

Assessing Student Attitudes on Farm Animal Welfare at a Veterinary College

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Abstract

In the U.S., controversy over the way in which food animals are raised and treated has led to increasing scrutiny of current techniques both in scientific and policy circles. As important stakeholders in animal welfare, the AVMA states that “veterinarians... have an opportunity and an obligation to help animal owners, caretakers, handlers, and policy makers protect and improve animals' welfare.”[1] This study was conducted to investigate veterinary student attitudes and perceptions regarding farm animal welfare. Veterinary students at Tufts Cummings School of Veterinary Medicine were surveyed online in the spring of 2014 about their attitudes toward farm animal welfare in five agricultural industries, the welfare implications of common procedures and conditions in those industries, as well as several factors relating to farm animal welfare. Fifty-three percent of students surveyed responded. Nonparametric statistics were used to analyze results. Demographically, most respondents were female, focusing on small animal

medicine, and with minimal past experience with farm animals. Students showed greatest overall concern for the welfare of animals in the poultry, egg, and swine industries. Students focusing on large animal medicine were most concerned about welfare in those industries as compared to those focusing on small or mixed animal medicine. Discrepancies in student attitudes toward related procedures and conditions both within and across industries revealed potential gaps in knowledge about current production systems. Students overwhelmingly felt the subject of animal welfare should be prioritized in their curriculum over all other choices. Veterinary schools should consider further incorporating welfare (science) into student education so that, as future veterinarians, students are well prepared to “[protect] animal health and welfare”.^[2]

Key Words Farm animal welfare, student attitudes, veterinary student

Introduction

Farm animal welfare is an important and increasingly contentious issue. In the United States, 9 billion land animals were slaughtered for food in 2013.^[3, 4] The sheer size of the industry results in many animals being affected by common practices; accordingly, ensuring that these standards provide animals with adequate welfare is decidedly important.

According to a survey funded by the American Farm Bureau in 2007, Americans are aware of potential issues concerning farm animal welfare and care about the animals’ well-being. When asked who should make decisions about animal welfare, 52 percent of respondents indicated experts, even over public opinion, potentially indicating an expectation of veterinary involvement.^[5]

The profession as a whole has also begun to recognize this role. In 2010, the American

Veterinary Medical Association, representing the U.S. veterinary profession, made a change to the veterinarian's oath, to include a responsibility to protect animal welfare and prevent suffering.[2, 6] However, veterinarians' role in animal welfare varies widely as does their understanding of what constitutes "good" welfare. This variation likely stems from what sorts of animals they work with, which industry they serve, and their individual background and training. The training they receive takes place at veterinary schools as students, where they learn how to appropriately care for animals and ensure their well-being. During this time, they form opinions on what they believe constitutes "good" animal welfare, opinions they will carry with them into their careers as future practitioners and policymakers who must uphold their oath to protect animal welfare.[6] Thus, understanding current student perceptions and attitudes towards farm animal welfare can assist in evaluating veterinary school curriculums and their emphasis on welfare issues.

Several studies have investigated attitudes of faculty and students at veterinary colleges toward farm animal welfare, to better understand the role of veterinary education. In 2005, Heleski et al. surveyed U.S. veterinary college faculty with large or food animal emphasis asking them questions regarding their general judgments of welfare within various industries, their concern regarding particular "animal production practices or outcomes", their beliefs about several factors related to welfare (individual animal production levels, behavioral needs, individual temperaments), their attitude toward animal use and care, and what topics they would prioritize in veterinary science research, resources, and teaching. Their results indicated a considerable level of concern regarding farm animal welfare, particularly for swine and poultry production. Only 35 percent of respondents felt predominant methods used to produce meat and layer birds provide an appropriate level of animal welfare. Faculty ranked the layer bird industry

highest for needing substantial welfare-related changes. The author explains that this can be explained by a pattern of increasing concern with increased industry intensification. The majority of participants thought acute interventions that cause pain, like castration, should be done with local anesthesia. While 93 percent agreed that farm animals have individual temperaments and 63 percent believe they can experience boredom, only a quarter thought the animals should be free to express the majority of their normal behavioral repertoire. Perhaps most relevant to veterinary education, when asked which topics should be prioritized for resource allocation at veterinary colleges, animal welfare ranked lowest among the choices.[7]

Several other significant studies relating to farm animal welfare and veterinary education concern the attitudes of veterinary students. In 2000, students at two British veterinary schools were surveyed to assess their attitudes toward animal welfare in terms of emotional empathy and belief in animal sentience. Paul et al. compared students of different genders and years of study to determine if these factors influenced their attitudes. The results indicated that there was a significant difference in perceived sentience of dogs, cats, and cows related to year of study; students in later years of study rated animals as having lower levels of sentience. The capacity to suffer boredom was most susceptible to lower ratings in later years of study. Additionally, a gender difference was evident in levels of emotional empathy with animals; females maintained high levels throughout veterinary school while males' empathy decreased in later years. Results of the study were "consistent with the hypothesis that a degree of hardening or detachment takes place during veterinary education".[8] Some believe that this hardening of attitudes toward animal welfare is a coping mechanism to deal with the demands of the profession; this study investigates students' attitudes over curricular years to determine if these results are consistent among veterinary students at other schools.

Further study of veterinary student attitudes was conducted in 2005 at Cornell University. Students at the veterinary school were surveyed with respect to their attitudes toward the humaneness of several common agricultural procedures as well as their opinions about animal cognition and emotion in both farm and companion animals. Results were compared between students of different career aspirations (e.g., small animal medicine vs. food animal medicine). Responses were also compared to assess if attitudes differed between species. There were significant differences in students' perceptions of cognitive abilities in different species; while over 90 percent thought dogs and cats have thought processes, emotions, and are emotionally affected by their environment, fewer attributed those abilities to cows, pigs, and small ruminants, and about 50 percent or fewer attributed them to poultry. When asked about the humaneness of certain procedures (like branding, castration, etc.) students considered these practices more humane in cows, pigs, and small ruminants than in dogs, cats, or poultry. Most students believed the procedures mentioned to be inhumane without the use of anesthesia. In the case of humane scoring, those aspiring to work with food animals were significantly different from students of small animal medicine; more food animal students tended to score procedures as humane for all species except the cat. The author concludes that perceptions of cognition and humaneness are inconsistent across species, especially with respect to farm animals.[9]

Also in 2005, first year veterinary students at the School of Veterinary Medicine, University of Pennsylvania, were surveyed to determine how previous experiences with animals may have shaped their future practice of veterinary medicine and their attitudes toward animal welfare and rights issues. The results showed that male students were much more likely to go into food-animal practice, but that females exhibited the most "humane attitudes to animals"; thus, the author suggests that it may be worthwhile for schools to encourage women to pursue

food-animal practice “given the recent growth of public concern for the welfare of production animals”. Another relevant finding was that those students growing up or working on a farm had reduced concern for animal welfare/rights. The author attributes this to previously studied associations between those with farming backgrounds having more utilitarian attitudes toward animals. The study concludes that action should be taken to lessen the gender bias in food animal medicine, both in the context of equal opportunity and animal welfare.[10]

This study aims to repeat some aspects of these previous studies in a different population (allowing comparison of students at different schools as well as veterinary students and veterinary faculty), while additionally focusing on a greater number of procedures and conditions specific to farm animals (in order to get the most thorough picture of how students approach not only industry practices as a whole, but also distinct aspects). A question explicitly asking students to rank different measures of welfare helps put other results in context. Students’ responses will be evaluated in light of their curriculum at Tufts Cummings School of Veterinary Medicine to see how their schooling may play a role in their attitudes while illuminating paths for improving their welfare education.

Material and Methods

Survey Instrument

An online questionnaire was developed consisting of a total of 54 closed-ended questions. Respondents were not forced to answer any question and could skip questions they did not want to answer. Subjects were allowed to mark only one answer choice per question. (**Table 1**)

The first section consisted of 4 demographic questions including expected graduation year (to determine year of study in veterinary school), gender, primary area of interest in

veterinary medicine (e.g. companion animal, large animal) and experience with farm animals (e.g. none, minimal). Answer choices for primary interest in veterinary medicine were 1) companion animal (dogs, cats, exotics), 2) equine only, 3) large animal (equine and food animal), 4) food animal only, 5) wildlife, 6) laboratory animal, and 7) mixed (large and small animal). Answer choices for experience with farm animals were 1) none, 2) minimal (e.g. academic teaching labs), 3) 4H, FFA, Hobby farming, and 4) Grew up or worked on a farm or in a farming community.

The second section consisted of 39 Likert-scale questions relating to farm animal welfare in 5 agricultural industries. The first 5 questions asked respondents to rate their agreement (e.g. strongly agree, agree, neutral/unsure, disagree, strongly disagree) with the statement “The common production methods in this industry provide animals with an acceptable level of welfare”, for the beef, dairy, swine, poultry, and egg industries. The remaining 34 questions asked respondents to indicate their level of concern (e.g. not concerning, not very concerning, neutral or unsure, somewhat concerning, very concerning) regarding the following common procedures and conditions with respect to animal welfare: branding, tail docking, dehorning, castration, and lameness for beef cattle, dehorning, tail docking, lameness, veal crates, calf separation from dam, and lack of pasture access for dairy cattle, piglet castration, tail docking, lameness, gestation crates, lack of pasture access, and lack of foraging substrate for swine, toe trimming, beak trimming, cage space (battery cages), forced molt, male chick culling, lack of pasture access, and lack of nesting/dust-bathing/foraging substrate for egg-laying hens, and toe trimming, beak trimming, lameness, lack of pasture access, and lack of foraging substrate for poultry.

The third section contained 10 questions surveying subjects’ attitudes toward various

factors related to farm animal welfare. The first set of questions asked respondents to rate “the current level of anesthesia/analgesia use for common husbandry practices” in the beef, dairy, swine, poultry, and egg industries on a Likert-scale (e.g. acceptable, acceptable with conditions, neutral or unsure, unacceptable without improvements, or unacceptable). Respondents were then asked to indicate their agreement (e.g. strongly disagree, disagree, neutral or unsure, agree, strongly agree) with the statement “Animals vary in temperament within breeds” for cows, pigs, and chickens. The following question asked participants to rank 1) production (i.e. gaining weight, producing eggs, etc.), 2) health (i.e. free from disease, good body condition, good hygiene, no lameness), and 3) expression of natural behavior (i.e. grazing, rooting, dust-bathing, nesting) in terms of their importance for evaluating farm animal welfare. Lastly, subjects were asked to indicate which answer choice most closely described their philosophy regarding farm animal use and care; their choices included: a) animals may be used unconditionally for human purposes, b) between a & c, c) animal welfare, d) between c & e, and e) animal rights.

The last question asked respondents to rank 4 subject areas related to their farm animal curriculum according to how they think they should be prioritized (whether in teaching, research, or extracurricular programs; subjects included 1) animal welfare, 2) environmental issues, 3) food safety, and 4) sustainable agriculture.

{Insert Table 1 here}

A copy of the survey can be obtained by request from the authors. This questionnaire was largely based on the questionnaire created by Heleski et al. in 2005 [7]; it was designed to both replicate and build on parts of that study in order to allow for potential validation of results and further expansion on issues it began to explore.

Distribution and Participants

The online questionnaire was distributed via email to all veterinary students (n=381) at the Tufts Cummings School of Veterinary Medicine. An initial email was sent in March of 2014 that included a brief introduction to the study, an invitation to enter a prize drawing for participating, and a link to the survey. Both a password and “CAPTCHA” were used to prevent computer-generated responses, hacking, or spamming by outside entities on the survey page. Students were prevented from completing the survey more than once. A reminder email was sent to the students once a week for three weeks following the initial email reminding them to participate if they had not done so already; the survey was active and accessible for a total of 4 weeks (ending April of 2014). Participation in the study was both voluntary and anonymous; students were presented with the terms of study participation and asked for their consent before they could access the study questions. Once students completed the survey, they were redirected to a separate page where they could enter a drawing for 1 of 4 \$25 Amazon gift cards; their answers to the survey were in no way linked to the information they entered on the prize entry page in order to maintain anonymity.

This study was reviewed and granted exemption by the Tufts Health Sciences Institutional Review Board.

Data Analysis

The online survey data was downloaded directly into IBM® SPSS® Statistics Standard GradPack 22 for analysis. Respondents who opened the survey but did not fill it out or who took 2 minutes or less to complete the whole survey were excluded from analysis (2 minutes was well below the expected time it would take to thoughtfully complete the survey and those responses

were deemed indiscriminate). All remaining responses, including surveys only partially completed, were included in analysis. Descriptive statistics including frequencies and medians were calculated.

In order to facilitate further analysis, the data were recoded into combined, workable groups: according to graduation year, students were grouped as being in either “first half of vet school” (2016/2017) or “second half of vet school” (2014/2015), according to their experience with farm animals as either “experienced” (4H/FFA/Hobby, Grew up/worked on a farm) or “inexperienced” (None or minimal), and according to primary area of interest in veterinary medicine (career focus) as either “Small animal” (Companion, Wildlife, Lab animal), “Large animal” (Equine, Food, Large), or “Mixed animal” (Mixed). Responses to relevant Likert-scale questions were combined to form a trichotomy: “Least concern” (included responses “agree”, “strongly agree” regarding provision of adequate welfare, “acceptable” or “acceptable with conditions” regarding current use of anesthesia/analgesia, and “not concerning” or “not very concerning” regarding common procedures and conditions), “Most concern” (included responses “strongly disagree” or “disagree” regarding provision of adequate welfare, “unacceptable” or “unacceptable without improvements” regarding current use of anesthesia/analgesia, and “very concerning” or “somewhat concerning” regarding common procedures and conditions), and “Neutral or unsure” which remained the same.

Responses to the Likert-scale question regarding animals varying in temperament was grouped as “disagree” (strongly disagree, disagree), “agree” (strongly agree, agree), and “neutral or unsure” which remained the same. Remaining responses in the form of rankings or multiple-choice were not changed.

Responses were all in the form of either nominal or ordinal variables and did not fall into

a normal distribution; therefore analysis was restricted to nonparametric statistical tests. Multiple comparisons were done using the Kruskal-Wallis test, with p values < 0.05 considered significant. Multiple comparisons that were significant were followed by post-hoc Mann-Whitney U pairwise comparisons; a Bonferroni correction was applied to all post-hoc comparisons (since multiple tests were always necessary).

Several analyses were performed to evaluate the attitudes of all the students as a whole.

The question regarding whether common production methods in each industry provide animals with an acceptable level of welfare was used as an indicator of how students generally view the welfare of animals in each of the five industries. Responses from all students were compared across industries to determine if there is a significant difference between perceived levels of welfare provided by each industry; pairwise comparisons were done to determine relative concern between each industry. To gain insight into how students view specific aspects of each industry, all responses were compared across the common procedures and conditions within that industry (e.g. castration vs. lameness in swine); pairwise comparisons were done to determine relative concern between procedures in that industry. Procedures or conditions that were common to multiple industries were compared across those industries (the number compared varied by procedure) to determine if students felt certain procedures were of more concern in certain animals than others (e.g. tail docking in swine vs. tail docking in dairy cattle); pairwise comparisons were done as needed to determine relative concern between animal type. The question regarding anesthesia/analgesia in each industry was evaluated using all responses, with multiple, then pairwise comparisons across industries. Similarly, the question regarding whether animals vary in temperament was evaluated using all responses, with multiple, then pairwise comparisons, but this time across species. Lastly, the questions involving ranking various

welfare measures and curriculum subject areas were analyzed by multiple comparison, then pairwise comparisons to establish that students prioritized some options over others and to establish whether there was a consensus as to how they (as a whole) would rank each option (significant differences between all pairwise comparisons).

In order to determine if year of study, gender, experience with farm animals, or career focus (primary interest in veterinary medicine) influenced how students viewed issues of welfare in farm animals, responses to the “general” question, asking whether students felt each industry provides an acceptable level of welfare, were subdivided into the respective categories and evaluated across industries for each demographic using multiple (for demographics with more than 2 categories), then pairwise comparisons. For example, male responses were compared to female responses for all five industries, and then compared to each other with respect to the beef industry.

Results

Independent variables (demographics)

Of the students contacted (n=381), 203 responded to the survey; accounting for the responses excluded (n=2), the response rate was still 53%. Twenty-one percent of students were graduating in 2014, 24% in 2015, 27% in 2016, and 28% in 2017 (**Table 2**). Eighty-eight percent of respondents were female and 12% were male. According to statistics reported by Tufts Veterinary School admissions for all veterinary students at the school, each of the four classes comprises about 25% of the total student population, 86% of the students are female, and 14% of the students are male [11-14]; the sample gathered in this study was very similarly proportioned. Forty-four percent of respondents were primarily interested in companion animal medicine, 2%

in equine only, 9 % in large animal (equine and food animal), 2% in food animal only, 11% in wildlife, 7% in laboratory animal, and 25% in mixed animal (large and small animal). Once combined, 63% of respondents fell into the small animal category, 12% into the large animal category, and 25% remained in the mixed animal category. Four percent of respondents said they had no experience with farm animals, 74% had minimal experience, 11% had 4H/FFA/Hobby farming experience, and 11% grew up or worked on a farm or in a farming community. When combined, 78% were categorized as inexperienced with farm animals, and 22% were experienced.

{Insert Table 2 here}

Overall welfare in five agricultural industries

All Students

Multiple comparisons showed that respondents' attitudes toward the level of welfare provided by each industry differed ($p=0.000$) (**Figure 1**). Pairwise comparisons (evaluated for significance at $p<0.005$ following a Bonferroni correction) indicated that students were most concerned about welfare in the poultry (60%) and egg (58%) industries (they were significantly different from all other industries). The swine industry was relatively less concerning (44%) and also significantly different from all other industries. The beef (30%) and dairy (31%) industries were of least concern with respect to welfare ($p\leq 0.001$ for these comparisons). There was no significant difference in perceived welfare between the beef and dairy industries and the poultry and egg industries.

{Insert Figure 1 here}

Year of Study

Pairwise comparisons between students in the first half of vet school and students in the second half of vet school showed no significant difference in views of welfare provided by each of the five industries. Year of study did not appear to influence students' attitudes.

Gender

Pairwise comparisons between male and female students found that more females (61%) were concerned about the level of welfare provided by the egg industry than males (42%) ($p=0.027$). Pairwise gender comparisons were insignificant for all other industries.

Career focus

Multiple comparison tests showed that students of different career focuses were significantly different in their opinions of the overall level of welfare provided by the swine ($p=0.011$), poultry ($p=0.006$), and egg ($p=0.023$) industries (**Table 3**). Post-hoc pairwise comparisons (evaluated for significance at $p<0.017$ following a Bonferroni correction) demonstrated that for the swine industry, significantly more large animal students (71%) were concerned about welfare than either small (41%, $p=0.004$) or mixed (40%, $p=0.007$) animal students. The same pattern was observed for the poultry industry: 88% of large animal students were concerned about welfare, whereas only 48% of mixed animal students ($p=0.001$) and 59% of small animal students ($p=0.007$) were concerned. With respect to the egg industry, 83% of large animal students were concerned, whereas only 52% of mixed animal students ($p=0.008$)

and 56% of small animal ($p=0.009$) students were concerned. It appears that students' primary area of interest in veterinary medicine does influence their attitudes toward welfare in some industries.

{Insert Table 3 here}

Experience

Pairwise comparisons of students experienced with farm animals and inexperienced with farm animals revealed no significant differences in their general views of the welfare provided by the five industries. Previous experience with farm animals did not appear to influence students' attitudes.

Common procedures and conditions

Beef Industry

Students viewed the common procedures and conditions in the beef industry differently with respect to welfare ($p=0.000$). Pairwise comparisons (evaluated for significance at $p<0.005$ following a Bonferroni correction) revealed that students were most concerned about lameness (80%), relatively less concerned about tail docking (44%) and branding (42%), and even less concerned about dehorning (31%) and castration (19%). There was no significant difference in comparisons of dehorning vs. castration, or in tail docking vs. branding; all other comparisons were significant ($p\leq 0.003$).

Dairy Industry

Students showed varying concern for the procedures and conditions common to the dairy industry ($p=0.000$). Post-hoc pairwise comparisons (evaluated for significance at $p<0.003$ following a Bonferroni correction) found that students were most concerned about lameness (84%), veal crates (75%), and lack of pasture access (79%), among which there was no significant difference. Respondents were significantly less concerned about calf separation from dam (45%) and tail docking (42%) (which were also not different from each other), and least concerned about dehorning (30%) ($p\leq 0.001$ where significance noted).

Swine Industry

Multiple comparisons found that students do not consider all procedures and conditions common to the swine industry of equal concern with respect to welfare ($p=0.000$). Pairwise comparisons (evaluated for significance at $p<0.003$ following a Bonferroni correction) indicated respondents were most concerned about lameness (70%) and lack of foraging substrate (71%) (no significant difference between the two). Comparatively less concerning was lack of pasture access (57%, $p\leq 0.002$), followed by gestation crates (40%, $p=0.000$). Of least concern were piglet castration (27%) and tail docking (24%) (with no significant difference between the two, but $p=0.000$ for any other comparison).

Egg Industry

Respondents showed differing levels of concern regarding the procedures and conditions common to the egg industry ($p=0.000$). Post-hoc pairwise comparisons (evaluated for significance at $p<0.002$ following a Bonferroni correction) found students were most concerned ($p=0.000$ compared to any other procedure) about cage space/battery cages (88%) and lack of

nesting/foraging substrate (81%), with no significant difference between the two. Cage space (battery cages) was the only condition (across all industries) that had a median of 5 (very concerning). Relatively less concerning were lack of pasture access (64%), forced molt (64%), and male chick culling (60%), which were not different from each other but were all significantly different ($p=0.000$) from cage space or foraging substrate. There was no difference for comparisons of beak trimming (52%) with chick culling or pasture access, and while the proportion of students concerned did not necessarily differ significantly between beak trimming and forced molt, the number of students who were neutral or unsure about forced molt with respect to welfare was significantly different ($p=0.001$). Toe trimming was of least concern (43%), significantly different ($p=0.000$) from all other procedures and conditions except beak trimming and chick culling.

Poultry Industry

Multiple comparisons indicated that students' attitudes toward the common procedures and conditions in the poultry industry varied significantly ($p=0.000$). Pairwise comparisons (evaluated for significance at $p<0.005$ following a Bonferroni correction) demonstrated that students were most concerned about lameness (77%) and lack of foraging substrate (78%) (with no significant difference between the two). Subsequently less concerning were lack of pasture access (65%, $p\leq 0.003$) and beak trimming (54%, $p=0.000$), with no significant difference between the two. Least concerning was toe trimming (41%), which was not different as compared to beak trimming, but was significantly different from pasture access ($p=0.000$).

Castration (across species)

There was no significant difference in how students viewed castration in beef cattle vs. swine.

Tail docking (across species)

Respondents were more concerned about tail docking in both beef and dairy cattle than in swine ($p=0.000$, evaluated for significance at $p<0.017$ following a Bonferroni correction).

Confinement (across species)

In a comparison of veal crates, gestation crates, and battery cages (evaluated for pairwise significance at $p<0.017$ following a Bonferroni correction), students found battery cages more concerning than either veal or gestation crates ($p\leq 0.001$) and veal crates more concerning than gestation crates ($p=0.000$). Proportions of concerned students were 88% (battery cages), 75% (veal crates), and 40% (gestation crates).

Lameness (across species)

Pairwise comparison across species (significant at $p<0.008$ following a Bonferroni correction) showed that students were more concerned about lameness in dairy than in swine ($p=0.002$), with no significant differences in concern among other species.

Lack of pasture access (across species)

Multiple comparisons showed that students differ in their concern over lack of pasture access across species (0.000). Post-hoc pairwise comparisons (evaluated for significance at $p<0.008$ following a Bonferroni correction) revealed that students were more concerned about

dairy cattle lacking pasture access than either swine, egg laying hens, or poultry chickens ($p \leq 0.003$).

Lack of foraging substrate (across species)

Students were significantly more concerned about egg laying hens lacking nesting/foraging substrate than swine ($p=0.011$), but comparisons of swine and poultry and egg laying hens and poultry chickens were insignificant (pairwise comparisons considered significant at $p < 0.017$ following a Bonferroni correction).

Factors relating to animal welfare

Philosophy

About half of respondents described their philosophy toward farm animal use and care as “animal welfare”, with the other half of students being almost equally split between a philosophy closer to unconditional use or an animal rights philosophy; while very few students were at either “end”, about 2% subscribe to an animal rights philosophy, while only 0.5% believe animals may be used unconditionally.

Anesthesia/Analgesia

There was a significant difference ($p=0.000$) in level of concern over current levels of anesthesia/analgesia use across industries (**Figure 2**). Pairwise comparisons (evaluated for significance at $p < 0.005$ following a Bonferroni correction) showed that students were more concerned (found levels of anesthesia/analgesia less acceptable) and/or more neutral/unsure about anesthesia/analgesia use in the poultry and egg industries than in either the beef or dairy

industries ($p=0.000$). The poultry and egg industries had the greatest proportion of students in the neutral/unsure category (53% and 57%, respectively). Pairwise comparisons with the swine industry, between beef and dairy, and between poultry and egg all showed no significant difference. Few students (<5%) found current anesthesia/analgesia use acceptable (without conditions) in *any* industry. Of the five industries, students felt that current anesthesia/analgesia was most acceptable in the dairy industry.

{Insert Figure 2 here}

Animal Temperament

While the majority (>60%) of students agreed that cows, pigs, and chickens varied in temperament within breeds, there were still significant differences across species ($p=0.000$). Pairwise comparisons (evaluated for significance at $p<0.017$ following a Bonferroni correction) revealed that students were most likely to agree that cows vary in temperament (88% agreed or strongly agreed) as compared to either pigs or chickens ($p=0.000$). However, differences occurred because students were more likely to answer neutral or unsure in the case of pigs and chickens; the proportion of students who disagreed that animals vary in temperament was almost identical (<2%) for all species. There was no significant difference in perceived temperament variation between pigs and chickens.

Welfare measures

A multiple comparison showed that students ranked the three measures differently ($p=0.000$) in terms of their importance to evaluating animal welfare. Pairwise comparisons

between measures were all significant ($p=0.000$, $p<0.017$ considered significant following a Bonferroni correction) and showed consistency in rankings among the majority of students. In terms of evaluating welfare, students ranked health as most important, expression of natural behavior as second-most important, and production as least important.

Curriculum

A multiple comparison evaluated whether students would prioritize certain subject areas over others in their farm animal curriculum and found a significant difference ($p=0.000$) in how students would rank the subjects. Pairwise comparisons (evaluated for significance at $p<0.008$ following a Bonferroni correction) indicated that the majority of students ranked animal welfare as the most important subject area, well above any other subject ($p=0.000$). There was no significant difference between rankings of any of the other three subjects (environmental issues, food safety, and sustainable agriculture); these subjects all had a median ranking of 2 while animal welfare had a median ranking of 4 (1=least important, 4=most important).

Discussion

To put these results in context, it is useful to consider the structure of Tufts' educational program. Farm animal curriculum, labs, and field experience are largely focused on beef and dairy cattle, less on swine, and minimal focus on poultry or egg laying hens. Hands-on experience with cattle typically involves working with individual animals, whereas the more limited experience with swine is usually at herd level. During their first year clinical skills course, students are exposed to pigs in a model swine operation with multiple types of housing set-ups, including gestation crates, while cattle and chickens they interact with are housed more

extensively, often in free-roaming barns, some with pasture access; students are not exposed to either veal crates or battery cages. Large animal faculty emphasize anesthesia and analgesia use for all procedures done on beef and dairy cattle and discuss other welfare considerations such as benefits and risks of both extensive and intensive systems for several species. Human-animal relations and an ethics course are required for all students and cover a variety of welfare topics. Students focusing on large animal medicine have additional and/or earlier exposure to large animal topics (including welfare) through extracurricular rounds and wet-labs, as well as the Tufts Ambulatory Service. These facets of the farm animal education Tufts' students receive are likely to influence students' attitudes toward farm animal welfare.

Taking a broad view of the results, students showed considerable concern for farm animal welfare. Chickens, whether in the poultry or egg industry were arguably most troubling to students across the board, with the majority of students sampled disagreeing that those animals are provided an acceptable level of welfare (**Figure 1**) and median scores for individual procedures most consistently remaining high (indicating greater concern). These results were very similar to those of Heleski et al., where the poultry and egg industries were of greatest concern, followed by swine, and then by the dairy and beef industries.[7] Echoing their interpretation, concern for animal welfare appears positively correlated with the level of intensification in these industries, with cattle typically being most free to move around and socialize with other cattle while pigs and chickens are usually intensively confined, have little room to move around, and are generally not provided with enrichment which would allow them to express more of their natural behaviors. As students rated ability to express natural behaviors as secondary only to health in its importance to welfare, it is logical they would find these industries problematic. However, it is unclear why the swine industry is less concerning to

students and faculty, as it is tenable that it is equally intensive as either of the chicken industries. As far as students are concerned, it is possible that their exposure to a model swine operation (but not to an intensive egg or poultry operation) in their clinical skills course may explain the difference in attitudes.

Interestingly, large animal students were most concerned about the welfare of animals in the intensive industries as compared to small or mixed animal students. (**Table 3**) This is in contrast to related results obtained by Levine et al. in 2005, which showed that food-animal students more often scored procedures as humane for all species except the cat (though it should be noted that our study compared responses across career focus for overall welfare concern rather than specific procedures). [9] One possible explanation is that the increased exposure to farm animal husbandry and welfare large animal students get compared to the other students may influence them to feel differently about the swine and chicken industries; perhaps their additional education makes them more aware of potential welfare issues. Another possibility is that food animal education at Tufts may be different from that at Cornell University (where Levine et al. surveyed students)[9] or that in the last 9 years curriculum and/or student views have fundamentally changed. Regardless, more in-depth investigation of food-animal student attitudes at multiple veterinary schools would be useful to narrow down why differences are occurring and to make sure all students are well educated on welfare issues regardless of school or career focus.

As opposed to the study by Paul et al. in 2000 [8], year of study did not seem to affect students' attitudes toward welfare in this study; however it should be noted that the previous study used a much more comprehensive and in-depth scale to evaluate student attitudes. It is important to point out that neither study had a negative control in which student attitudes would be surveyed before entering veterinary school to determine what effect exposure to curriculum

has in relation to how students viewed issues prior. This would be especially useful if a longitudinal study were conducted, surveying the same students over time; both of these studies were cross-sectional and therefore less definitive.

In contrast to the Serpell study in 2005 [10], this study found no significant differences among attitudes of students with different farm animal experience and fewer differences among female and male students. While both studies evaluated views on welfare across demographic parameters, the questions asked in relation to welfare were very different: this study focused solely on farm animal welfare within certain industries, while the previous study asked specific questions about a variety of animal welfare and rights issues (not only farm animal). Additional differences in findings may be a result of the time that has passed and/or the schools at which each study was conducted. Here, again, a study of students' attitudes toward farm animal welfare issues spanning multiple veterinary schools would be beneficial.

A pattern of relatively less concern for pigs was discovered when specific procedures or conditions common to multiple industries were compared (**Figure 3**). While reasonable that tail docking and lack of pasture access would be of more concern in cows than pigs (based on the utility of a cow's tail, the lack of scientific literature supporting tail docking in cattle, and the fact that they are grazing animals), it is unclear why students would differentiate between the effects of confinement, lameness, and lack of foraging substrate on pig welfare as compared to cows or chickens. Pigs experience pain in similar ways and are arguably in as much need of the stimulation, enrichment, and opportunity to engage in natural behaviors that current production systems may prohibit as either of these other species. [15, 16] Perhaps most surprising is students' relative lack of concern for sows in gestation crates compared to veal crates or battery cages; this may again be reflective of students' experience with gestation crates but not veal

crates or battery cages at Tufts. In any case, curriculum should be such that students are aware of welfare considerations for all common production systems so that if needed, they can provide an educated opinion.

{Insert Figure 3 here}

Within-industry comparisons of common procedures and conditions showed that students consistently were most concerned about lameness, intensive confinement systems, and limitations on animals' expression of natural behavior such as lack of pasture access or foraging substrate, regardless of the industry (with the exception of gestation crates, as addressed above). This likely follows from Tufts' emphasis on the acute and chronic pain associated with lameness in farm animals and students' self-stated preference for expression of natural behavior as a measure of welfare. In some cases, students viewed intensive confinement systems and lack of pasture or foraging substrate significantly differently; while not all animals in the industries mentioned are intensively confined and not all animals lacking pasture access or foraging substrate are in gestation crates or battery cages, etc., it is crucial that students be aware when certain procedures and conditions occur together or as a result of another. Students were typically less concerned about acute procedures and conditions (such as castration), but may be assuming that they are being done with anesthesia/analgesia, as it was not specified in the question.

For questions of animal temperament and anesthesia/analgesia significant differences more often occurred as a result of many students responding neutral or unsure, particularly in the cases of swine and poultry (**Figure 2**). This may suggest that students potentially lack the knowledge to make an educated decision as it is accepted that not only cows, but also pigs and

chickens are capable of feeling pain and varying in temperament.[17-20] This may again be a result of greater curricular emphasis on beef and dairy issues and one-on-one interaction with beef and dairy cattle, while swine and poultry education at Tufts are comparatively weak. These results indicate that students would benefit from increased discussion of pain management for all species.

{Insert Figure 4 here}

In contrast to the findings of Heleski et al. when they surveyed veterinary faculty in 2005 [7], students overwhelmingly prioritized animal welfare as *most* important in their farm animal curriculum, including in research, teaching, and extracurricular activities (**Figure 4**). Farm animal welfare education could certainly be expanded and improved by incorporating up-to-date welfare science in food animal courses; currently a welfare science course is offered as an elective at Tufts. Further student exposure to a variety of production systems (especially swine and poultry operations) both through clinical skills and the ambulatory service would provide a more well rounded education.

Conclusions

Farm animal education at Tufts is primarily centered around beef and dairy cattle, with respectively less focus on swine and poultry. Overall, students showed most concern for the welfare of animals in the poultry, egg, and swine industries. Students focusing on large animal medicine were significantly more concerned about animals in those industries than either small or mixed animal medicine students. Curricular year and previous experience with farm animals

did not appear to influence students' views. For all species, students were most troubled by lameness, limits on expression of natural behavior such as lack of pasture or foraging substrate, and forms of intensive confinement, with the exception of the gestation crate. Students were most ambivalent about current use of anesthesia and analgesia use, especially in the swine and poultry industries, suggesting a possible gap in their knowledge. The student attitudes illuminated in this study could be attributed to their relative lack of education about the swine, poultry, and egg industries, a pattern of greater intensification compared to the beef or dairy industries, or simply genuine concern; the design of this study did not allow us to distinguish between these alternatives. Future studies should investigate student attitudes at other veterinary colleges in relation to their curricular structure and/or attempt a longitudinal study of veterinary students before entering school and throughout curricular years. Undoubtedly, an increased focus on welfare and welfare science in veterinary student education would not only be beneficial, but would be welcomed by students and is critical to helping them fulfill their oath to ensure animal welfare in their future careers as veterinarians.[2]

Acknowledgements

Special thanks to the Center for Animals and Public Policy at Tufts University for helping fund this study and to Dr. Allen Rutberg for his statistical advice.

Figure Captions

Figure 1. Percentage of students who disagree (strongly disagree/disagree) that the common production methods used by each of five industries provide animals with an acceptable level of welfare.

Figure 2. Percentage of students who found the current level of anesthesia/analgesia use for common husbandry practices in each of five industries acceptable, unacceptable, or were neutral or unsure. Students answering “acceptable” and “acceptable with conditions” were combined in the “acceptable” category and students answering “unacceptable” and “unacceptable without improvements” were combined to form the “unacceptable” category.

Figure 3. Percentage of students concerned about selected common procedures and conditions across five industries with respect to welfare. Students answering “somewhat concerning” or “very concerning” formed the combined percentage shown.

Figure 4. Percentage of students ranking each of four subject areas as “most important” with respect to prioritization in curriculum (teaching, research, extracurricular programs, etc.).

Table 1. Questionnaire

Question	Question Type	Answer Choices
Expected graduation year	Multiple Choice (choose only one)	2014 2015 2016 2017
Gender	Multiple Choice (choose only one)	Female Male
Primary area interest in veterinary medicine	Multiple Choice (choose only one)	Companion animal Equine only Large animal (Equine + Food animal) Food animal only Wildlife Laboratory animal Mixed (Large and Small animal)
Experience with farm animals	Multiple Choice (choose only one)	None Minimal 4H/FFA/Hobby farming Grew up/worked on a farm
The common production methods used in this industry provide animals with an acceptable level of welfare (Beef, Dairy, Poultry, Egg, Swine)	Likert Scale	Strongly disagree Disagree Neutral/unsure Agree Strongly agree
According to your own personal views, which (if any) of the following common procedures and conditions are concerning with respect to animal welfare: Beef cattle <ul style="list-style-type: none"> • Branding • Tail docking • Dehorning • Castration • Lameness Dairy cattle <ul style="list-style-type: none"> • Dehorning • Tail docking • Lameness • Veal crates • Calf separation from 	Likert Scale	Not concerning Not very concerning Neutral/unsure Somewhat concerning Very concerning

<p>dam</p> <ul style="list-style-type: none"> • Lack of pasture access <p>Swine</p> <ul style="list-style-type: none"> • Piglet castration • Tail docking • Lameness • Gestation crates • Lack of pasture access • Lack of foraging substrate <p>Egg laying hens</p> <ul style="list-style-type: none"> • Toe trimming • Beak trimming • Cage space (battery cages) • Forced molt • Male chick culling • Lack of pasture access • Lack of nesting/dust-bathing/foraging substrate <p>Poultry</p> <ul style="list-style-type: none"> • Toe trimming • Beak trimming • Lameness • Lack of pasture access • Lack of foraging substrate 		
<p>According to your personal views, how would you rate the current level of anesthesia/analgesia use for common husbandry practices in each of the following industries? (Beef, Dairy, Swine, Poultry, Egg)</p>	<p>Likert scale</p>	<p>Acceptable Acceptable with conditions Neutral/Unsure Unacceptable without improvements Unacceptable</p>
<p>Animals vary in temperament within breeds. (Cows, pigs, chickens)</p>	<p>Likert scale</p>	<p>Strongly disagree Disagree Neutral/Unsure Agree</p>

		Strongly agree
According to your own personal views on farm animal welfare, rank the importance of the following for evaluating farm animal welfare (Production, Health, Expression of Natural Behavior)	Rank (choose one ranking per choice)	1=least important 3=most important
Which philosophy is closest to your own regarding farm animal use and care?	Multiple choice (choose only one)	A. Animals may be used unconditionally for human purposes B. Between A & C C. Animal welfare D. Between C & E E. Animal rights
In terms of your farm animal curriculum, which subject areas do you think should be prioritized (whether in teaching, research, or extracurricular programs)? (Animal welfare, Environmental issues, Food safety, Sustainable agriculture)	Rank (choose one ranking per choice)	1=least important 4=most important

Table 2. Demographic characteristics of Tufts veterinary students responding to an online survey of attitudes toward farm animal welfare

Demographics	Percentage of Students (n=201)
Expected Graduation Year	
2014 (Fourth year student)	21
2015 (Third year student)	24
2016 (Second year student)	27
2017 (First year student)	28
Gender	
Female	88
Male	12
Primary Area of Interest in Veterinary Medicine (Career focus)	
Companion Animal	44
Wildlife	11
Laboratory Animal	7

Large Animal (Equine + Food animal)	9
Equine only	2
Food Animal only	2
Mixed (Large and Small Animal)	25
Experience with Farm Animals	
None	4
Minimal	74
4H/FFA/Hobby Farming	11
Grew up/Worked on a Farm or in a Farming Community	11

Table 3. Comparison of overall concern for welfare in five agricultural industries across career focuses.

Industry	Percentage of students concerned	Significance (evaluated at $p < 0.017$ following Bonferroni correction)
Beef	Small Animal: 31.7 Large Animal: 33.3 Mixed Animal: 24	No significant difference between students of different career focuses
Dairy	Small Animal: 29.3 Large Animal: 50 Mixed Animal: 26	No significant difference between students of different career focuses
Poultry	Small Animal: 59.3 Large Animal: 87.5 Mixed Animal: 48	Small An v Large An: $p = 0.007$ Small An v Mixed An: NS Large An v Mixed An: $p = 0.001$
Egg	Small Animal: 56.1 Large Animal: 83.3 Mixed Animal: 52	Small An v Large An: $p = 0.009$ Small An v Mixed An: NS Large An v Mixed An: $p = 0.008$
Swine	Small Animal: 40.7 Large Animal: 70.8 Mixed Animal: 40	Small An v Large An: $p = 0.004$ Small An v Mixed An: NS Large An v Mixed An: $p = 0.007$

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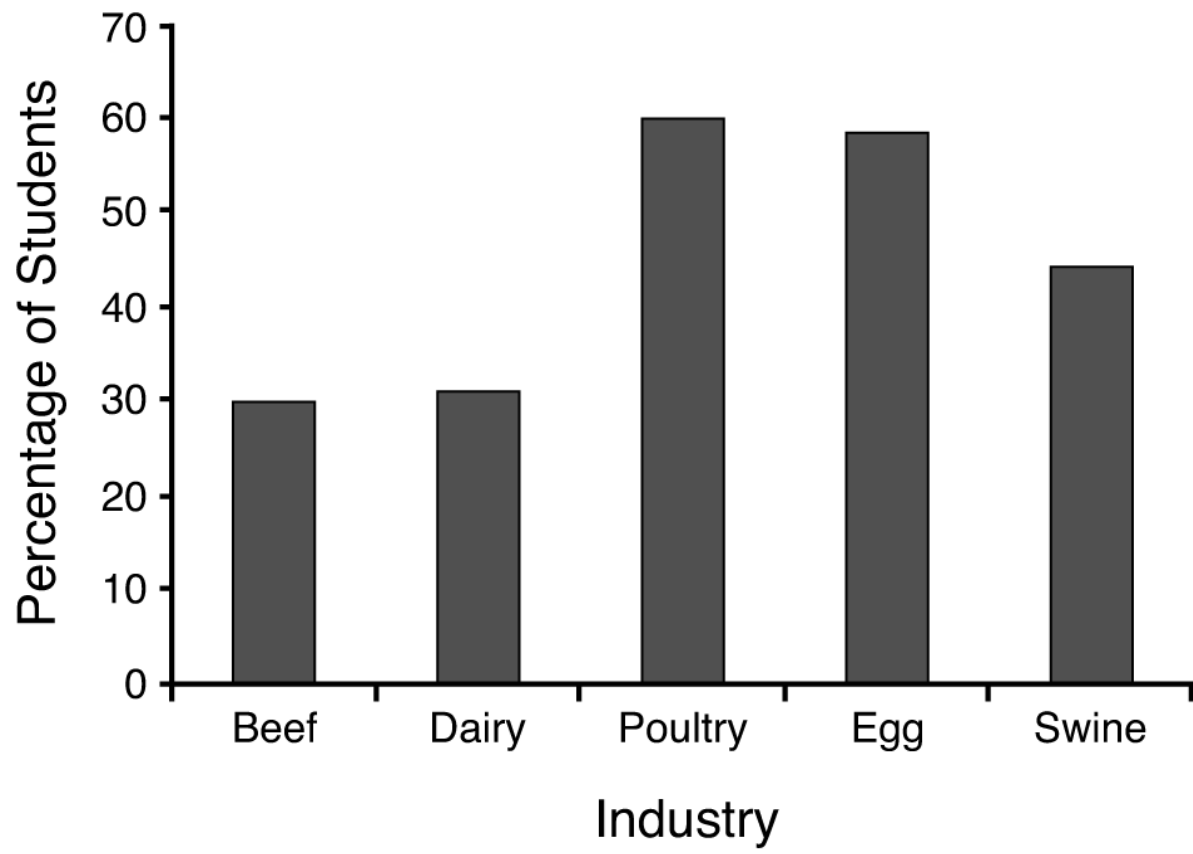


Fig. 1

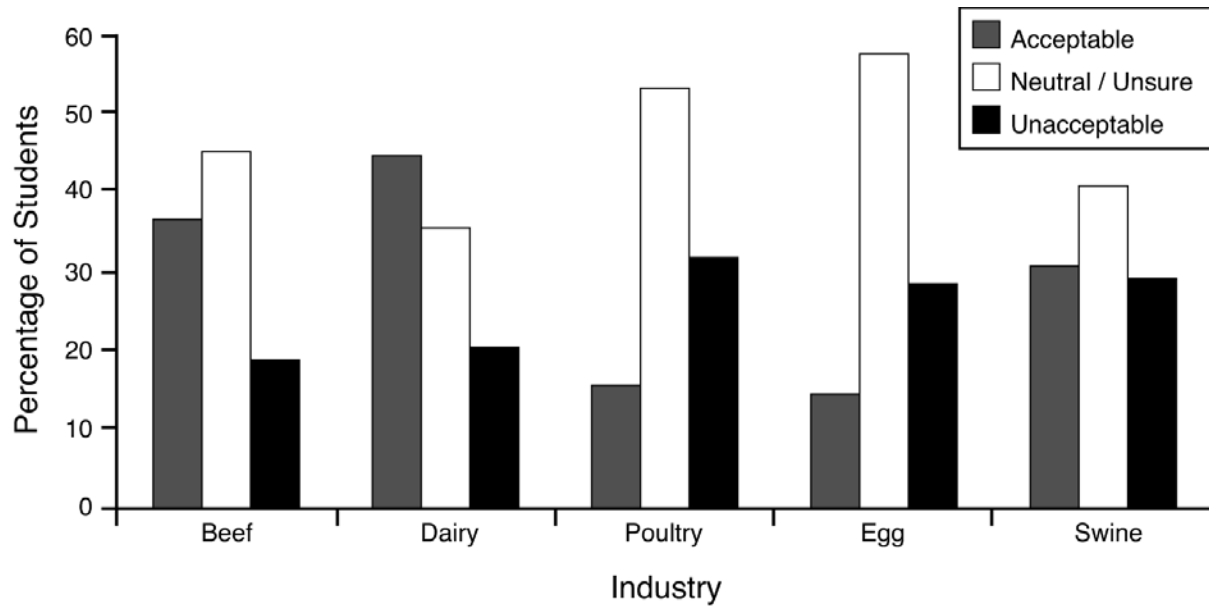


Fig. 2

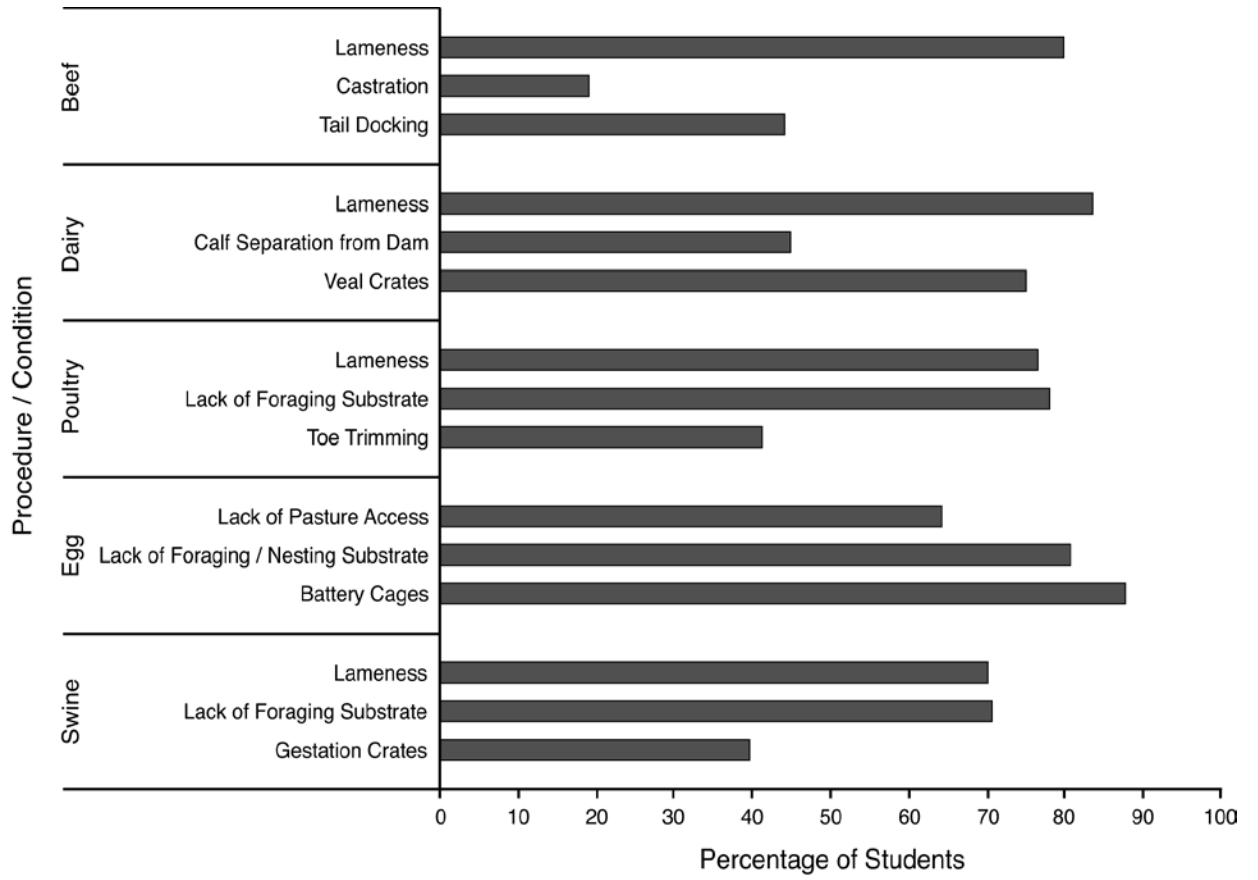


Fig. 3

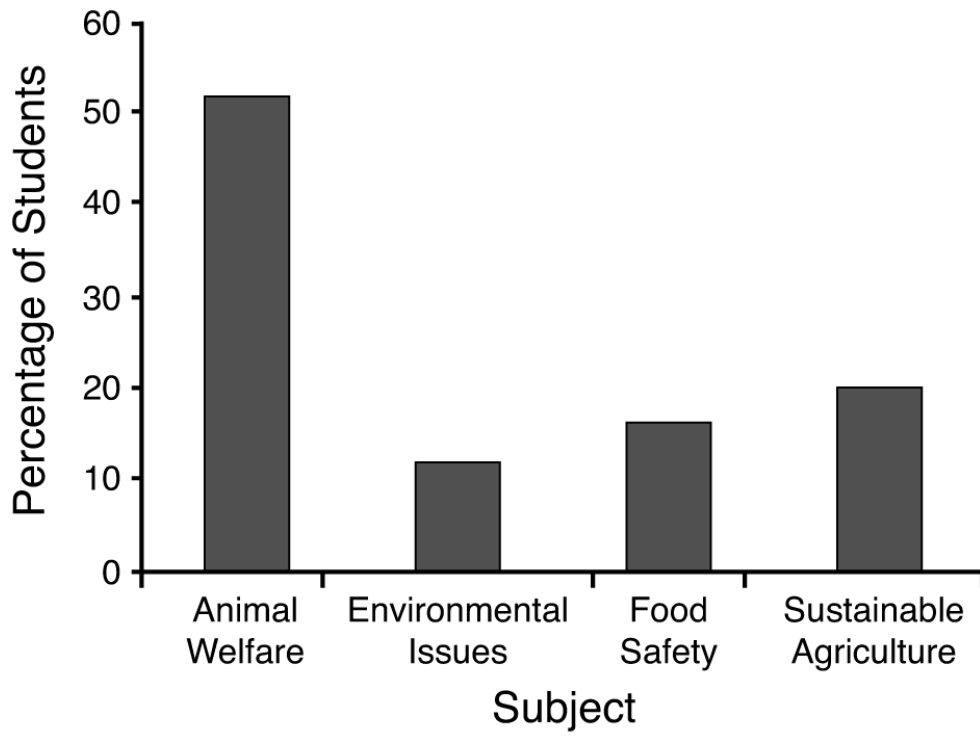


Fig. 4.