odds of reporting receiving animal welfare updates very to extremely often (Table 1), and when adjusting for month of survey completion, sex, age and race, the significance of this difference persisted. The month of survey completion had a linear effect on the self-perceived frequency of updates received, with the odds of a participant receiving updates very to extremely often decreasing as time elapsed. The odds of participants receiving updates very to extremely often were therefore significantly lower in October than in July.

Compared with females, males had greater odds of reporting receiving updates very to extremely often (Table 1). Meanwhile, age had a linear effect, with the likelihood of reporting receiving updates very to extremely frequently increased with age. Lastly, participants who were 40–49, 50–59 and over 60 years old had higher odds of reporting receiving updates very to extremely often compared to 30- to 39-year-olds (the largest age demographic and thus the reference group).

Reported sources of crisis communication

Out of 132 SRC workers, 75% reported at least one update source (Table 2). Top communication sources reported from this group included, in order of frequency of reporting, government resources, the Association for Animal Welfare Advancement (including their COVID-19 digest), the American Society for the Prevention of Cruelty to Animals, the National Animal Care and Control Association and the US CDC (Table 2).

Out of 1209 SAV workers, 64% reported at least one update source (Table 2). Top communication sources reported from this group, in order of frequency of reporting, include the American Veterinary Medical Association (AVMA), local state or federal government, local or state veterinary associations or veterinary boards, news sources such as press releases or conferences and the US CDC. See Table 2 for the remaining top 10 identified resources and Table S5A,B for the remaining identified resources from both ACW groups.

TABLE 1 Odds ratios (ORs) of animal care workers receiving animal welfare updates very to extremely often, reporting having expert knowledge, and having animal welfare concerns during the COVID-19 pandemic

	Concern (yes)		Knowledge		Updates	
	<i>N</i> (%)	OR (95% CI); <i>p</i> -value	<i>N</i> (%)	OR (95% CI); <i>p</i> -value	<i>N</i> (%)	OR (95% CI); <i>p</i> -value
Primary unadjusted model						
SAV Workers (<i>N</i> = 1209)	841 (70.08) ^a	Ref	175 (14.50) ^a	Ref	328 (27.40) ^a	Ref
SRC Workers (<i>N</i> = 132)	106 (80.30) ^a	1.74 (1.11–2.72); <i>p</i> = 0.015	30 (22.90) ^a	1.75 (1.13–2.71); <i>p</i> = 0.012	81 (61.36) ^a	4.21 (2.90–6.11); <i>p</i> < 0.001
Primary adjusted model						
SAV Workers		Ref		Ref		Ref
SRC Workers		2.07 (1.28–3.34); <i>p</i> = 0.003		1.72 (1.06–2.78); <i>p</i> = 0.025		3.05 (2.67–6.12); <i>p</i> < 0.001
Covariate unadjusted models						
Age						
Age		0.88 (0.80–0.97); <i>p</i> = 0.011		1.03 (0.92–1.16); <i>p</i> = 0.55		1.31 (1.19 – 1.43); <i>p</i> < 0.001
18–29 (<i>N</i> = 246)	176 (71.84) ^a	0.88 (0.62–1.24); <i>p</i> = 0.47	31 (12.60) ^a	0.83 (0.53–1.30); <i>p</i> = 0.41	45 (18.37) ^a	0.63 (0.43–0.92); <i>p</i> = 0.017
30–39 (<i>N</i> = 473)	351 (74.36) ^a	Ref	70 (14.83) ^a	Ref	124 (26.33) ^a	Ref
40–49 (<i>N</i> = 350)	241 (69.45) ^a	0.78 (0.58–1.07); <i>p</i> = 0.12	62 (17.77) ^a	1.24 (0.85–1.80); <i>p</i> = 0.26	122 (35.16) ^a	1.52 (1.12–2.05); <i>p</i> = 0.007
50–59 (<i>N</i> = 185)	127 (69.02) ^a	0.77 (0.53–1.12); <i>p</i> = 0.16	28 (15.14) ^a	1.02 (0.64–1.65); <i>p</i> = 0.92	78 (42.62) ^b	2.08 (1.45–2.97); <i>p</i> < 0.001
60+ (<i>N</i> = 83)	50 (61.73) ^b	0.56 (0.34–0.91); <i>p</i> = 0.020	13 (15.66) ^a	1.07 (0.56–2.03); <i>p</i> = 0.84	39 (48.75) ^b	2.66 (1.64–4.32); <i>p</i> < 0.001
Sex						
Female (<i>N</i> = 1222)	875 (71.90) ^a	Ref	176 (14.43) ^a	Ref	362 (29.79) ^a	Ref
Male (<i>N</i> = 98)	57 (60.00) ^b	0.59 (0.38–0.90); <i>p</i> = 0.015	24 (24.49) ^a	1.92 (1.18–3.13); <i>p</i> = 0.009	41 (43.62) ^b	1.82 (1.19–2.79); <i>p</i> = 0.006
PNTS (<i>N</i> = 18)	13 (72.22) ^a	1.02 (0.36–2.87); <i>p</i> = 0.98	3 (16.67) ^a	1.19 (0.34–4.14); <i>p</i> = 0.79	5 (27.78) ^a	0.91 (0.32–2.56); <i>p</i> = 0.85
Race						
White (<i>N</i> = 1215)	857 (70.94) ^a	Ref	176 (14.51) ^a	Ref	375 (31.12) ^a	Ref
Non-white/other (<i>N</i> = 79)	58 (74.36) ^b	1.19 (0.70–2.00); <i>p</i> = 0.52	17 (21.52) ^a	1.62 (0.92–2.83); <i>p</i> = 0.10	18 (22.78) ^a	0.65 (0.38–1.12); <i>p</i> = 0.12
PNTS (<i>N</i> = 42)	29 (69.05) ^a	0.91 (0.47–1.78); <i>p</i> = 0.79	11 (26.19) ^a	2.09 (1.03–4.24); <i>p</i> = 0.04	15 (36.59) ^b	1.28 (0.67–2.44); <i>p</i> = 0.46
Time						
Month		0.91 (0.80–1.03); <i>p</i> = 0.17		1.19 (1.02–1.39); <i>p</i> = 0.024		0.72 (0.63–0.82); <i>p</i> < 0.001
July (<i>N</i> = 336)	238 (71.26) ^a	Ref	47 (14.03) ^a	Ref	128 (38.32) ^a	Ref
August (<i>N</i> = 499)	374 (75.40) ^a	1.24 (0.90–1.69); <i>p</i> = 0.18	66 (13.23) ^a	0.93 (0.62–1.40); <i>p</i> = 0.73	162 (32.66) ^a	0.78 (0.58–1.04); <i>p</i> = 0.09
September (<i>N</i> = 353)	229 (64.87) ^a	0.74 (0.54–1.03); <i>p</i> = 0.07	60 (17.05) ^a	1.26 (0.83–1.91); <i>p</i> = 0.28	92 (26.44) ^b	0.58 (0.42–0.80); <i>p</i> < 0.001
October (<i>N</i> = 151)	105 (71.43) ^b	1.01 (0.66–1.55); <i>p</i> = 0.97	32 (21.33) ^a	1.66 (1.01–2.73); <i>p</i> = 0.046	26 (17.45) ^b	0.34 (0.21–0.55); <i>p</i> < 0.001

Note: The sample population consists of two groups of animal care workers: individuals who work at small or companion animal veterinary (SAV) hospitals and individuals who work in a shelter/rescue/control (SRC) environment. Responses include those who were concerned of animal welfare (yes), reported expert knowledge (>median of 4) and received updates very or extremely often (>median of 3) pertaining to animal welfare. Adjusted models were controlled by time (in months) at survey completion and demographic variables, that is, sex, race and age.

Abbreviations: CI, confidence interval; PNTS, prefer not to say.

^a<1% missing data.

^b1%–5% missing data.

TABLE 2 Self-reported sources of pandemic-related animal welfare information for animal care workers and the frequency of communication from these sources

Updates response	SAV workers, N = 1209	SRC workers, N = 132	
Reported no sources	431 (35%)	33 (25%)	
Reported at least one source	778 (64%)	99 (75%)	
Update sources	N (%)	Update sources	N (%)
American Veterinary Medical Association	382 (49.1%)	Local, state or federal government	67 (67.7%)
Local, state or federal government	304 (39.1%)	Association for Animal Welfare Advancement, including COVID-19 digest	30 (30.3%)
Local or state veterinary association or board	273 (35.1%)	American Society for the Prevention of Cruelty to Animals	25 (25.3%)
News, for example, press releases or press conferences	131 (16.8%)	National Animal Care and Control Association	19 (19.2%)
Centers for Disease Control	103 (13.2%)	Miscellaneous, for example, NASAAEP: Animal Disaster Planning, FEMA	18 (18.2%)
Miscellaneous, for example, drug suppliers, Facebook DVM Groups	66 (8.5%)	Centers for Disease Control	16 (16.2%)
Own or local veterinary hospital (or Veterinary Hospital Management Association)	65 (8.4%)	The Humane Society of the United States	15 (15.2%)
Specialty organisations, for example, Feline Veterinary Medical Association	53 (6.8%)	Own or local animal shelter or humane society	14 (14.1%)
American Animal Hospital Association	51 (6.6%)	American Veterinary Medical Association	12 (12.1%)
US Department of Agriculture, for example, Animal and Plant Health Inspection Service	41 (5.3%)	Maddie's Fund	12 (12.1%)

Note: Sources are not mutually exclusive.

Abbreviations: DVM, Doctor of Veterinary Medicine; FEMA, Federal Emergency Management Agency; NASAAEP, National Alliance of State Animal and Agricultural Emergency Programs; SAV, small animal veterinary; SRC, shelter, rescue and control.

Self-perceived knowledge

SRC workers had greater odds of reporting having expert knowledge of pandemic-related animal welfare effects compared to SAV workers (Table 1). When adjusting for month of survey completion, sex, age and race, the significance of this difference persisted. A linear effect was identified where participants' reported level of knowledge increased over time, with those completing the survey during October having 66% greater odds of reporting having expert knowledge than those completing the survey during July.

Males had greater odds of reporting having expert knowledge compared to females. Participants who preferred not to list their race had higher odds of reporting having expert knowledge compared to white participants, but the former group had a small sample size, which limits the interpretation of these findings.

For self-perceived knowledge dichotomised at the Likert scale mid-point of 3 (moderate knowledge), unadjusted and adjusted model significance was maintained (Table S3). However, different results were identified for unadjusted covariate analyses, that is, there was an independent effect of age but no independent effect of time, sex or race.

Age was found to have a linear effect on self-perceived knowledge, with the odds of participants reporting to be very knowledgeable or having expert knowledge increased with age. Participants aged

18–29 years had lower odds of reporting to be very knowledgeable or having expert knowledge compared to those aged 30–39 years. The opposite effect was found for those aged 40–49 years and those aged over 60 years, where these two groups had greater odds of reporting being very knowledgeable or having expert knowledge compared to those aged 30–39 years.

Overall, for both ACW groups combined, the frequency of updates was associated with self-perceived knowledge, where ACWs who reported receiving very to extremely frequent updates had greater odds of reporting having expert knowledge.

Animal welfare concerns

SRC workers had greater odds of reporting having pandemic-related animal welfare concerns compared to SAV workers (Table 1), and this relationship strengthened in the adjusted model. Neither the month of survey completion nor race had an effect on whether participants had animal welfare concerns. However, males had lower odds of reporting having animal welfare concerns than females, and a linear effect of age was identified, with increasing age associated with lower odds of having concerns. Participants aged over 60 years also had lower odds of reporting having concerns when compared with those aged 30–39 years.

TABLE 3 Animal care workers' self-reported presence of and most frequently reported pandemic-related animal welfare concerns

Presence of concerns ^a	SAV workers, N = 1200 ^a (%)	SRC workers, N = 132	
No concerns	359 (29%)	26 (20%)	
Had concern	841 (70%)	106 (80%)	
Had concerns, no written response	Any concern with written response	Had concerns, no written response	Any concern with written response
560 (66%)	268 (33%)	56 (42%)	46 (37%)
Types of concerns	N [(X/268)%]	Types of concerns	N [(X/46)%]
Pet care and financial instability (general)	111 (41%)	Pet care and financial instability	13 (28%)
Delayed animal care	47 (17%)	Pet care and housing fragility	7 (15%)
Increase in relinquishment or pet abandonment	43 (16%)	Increase in relinquishment or pet abandonment	7 (15%)
Pet behaviour problems, for example, lack of socialisation, change in routine	33 (12%)	Delayed animal care	5 (10%)
Inability to afford care due to job loss	32 (11%)	Lack of resources for operations	4 (8%)
Pet-owners returning to work, disruption in pet care	24 (8%)	Inability to afford care due to job loss	3 (6%)
Higher demand/more cases	23 (8%)	Owners return to work—pet behaviour problems	3 (6%)
Animal abuse/neglect	13 (4%)	Problems with funding	3 (6%)
Increase in pet euthanasia	12 (4%)	Pet-owner illness/death	3 (6%)
Misinformation/lack of information on COVID-19 transmission	11 (4%)	Less staff/volunteers for operations	3 (6%)

Abbreviations: SAV, small animal veterinary; SRC, shelter, rescue and control.

^aMissingness less than 1%.

Reported SRC worker concerns

For SRC participants, 80% reported that they had animal welfare concerns (Table 3). The accompanying open-ended question asked participants to describe their response selection, and out of the 106 participants, 46 (37%) provided a response. Four responses were omitted as they were not relevant to animal welfare. Of the provided responses, the top reported concerns included pet owner financial instability, pet owner housing fragility, increased pet relinquishment or abandonment and delayed pet care.

Reported SAV worker concerns

Of the 1209 SAV participants, 841 (70%) reported that they had animal welfare concerns (Table 3), and out of this group, 33% provided a written response. A total of 268 participants provided concerns relevant to animal welfare during the pandemic and were included for analysis. Thirteen responses were omitted as they did not meet this criterion.

The top reported animal welfare concerns included pet owner financial instability, delayed animal care, increased relinquishment or pet abandonment, pet behavioural problems (for example, lack of pet socialisation) and pet owner inability to afford pet care due to job loss. For both ACW groups, see Table 3 for the remaining top 10 identified con-

cerns and Table S6A,B for the remaining identified concerns.

Exploratory analyses: clinical versus non-clinical ACW perspectives

Due to inherent differences in clinical and non-clinical work duties and associated experiences, stratified analyses were conducted to assess potential differences in responses between clinical and non-clinical SRC and SAV workers (see Tables S7–S9). A significant interaction was identified between clinical role status and ACW group (Table S7). It was found that there were significant differences in the reported frequency of updates received, with clinical SRC workers having higher odds of reporting receiving updates very to extremely often compared to clinical SAV workers (Table S7). This was also true for non-clinical SRC workers compared to SAV workers, but this relationship was weaker.

Clinical SRC workers also had higher odds of reporting having expert knowledge on pandemic-related animal welfare effects compared to clinical SAV workers (Table S8). A similar relationship may also be present for those without a clinical role, but our *p*-value is identical to our predetermined alpha value of 0.05. There were no significant differences found between clinical or non-clinical SRC workers and SAV workers in terms of having animal welfare concerns (Table S9).

Sensitivity analyses

Association between frequency of received updates, self-perceived knowledge and animal welfare concerns

There was not a high level of association between animal welfare concerns and self-perceived knowledge (36%; $\kappa = 0.01$; $p = 0.23$) or between animal welfare concerns and the frequency of updates (43%; $\kappa = 0.02$; $p = 0.07$). However, a high level of agreement was identified between self-perceived knowledge and frequency of updates (68%; $\kappa = 0.14$; $p < 0.0001$).

To investigate how update frequency may influence knowledge, a chi-squared analysis was performed. There was a statistically significant relationship between reporting very or extremely frequent updates and reporting to be very or extremely knowledgeable ($\chi^2(1) = 37.2$; $p < 0.001$). ACWs who reported updates as very or extremely frequent were more likely to rate themselves as very or extremely knowledgeable (78.6%). However, it was also found that ACWs who reported updates to be moderately frequent or less often were also more likely to report feeling very or extremely knowledgeable (61.5%). For clear interpretation, knowledge level was dichotomised at a midpoint of 3.

Association among demographic variables

Sex ($\kappa = 0.11$; $p < 0.001$) and race ($\kappa = 0.03$; $p = 0.05$) had a statistically significant association with ACW group. Ninety-two percent of SAV workers ($N = 1117/1209$) and 79% of SRC workers ($N = 105/132$) were female. For both groups, the majority of participants were white, that is, 93% of SAV workers ($N = 1102/1209$) and 85% of SRC workers ($N = 113/132$). However, these two demographic variables were still included in adjusted analyses to control for these demographic characteristics.

DISCUSSION

This study contributes to the sparse literature on crisis health communication pertaining to animal welfare,¹³ notably during a public health emergency: the COVID-19 pandemic. SRC workers were more likely to report receiving pandemic-related animal welfare updates very to extremely often and having expert knowledge. This was also true for clinical SRC workers compared to clinical SAV workers, and a weaker relationship in the same direction was identified between non-clinical SRC workers and SAV workers. SRC workers were also more likely to report having pandemic-related animal welfare concerns than SAV workers, and clinical role status did not affect this relationship.

Assessing animal welfare crisis communication

Possible reasons for differences in the self-perceived knowledge of ACW groups

A statistically significant association was found between ACWs reporting receiving very frequent pandemic updates and reporting high self-perceived knowledge. This, in turn, may suggest the success of top-down animal welfare crisis communication, particularly for animal SRC networks during the pandemic. However, the reverse relationship was less evident, that is, ACWs who reported less frequent updates (moderately or less) did not consistently report lower self-perceived knowledge (moderately or less). This suggests that there may be additional factors at play that may have affected self-perceived knowledge ratings, such as inherent differences in core job duties and work environments between ACW groups. Furthermore, the survey did not explicitly state 'Based on the updates you have received, how would you rate your knowledge on pandemic impacts on animal welfare?' Although this may have aided in making the relationship between frequency of updates and self-perceived knowledge more clear, it is still impossible to fully control the influence of external factors on participant self-assessments, as individual perceptions are inherently shaped by multiple factors. Regardless, the results presented within this paper still provide some insight into the potential success of crisis communication dissemination. To advance this investigation, future studies, if feasible, should acquire examples of the update material disseminated to ACWs, and based on this information, design and implement an assessment on the topics identified. This may more directly and clearly identify if materials did have a positive impact on ACWs' self-perceived knowledge.

The results of this study suggest that ACW clinical role status may also affect the frequency of updates received, especially for clinical SRC workers (Table S7). Furthermore, compared to both clinical and non-clinical SRC workers, SAV workers had a lower likelihood of reporting being very knowledgeable or having expert knowledge (Table 1, Table S8), or being moderately knowledgeable or above (Table S3).

Using the same study population as Dalton et al.,²⁰ Marquez et al. found that, compared to veterinarians, SAV administrative/support personnel and veterinary technicians and assistants had higher odds of reporting feeling ready, willing and able (RWA) to work during the COVID-19 pandemic.²³ The RWA framework is a set of standardised guidelines that are commonly used to assess workforce performance, such as during public health crises.^{20,24} It is important to note that the 'readiness' domain also includes the assessment of work-related professional barriers, which, notably, includes lack of knowledge.²⁴

However, within the present study, it is possible that differences in self-perceived knowledge between ACW groups is not due to lack of knowledge of *what* impacts the pandemic has exerted on population-level animal welfare, especially due to ACW groups having a moderate amount of overlap in the top 10 concerns reported (Table 3), but instead *how* to address them. For example, within this study, client financial instability was the most frequently reported concern by both ACW groups (Table 3). Similarly, in a global mixed-methods survey targeting veterinary personnel ($N = 540$) from 22 countries, it was found that one of the most commonly reported types of ethically challenging situation (ECS) was navigating how to proceed when clients faced financial constraints (39.4%; $n = 195$).²⁵ It is also noteworthy that this was reported to be participants' most commonly experienced (64.4%; $n = 348$) and the most recently experienced (22.4%; $n = 121$;) ECS. Future research should ascertain how different ACW organisations navigate situations where clients have financial difficulties and assess the efficacy of these strategies; for example, post-intervention assessments could track the frequency of relinquishment events over time. Overall, given that financial instability was a top concern for both ACW groups in this study, and that SAV workers likely interact with individual pet owners more frequently over the duration of a pet's life compared to SRC workers (dependent on organisational capacity), addressing this issue, along with bridging the collaborative gap between SAV and SRC workers, may be especially critical in protecting population-level animal welfare and pet owner wellbeing.

Communication sources on animal welfare

While both ACW groups reported receiving information from non-profit or specialty organisations, SAV workers appeared to largely report receiving information from organisations that focused on veterinary medicine, for example, the Feline Veterinary Medical Association and the American Animal Hospital Association (Tables 2 and S5B), whereas SRC workers often reported receiving information from specialty organisations that primarily pertained to animal care and wellbeing, for example, the Association for Animal Welfare Advancement and the American Society for the Prevention of Cruelty to Animals (ASPCA; Tables 2 and S5A). This observation may be important as it could explain the differences in self-perceived knowledge between SAV and SRC workers within this study. These results may highlight the need for top-level public and animal health and welfare organisations to harmonise information (e.g., medical and animal welfare materials) for ACW groups, especially those in clinical SAV roles, during future zoonotic disease public health crises that impact companion animals. Further research is needed on whether this would

close the gap in self-perceived knowledge between SRC and SAV workers.

With regard to identified organisations that distributed animal welfare updates during the pandemic, at the time of this study, work by Powell et al. appeared to be the only empirical study that provided insight on this for ACW workers, particularly for SRC workers.¹² Several resources identified in Powell et al.'s work were also identified within the present study, that is, the CDC, state/local government, the AVMA, non-profits such as the ASPCA, relevant university stakeholders and ACW peers.¹² This may further support the successful top-down reach of these organisations. Future studies should explore the methods via which crisis information was disseminated (e.g., social media or email updates) and evaluate the effectiveness of these strategies in enhancing ACW knowledge.

Animal welfare concerns

Within this study, both ACW groups cited pet owner financial instability, delayed animal care, increases in pet relinquishment and pet behavioural changes, for example, pet anxiety due to changes of routine (e.g., owners returning to work), as pandemic-related animal welfare concerns. It may be valuable for public health entities to discuss how ACWs can address these concerns in future top-down crisis communication.

In particular, addressing financial instability should be prioritised by public health organisations as this is a commonly reported animal welfare challenge experienced especially by low-income pet owners, both before²⁶ and, highly exacerbated, during the pandemic.^{27,28} One potential approach may be implementing in-house payment plan systems. For example, Cammisa and Hill found that, across six years of payment plan data from 21,255 client accounts across 397 pet care organisations using in-house payment plans (managed via the platform 'VetBilling'), 92% of closed accounts were paid in full, even though 70% of these accounts had a soft credit-check rating, suggesting they may have been denied through a traditional credit application process.²⁹

Within this study, both ACW groups cited pet owner job loss as an associated or causal factor for financial difficulties; however, only SRC workers noted pet owner housing fragility to also be of concern (Table 3). It is important to note that housing instability is likely also an indicator of financial crisis.³⁰ Overall, it is possible that, within this study, some of the ACW concerns found were addressed by the identified communication sources. However, future research is needed to determine to what degree animal welfare was discussed within top-down crisis communication to ACWs during this and future zoonotic crises.

Limitations

It is important to note that the generalisability of this study may be limited. Both ACW groups were predominantly white females, and while this is consistent with the known demographics of the profession, we obtained few perspectives from male participants and those from other racial and ethnic groups. Some pandemic animal welfare concerns and additional update sources could have been missed as a result. The small sample size of SRC workers ($N = 132$) compared to that of SAV workers ($N = 1209$) also could have impacted the power of the analyses. Future efforts should be made to increase the accessibility of this survey to SRC workers, especially clinical SRC workers, and ACWs from diverse racial and ethnic backgrounds.

Another limitation is that the parent study did not collect the specific content of the updates received by participants, as it was not relevant to the study's purpose. Future studies should aim to acquire example content for qualitative examination; furthermore, implementing an assessment to directly measure ACW knowledge instead of solely relying on a self-rating system could also be of value. Doing so may better evaluate the success of top-down communication by measuring the extent to which ACWs understand the information presented to them.

Furthermore, while this study was focused on top-down information sharing, crisis response strategies that use a bi-directional approach to relay the knowledge and experiences of the front-line workforce to decision makers is also critical during One Health emergencies, and future studies should consider this more explicitly. Future studies should explore potential methodologies and strategies for ACWs to contribute information effectively, in a bottom-up capacity, to public and animal health authorities, for example, through an artificial intelligence-assisted electronic data management platform designed to organise, prioritise and communicate summarised insights. Overall, improving methodologies of bottom-up communication could help promote message clarity and also strengthen response efforts by ensuring that client and community concerns are promptly relayed for timely action. Additionally, as situations evolve, authorities can more accurately assess and address emerging challenges.

CONCLUSION

Differences in self-perceived frequency of receiving animal welfare updates, self-perceived knowledge and level of animal welfare concern between ACW groups potentially highlight a need for the top-level public health or animal welfare entities identified in this study to harmonise the gathering and dissemination of crisis information to ACW groups, especially to benefit SAV workers as a whole and clinical SAV workers in particular. This is especially important as SAV workers typically interact with the public in a unique, ongoing

fashion, that is, their role in providing routine animal care across the lifespan of the pet allows them to engage with individual clients and their pets more consistently over time compared to SRC workers. However, it is important to note that SRC workers involved in sustained, community-based efforts may closely mirror this level of engagement. Overall, these results further highlight the need to support SAV workers during crises impacting animal welfare.

By providing harmonised educational support for both ACW groups, these differences in self-perceived knowledge could be lessened, particularly for clinical SAV workers, which would consequently directly benefit their local communities. Future research may wish to further assess rapid response top-down communication for ACW groups, with particular focus on assessing clinical versus non-clinical worker support received and self-perceived knowledge. Overall, the findings of this study could be used to improve crisis preparedness and top-down crisis communication for ACWs with diverse roles, and also aid in selecting topics to focus on when developing preparedness strategies for ongoing and future zoonotic public health crises, including SARS-CoV-2 (the causative agent of COVID-19), highly pathogenic avian influenza A (H5N1), mpox and others.

AUTHOR CONTRIBUTIONS

Sharmaine Miller was responsible for conceptualisation, methodology, investigation, final data analysis, writing the original through final drafts and creating tables and figures. Joyce X. Kwan contributed to conceptualisation, methodology, investigation, project administration and writing through review and editing. Kathryn R. Dalton contributed to investigation, provided resources and participated in writing through review and editing. Kaitlin B. Waite was involved in investigation and writing through review and editing. Meghan F. Davis contributed to investigation, supervision and writing through review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known conflicting financial interests or personal affiliations that could influence the findings reported in this paper.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available upon request from the corresponding author.

ETHICS STATEMENT

This study was a secondary data analysis nested within the parent study 'Assessing COVID-19 Pandemic Risk Perception and Response Preparedness in Veterinary and Animal Care Workers' (CoVET).²⁰ This study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (IRB#: 00012854). Participants provided electronic informed consent prior to completing the survey.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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