The Influence of Messaging on Perceptions of Careers in Veterinary Medicine: Do Gender Stereotypes Matter?

Samantha L. Morello ■ Nicole Rogus-Pulia ■ Janet L. Branchaw ■ Markus Brauer ■ Jordan M. Schwakopf ■ Molly Carnes

ABSTRACT

The veterinary medical workforce is increasingly female; occupational feminization often transfers stereotypes associated with the predominant gender onto the profession. It is unknown whether within veterinary medicine a feminized public image is a possible contributor to the reduction in male applicants to training programs. The influence of stereotypically gendered messaging on how male and female undergraduate students perceive veterinary medicine was investigated in 482 undergraduate students enrolled in five introductory or second-level biology courses. Two short videos introducing the field of veterinary medicine were developed with imagery and language selected to emphasize either stereotypic feminine (*communal*) or masculine (*agentic*) aspects of the field. Participant groups were randomly assigned one of the two videos (feminine/communal or masculine/agentic) or no video (no exposure). An outcome survey elicited impressions of the field of veterinary medicine and gathered demographic data. There was a significant linear trend of condition on perception of the profession as feminine or masculine and on perception of the activities of a veterinarian as feminine/communal or masculine/agentic. Female participants were significantly more likely to agree that someone of their gender would be valued in the profession. Male participants reported significantly higher self-efficacy scores for performing the tasks of a veterinarian when they viewed the feminine stereotype video. These results demonstrate that gendered perceptions of the field can be manipulated. Intentional gendered messaging should be further explored as one strategy to broaden the talent pool in the workforce by attracting men back to the field.

Key words: veterinary education, gender, stereotypes, occupational segregation

INTRODUCTION

In 1903, when veterinary medicine was a practice centered around horses essential for work and for transport as well as agricultural livestock, the first woman graduated from a US veterinary medical college. Much had changed by the late 1980s, by which time veterinary medicine had become a profession predominantly providing care to household pets and the American Association of Veterinary Medical Colleges first reported a matriculation rate of over 50% women.[1] Since then, the proportion of women graduating from veterinary medical colleges and entering practice grew quickly. Twenty years later, in 2009, women outnumbered men in the profession at large, and today women make up over 80% of student bodies in US veterinary medical colleges.[2] The proportion of women has largely plateaued in recent years; concurrently, a proportionally greater number of men enrolled nationally as first-year veterinary students compared with those represented within the applicant pool, suggesting a possible mediating effect for the plateau.[3–5]

The term *occupational feminization* describes the process by which women make up an increasingly larger proportion of a workforce (female share) that was traditionally dominated by men.[6] The causes for such a shift are not necessarily clear, nor are they discrete. While in some instances there is a loss of men from the field allowing for increased entry of women, in others, a change occurs in the constructs of the profession—such as a drop in wages or the perception of physical, intellectual, or emotional requirements associated with the work being performed—that drives the demographic shift.[7,8] Too, societal factors such as government policies in the late 1960s and early 1970s targeting equal pay and sex discrimination, as well as rapid population growth and the need for a labor force expansion, led to a rapid influx of women in the workforce but facilitated an economic redistribution of women toward lower-ranking and lower-paying occupations and industries that may have contributed to professional segmentation.[9] More likely, multiple forces combined and worked reciprocally, facilitating and potentiating change in the veterinary workforce. While the emergence of women into a field historically dominated by men should be regarded as a sign of progress, evolution that results in a significant imbalance may not always be cause for celebration or evidence of gender equity.[6,10] Occupations or specialties in which women are overrepresented have been shown to pay less and are associated with lower status compared with occupations requiring similar skill and education level that are dominated by men.[6,7,10–14] In the case of veterinary medicine, feminization has occurred in parallel with a refocusing from production animals to pets, a stagnation in wages amid rising educational costs, and a general disparity in starting incomes compared with professionals entering other areas of science, technology, engineering, mathematics, or medicine (STEMM).[3,15] As is the case in many fields,[10,16] in our research, we have found that within veterinary medicine, women have lower salaries than men.[17,18] While veterinary professionals are unquestionably highly valued members of society, various methods of assessing occupational prestige have consistently ranked veterinary medicine lower than other medical or science professions that require the same or fewer years of education.[19,20]

Factors affecting the entry of women into STEMM where they have been traditionally underrepresented have been widely investigated.[21] Academic and cultural stereotypes, mentorship, role models, and the existence of implicit and explicit biases

have all been implicated as gatekeepers or barriers.[21] The use of gender-associated words and phrases has been shown to impact the proportion of women versus men applying for jobs,[22,23] and gender-stereotypic imagery has been correlated with occupational segregation as well as prestige.[24] Experimental interventions aimed at thwarting or neutralizing stereotypes have shown promise to help increase interest levels for enrollment of women into male-dominated programs such as computer science.[25] Myriad programs exist in academia and industry to support the recruitment and retention of women in STEMM, although few interventions have been tested with experimental designs in real-world settings.[21,26,27] Despite the compendium of research addressing the underrepresentation of women, limited work investigates the factors that deter men from entering a profession or, conversely, that might be effective in engaging them, and this topic has not been studied in veterinary medicine to date.[28,29]

While it is indeed a notable achievement for women to have overtaken a high-level professional field such as veterinary medicine, which requires graduate and often post-graduate training, the negative effects of occupational feminization may present a challenge for the profession as a whole. In light of the ongoing decline in the male share of the field, considering ways to achieve a more balanced labor force, including recognizing the potential influence that gender stereotypes might have in portrayals of veterinary medicine, holds value.

Social role theory, first developed in 1987 by Alice Eagly and published on extensively since, postulates that gender stereotypes derive from gendered occupations and social roles.[30,31] As a result, feminine stereotypes are strongly associated with communal behaviors (e.g., nurturing, supportive) while masculine stereotypes are strongly associated with agentic behaviors (i.e., involving human agency, e.g., assertive, independent). Occupational roles and gender stereotypes tend to be mutually reinforcing.[24,32,33] One's view of an occupation is informed by whom one sees in the occupation; therefore, as women come to occupy the vast occupational share of veterinarians, society may perceive veterinary medicine to require stereotypically feminine-gendered communal rather than masculine-gendered agentic traits. Gender schemas have been implicated in perceptions of competence, rewards structures, and the generation of biases in ways that serve to disadvantage women compared with men.[34] Given the lower value placed on women and the role of women in society as a whole,[35] this feminization of veterinary medicine threatens to lower the status of the entire profession.[6]

We conducted an experimental study to determine whether stereotypically gendered messaging, presented though visual imagery, keywords, and phrases, can influence whether undergraduate students perceive veterinary medicine as embodying features associated with stereotypically masculine or feminine careers. We further examined whether the use of masculine and feminine gender stereotypes in career messaging would alter how both male and female undergraduate students perceived the status and scientific nature of the field and whether the specific use of masculine stereotypes would increase career path interest among male students.

MATERIALS AND METHODS

Study Population

The University of Wisconsin—Madison Institutional Review Board determined that this study met criteria for exempt human subjects research in accordance with Category 2 as defined under 45 CFR 46. The study was conducted in 53 class sections across five introductory or second-level biology undergraduate courses. One course section was removed from analysis because the instructor attempted to guess the study purpose in front of participants during the outcome survey. All students were required to be at least 18 years of age to be included in analysis. Biology courses were selected for the likelihood that a high proportion of students would be interested in science and health care fields. Within each course, class sections were randomly assigned to one of six conditions: the first three were (a) veterinary medicine, feminine stereotype, (b) veterinary medicine, masculine stereotype, and (c) veterinary medicine, non-exposure. The remaining three conditions were created similarly regarding careers in speech-language pathology. Although carried out by the same study team and during the same time period, the experiments and the participants for speech-language pathology were discrete from those conducted for veterinary medicine; no class section or participant was exposed to both studies, and the outcome data for speech-language pathology are considered separately and reported elsewhere. No class section or individual could participate more than once. Data collection took place across 13 days between September 30 and November 22, 2019. A total of 955 eligible participants completed surveys, of which 482 participated in the veterinary medicine arm of the experiment (26 class sections).

Experimental Intervention and Outcome Assessment

We constructed two videos to serve as an introduction to the profession of veterinary medicine. Each video was approximately 2 minutes in length and consisted of a series of images with a voice-over narrative, designed to introduce the observer to a potential career as a veterinarian. In each iteration of the two videos, we selected images and language to be representative of either a feminine/communal or masculine/agentic stereotype. Tables 1 and 2 provide examples of gender-stereotypic language and imagery, respectively, utilized in the videos; full transcripts of the videos are provided in Appendix 1 and videos can be accessed at https://doi.org/10.3138/jvme-2020-0143 (online-only Appendices 1A and 1B). Language and imagery outlining traits representative of feminine/communal and masculine/agentic stereotypes were reviewed and approved by the research team, several of whom study stereotypes and gender bias (SM, MB, MC, NRP). The intent was to make the portrayal of veterinary medicine authentic while emphasizing through words and pictures the activities most strongly aligned with masculine and feminine stereotypes (rather than gender-neutral activities), including, simply, the depiction of more of men in the masculine stereotype video and more women in the feminine stereotype video. Prior to study initiation, five veterinarians who were not aware of the purpose of the study viewed the videos and confirmed the accuracy of the message conveyed in each video.

Research assistants from the study team arrived at classrooms 10 minutes before the class start time to help class instructors set up the video. At the start of class, students were informed that they were invited to be part of a research study investigating what students think about career paths in different fields of science offered at the University of Wisconsin—Madison, but specific study objectives were not revealed. Participants were asked to either watch a video and fill out a survey or only fill out a survey (non-exposure group). The research assistants informed all students that participation was voluntary, was anonymous, and would have no effect on any grade in that course or any other. Instructors then played the video at the beginning of the class period. Research assistants distributed written outcome

Table 1: Gender-stereotypic language utilized in either the feminine/communal or masculine/agentic stereotype video

Feminine/communal	Masculine/agentic
"Open doors to a variety of career choices"	"Open doors to a variety of cutting-edge career choices"
Information	Science
Fulfilling, care for others	Mentally and physically challenging
Help … animals get healthy	Use new technologies
Develop rewarding relationships	Perform innovative procedures
Pets are family members	Chance to perform surgeries
Giving support … is gratifying	Sports medicine; high-level athletes
Provide compassion	Solve puzzles [in] very sick patients
Collaborate with a team	High-level skills
Support and outreach to community	Lead teams
Shelters and rescues	Entrepreneurship
Teaching	Business owner, financially rewarding
Educate students, expand professional community	Educating future generations of veterinarians
Be part of research	High-level research careers, lead studies
[Leading to] healthier animals and communities	Make discoveries, develop medical technologies
Flexible and family-friendly work environment	

Quotes	
"I wanted to be a vet ever since I was a kid, and I just feel so lucky to have turned that dream into a reality. I can't think of anything better than taking care of animals, and their people, and doing it as my job." "A career in veterinary medicine has given me the space to learn and grow in so many ways. I'm becoming a better doctor and a better communicator every day. Sickness can be stressful, but it's so rewarding to be part of the cure."	"Being a vet has been a truly awesome career for me. It's really a work-hard, play-hard experience, where I get to make the connections between the science that I know, and the things that I can do." "One of the greatest things about being a vet is realizing how much of what we do impacts the world around us. It's not just about pets; it's about the health of animals that feed the population, and the research that gets done on animals before it gets conducted in people. We're an important part of so much that goes on."

Note: Phrases are paired where appropriate to highlight the dichotomous presentation of some stereotypical text. Certain expressions are paraphrased but meaning is preserved.

Table 2: Gender-stereotypic imagery utilized for either the feminine/communal or masculine/agentic stereotype video

Feminine/communal	Masculine/agentic
Women overrepresented (both genders present)	Men overrepresented (both genders present)
Subjects posing with baby animals	Equine/bovine/exotic species more strongly represented
Scrubs > white coats	Acts demonstrating physical strength
Individual holding dog with *volunteer* T-shirt	Orthopedic surgery, sports medicine
Female students around a table	Male teacher educating students
Team of men and women next to research poster	Laboratory imagery (microscopes, pipette) with single men present
Family portrait (parents, two children) sitting with dog	Male clinic owners

Headshots for quotes	
Women holding dogs (2)	Man holding dog Man standing next to dog

surveys with consent forms attached (online-only Appendix 2) once the video ended and at the start of the class period for the non-exposure group. Participants were given approximately 5 minutes, with more time allowed if needed, to complete the surveys before research assistants collected them and left the classroom.

We designed the outcome survey to elicit participants' impressions of the field of veterinary medicine using 7-point Likert scales and to gather demographic data. Questions were organized into the following topics: perception of the field as feminine or masculine (e.g., "How masculine/feminine do you think the field of veterinary medicine is?"), perception of the gendered nature of activities within the profession (e.g., "Veterinarians often think analytically" and "Veterinarians often help others"), social status of the profession (e.g., "Veterinarians enjoy a high social status"), scientific nature of the field (e.g., "For me, veterinary medicine is a scientific field"), self-profession overlap (e.g., "How similar are you to individuals who work in veterinary medicine?"), value of gender in the profession (e.g., "How much do you think someone with your gender will be

valued in the field of veterinary medicine?"), self-efficacy (e.g., "I would expect to do well in veterinary medicine classes"), level of interest in the profession (e.g., "How interested are you in acquiring more knowledge about career opportunities in veterinary medicine?"), and likelihood of pursuing a career in veterinary medicine (measured on a 0%–100% scale). Demographic data included age, gender, and race/ethnicity. No identifying information was requested.

Data Analysis
Data were manually entered and managed using an electronic data capture tool[a] hosted at the University of Wisconsin—Madison, School of Medicine and Public Health.[36] For the purpose of analysis, scores for the question "Having a career in veterinary medicine would be too challenging for me" were reversed to maintain a similar scale with other self-efficacy items (i.e., higher values mean higher self-efficacy). Scores for individual questions were combined to generate an average score for the subjective topics described above. All data were analyzed using statistical software[b] and p was set at < .05. To compare demographic data of the three groups (masculine stereotypic video, feminine stereotypic video, and no exposure), a Chi-square test of proportions was used to compare gender and race, and a one-way ANOVA was used to compare age. We conducted a series of 3 (condition: masculine stereotypic video vs. no video vs. feminine stereotypic video) × 2 (gender: male vs. female) ANOVAs. To test our focused hypotheses, we created two orthogonal contrasts for the condition factor, the linear trend for condition (−1, 0, 1; for masculine stereotypic video, no video, and feminine stereotypic video, respectively), and quadratic trend for condition (1, −2, 1; for masculine stereotypic video, no video, and feminine stereotypic video, respectively). Note that the latter contrast compares the no exposure control condition to the two video conditions. The three respondents who identified as gender-nonbinary or did not indicate their gender were excluded from the analyses due to small sample size.

RESULTS

Demographic Data
A total of 482 students participated in the study; 148 saw the feminine stereotype video, 189 saw the masculine stereotype video, and 145 saw no video. Demographic data for the overall population of the study and for each exposure group are provided in Table 3; 481 out of 482 participants provided information regarding their gender (317 female, 162 male, and 2 self-described); and 480 of 482 provided information about their race/ethnicity (359 white, 72 Asian/Asian American, 23 mixed ethnicity, 14 Hispanic/Latino/a, 8 Black/African American, 1 Native American/American Indian, and 3 self-described). There were no differences between groups for age, gender, or race ($p = .76$, $p = .54$, $p = .63$, respectively).

Perception of the Profession as Feminine or Masculine
A significant linear trend of condition (masculine stereotype video < no video < feminine stereotype video; Figure 1) demonstrates that participants who saw the feminine stereotype video perceived the profession as more feminine than participants who saw no video, and participants who saw no video perceived the profession as more feminine compared with participants who saw the masculine stereotype video: $F(1, 473) = 29.189$, $p < .001$. The effect was not moderated by participants' gender ($p = .462$). Neither the quadratic trend of condition (average of masculine and feminine video > no video) nor the quadratic trend by gender interaction was significant ($p = .982$ and $p = .528$, respectively). These results suggest that our manipulation of the gendered perception of veterinary medicine was highly effective for participants of all genders.

Table 3: Demographic data—gender, age, and race/ethnicity—for the overall study population and for each individual exposure group

Demographic category	Masculine/agentic stereotype	Feminine/communal stereotype	No exposure	Overall
	No. (%)			
Gender				
Male	70 (37)	41 (27.7)	51 (35.4)	162 (33.7)
Female	119 (63)	106 (71.6)	92 (63.9)	317 (65.9)
Self-describe	0 (0)	1 (0.7)	1 (0.7)	2 (0.4)
Race/ethnicity				
White/Caucasian	140 (74.1)	111 (75.5)	108 (75.0)	359 (74.8)
Hispanic/Latino/a	5 (2.6)	7 (4.8)	2 (1.4)	14 (2.9)
Black/African American	3 (1.6)	1 (0.7)	4 (2.8)	8 (1.7)
Asian/Asian American	31 (16.4)	18 (12.2)	23 (16.0)	72 (15)
Native American/American Indian	0 (0)	1 (0.7)	0 (0)	1 (0.2)
Pacific Islander/Native Hawaiian	0 (0)	0 (0)	0 (0)	0 (0)
Self-describe	0 (0)	2 (1.4)	1 (0.7)	3 (0.6)
Multiple	10 (5.3)	7 (4.8)	6 (4.1)	23 (4.8)
	M (SD)			
Age	19.4 (1.08)	19.4 (1.39)	19.4 (1.44)	19.4 (1.30)

Note: No significant differences were detected between groups for any variable.
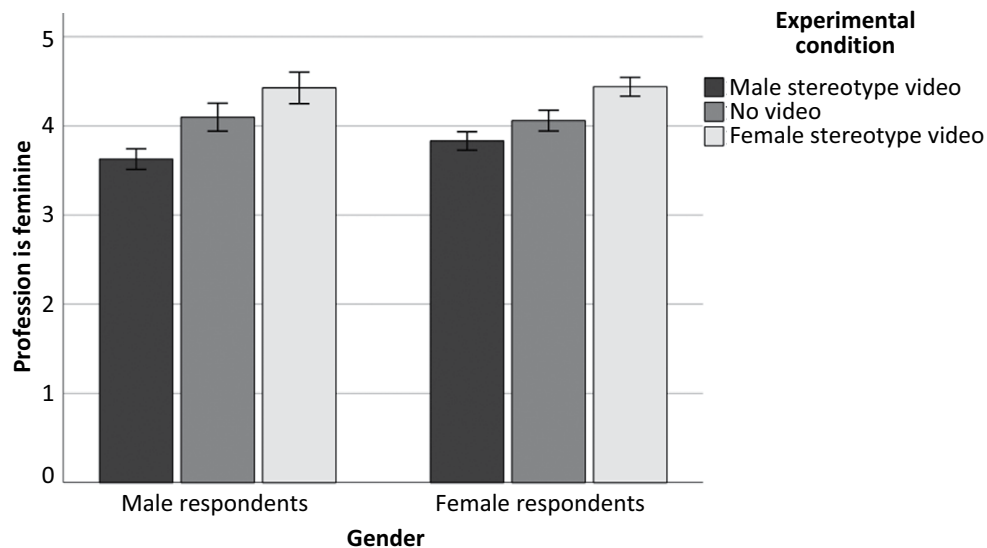
Figure 1: Bar graphs with standard error (*SE*) bars (+/−1 *SE*) where the *y* axis represents average participant response scores to questions soliciting subjective information regarding perception of the field as feminine or masculine, following exposure to a masculine stereotypic video (dark gray), feminine stereotypic video (cream), or no video (light gray)

Notes: Responses were based on a 7-point Likert scale where 1 corresponds to *very masculine*, 7 to *very feminine*, and 4 is neutral. Masculine participants and feminine participants are indicated separately on the *x* axis. There was a significant linear trend of condition (male stereotype video < no video < female stereotype video; *p* < .001) observed.
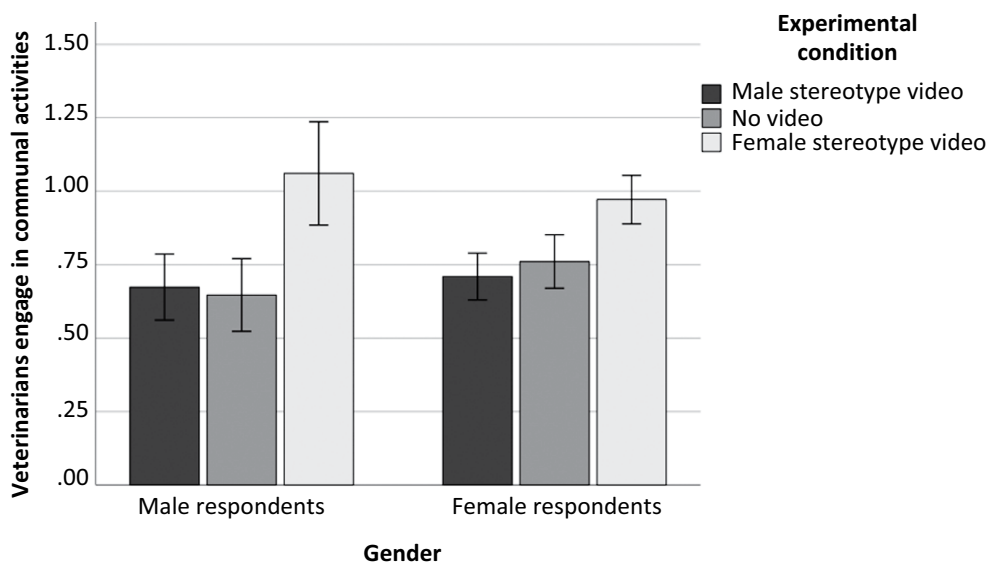
Figure 2: Bar graphs with standard error (*SE*) bars (+/−1 *SE*) where the *y* axis demonstrates a composite score reflecting the perceived gender stereotype of activities performed by veterinarians following exposure to a masculine stereotypic video (dark gray), feminine stereotypic video (cream), or no video (light gray)

Notes: All composite scores were greater than 0, demonstrating a higher level of agreement with feminine/communal qualities. Masculine participants and feminine participants are indicated separately on the *x* axis. There was a significant linear trend of condition (masculine stereotype video < no video < feminine stereotype video; *p* = .003) observed.

Activities of a Veterinarian Perceived as Feminine/Communal or Masculine/Agentic

We created a composite score by subtracting participants' levels of agreement with statements related to agentic activities (e.g., veterinarians have autonomy, veterinarians think analytically) from their level of agreement with statements related to communal activities (e.g., veterinarians help others, veterinarians work

in a team; see online-only Appendix 2). There was a significant linear trend of condition (masculine stereotype video < no video < feminine stereotype video; Figure 2), demonstrating that participants who saw the feminine stereotype video perceived activities pertaining to a career in veterinary medicine as more feminine than participants who saw no video, and participants who saw no video perceived the activities as more feminine than

participants who saw the masculine stereotype video: $F(1, 472)$ = 9.129, p = .003. This effect was not moderated by participant gender (p = .559). Neither the quadratic trend of condition nor the quadratic trend by gender interaction were significant (p = .115 and p = .462, respectively).

Social Status of the Profession
The linear trend of condition (masculine stereotype video > no video > feminine stereotype video) was in the predicted direction but not statistically significant: $F(1, 472)$ = 2.189, p = .140. This effect is not moderated by gender (p = .861). Interestingly, there was a significant quadratic trend (average of masculine and feminine video > no video): participants who saw a video (regardless of whether it demonstrated the masculine or feminine stereotype) perceived the profession to have a higher status than participants who saw no video: $F(1, 472)$ = 4.699, p = .031. The quadratic trend by gender interaction was not significant (p = .248). The average outcome scores measuring social status were close to the neutral value of 4 (scale 1–7) for all three groups (masculine stereotype video: 4.84; feminine stereotype video: 4.65; no exposure: 4.47).

Field Is Scientific
The linear trend of condition (male stereotype video > no video > female stereotype video) was in the predicted direction but not statistically significant: $F(1, 473)$ = 1.943, p = .164. This effect is not moderated by participant gender (p = .242). Neither the quadratic trend of condition nor the quadratic trend by gender interaction was significant (p = .214 and p = .793, respectively).

Self-Profession Overlap
We theoretically expected a linear trend of condition by gender interaction. For male participants, we predicted the masculine stereotypic video to produce the highest overlap (e.g., highest perception of similarity to others in the profession) and the feminine stereotypic video to produce the lowest overlap, whereas we predicted the opposite pattern for female participants. This

predicted linear trend of condition by gender interaction was not statistically significant: $F(1, 473)$ = 0.000, p = .994. Interestingly, there was a marginally significant quadratic trend: participants of both genders reported greater self-profession overlap when they saw a video (regardless of whether it was the masculine or feminine stereotypic video) than when they saw no video: $F(1, 473)$ = 3.266, p = .071. Neither the linear trend of condition nor the interaction between the quadratic trend and gender were significant (p = .902 and p = .492, respectively).

Value in the Field Based on Gender
For the concept that a particular gender would be valued in the field, as with self-profession overlap, we expected a linear trend of condition by gender interaction. This predicted interaction was not statistically significant: $F(1, 473)$ = .033, p = .855. There was a main effect of gender—that is, female participants were significantly more likely than male participants to agree that someone of their gender would be valued in the profession: $F(1, 473)$ = 17.943, p < .001 (Figure 3). No other effects were statistically significant (p > .076).

Self-Efficacy
There was a significant linear trend of condition by gender interaction in the opposite direction of what was expected: $F(1, 473)$ = 6.621, p = .010 (Figure 4); male participants reported higher levels of self-efficacy for their ability to succeed in the field of veterinary medicine after viewing the feminine stereotype video. The quadratic trend by gender interaction was nonsignificant (p = .238). The linear trend was also significant: $F(1, 473)$ = 8.111, p = .005. Students overall reported greater self-efficacy after seeing the feminine stereotype video than after seeing the masculine stereotype video or not seeing a video at all, but this effect was entirely driven by male participants.

Interest in Profession
The only significant effect was the quadratic trend of condition: participants reported greater interest in veterinary medicine after
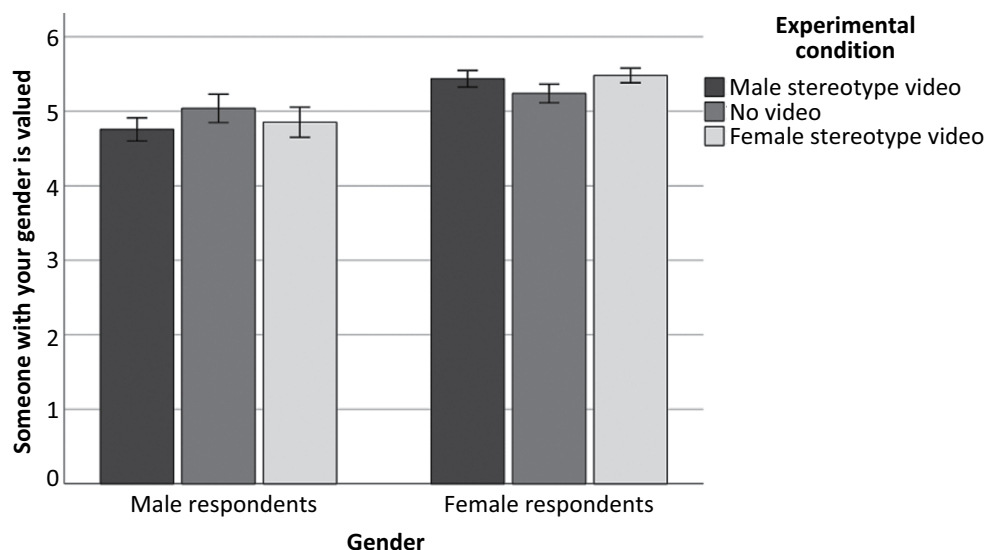

Figure 3: Bar graphs with standard error (*SE*) bars (+/−1 *SE*) where the *y* axis represents average participant response scores reflecting the perception of whether someone of their own gender would be valued in the field of veterinary medicine, following exposure to a masculine stereotypic video (dark gray), feminine stereotypic video (cream), or no video (light gray)

Notes: Masculine participants and feminine participants are indicated separately on the *x* axis. Feminine participants were significantly more likely than male participants to agree that their gender would be valued in the profession (*p* < .001).
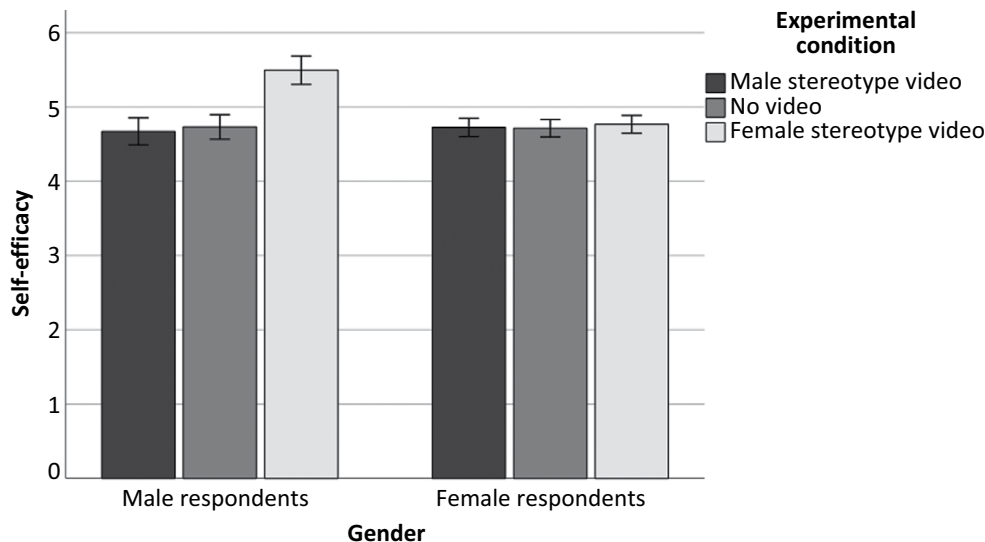
Figure 4: Bar graphs with standard error (*SE*) bars (+/−1 *SE*) where the *y* axis represents average participant response scores to questions surrounding self-efficacy, following exposure to a masculine stereotypic video (dark gray), feminine stereotypic video (cream), or no video (light gray)

Notes: Masculine participants and feminine participants are indicated separately on the *x* axis. There was a significant linear trend of condition by gender interaction (*p* = .010), where men who viewed the feminine stereotype video demonstrated higher levels of self-efficacy.

seeing any video, regardless of the stereotypical nature of the video, compared with when they saw no video: $F(1, 473) = 8.948$, $p = .003$. This effect was not moderated by participant gender ($p = .260$). Neither the linear trend of condition nor the linear trend by gender interaction were statistically significant ($p = .394$, $p = .640$, respectively). There was no main effect of gender: female participants were as interested as male participants in veterinary medicine: $F(1, 473) = 1.774$, $p = .184$. These results should be interpreted with caution since the outcome variable is skewed; the average agreement levels for interest in the field were low for all three groups (masculine stereotype video: 2.56; feminine stereotype video: 2.39; no exposure: 1.94).

Likelihood of Pursuing a Career in the Field
The quadratic trend of condition was statistically significant: participants reported greater likelihood of pursuing a career in veterinary medicine after seeing a video, regardless of the stereotypical nature of the video, compared with when they saw no video: $F(1, 462) = 5.813$, $p = .016$. This effect was not moderated by gender ($p = .361$). Neither the linear trend nor the linear trend by gender interaction were statistically significant ($p = .619$ and $p = .994$, respectively). There was a main effect of gender: female participants reported greater likelihood of pursuing a career in veterinary medicine than male students overall: $F(1, 462) = 6.940$, $p = .009$. Again, these results should be interpreted with caution since the outcome variable is skewed, owing to the very low average likelihood of pursuing veterinary medicine reported among all groups (masculine stereotype video: 12.8%; feminine stereotype video: 12.1%; no exposure: 6.9%).

DISCUSSION
We found that selectively emphasizing stereotypically masculine- or feminine-gendered aspects of veterinary medicine in imagery and narratives effectively shaped undergraduate biology students' perceptions of the field. We were able to manipulate students' opinions on the feminine or masculine nature of the profession and its activities and alter the way in which male

and female students perceived the social status of a career in veterinary medicine. Although we were unsuccessful in using stereotypes to elevate the perceived scientific value of the field or in influencing career path interest among male participants, our success in changing the gendered perception of veterinary medicine suggests that this strategy should be further investigated as a potential way of encouraging more men to consider a career in the increasingly feminized field of veterinary medicine.

Gender bias has been demonstrated in word embeddings globally from Google News,[37] to job advertisements,[22,23] to National Institutes of Health (NIH) application critiques[38] and have even guided how computer software programs have been trained to associate women with images that depict actions such as cooking, shopping, and washing.[39] As background for performing this study, we conducted simple Google image searches for the terms *veterinary*, *veterinary medicine*, and *veterinarian*. The gender presentation of the individual photographed, the agency and autonomy demonstrated by the veterinarian, the clothing worn (i.e., scrubs vs. white lab coat), and the overall content depicted in those images were much more reflective of the images portrayed in our feminine stereotypic video than our masculine stereotypic video. These images were often in stark contrast to those observed when we searched terms such as *physician*, *doctor*, *orthopedic surgeon*, or *scientist*, which were generally more reflective of the images in our masculine stereotypic video. Given how easily we were able to manipulate the gendered view of veterinary medicine, it is highly likely that the current way in which veterinary medicine is presented through images, phrases, and real-life experiences with a predominately female workforce has established the field as feminine in the public eye. This is consistent with our finding that the controls exposed to no video perceived that veterinarians perform activities more strongly associated with communal, or stereotypically feminine, behaviors over agentic, or stereotypically masculine, behaviors. Gender identity is established early, and stereotypic masculine and feminine norms are continually reinforced, internalized, and found to influence career interest.[40,41] While both men and

women may suffer social penalties for violating these gender norms, it may be particularly problematic that veterinary medicine is increasingly messaged as a feminine/communal field as the censure against men's communal behavior is even greater than that against women's agentic behavior.[42,43]

Even without social censure, the current feminized view of the veterinary field—while fostering women's career aspirations—may be sending the unintended message to men that they do not fit in the field. If this is occurring, it may contribute to the drop in male applicants to training programs.[44] Converse arguments have been made about how the lack of emphasis on communal goals in mathematics, computer science, and engineering may discourage women from pursuing careers in these fields and how emphasizing the ability of these fields to achieve stereotypically feminine-gendered communal goals can attract more women into these fields.[21,25,45,46] To our knowledge, no previous study has attempted to change the perception of an occupation with a predominantly feminine share to be more stereotypically masculine/agentic by manipulating gendered messaging. Our study shows that it is possible to do so.

Male participants reported significantly increased self-efficacy scores after viewing the feminine stereotypic video. Self-efficacy refers to an individual's belief about how well they might be able to execute a necessary set of tasks within a proposed situation and is an important predictor of career interest among undergraduates.[47] Because work performed by women is valued lower than work performed by men,[12] and because feminine stereotypes create implicitly lower performance standards (e.g., "great for a girl"),[48] male participants may have felt that succeeding in a feminine-gendered occupation would be easy.

Our attempts at gendered messaging did not affect how participants viewed the social status of veterinary medicine; however, both scores in the control group and post-exposure to either video were close to a neutral answer (4.4–4.8 on a 1–7 scale). Through their interactions with veterinarians or through the public image of veterinary medicine, the students may already have formed an opinion of the status of veterinary medicine, which is generally viewed as less prestigious than other medical or scientific fields.[15,20] The social status of a profession may be linked to how it is valued by society not just holistically but also economically. Occupational gender segregation can be linked to income discrepancies across all segments of the US workforce[49] and even among specialty areas in human medicine.[6] Too, the effects of an occupation becoming more feminine have been shown to drive down average earnings within the profession.[7] As veterinary medicine becomes feminized, with a predominantly female workforce engaged in communal activities, it risks suffering this same fate. It is imperative that the gender bias that disadvantages individual women and entire fields be addressed.[26] More bachelor's degrees in biology are conferred upon women than upon men annually in the United States.[50] Even within our study population, more undergraduate biology students were women (66%), suggesting that the biological sciences as a whole may already attract women more readily than men, creating a particularly difficult environment for a balanced matriculation into veterinary programs. However, the multiple benefits to veterinary medicine of attracting male applicants cannot be ignored. We have demonstrated that intentionally emphasizing the masculine stereotypic/agentic aspects in portrayal of the field holds promise.

Our study has limitations. The videos were created to be highly stereotypical, likely surpassing the gendered nature of most messaging that occurs in real life. However, this was a critical element in determining whether stereotypical messaging can be used as an intervention, and veterinary professionals who prescreened the videos, without knowledge of our study objectives, viewed them as authentic portrayals of aspects of a career in veterinary medicine. The low level of career interest observed among our participants and our inability to affect their interest or likelihood of pursuing the career path to any relevant degree may reflect the need to influence beliefs about the profession earlier, and perhaps with greater frequency. Future research may be directed at accessing and/or influencing an earlier population, such as high school or even elementary school students. Studying this cohort may help demonstrate whether gender stereotypes about the profession are formed at a younger age and if they may be similarly influenced by images and narratives. Our participants were predominantly white, and we did not address representation of diverse racial and ethnic groups in our imagery and narrative. Only a small ($n = 2$) number of participants self-described their gender identity, and we did not solicit information on sexual orientation; therefore, it is also impossible to determine the interaction between a gender identity or sexual preference and the gender stereotypes presented. However, our success in manipulating the gendered view of the field bodes well for future research in this area.

It is unclear whether emphasizing masculine/agentic aspects of veterinary medicine in messaging would effectively recruit more men to the profession. However, our results show that messaging can influence how the veterinary medicine field is viewed. This research should make leaders in the field take note and stimulate further investigation into how messaging of veterinary medicine could be used to broaden its appeal to all potential talent.

NOTES
a REDCap (Research Electronic Data Capture) is a secure web-based application designed to support data capture for research studies, providing (a) an intuitive interface for validated data entry; (b) audit trails for tracking data manipulation and export procedures; (c) automated export procedures for seamless data downloads to common statistical packages; and (d) procedures for importing data from external sources.[36]

b IBM SPSS Statistics for Windows v. 26; IBM Corp., Armonk, NY, USA.

REFERENCES
1 McPheron T. 2007 is DVM Year of the Woman: history of female veterinarians paved with individual struggles and triumphs

[Internet]. Schaumburg (IL): American Veterinary Medical Association; 2007 Jun 1 [cited 2021 Apr 28]. Available from: https://www.avma.org/javma-news/2007-06-15/2007-dvm-year-woman.

2 Loyle D. Bridging the gender gap in veterinary medicine. DVM 360 [Internet]. 2015 Apr 29 [cited 2021 Apr 28]. Available from: https://www.dvm360.com/view/bridging-gender-gap-veterinary-medicine.

3 Association of American Veterinary Medical Colleges (AAVMC). Annual data report 2017–2018: a report of the Association of American Veterinary Medical Colleges [Internet]. Washington (DC): AAVMC; 2018 [cited 2021 Apr 28]. Available from: https://www.aavmc.org/assets/Site_18/files/Data/2017-2018%20AAVMC%20Annual%20Data%20Report%20(ID%20100161).pdf.

4 Association of American Veterinary Medical Colleges (AAVMC). Annual data report 2018–2019: a report of the Association of American Veterinary Medical Colleges [Internet]. Washington (DC): AAVMC; 2019 [cited 2021 Apr 28]. Available from: https://www.aavmc.org/assets/Site_18/files/Data/2018-19%20AAVMC%20PDR%20(ID%20104197).pdf.

5 Association of American Veterinary Medical Colleges (AAVMC). Annual report data 2019–2020: a report of the Association of American Veterinary Medical Colleges [Internet]. Washington (DC): AAVMC; 2020 [cited 2021 Apr 28]. Available from: https://www.aavmc.org/assets/Site_18/files/Data/2019%20AAVMC%20Annual%20Data%20Report%20(ID%20100175).pdf.

6 Pelley E, Carnes M. When a specialty becomes "women's work": trends in and implications of specialty gender segregation in medicine. Acad Med. 2020;95(10):1499–506. https://doi.org/10.1097/ACM.0000000000003555. Medline:32590470

7 Levanon A, England P, Allison P. Occupational feminization and pay: assessing causal dynamics using 1950–2000 US census data. Soc Forces. 2009;88(2):865–91. https://doi.org/10.1353/sof.0.0264.

8 Pan J. Gender segregation in occupations: the role of tipping and social interactions. J Labor Econ. 2015;33(2). https://doi.org/10.1086/678518.

9 Bayard K, Hellerstein J, Neumark D, et al. New evidence on sex segregation and sex differences in wages from matched employee-employer data. J Labor Econ. 2003;21:887–922. https://doi.org/10.1086/377026.

10 Bolton S, Muzio D. The paradoxical processes of feminization in the professions: the case of established, aspiring and semi-professions. Work Employ Soc. 2008;22:281–99. https://doi.org/10.1177/0950017008089105.

11 Rogus-Pulia N, Humbert I, Kolehmainen C, et al. How gender stereotypes may limit female faculty advancement in communication sciences and disorders. Am J Speech Lang Pathol. 2018;27:1598–611. https://doi.org/10.1044/2018_AJSLP-17-0140. Medline:30383189

12 Alksnis C, Desmarais S, Curtis J. Workforce segregation and the gender wage gap: is "women's" work valued as highly as "men's"? J Appl Soc Psychol. 2008;38:1416–41. https://doi.org/10.1111/j.1559-1816.2008.00354.x.

13 Bolton SC, Muzio D. Can't live with 'em; can't live without 'em: gendered segmentation in the legal profession. Sociology. 2007;41:47–64. https://doi.org/10.1177/0038038507072283.

14 Goldin C. A grand gender convergence: its last chapter. Am Econ Rev. 2014;104:1091–19. https://doi.org/10.1257/aer.104.4.1091.

15 Torpey E. Employment outlook for graduate-level occupations [Internet]. Washington (DC): Career Outlook, US Bureau of Labor Statistics, August 2018 [cited 2021 Apr 21]. Available from: https://www.bls.gov/careeroutlook/2018/article/pdf/graduate-degree-outlook.pdf.

16 Butkus R, Moyer DV, Bornstein SS, Thomas Hingle S. Achieving gender equity in physician compensation and career advancement. Ann Intern Med. 2018;168:721–23. https://doi.org/10.7326/M17-3438. Medline:29710100

17 Morello SL, Colopy SA, Chun R, et al. Work, life, and the gender effect: perspectives of ACVIM diplomates in 2017. Part 2—the intersection of personal life and professional career. J Vet Intern Med. 2020;34(5):1837–44. https://doi.org/10.1111/jvim.15873. Medline:32813306

18 Morello SL, Colopy SA, Bruckner K, et al. Demographics, measures of professional achievement, and gender differences for diplomates of the American College of Veterinary Surgeons in 2015. J Am Vet Med Assoc. 2019;255:1270–82. https://doi.org/10.2460/javma.255.11.1270. Medline:31730429

19 Davis JA, Smith TW, Hodge RW, et al. Colorado adoption project: resources for researchers [Internet]. Chicago (IL): National Opinion Research Center (NORC); 1989 [cited 2021 Apr 28]. Available from: http://ibgwww.colorado.edu/~agross/NNSD/prestige%20scores.html.

20 McCarthy N. America's most prestigious professions in 2016 [Internet]. Forbes. 2016 Mar 31 [cited 2021 Apr 28]. Available from: https://www.forbes.com/sites/niallmccarthy/2016/03/31/americas-most-prestigious-professions-in-2016-infographic/#3caecbeb1926.

21 National Academies of Sciences, Engineering, and Medicine. Promising practices for addressing the underrepresentation of women in science, engineering, and medicine: opening doors. Washington (DC): National Academies Press; 2020.

22 Born MP, Taris TW. The impact of the wording of employment advertisements on students' inclination to apply for a job. J Soc Psychol. 2010;150:485–502. https://doi.org/10.1080/00224540903365422. Medline:21058576

23 Gaucher D, Friesen J, Kay AC. Evidence that gendered wording in job advertisements exists and sustains gender inequality. J Pers Soc Psychol. 2011;101:109–28. https://doi.org/10.1037/a0022530. Medline:21381851

24 Cejka MA, Eagly AH. Gender stereotypic images of occupations correspond to the sex segregation of employment. Pers Soc Psychol Bull. 1999;4:413–23. https://doi.org/10.1177/0146167299025004002.

25 Cheryan S, Plaut VC, Davies PG, et al. Ambient belonging: how stereotypical cues impact gender participation in computer science. J Pers Soc Psychol. 2009;97:1045–60. https://doi.org/10.1037/a0016239. Medline:19968418

26 Carnes M, Devine PG, Baier Manwell L, et al. The effect of an intervention to break the gender bias habit for faculty at one institution: a cluster randomized, controlled trial. Acad Med. 2015;90:221–30. https://doi.org/10.1097/ACM.0000000000000552. Medline:25374039

27 Moss-Racusin CA, van der Toorn J, Dovidio JF, et al. Scientific diversity interventions. Science. 2014;343:615–16. https://doi.org/10.1126/science.1245936. Medline:24503840

28 Gavine A, Carson M, Eccles J, et al. Barriers and facilitators to recruiting and retaining men on pre-registration nursing programmes in Western countries: a systemised rapid review. Nurs Educ Today. 2020;88:104368. https://doi.org/10.1016/j.nedt.2020.104368. Medline:32092602

29 MacWilliams BR, Schmidt B, Bleich MR. Men in nursing. Am J Nurs. 2013;113:38–44. https://doi.org/10.1097/01.NAJ.0000425746.83731.16. Medline:23247678

30 Eagly AH. Gender differences in social behavior: a social-role interpretation. London: Psychology Press; 1987.

31 Eagly AH, Wood W. Social role theory. In: Handbook of theories of social psychology. Vol. 2. Thousand Oaks (CA): Sage Publications Ltd.; 2012. p. 458–76.

32 Haines EL, Deaux K, Lofaro N. The times they are a-changing … or are they not? A comparison of gender stereotypes, 1983–2014. Psychol Women Quart. 2016;40:353–63. https://doi.org/10.1177/0361684316634081.

33 Glick P, Zion C, Nelson C. What mediates sex discrimination in hiring decisions? J Pers Soc Psychol. 1988;55:178–86. https://doi.org/10.1037/0022-3514.55.2.178.

34 Valian V. The cognitive bases of gender bias Brooklyn Law Rev [Internet]. 1999 [cited 2021 Apr 28];65:1037–62. Available from: https://brooklynworks.brooklaw.edu/blr/vol65/iss4/3.

35 Ridgeway CL. Gender, status, and leadership. J Soc Issues. 2001;57:637–55. https://doi.org/10.1111/0022-4537.00233.

36 Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42:377–81. https://doi.org/10.1016/j.jbi.2008.08.010. Medline:18929686

37 Bolubasi T, Chang K-W, Zou J, et al. Man is to computer programmer as woman is to homemaker? Debiasing word embeddings. arXiv [Internet]. 2016 Jul 21 [cited 2021 Apr 28]. Available from: https://arxiv.org/abs/1607.06520.

38 Kaatz A, Magua W, Zimmerman DR, et al. A quantitative linguistic analysis of National Institutes of Health R01 application critiques from investigators at one institution. Acad Med. 2015;90:69–75. https://doi.org/10.1097/ACM.0000000000000442. Medline:25140529

39 Zhao J, Wang T, Yatskar M, et al. Men also like shopping: reducing gender bias amplification using corpus-level constraints. arXiv [Internet]. 2017 Jul 29 [cited 2021 Apr 28]. Available from: https://arxiv.org/abs/1707.09457.

40 Tellhed U, Bäckström M, Björklund F. The role of ability beliefs and agentic vs. communal career goals in adolescents' first educational choice. What explains the degree of gender-balance? J Vocat Behav. 2018;104:1–13. https://doi.org/10.1016/j.jvb.2017.09.008.

41 Stout JG, Grunberg VA, Ito TA. Gender roles and stereotypes about science careers help explain women and men's science pursuits. Sex Roles. 2016;75:490–99. https://doi.org/10.1007/s11199-016-0647-5.

42 Block K, Croft A, Schmader T. Worth less? Why men (and women) devalue care-oriented careers. Front Psychol. 2018;9:1353. https://doi.org/10.3389/fpsyg.2018.01353. Medline:30147665

43 Croft A, Schmader T, Block K. An underexamined inequality: cultural and psychological barriers to men's engagement with communal roles. Pers Soc Psychol Rev. 2015;19:343–70. https://doi.org/10.1177/1088868314564789. Medline:25576312

44 Brown ER, Diekman AB. What will I be? Exploring gender differences in near and distant possible selves. Sex Roles. 2010;63:568–79. https://doi.org/10.1007/s11199-010-9827-x.

45 Diekman AB, Steinberg M, Brown ER, et al. A goal congruity model of role entry, engagement, and exit: understanding communal goal processes in STEM gender gaps. Pers Soc Psychol Rev. 2017;21:142–75. https://doi.org/10.1177/1088868316642141. Medline:27052431

46 Clark EK, Fuesting MA, Diekman AB. Enhancing interest in science: exemplars as cues to communal affordances of science. J Applied Soc Psychol. 2016;46:641–54. https://doi.org/10.1111/jasp.12392.

47 Betz NE, Voyten KK. Efficacy and outcome expectations influence career exploration and decidedness. Career Dev Q. 1997;46(2):179–89. https://doi.org/10.1002/j.2161-0045.1997.tb01004.x.

48 Biernat M, Vescio TK. She swings, she hits, she's great, she's benched: implications of gender-based shifting standards for judgment and behavior. Pers Soc Psychol Bull. 2002;28:66–77. https://doi.org/10.1177/0146167202281006.

49 Washington Center for Equitable Growth. Occupational segregation in the United States [Internet]. Washington (DC): Washington Center for Equitable Growth; 2017 Sept [cited 2021 Apr 28]. Available from: https://equitablegrowth.org/wp-content/uploads/2017/09/092717-occupational-seg.pdf.

50 National Center for Education Statistics (NCES). Digest of education statistics table 325.20 [Internet]. Washington (DC): Institute of Education Sciences NCES; 2019 [cited 2021 May 7]. Available from: https://nces.ed.gov/programs/digest/d19/tables/dt19_325.20.asp.

AUTHOR INFORMATION

Samantha L. Morello, DVM, Diplomate ACVS-LA is a Consultant with Morello Veterinary Insights LLC and a Courtesy Associate Clinical Professor with the Center for Veterinary Business and Entrepreneurship in the Department of Clinical Sciences at Cornell University. Email: vetsam@gmail.com. Interests include musculoskeletal disease, gender diversity, work–life intersection, career trajectories, and the wage gap in veterinary medicine.

Nicole Rogus-Pulia, PhD, CCC-SLP, is Assistant Professor, Departments of Medicine and Surgery, School of Medicine and Public Health; Department of Communication Sciences and Disorders, University of Wisconsin—Madison; and Geriatric Research Education and Clinical Center (GRECC), William S. Middleton Memorial Veterans Hospital, Madison WI 53706 USA. Email: npulia@wisc.edu. Interests include improving diagnosis and treatment of dysphagia (swallowing dysfunction) in older adults, translating research in the field of dysphagia to clinical practice, and diversifying clinicians and researchers in the field of speech-language pathology.

Janet L. Branchaw, PhD, is Assistant Professor, Department of Kinesiology, School of Education, University of Wisconsin—Madison, 1300 University Ave., Madison, WI 53706 USA. Email: branchaw@wisc.edu. Interests include interventions to support undergraduate and graduate STEMM research trainee development; interventions to support 2- to 4-year STEMM transfer student transitions; and undergraduate biology teaching, learning, and assessment.

Markus Brauer, PhD, is Professor of Social Psychology, Department of Psychology, and Wisconsin School of Business, University of Wisconsin—Madison, Madison WI 53706 USA. Email: markus.brauer@wisc.edu. Interests include prejudice, discrimination, and interventions to promote diversity and inclusion.

Jordan M. Schwakopf, is Customer Service Data Specialist, NeuGen LLC., Madison, WI 53713 USA. Her research interests include motivating behavior change and improving data collection and reporting practices.

Molly Carnes, MD, MS, is Professor, Department of Medicine, School of Medicine, and Public Health and Department of Industrial and Systems Engineering, College of Engineering, University of Wisconsin—Madison, Madison, WI 53706 USA. Email: mlcarnes@cwhr.wisc.edu. Interests include diversifying the scientific and medical workforce and how stereotypes can unintentionally perpetuate inequities.

APPENDIX 1: TRANSCRIBED VIDEO NARRATIVES

FEMININE/COMMUNAL NARRATIVE

As an undergraduate student here at the University of Wisconsin—Madison, you're receiving a world-class education that will open doors to a variety of career choices for you. This short video will help introduce you to the graduate program in veterinary medicine, so you can see what a professional career as a veterinarian looks like.

As a veterinarian, you'll be able to use the information you've learned in the classroom in a profession that's fulfilling and allows you to care for others.

You'll get to help many different kinds of different animals get healthy.

You'll get to develop relationships with their owners, which can be rewarding.

For many of us, pets are family members, and giving support during illness and recovery can be so gratifying.

You'll get to collaborate with a great team of people, providing compassionate care to all of your animals.

You'll get the chance to provide support and outreach to the local community, through nonprofit organizations like shelters and rescues.

If you've got an interest in teaching, you can play a role in educating students and young veterinarians, which is a great way to expand your professional community.

There are also opportunities to be a part of research that can lead to healthier animals and communities.

The work environment in veterinary medicine is flexible and family-friendly, providing balance between a happy personal and professional life.

Here are a few examples from some graduates from the UW Veterinary Medicine program:

> "I wanted to be a vet ever since I was a kid, and I just feel so lucky to have turned that dream into a reality. I can't think of anything better than taking care of animals, and their people, and getting to do it as my job."

> "A career in veterinary medicine has given me the space to learn and grow in so many ways. I'm becoming a better doctor and a better communicator every day. Sickness can be stressful, but it's so rewarding to be part of the cure."

MASCULINE/AGENTIC NARRATIVE

As an undergraduate student here at the University of Wisconsin—Madison, you're receiving a world-class education that will open doors to a variety of cutting-edge career choices in the sciences. This short video will introduce you to the graduate program for a Doctorate of Veterinary Medicine, so you can see what a professional career as a veterinarian looks like.

As a veterinarian, you'll be able to use the science that you've learned in the classroom in a profession that is mentally and physically challenging.

You'll get to use new technologies and perform innovative procedures to treat patients with complicated problems.

You'll have the chance to perform surgeries on lots of different species of patients.

You may develop an interest in sports medicine and have the chance to practice on some very high-level athletes.

You'll have to solve puzzles by figuring out how the symptoms of very sick patients fit together to cause disease.

You'll use high-level skills to lead teams of people who provide care on the front lines.

If you have an interest in research, there are also tons of opportunities to pursue some very high-level careers, where you can lead your own studies to make discoveries and develop medical technologies in areas like bioengineering or pharmaceuticals.

On the other hand, if you've got an entrepreneurial interest, you can become a business owner and build your own practice. It can be financially rewarding and offers lots of independence.

There are also opportunities for educating future generations of veterinarians.

Here are a few examples of statements from some graduates from the UW Veterinary Medicine program:

> "Being a vet has been a truly awesome career for me. It's really a work-hard, play-hard experience, where I get to make the connections between the science that I know and the things that I can do."

> "One of the greatest things about being a vet is realizing how much of what we do impacts the world around us. It's not just about pets; it's about the health of animals that feed the population, and the research that gets done on animals before it gets conducted on people. We're an important part of so much that goes on."