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Compassion Fatigue and Satisfaction in US Army Laboratory Animal Medicine Personnel

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Compassion fatigue (CF) has been described in various "caring professions," particularly the human medical field. Recently, CF has been identified as a concern in animal care professions, specifically veterinary medicine. Despite the perception that veterinary personnel in animal research are at increased risk of CF, few studies have assessed CF in this population. The current cross-sectional study aimed to describe the prevalence of both CF and compassion satisfaction (CS) among active-duty veterinary personnel in Department of Defense animal research environments, using the Professional Quality of Life Scale (ProQOL). The ProQOL measures burnout and secondary traumatic stress as representative of compassion fatigue, while also measuring the inverse of CF, or CS. The current study set out to identify factors associated with both CF and CS. Validated scales of measurement were used to assess the frequency of exposures and outcomes of interest, while associations were analyzed using linear regression models. The study found that most survey respondents reported high levels of CS and low levels of BO and STS. Factors associated with higher levels of CF and lower CS included working with NHPs, difficulty working with primary investigators, loneliness, and euthanasia distress. These findings can inform future studies of CF in animal research environments and bolster initiatives to reduce occupational stress by the preventing and mitigating CF.

Abbreviations: BO, burnout; CF, compassion fatigue; CS, compassion satisfaction; NHP, non-human primate; ProQOL, Professional Quality of Life Survey; STS, secondary traumatic stress

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Veterinarians and veterinary technicians enter their profession because of their love for animals and their desire to care for and 'help' them.[1,3,5,18,19] However, after beginning practice, veterinarians and veterinary technicians frequently experience high occupational stress and demanding work environments, resulting in the development of compassion fatigue (CF).[1] Although the definition of CF has evolved over time, and conceptual models vary between different researchers,[9] CF is defined by one group as "the mental weariness resulting from exertion that is associated with attending to the emotional and physical pain of others."[5] CF was first documented in nurses[11] and has been studied in a variety of caregiving professions.[7,13,20,22,25] Although CF is viewed as an important issue for animal care workers, few studies have assessed the prevalence of CF or risk factors for developing CF in veterinary medicine.[5]

Laboratory animal veterinarians and technicians in biomedical research facilities are a unique cohort of animal care workers who may have increased risk of developing CF.[14] Veterinary care providers in animal research environments interact with research animals daily, providing preventive and emergency veterinary care, husbandry, veterinary support for research procedures, and environmental enrichment. Daily interaction with animals and the passion for animal health and welfare that drives individuals to enter the field of veterinary medicine results in an emotional connection known as the "human-animal-bond."[5,8] Workers who develop an emotional bond with the animals, and yet must perform duties that may require the death of the animal or cause animals to experience pain or distress, may be at risk of CF.[14] CF can decrease a worker's job satisfaction, mental health, and overall performance. Despite these negative effects of CF, few studies have assessed CF in individuals who work with research animals.

US Army laboratory animal veterinarians comprise the military occupation area of concentration of 64C, "Veterinary Laboratory Animal Medicine officer." The 64C veterinary specialty includes current residents in the US Army Laboratory Animal Medicine Residency program and diplomates of the American College of Laboratory Animal Medicine (ACLAM).[28] US Army veterinarians who are not part of a residency program, or who have not achieved specialty board certification make up the military occupation area of concentration of 64A, "Field Veterinary Service Officer." A 64A is a graduate of an American College of Veterinary Medicine-accredited school of veterinary medicine and maintains an active and unrestricted veterinary license.[28] Military veterinarians in research who are not yet ACLAM board-certified must have extensive training and experience in laboratory animal medicine to work in Department of Defense (DOD) animal care and use programs.[6] Job duties and responsibilities of veterinarians in DOD research environments directly mirror ACLAM diplomates serving in other government or civilian research institutions. A military Laboratory Animal Medicine veterinarian is responsible for: planning, directing and participating in the care, treatment, and management of laboratory animals; designing facilities and equipment for animal care and use programs to support DOD Research, Development, Test, and Evaluation (RDT and E), and training activities involving the use of animals.[28] They may

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also be involved in obtaining and maintaining accreditation by AAALAC, International (formerly Association for Assessment and Accreditation for Laboratory Animal Care) for all appropriate animal use RDT and E and training activities; supervising all aspects of animal care and use, and operation of RDT and E or training projects involving animals.[28] Laboratory animal veterinarians may also be involved in consulting, collaborating with and advising researchers on animal-use research, ensuring programs, protocols, and experiments are performed in accordance with the guidelines, laws, rules, and regulations of national and international agencies.[28] These officers are also charged with managing research resources, including animal populations, animal facility space, and core capabilities required for animal use in DOD RDT and E and training activities, and with supporting the evaluation of therapeutics, vaccines and medical devices intended for human use in animal models in accordance with Good Laboratory Practices standards.[28]

Enlisted animal care specialists in the military occupational specialty of 68T (animal care specialists) serve alongside veterinarians and veterinary technicians performing technical tasks in support of veterinary procedures and animal care (including animal husbandry, assisting with physical examinations, assisting with surgical procedures, assisting with euthanasia, etc.). The job duties of the animal care specialists are comparable to an Assistant Laboratory Animal Technician, and indeed many 68Ts pursue American Association for Animal Laboratory Science certification once they satisfy the minimum laboratory animal experience requirements.[6]

US Army laboratory animal medicine personnel represent a unique population within the laboratory animal medicine workforce. While the job duties and responsibilities of Army laboratory animal medicine personnel are comparable to those of other government and civilian animal research institutes, active-duty personnel are subject to additional, unique stressors. Army workplaces experience constant fluctuation of personnel due to new military assignments, which may cause inhibited, disrupted, or delayed team cohesion. Service members may also experience geographical separation from their peers, friends, and families, which can result in feelings of isolation and loneliness. Enlisted animal care specialists may be assigned to work in biomedical research without full knowledge of job requirements or expectations, and for most it will be their first exposure to working with laboratory animal species.[6] These external factors may influence potential coping mechanisms for these service members, increasing their risk for experiencing emotional stress and burnout.

CF has been described as consisting of 2 components: burnout (BO) and secondary traumatic stress (STS).[26] Burnout is defined as a feeling of hopelessness at work and difficulty in carrying out one's job effectively.[26] Secondary traumatic stress in a health care worker has been described as a work-related, secondary exposure to extremely stressful or traumatic events that cause the worker to experience an extreme state of tension and preoccupation with suffering in the medical setting.[26] STS can result from either a single incident or daily stressful events and can interfere with a person's ability to perform their job[19,26] (Figure 1). Conversely, compassion satisfaction (CS) refers to the feelings of pleasure that result from contributing positively to one's work or the greater good of society[26] (Figure 2). CF has been described in healthcare providers as resulting in emotional exhaustion, depression, frustration, depersonalization, sense of loss in one's achievements, recurring nightmares or flashbacks, substance abuse or other compulsive behaviors, lack of self-care; as such, CF can significantly and adversely affect patient

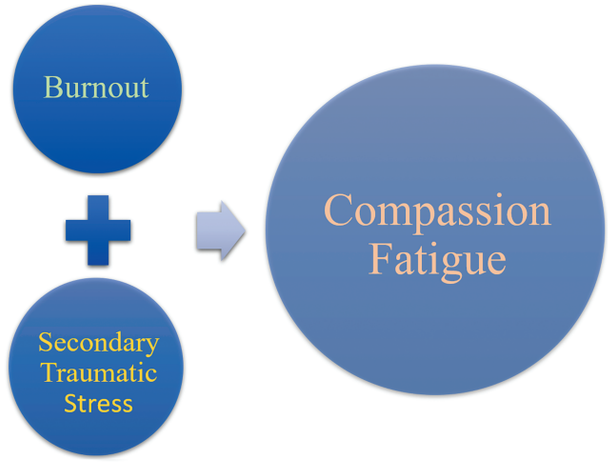

Figure 1. Components of Compassion Fatigue

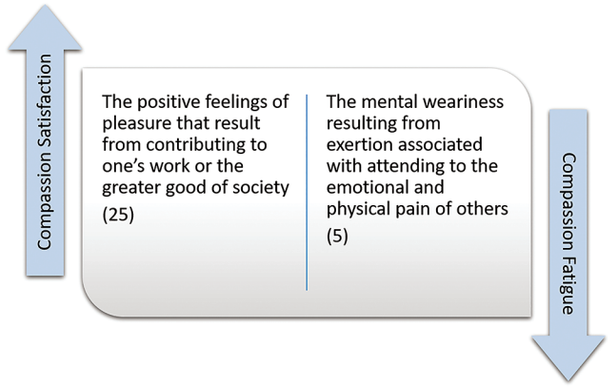

Figure 2. Comparison of Compassion Fatigue and Compassion Satisfaction

care.[12,15] Similarly, CF in animal care work environments can cause a high rate of employee absenteeism or excessive worker compensation claims; high personnel turnover; lack of team cohesion; aggressive behavior among staff; unwillingness of staff to respect rules and/or deadlines; increased negativity, increased mistakes, safety violations, or occupational health reports; increased stress experienced by research animals; and decreased quality of animal or medical care.[15]

A variety of exposures specific to laboratory animal medicine have been observed or proposed to affect the occupational and emotional stress of animal care workers.[3] Veterinary workers in animal research environments may face moral and emotional conflict when their role requires the euthanasia of animals as a study endpoint or when procuring and caring for animals, knowing that these animals may require euthanasia and tissue collection as a study endpoint.[14,15] Euthanasia distress is often described as an occupational stressor in veterinary medicine, and can vary with different species and the levels of attachment the caregiver has to an animal.[1,3,19,23] Veterinarians in companion animal practice experience euthanasia distress when making end-of-life decisions with their clients and patients.[19,23] One group found that although euthanasia frequency was not associated with higher compassion fatigue, personnel reporting less control over euthanasia reported higher compassion fatigue.[14]

Some approved research protocols may require an animal to experience pain or distress. Veterinarians and other professionals who serve on Institutional Animal Care and Use Committees

(IACUCs) must carefully weigh the harm: benefit ratio of the proposed research. Higher degrees of pain or stress experienced by research animals have been associated with higher compassion fatigue and lower compassion satisfaction in laboratory animal medicine workers.[14] Protocols involving unalleviated pain and distress to animals are classified as "Category E Studies" under the United States Department of Agriculture (USDA) pain categories for animal research. Supporting these studies and observing animals in distress while unable to intervene may increase the risk of secondary traumatic stress in animal care staff.

Personnel working in animal research environments may also experience an absence of social support and increased loneliness due to the social stigma associated with animal research, which can reduce individual coping mechanisms for stress.[4,14,15] One study determined that lower self-reported social support was associated with higher compassion fatigue and lower compassion satisfaction.[14] The current study further explores this association, measuring the association of loneliness with compassion fatigue and compassion satisfaction. We hypothesized that a lack of social support is one of several contributors to an individual's overall level of loneliness.

Recognizing CF's existence in laboratory animal medicine and establishing potential associations between situations specific to the field and the development of CF can assist in creating effective programs to address and mitigate the components of CF and to decrease occupational stress in the animal research workplace. We hypothesized that higher levels of euthanasia distress, self-reported difficulty in working with primary investigators, higher levels of loneliness, working with nonhuman primates (NHPs), and supporting Category E studies would be associated with lower levels of CS and higher levels of BO and STS, indicating higher overall experience of CF.

Materials and Methods

Study Design. This study is a cross-sectional survey study of respondent experiences and perceptions among personnel who served in DOD animal research environments within 5 y of the survey administration. Data were collected from an online, nonrandom, convenience sample of active-duty veterinarians and animal care specialists in several locations.

Subject Recruitment and Eligibility. The target population for the study was active-duty Veterinary Corps officers and animal care specialists in the military occupational specialty 68T, serving in DOD animal research environments. The total number of job authorizations for Veterinary Corps officers and animal care specialists in animal research at the time of the study were 63 and 83, respectively. Due to the nature of active-duty personnel changing jobs approximately every 3 y, eligibility was expanded to those who served in animal research environments within 5 y of the survey. Given the eligibility criteria, the source population was estimated to be approximately 150 personnel.

The Army Public Health Center Office of Human Protections reviewed the study protocols, determined this project to be public health practice with minimal risk to subjects, and approved the study (Project no. 16-511.M1). Data were collected using a protocol approved by the Army Public Health Center Public Health Review Board. Participation in the survey was completely voluntary, and management did not participate in subject recruitment activities. Recruitment emails were distributed upon activation of the online survey, and reminders were sent weekly for one month until the availability of the online survey was closed. Recruitment emails were sent by the Consultant to the US Army Surgeon General for Laboratory Animal Medicine, senior veterinary enlisted personnel, and the Compassion in Animal Research Environments (CARE) Working Group to active-duty US Army veterinary personnel currently serving laboratory animal medicine assignments. The announcement was also sent to closed Facebook groups comprised of the target individuals. Recruitment emails and social media announcements explained the purpose of the survey and contained a URL link opening the survey. Those who opened the survey link were directed to a webpage containing an introduction to the survey. To participate in the study, respondents were required to have computer and internet access, be able to read and understand English, and to provide informed consent. Only completed surveys were included in the analysis, thereby reducing the chance of analyzing incomplete responses of a participant who may later have completed the survey in full. Responses were reviewed to verify duplicate survey entries were not received.

Data Collection. Demographic data were collected for the following variables: sex, age, rank, military occupation, deployment history, time in service, and current employment environment. The Professional Quality of Life (ProQOL) Measure, Version 5 (ProQOL-V) measure was used to measure CS, BO, and STS. The ProQOL-V consists of 3 subscales measuring CS (α scale reliability 0.88), BO (α scale reliability 0.75), and STS (α scale reliability 0.81).[26] Participants are classified as having low levels in each domain if their sum score is less than or equal to 22, average levels if their sum score is between 23 and 41, and high levels if their sum score is greater than or equal to 42.[26] The ProQOL-V scales can also be assessed on a continuous scale for statistical association with other variables, as recommended by the ProQOL Manual. The UCLA Loneliness scale, Version 3 is a validated 20-item questionnaire with 4 response categories.[10,21] The response scale ranged from 1 (never) to 4 (often). Cronbach α across all 5 items was 0.93. Loneliness scale score of 65 to 80 indicates a severe high degree, 50 to 64 indicates a moderately high degree, 35 to 49 indicates a moderate degree, and 20 to 34 indicates a low degree of loneliness.[17] The survey contained 5 questions from the validated, 8-item questionnaire designed to measure euthanasia distress.[30] Questions related to euthanasia in nonlaboratory animal environments were removed. Each statement had 5-item Likert scale response levels ranging from 'strongly disagree' to 'strongly agree'.[30] Cronbach α across all 5 items was 0.74. The range of possible scores was 5 to 25, with higher scores indicating higher euthanasia distress. The survey included several "group-designed" questions developed by laboratory medicine and public health experts for this study to cover topics for which available scale measures were not felt to be appropriate. These questions addressed occupational stressors specific to laboratory medicine, coping and stress mitigation strategies, and training needs.

External validation and pretesting of the survey were performed by administering the survey to 7 stakeholders to solicit feedback on its usage, scope, and length. Stakeholders included epidemiologists, civilian veterinary workers in DOD animal research environments, US Army laboratory animal medicine leadership, and civilian veterinarians in academic environments. Feedback from pretesting was used to design the final survey.

Data Analysis. Selection of exposures of interest required careful consideration of all possible hypothesized contributors to CF and CS. To guide the data analyses and ensure exposures were selected with limited confounding, a directed acyclic graph (DAG) was created to demonstrate the conceptual relationship of exposures and risk factors that can lead to development of CF (Figure 3). The DAG demonstrates hypothesized relationships

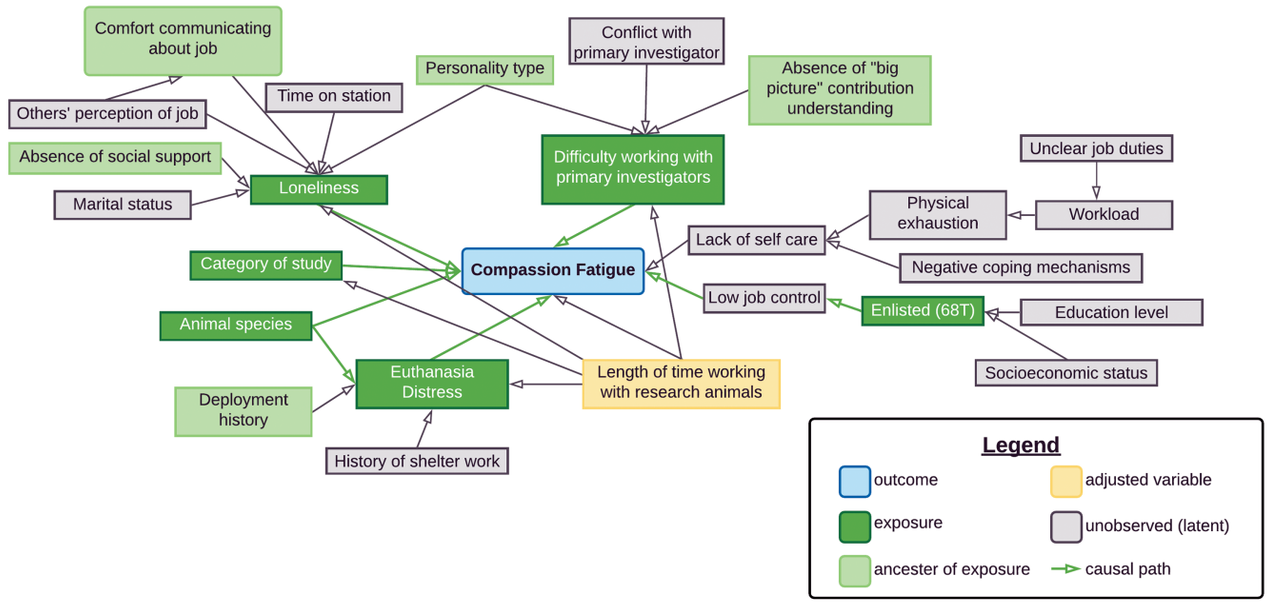

Figure 3. Directed Acyclic Graph displaying hypothesized relationships between exposures and outcome of interest

of exposures with outcomes, including effect modifiers, precision variables, and/or mediators, and determines the minimal sufficient adjustment set necessary to assess the effect of the exposure on the outcome in the adjusted linear regression model.[27] For example, exposure to euthanasia distress leads to the outcome of CF with the additional confounding variable of animal species (Figure 3).

We assigned the following variables as exposures of interest (independent variables): USDA category of study, euthanasia distress, loneliness, self-reported difficulty working with primary investigators, and working with nonhuman primates. USDA category of study was assessed as a binary variable (experience working with Category E studies compared with Categories B, C, and/or D); euthanasia distress was assessed as a numeric variable (scale range 5 to 25); loneliness was assessed as a numeric variable (scale range 20 to 80); difficulty working with primary investigator was assessed as a binary variable (respondent did or did not select this factor as the most stressful about an individual's job); and working with NHPs was assessed as a binary variable (respondent had or did not have experience working with NHPs). Respondents who did not indicate experience working with NHPs, but did select experience working with other research animals, served as the comparison group. Other research animals included rats, mice, pigs, guinea pigs, ferrets, goats, sheep, cats, rabbits, zebrafish, dogs, horses, gerbils, chinchillas, reptiles, and alpacas.

Outcomes of interest (dependent variables) were the 3 components of compassion fatigue: CS, BO, and STS. Each was assessed as a numeric variable (scale range 10 to 50). Internal reliability of the scales for the survey population was assessed by calculating Cronbach alphas.

Statistical analyses were performed using R Software V3.5.1. Linear regression was performed to assess the association of each exposure of interest and each of the 3 outcomes of interest (CS, BO, and STS). Multivariate linear regression was then performed, adjusting for confounders (variables associated with the exposure and outcome) and precision variables (variables associated with the outcome, but not exposure). Statistical significance of associations was set as P values less than or equal to 0.05. Potential confounders were selected a priori, based on the subject-matter knowledge of the lead author, and included: sex (male or female), age (less than 30, between 30 and 39, or greater than or equal to 40), military occupation (64A and 64C or 68T), and time spent working with research animals (less than 3 y or greater than or equal to 3 y). Working with NHPs (vs. not working with NHPs) was considered to be an additional confounder when evaluating euthanasia distress. Further analysis was performed by fitting a larger multivariate regression model for each outcome with all exposures determined to be statistically significant in the adjusted model (P values less than or equal to 0.05), still adjusting for confounders and precision variables. Due to the exploratory nature of the analysis, adjustment for multiple comparisons was omitted in order to avoid loss of sensitivity. The design and report for this study were conducted in accordance with STROBE standards for cross-sectional studies.[29]

Results

The target population, active-duty US Army Veterinary Corps personnel who worked in animal research environments within 5 y of survey administration, was approximately 150. The survey was completed by 67 respondents, yielding an estimated 67/150 (45%) response rate. 51/67 (76%) survey respondents were currently working with animals in research environments, while 14/67 (21%) were not currently working in animal research environments but had done so within 5 y of the survey. Two participants (2/67; 3%) were excluded from the study population due to not meeting the inclusion criteria of having worked with research animals within 5 y of the survey. Of the 65 survey respondents included in the study population, 37 were veterinarians and 28 were animal care specialists (Figure 4).

Demographic characteristics of study population are reported in Table 1. The distribution of male to female study participants (female predominance) was representative of the sex distribution within the target population of active-duty veterinarians and animal care specialists.

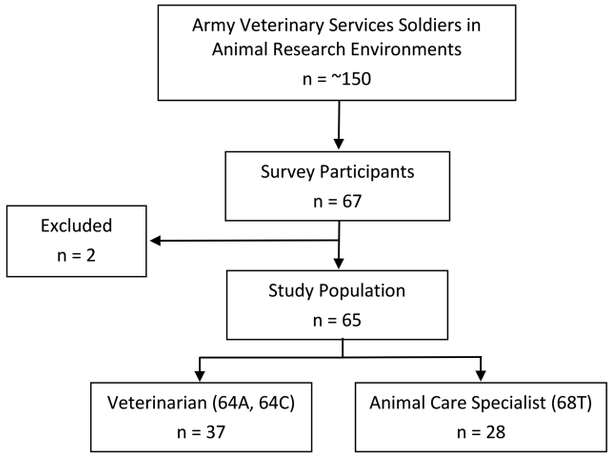

Figure 4. Survey respondents

Of the study participants, approximately half (52%) reported high CS, while 48% reported low to moderate CS. Higher proportions of veterinarians reported high CS (21/37 [57%]) than did animal care specialists (13/28 [46%]) (Table 2). Over a third (37%) of study participants indicated moderate BO, while 63% indicated low BO. BO score distributions were similar between veterinarians and animal care specialists. High BO or STS was not reported by any of the respondents. Moderate STS was reported by 15% of the study population, while 85% reported low STS. Higher proportions of moderate STS were reported among animal care specialists (5/28 [18%]) compared with veterinarians (5/37 [13.5%]). 14% of participants reported moderate levels of both BO and STS (Table 2). Descriptive statistics for the results are displayed in Table 3. The distributions of CS, BO, and STS scores (Figure 5) show that variability in reported STS scores is less than both CS and BO. While the majority of respondents reported low STS and low to moderate BO, CS scores were moderate to high. Cronbach α calculations for the subscales of CS, BO, and STS are displayed in Table 4. In general, the reliability of the measures was judged to be high (0.81-0.93). (Figure 5).

Results of unadjusted linear regression testing the strength of association between the exposures of interest and outcomes are displayed in Table 5. Statistically significant associations with higher levels of BO within the study population included working with NHPs, self-reported difficulty working with primary investigator, higher levels of loneliness, and higher levels of euthanasia distress. Higher levels of STS in the study population were significantly associated with working with NHPs, higher levels of loneliness, and higher levels of euthanasia distress. Self-reported difficulty working with primary investigators, higher levels of loneliness, and higher levels of euthanasia distress were all statistically significant in association with decreased CS. The survey population did not reveal statistically significant associations between respondents working with Category E studies and BO, STS, or CS.

Adjusted linear regression results are displayed in Table 6. Adjusting for age, sex, military occupational specialty, and time spent working with research animals, the average BO scale score reported for survey respondents working with NHPs was 7.8 points higher (95% CI [3.3, 12.3]; *P* value 0.001), STS score was 4.6 points higher (95% CI [1.2, 8.0]; *P* value 0.01), and CS score was 5.0 lower (95% CI [-10.1, -0.2]; *P* value 0.06) than survey respondents who reported not working with NHPs.

Table 1. Sociodemographic characteristics of study population

Characteristics	% (n)
Sex	
Male	32% (21)
Female	68% (44)
Age	
<30	17% (11)
30–39	46% (30)
≥40	37% (24)
Grade/Rank	
E1-E4 / PV1-SPC	18% (12)
E5-E6 / SGT-SSG	22% (14)
E7-E9 / SFC-SGM	3% (2)
O1-O3 / 1LT-CPT	3% (2)
O4-O7 / MAJ-BG	54% (35)
Military occupation	
64A (Field veterinary service officer)	3% (2)
64C (Veterinary laboratory animal medicine)	54% (35)
68T (Animal care specialist)	43% (28)
Time in service (years)	
<1	0% (0)
1-4	15% (10)
5-9	25% (16)
10-19	52% (34)
>20	8% (5)
Deployment history	
Yes	45% (29)
No	55% (36)
Current employment environment	
Laboratory/Research	63% (41)
Staff officer	6% (4)
Personnel management/administrative	3% (2)
Long term health education and training (Residency program)	15% (10)
Other	12% (8)

In a model adjusting for the same covariates, using reported difficulty working with primary investigators as a top job stressor, survey respondents reporting such difficulty had, on average, BO scores 3.8 points higher (95% CI [0.3, 7.3]; *P* value 0.03), STS scores 2.5 points higher (95% CI [-0.8, 5.9]; *P* value 0.14), and CS scores 4.0 points lower (95% CI [-7.7, -0.4]; *P* value 0.03), than those who did not report difficulty working with primary investigators as a top job stressor.

In a model using loneliness as the exposure of interest, with the same covariate adjustments, for each 10 point increase in scores on the loneliness scale, respondents scored, on average, 4.0 points higher (95% CI [3.0, 6.0]; *P* value < 0.001) on the BO scale, 3.0 points higher (95% CI [1.0, 4.0]; *P* value 0.001) on the STS scale, and 4.0 points lower (95% CI [-5.0, -2.0]; *P* value < 0.001) on the CS scale.

In a model adjusting for sex, age, military occupational specialty, time spent working with research animals, and experience working with NHPs, each 5 point increase in scores on the euthanasia distress scale was associated, on average, with a score 3.0 points higher (95% CI [1.0, 4.5]; *P* value < 0.001) on the BO scale, 2.5 points higher (95% CI [0.5, 4.0]; *P* value 0.007) on the STS scale, and 2.5 points lower (95% CI [-4.5, -1.0]; *P* value 0.006) on the CS scale.

In larger multivariate, linear regression models, adjusting for the other statistically significant exposures, as well as sex,

Table 2. Burnout, Secondary Traumatic Stress, and Compassion Satisfaction scores by military occupational specialty.

	Veterinarians % (n)	Animal care specialists % (n)	All % (n)
Burnout (BO)			
Low	62% (23)	64% (18)	63% (41)
Moderate	38% (14)	36% (10)	37% (24)
High	0	0	0
Secondary traumatic stress (STS)			
Low	86.5% (32)	82% (23)	85% (55)
Moderate	13.5% (5)	18% (5)	15% (10)
High	0	0	0
Compassion satisfaction (CS)			
Low	3% (1)	0	2% (1)
Moderate	40% (15)	54% (15)	46% (30)
High	57% (21)	46% (13)	52% (34)

Scores for each subscale could range from 10–50.
Categories were defined and scored as required in the 2010 ProQOL Manual; scores between 5–21 were considered low, 23–41 moderate, and 42–50 high (25).

Table 3. Descriptive Statistics for Burnout, Secondary Traumatic Stress, and Compassion Satisfaction scores

	Mean	*SD*	*Min*	*Max*
Burnout (BO)				
All	20.83	6.84	10	39
Veterinarians	20.57	6.43	11	39
Animal care specialists	21.18	7.45	10	39
Secondary traumatic stress (STS)				
All	18.95	5.80	10	40
Veterinarians	19.08	6.20	11	40
Animal care specialists	18.79	5.33	10	32

age, military occupational specialty, and time spent working with research animals, all previously statistically significant exposures for the outcomes of BO and CS remained statistically significant. When adjusting for all significant exposures, confounders, and precision variables, loneliness was the only statistically significant risk factor for the outcome of STS.

Discussion

Our study of military lab animal workers, the first to assess CF in active-duty laboratory animal veterinary personnel, found job-related stressors to contribute to decreased CS and increased BO and STS. While most of the survey population reported low BO (63%), low STS (85%), and high CS (52%), the study did identify the prevalence of moderate BO (37%), moderate STS (15%), and moderate to low CS (48%) within the population.

High CS may counterbalance BO and STS. High reported CS may be unique to the military population, as the US Army has several training programs and resources designed to support occupational and behavioral health. For example, active-duty personnel are required to complete annual resiliency training. In addition, active-duty personnel have readily available behavioral health resources, including behavioral health clinics available 24 h a day, 7 d a week, free counseling services through Military One Source, the ability to speak with and receive confidential counsel from chaplains, and a well-defined support structure

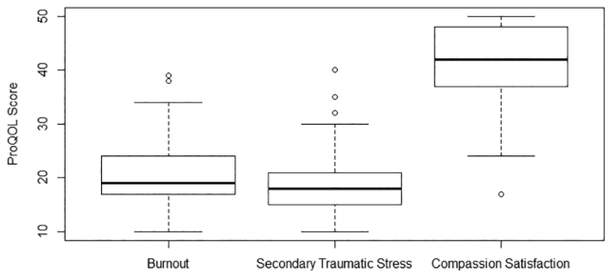

Figure 5. Total distribution of Burnout, Secondary Traumatic Stress, and Compassion Satisfaction

Table 4. ProQOL-V Subscale Reliability

Item	Study Cronbach α
Burnout (BO)	0.86
Secondary traumatic stress (STS)	0.81
Compassion satisfaction (CS)	0.93

through the chain-of-command. Regular feedback on job performance is received through quarterly counseling and annual performance evaluations. Other benefits active-duty personnel experience that may increase their job satisfaction, when compared with their civilian counterparts, include being salaried employees of the government, having little to no student loan debt, receiving comprehensive healthcare at no cost through the military healthcare system, and having the opportunity for career advancement through promotion.

As demonstrated by the DAG in Figure 3, numerous factors can contribute to the development of CF. Lack of self-care could not be observed or measured in the survey. Military occupational specialty was included in the multivariate linear regression analysis as a precision variable. The remaining variables were exposures of interest for the study (loneliness, the pain category of the study, animal species, euthanasia distress, military occupational specialty, and lack of self-care) and were hypothesized to affect CF (as measured by BO, STS, and CS).

The use of NHPs in research has been reported by individual researchers to contribute to strong moral struggles.[24] One group found that animal caregivers and veterinarians working in laboratories on University of California campuses reported not wanting to work with primates out of concern for managing their emotional involvement.[3] Conversely, a previous study conducted with laboratory animal medicine workers did not find a significant association between self-reported animal type worked with most and CF.[14] However, our study found working with NHPs (compared with those who had never worked with NHPs) was significantly associated with higher BO and STS. Although the observed association with CS was not significant ($P = 0.06$), results suggest working with NHPs may be associated with less CS. Differences in study outcomes related to animal species may be related to categorization criteria used by the authors (animal type worked with most compared with animal type worked with ever; mice/NHP/rats/farm/companion/other compared with NHP/other). This study provides evidence that this area may be of interest in further research studies. Different species of animals may invoke different levels of attachment from those who work with them, depending on how similar to humans the animal is perceived to be (that is ability of animal to express empathy, intelligence, etc.), or the experiences they have had with specific animals in the past, either at home

Table 5. Results of unadjusted linear regression analysis modeling associations between exposures of interest and burnout, secondary traumatic stress, and compassion satisfaction.

	Burnout			Secondary traumatic stress			Compassion satisfaction		
Exposure	β	95% CI	*P* value	β	95% CI	*P* value	β	95% CI	*P* value
Nonhuman Primates (vs other species)	4.0*	0.3-7.8	0.03	2.7*	-0.002, 5.4	0.05	-0.3	-4.0, 3.5	0.89
Category E studies (vs other)	1.7	-2.4, 5.8	0.44	1.5	-1.2, 4.2	0.27	0.4	-4.1, 5.0	0.85
Difficulty working with Primary Investigator	3.3	-0.2, 7.0	0.06	2.4	-0.9, 5.7	0.15	-3.7	-8.0, 0.6	0.09
Loneliness	0.5*	0.3, 0.6	<0.001	0.3*	0.1, 0.4	0.001	-0.4*	-0.6, -0.2	<0.001
Euthanasia Distress	0.6*	0.3, 0.9	<0.001	0.5*	0.2, 0.8	0.003	-0.6*	-1.0, -0.3	<0.001

β is the linear regression coefficient; it represents the difference in the outcome associated with a one-unit difference in the exposure.
*indicates statistical significance ($P \leq 0.05$).

Table 6. Results of adjusted linear regression analysis modeling associations between exposures of interest and burnout, secondary traumatic stress, and compassion satisfaction.

	Burnout			Secondary traumatic stress			Compassion satisfaction		
Exposure	β	95% CI	*P* value	β	95% CI	*P* value	β	95% CI	*P* value
Nonhuman Primates (vs other species)	7.8*	3.3, 12.3	0.001	4.6*	1.2, 8.0	0.01	-5.0	[a]10.1, -0.2	0.06
Category E studies (vs other)	4.1	-1.3, 9.5	0.15	3.1	[a]0.9, 7.1	0.13	-3.8	[a]9.4, 1.8	0.18
Difficulty working with Primary Investigator	3.8*	0.3, 7.3	0.03	2.5	[a]0.8, 5.9	0.14	-4.0*	[a]7.7, -0.4	0.03
Loneliness	0.4*	0.3, 0.6	<0.001	0.3*	0.1, 0.4	0.001	-0.4*	[a]0.5, -0.2	<0.001
Euthanasia Distress[a]	0.6*	0.2, 0.9	<0.001	0.5*	0.1, 0.8	0.007	-0.5*	[a]0.9, -0.2	0.006

β was adjusted for age, sex, time spent working with research animals, and military occupational specialty (technician compared with veterinarian).
[a]also adjusted for working with NHPs compared with other species.
*indicates statistical significance ($P \leq 0.05$).

or in the workplace.[24] This implies that working with NHPs should be considered in assessing workplace risks such as CF for employees in animal research environments. Future studies are indicated to determine associations of working with other species of interest (particularly cats, dogs) and prevalence of CF.

The associations of working with animals in Category E studies were not statistically significant; however, the linear regression coefficient in Table 5 suggests Category E studies may be associated with higher levels of BO and STS, and lower CS. The study population may have been too small to detect a statistically significant association for Category E studies and CF. In addition, most participants had worked with Category E Studies, leaving a small group for comparison. Future studies with more participants are necessary to gather more information on the significance of this association.

Individuals who reported difficulty working with primary investigators had statistically significant associations with increased BO as well as decreased CS. Results suggest that difficulty working with primary investigators may also be associated with increased STS. These results may be due to the different motivations of primary investigators and laboratory animal medicine personnel. According to one report, veterinarians and technicians enter the field due to their affinity for animals, while researchers are attracted by the science.[24] Primary investigators are primarily motivated to generate quality data, while animal care personnel are focused first on animal care and enrichment.[24] The recognition of these interactions as a stressor and its effect on CF indicates a need for additional training or other interventions. Training should focus on mitigating this stressor by fostering mutual understanding and improving communication between lab animal medicine personnel and primary investigators.

Higher loneliness scores were also significantly associated with higher BO and STS, as well as lower CS. Many risk factors affecting loneliness in active-duty personnel are unique to military populations, as the hierarchical structure and overall culture of the military differs dramatically from those of civilian life.[2] One study found platoon cohesion and support, relationship satisfaction with friends, and relationship satisfaction with platoon members were protective factors for loneliness of active-duty personnel.[2] Further studies to increase understanding of the risk factors contributing to loneliness specific to active-duty laboratory animal medicine personnel may indicate how to prevent both loneliness and resultant frequency of CF in the population. Meanwhile, leadership should consider increasing opportunities for camaraderie and team building in laboratory animal care personnel to combat loneliness.

Euthanasia distress levels were significantly associated with higher BO and STS and lower CS. Many studies report that veterinary personnel consider euthanasia to be a main cause of occupational stress.[1,16,19,23] Euthanasia of research animals may be a daily occurrence, but few studies have evaluated the emotional stress that euthanasia causes in those providing care for animals.[23] One group presented euthanasia distress as a key contributor to CF development in animal caregivers, yet also recognized the contributions of other common occupational stressors.[23] Understanding the connection of euthanasia distress with CF may help leaders and behavioral health personnel who interact with army veterinary personnel provide better emotional and psychologic support and more appropriate

resources to cope with this stressor. While our study aimed to examine the association of euthanasia distress with CF and CS, it did not explore the relationship of euthanasia frequency to CF and CS. Although one study did not find an association between euthanasia frequency and CF, more research is necessary to determine the factors that contribute to increased euthanasia distress, such as the species being euthanized and the individual's experience with euthanasia.[14]

Our study has several limitations. The survey population was small (n = 65), yet that number represents 45% of the target population (estimated to be approximately 150 personnel), and the demographics of the respondents are reasonably representative of US Army laboratory animal medicine veterinarians and animal care specialists working in animal research environments. At the same time, the results may not be representative of all US Army lab animal medicine personnel. Nonresponse bias may be present, as those who chose to participate in the study may be more or less unhappy working in research environments than were those who did not respond, which would cause the data to be skewed. Our study likewise uses on self-reported data, asking respondents to describe their experience while working in animal research environments within 5 y of survey administration; responses may therefore be subject to recall bias. Self-care, which was hypothesized in the DAG (Figure 3) to be associated with CF, could not be assessed in the survey. Quantitative methods alone were used to assess the impact of the exposures on CF; future studies could incorporate mixed-method studies to further evaluate how the population is impacted by CF through use of focus groups or individual interviews. Qualitative methods would be especially beneficial in determining the impact self-care has on CF.

Respondents who indicated moderate levels of BO, STS, and CS represent a proportion of the population that would benefit from improved processes. Interventions may be warranted to shift those who report moderate levels of BS, STS, and CS to reporting low BO and STS, and high CS. Understanding which specific factors affect BO, STS, and CS is important to developing appropriate initiatives to support wellbeing in the population.

Although the limitations of this study were recognized, the study nonetheless provides recognition of the prevalence of moderate levels of BO, STS, and CS in US Army active-duty veterinary personnel working in laboratory animal medicine, as well as the absence of high BO or high STS in the survey population. To our knowledge, ours is the second study performed to determine if CF, as measured by BO, STS and CS, is a concern in the laboratory animal medicine workplace and to assess exposure to occupational stressors that may be associated with high BO and STS and low CS. This is the first study to investigate the association of CF and CS with loneliness and difficulty in working with primary investigators. This knowledge helps guide the development of training and programs to reduce and prevent CF within the population. In addition, it identifies the need for more research to assess the amount and effects of CF in laboratory animal research environments.

Conclusion

The development of CF is multifactorial. Understanding the factors associated with higher levels of BO and STS, and lower levels of CS can support the creation of strategies to mitigate CF. This study evaluated the prevalence of CF and CS in active-duty veterinary personnel working in animal research. Although a majority of the population reported low levels of BO and STS and high levels of CS, some individuals reported moderate levels of BO, STS, and CS. Individuals reporting moderate levels of BO, STS, and CS reveal a proportion of the population that may benefit from intervention programs. None of the study participants reported high levels of BO or STS. Working with NHPs, difficulty working with primary investigators, loneliness, and euthanasia distress were determined to be associated with higher BO and STS, and/or lower CS. Additional research is indicated to determine the extent to which these factors influence development of CF in laboratory animal medicine personnel in order to further the development of intervention and support programs in animal research facilities.

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