Breaking Barriers: The landscape of human and veterinary medical anatomy education and the potential for collaboration

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Running Title: Comparing human and veterinary medical education

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ABSTRACT

Despite human (HUM) and veterinary (VET) medical institutions sharing the goal of educating future clinicians, there is little collaboration between them regarding curricular and pedagogical practices during the preclinical/basic science training years. This may be, at least in part, due to a lack of understanding of each type of curriculum. This study presents data about curricula, student populations, pedagogical methodologies applied, and anatomy educators’ training at both HUM and VET institutions. Preclinical curricula, admissions criteria, and student demographics were analyzed for 21 institutions in the United States having both HUM and VET schools. This dataset was augmented by a questionnaire sent to anatomists internationally, detailing anatomy curricula, pedagogies applied, and anatomy educators’ training. Many curricular similarities between both training programs were identified, including anatomy education experiences. However, VET programs were found to include more preclinical coursework than HUM programs. Students who matriculate to VET or HUM schools have similar academic records, including prerequisite coursework and grade point average (GPA). Median HUM class size was significantly larger, and the percentage of women enrolled in VET institutions was significantly higher. Training of anatomy educators was identical with one exception: VET educators are far more likely to hold a clinical degree. This study elucidates the substantial similarities between VET and HUM programs, particularly in anatomy education, underscoring the potential for collaboration between both types of programs in areas such as interprofessional education, bioethics, zoonotic disease management, and postgraduate training.

Keywords: gross anatomy education, medical education, veterinary education, veterinary anatomy, curriculum content
INTRODUCTION

Human (HUM) and veterinary (VET) medical institutions share the same goal of educating the next generation of clinicians and producing graduates who are highly competent in the practice of medicine. Given these shared goals, it is not surprising that human and veterinary health professional programs also share some core competencies and/or accreditation standards (Larsen, 2021). The model of education used to train both types of future clinicians is underpinned by the Flexner Report (Flexner, 1910). Both degrees in the United States (US) are four years in length, with a foundation of preclinical coursework that is rounded out in the final years with supervised clinical experiences. Human (HUM) medical education traditionally allows for approximately two years of preclinical coursework followed by two years of clinical rotations, whereas veterinary (VET) medical education generally provides just under three years of preclinical coursework followed by just over a year of clinical rotations.

Historically, both programs include instruction in the traditional basic sciences (e.g. anatomy, physiology, neurobiology, etc.). However, the specific similarities and/or differences in basic science fields covered in each type of program have not been fully elucidated. In addition, teaching methods and practices are similar between the two types of programs, with both types of institutions using didactic sessions, laboratory sessions, team-based learning (Mills et al., 2007; Crowther and Baillie, 2016; Burgess et al., 2017), problem-based learning (Lane, 2008; Fletcher et al., 2015; Burgess et al., 2017), and/or other active learning pedagogies like flipped classrooms (Hew and Lo, 2018; Matthew et al., 2019). Methods to teach anatomy to both VET and HUM students are also similar (Larsen, 2021), including utilizing dissection (Gummery et al., 2018; McWatt et al., 2021) and prosection (Provo and Lamar, 1995; Theoret et al., 2007; McWatt et al., 2021). While HUM anatomy courses only dissect a single species, VET anatomy courses dissect multiple species, which often includes a domestic carnivore (e.g. dog and/or cat) in its entirety, followed by complete or partial dissections of various ungulate species (e.g. horse, ox, small ruminant, and/or pig). Despite these acknowledged similarities, there has not been a comprehensive and direct comparison made between the HUM and VET institutions regarding how each student population is taught anatomy.

A shortage of HUM anatomy educators was recently noted (Wilson et al., 2020). Human medical departmental leaders will have “moderate” to “great” difficulty in hiring qualified anatomy
educators in the human medical field over the next several years (Wilson et al., 2020). This has brought a focus on training the next generation of anatomy educators, including through graduate programs (Brokaw and O'Loughlin, 2015), postdoctoral fellowships in anatomy education (Schaefer et al., 2019), and/or continuing education (Wilson et al., 2018; Richardson-Hatcher et al., 2018). However, while some have investigated the degrees and qualifications of the current population of HUM anatomy educators (Schaefer et al., 2019) as a precursor to identifying a path forward to address the shortage of anatomists, this work has not gone into much depth regarding anatomy educators’ training and has excluded veterinary anatomy educators.

The exclusion of veterinary anatomy educators in studies such as these underscores the little communication and collaboration between these groups regarding curricular and pedagogical practices. Many areas exist where VET and HUM anatomy educators can collaborate and share knowledge (Larsen, 2021). Some examples include, but are certainly not limited to, studies pertaining to mental health among professional students (Brenneisen Mayer et al., 2016; Karaffa and Hancock, 2019a) and attitudes towards these issues (Chiles et al., 2017; Karaffa and Hancock, 2019b), adequately preparing students for the rigors of professional anatomy curricula through targeted pre-matriculation boot camps (McNulty et al., 2016; Herling et al., 2017), exploring the use of cadavers in education (Gummery et al., 2018; Peeler et al., 2018), bioethics (Magalhães-Sant'Ana, 2016), and incorporating three-dimensional (3D) printing technology into anatomical and medical education (Lim et al., 2016; Schoenfeld-Tacher et al., 2017; Lim et al., 2018; Sunol et al., 2019). Other opportunities for collaboration in pedagogical approaches to benefit the broader health professional student population include interprofessional education (IPE), when two or more professions in health care create a collaborative learning environment (Buring et al., 2009).

However, collaboration between VET and HUM anatomy educators cannot occur unless the practices and background of each is known to both. It is the authors’ experience that this gap in knowledge may be a limiting factor to collaboration, especially given that no study directly compares these two populations. Therefore, the aim of the current study was to gather data about curricula and student populations enrolled in each type of HUM and VET program within the U.S., pedagogical methodologies utilized to educate these students in anatomy coursework, and anatomy educators’ training at both HUM and VET institutions worldwide. The hypothesis for this study was that these
two types of institutions do not differ significantly in these aspects. Therefore, the overarching goal of this study is to determine how similar HUM and VET institutions are to each other in an effort to better educate the anatomy field about both types of programs, particularly as it relates to anatomy education, and to encourage collaboration that could benefit those involved in educating future clinicians.

MATERIALS AND METHODS

This study was reviewed and approved by the Institutional Review Boards of Indiana University (Protocol No. 1806158847), Tufts Health Sciences (Protocol No. 13052), and Louisiana State University Health Sciences Center (Protocol No. 10247).

Curricular Analysis

Institutions in the United States that house both a human (HUM) and veterinary (VET) professional school accredited by either the Association of American Veterinary Medical Colleges (AAVMC) or the Association of American Medical Colleges (AAMC) were included in the analyses. Data were obtained from publicly-available websites hosted by the institutions, and/or via public databases hosted by either the AAVMC or the AAMC. General curriculum criteria were analyzed, including descriptions of courses offered; additionally, admissions criteria and student demographics were also examined. These analyses were conducted over several months within 2019, and the most recent data were obtained and included in the analysis. Therefore, data may pertain to a class that matriculated in 2017, 2018, or 2019 depending on how often institutions and/or the AAVMC and AAMC update websites. Overall curriculum structure (isolated or integrated), required preclinical coursework (i.e., offered prior to clinical rotations), elective coursework offered in the anatomical sciences, and average class size were analyzed. From the data on admissions criteria: pre-requisite grade point average (GPA); pre-requisite courses for admission; what standardized exam, if any, is required, and the minimum score required on that exam; required minimum GPA (if applicable); and number of applicants were all collected for analysis. Applicant demographics were also recorded, if available, including residency status and gender distribution. Lastly, student demographics of the most recent matriculating class were analyzed: undergraduate GPA (if applicable), standardized
examination average scores (if applicable), U.S. state residency status, gender distribution, and age distribution.

There were no subjective ratings involved in data acquisition requiring reliability statistics. However, to ensure consistency in interpretation of curricular data, two authors (M.A.M. and R.S.L.) independently extracted data for schools identified as difficult to interpret. These two authors then reviewed the extracted data and resolved any discrepancies through discussion and consensus. Through this process it was determined that all curricular data extracted were interpreted and reported here consistently.

**Participant Selection and Questionnaire Distribution**

In addition to analyzing the curricula and student data at US institutions that house both a VET and HUM school, a questionnaire aimed specifically at examining anatomy curricula and educators’ training in more detail was sent to anatomists around the world (Suppl. File 1). The questionnaire was built using Qualtrics software (Qualtrics\textsuperscript{XM}, Provo, UT) and distributed broadly to anatomical educators via message boards and listservs of anatomical societies of which the authors are members, social media, and personal emails.

The questionnaire asked participants to provide background on their education. This included terminal degree(s); school from which obtained this degree(s) was obtained; Ph.D. dissertation title, if applicable; completion of any post-doctoral training; and whether any formal training in educational pedagogies. Participants were also asked to provide current position title and institution, student populations taught, and participation in specific gross anatomy courses.

In order to obtain a more granular look at the students’ learning experiences in anatomy within each type of VET or HUM curricula, respondents were asked to provide information about the educational practices employed within their anatomy courses, specifically: the use of dissection, prosection, a combination, or other; how many students per cadaver; average class size; faculty : student ratios within the anatomy laboratory; teaching assistant : student ratios within the anatomy laboratory; how students are assessed; whether VET educators teach the species comparatively or individually; and whether any other anatomy courses are offered to students beyond the pre-clinical core-courses.
Questionnaire participation was not limited to those who teach HUM or VET, however, responses were isolated and separated into those categories for the purpose of the current study. Responses to the educator questionnaire were excluded if the respondent did not teach either HUM (M.D. / D.O./ M.B.B.S.) or VET (D.V.M. / B.V.Sc.) students or did not complete the questionnaire. Since anatomy curriculum questions were fill-in, if multiple individuals from the same institution responded and provided differing data, values from each respondent were averaged. For example, if one individual reported “1 faculty member per 30 students” and another individual from the same institution reported “1:35”, these two data points were averaged to 1:32.5.

Statistical Analysis

Quantitative data (e.g. numbers of applicants, students, etc.) were exported and organized using Excel, version 16 (Microsoft Corp., Redmond, WA). All data were visually tested for distribution normality and all were found to lack normal distribution. Therefore, non-parametric descriptive statistics and independent samples Mann-Whitney U tests were used in analyses, with \( P < 0.05 \) considered significant. All data were evaluated using SPSS statistical analysis package, version 26 (IBM Corp., Armonk, NY).

RESULTS

Curricular Analysis

Presently in the U.S. there are a total of 30 professional veterinary schools that are accredited by the American Veterinary Medical Association, 157 institutions that grant an MD degree (accredited by the Liaison Committee on Medical Education), and 44 that grant a DO degree (accredited by the American Osteopathic Association Commission on Osteopathic College Accreditation). Twenty-one U.S. institutions were identified that have both HUM and VET schools or colleges to conduct the overarching curricular evaluation. The institutions included in these analyses are outlined in Table 1.

General science prerequisites were similar, however advanced upper level science courses were more often required for admission into VET institutions. Undergraduate prerequisites for
admission into both types of institutions in the U.S. are outlined in Figure 1. Courses in general (inorganic) chemistry, organic chemistry, biology, and physics were all common prerequisite courses, and often times the accompanying laboratory sections of these courses were required as well. However, VET institutions often had additional upper level scientific prerequisites that were not required for admission into HUM institutions, including biochemistry, genetics, and microbiology. A larger percentage of VET institutions also required English/composition and courses in the humanities.

**The applicants and matriculating students in both types of programs were similar, with a couple notable differences.** The U.S. state residency status of applicants and matriculants were similar between both types of programs (Fig. 2A). However, the average matriculating class sizes between VET and HUM institutions were significantly different; median VET class size was significantly smaller than HUM (Fig. 2B). Additionally, the median total number of applications and applicants per class seat were also significantly lower in VET compared to HUM (Figs. 2C, 2D).

The matriculating student populations themselves didn’t significantly differ in undergraduate GPA, either overall (Fig. 3A) or science coursework only (Fig. 3B). However, the percentage of females enrolled in VET institutions is significantly higher (Fig. 3C).

**Despite many similarities in preclinical coursework, veterinary medical curricula include more comprehensive preclinical coursework.** Preclinical coursework in both types of programs are outlined in Figure 4. Overall, preclinical coursework in the basic sciences was very similar between VET and HUM. Many preclinical courses covered similar, if not identical fields, especially in the anatomical sciences. For example, similar percentages of HUM and VET programs examined required preclinical coursework in anatomy, embryology, and neurobiology. Many other fields such as pharmacology, immunology, physiology, and clinical skills were also found in the curricula of both VET and HUM schools, though to varying degrees. Few institutions listed advanced preclinical coursework in anatomy that are offered to VET and HUM students outside of their first-year core anatomy courses. However, when listed, a range of elective anatomy courses were identified through both the curricular analysis and questionnaire data from anatomy educators that included, but were
not limited to supervised teaching experiences and advanced dissection coursework covering anatomy in one or multiple species, including exotic species (e.g. aquatic or avian).

There were notable differences in preclinical coursework found as well. VET programs are more likely to have preclinical curricula where courses are isolated with respect to each other (55% of VET vs. 0% of HUM). Human medical programs were all determined to be integrated curricula or partially integrated. VET curricula also often required more advanced preclinical coursework, including nutrition, radiology/imaging, surgery, anesthesia, and toxicology.

Questionnaire

Viable responses to the questionnaire sent to anatomy educators who taught either VET or HUM students were received from 146 individuals (n = 37 VET; n = 109 HUM). Responses providing anatomy curricular data represented institutions from the U.S. (VET, n = 17; HUM, n = 47), Canada (VET, n = 3; HUM, n = 4), and elsewhere worldwide (e.g. Europe, Asia; VET n = 3; HUM n = 12).

Anatomy laboratory learning experiences are very similar. Gross anatomy educators provided more granular data regarding the curricular structure in anatomy courses at both types of institutions. These data demonstrated that HUM classes were significantly larger than VET classes ($P = 0.002$). When examining the overall methods used to teach gross anatomy, 95% of VET programs use a combination including dissections and prosections compared to 50% of HUM programs; an additional 30.3% of HUM institutions use dissection only (Fig. 5A). Assessment methods were similar, with the majority of both types of institutions using written exams (93.9% HUM, 95.8% VET) and practical exams that require students to identify tagged structures (83.1% HUM, 100% VET). The ratio of students/cadaver was significantly higher ($p<0.001$) in HUM (6 students/cadaver) compared to VET (4 students/cadaver). Median faculty:student ratios were the same in VET and HUM anatomy courses (1:23 for each; $P = 0.81$; Fig. 5B). Mean teaching assistant:student ratios were also the same between VET or HUM anatomy courses (1:17 for VET, 1:14 for HUM; $P = 0.954$).
Anatomy educators teaching at veterinary medical schools are far more likely to hold a clinical degree compared to those teaching at human medical schools. The educational background of anatomy educators was nearly identical with one exception: 54.1% of VET faculty had a clinical degree compared to 9.2% of HUM faculty (Figs. 6A & B). A majority of educators have a Ph.D. (64.9% VET; 79.8% HUM), and almost all of those Ph.D. degrees were obtained in a scientific field (95% VET, 70.6% HUM) as opposed to education. The same percentage (29%) of VET and HUM educators did not have any formal training in education, and similar percentages of VET (19%) and HUM (21%) educators obtained their training in education and pedagogy only through professional development opportunities (Fig. 6C).

DISCUSSION

This study outlines that most parameters evaluated from the curricular analyses and the questionnaire indicate that VET and HUM institutions are similar in their overall curricular structure, student populations, anatomy curricula, and anatomy educators. This is evidenced by similar prerequisite and preclinical coursework, similarities in matriculating student populations, student anatomy laboratory experiences, and anatomy educators’ training. This is unsurprising, given the common goal shared between both institutions: to educate future clinicians. By sharing the similarities in the education of HUM and VET medical students, the authors hope that this knowledge will inspire more collaboration, at least in the areas of interprofessional education, bioethics, and zoonotic disease management (a demonstrated educational need by the current COVID-19 pandemic), to better educate both student populations and mutually benefit all involved. Given that changes in HUM medical education ultimately are paralleled in VET medical education (Clarke and Hodgson, 2017; Molgaard et al., 2019) and include a focus on competency-based education (NAVMEC Board of Directors, 2011), these data indicate that education studies conducted in HUM and VET institutions, particularly in anatomical education and pedagogy, can be potentially translated across both types of students. Given the similarities in applicant and matriculant data, it is highly unlikely that students in each type of program learn differently than their counterparts, so published studies could be applied to improve the experience learners at both VET and HUM institutions, regardless of the population in which the study was conducted.
Curricula

This study found that US VET institutions offer more advanced preclinical coursework. This is unsurprising, as VET programs universally have three preclinical years and one clinical year, compared to HUM’s two preclinical and two clinical years. The differences found in preclinical coursework are likely due to several reasons, but mostly because veterinary students are required to learn about the systems and disease processes of all species, at the very least the common domestic species (dog, cat, horse, ox, pig, and small ruminants such as sheep and goats), as opposed to human medical students who only need to learn about these processes in a single species. Human medical schools have even shortened their preclinical curriculum to under two years, sometimes as short as 12-15 months, and are shifting towards direct training of HUM students in the clinics as opposed to didactic preclinical courses (Emanuel, 2020). In addition, more advanced preclinical coursework in clinical subjects, such as surgery and anesthesia, are often required of VET students, as veterinarians are not required to obtain further training through an internship and/or residency program prior to practicing medicine in their field unless they decide to specialize. Therefore, added didactic instruction in these topics in the preclinical years is often necessary to adequately prepare VET graduates for clinics and their subsequent careers.

There may also be a relationship between prerequisites for admission into each type of program and inclusion of these topics in the preclinical curriculum. For example, 100% of VET institutions evaluated require biochemistry as a prerequisite for admission compared to 29% of HUM institutions. Comparatively, required preclinical biochemistry coursework is less common in VET institutions (19%) compared to HUM institutions (52%). However, further work needs to be conducted to indicate the true relationship between prerequisite coursework and inclusion or exclusion of that topic or field in a professional medical curriculum.

There is a lack of a difference between GPAs (either overall or science coursework) of matriculating students to either HUM or VET institutions, which indicates that the students matriculating into each program are academically similar. However, there is a long-standing assumption that the VET application process is more competitive, given the fewer number of VET schools available compared to HUM. This study found that HUM institutions have a significantly
larger number of applications per class seat when compared to VET, which may support the opposite, that it may be more difficult for one to obtain admission into HUM schools over VET. Though despite large differences in application pool numbers, the students who are ultimately admitted to each type of program do not appear to be different in their undergraduate performance. However, these data do not consider the quality of all applications received by each type of institution, and that should be explored in future work.

Opportunities for Collaboration

One area in which both types of programs could benefit from collaboration in pedagogical approaches to benefit their own students more directly is in interprofessional education (IPE). IPE allows students to gain interprofessional team experience across fields (Chaddock, 2012; Estrada et al., 2016), however IPE investigation and collaboration is primarily limited to HUM health professions. IPE activities that include VET students are incredibly important as the need for collaboration between HUM and VET professionals increases with the rise of complex bioethical issues (Magalhães-Sant'Ana, 2016), as evidenced by debate over the proposed rat-human embryo experiments (Cyranoski, 2019) and zoonotic diseases (Wilkes et al., 2019), exemplified by the COVID-19 pandemic. Calls for medical education to incorporate IPE into curricula are only increasing (Dykstra and Baitchman, 2021). Very few schools engage both VET and HUM students in these activities (Courtenay et al., 2014; Dykstra and Baitchman, 2021), and this lack of collaboration is potentially due, in part, to the aforementioned disconnect between these programs. Helping educators at both types of institutions understand their shared goals, curricula, and pedagogies as outlined in this study can only facilitate more IPE activities, including incorporating IPE in the context of anatomy education (Pawlina and Drake, 2015).

Given the similarities in curricula found, other specific examples of where collaboration between VET and HUM programs could occur in curricular matters include collaboration regarding differences between the overall training of the two types of medical professionals. Clinicians who practice veterinary medicine are deemed qualified and licensed to practice medicine without further training following obtaining their medical degree and passing the North American Veterinary Licensing Examination® (NAVLE). Comparatively, those who practice human medicine are required
to obtain additional training through a residency program. There are multiple components to the United States Medical Licensing Examination® (USMLE), taken throughout their pre- and post-doctoral training. The benefits of the USMLE exams have been widely debated within the HUM medical education field (Hill, 2020) and discussions have been ongoing amongst VET educators as to whether implementation of a similar standardized testing process would be beneficial for veterinary medical students.

Anatomy Curricula

VET programs were more likely to use a combination of prosection and dissection in their anatomy courses. The differences found in the current study between VET and HUM may be attributed to the time allotted to complete preclinical anatomy coursework in each curriculum. Further, this difference is also likely due to the number of species being dissected in VET compared to HUM institutions, necessitating more time to complete dissections and the use of prosected specimens. While it is relatively easy to dissect the entirety of a dog or cat, it is more time consuming for students to perform dissections on the entirety of the larger species, specifically the horse or ox. Overall time in the curricula dedicated to gross dissection may be comparable between VET and HUM institutions. While this question was not specifically asked in the present study, it is unlikely that VET anatomy courses are six times longer than anatomy courses in HUM institutions, which would allow for a thorough dissection of all six domestic species. Therefore, prosections likely help mitigate some of the time constraints that VET anatomy educators face in their respective comparative anatomy courses.

Faculty to student ratios in the anatomy laboratory were identical between both types of institutions (1 to 23), which may be used as a guide for all institutions regarding staffing within anatomy courses. The authors realize there are many factors that must be considered when determining staffing levels within the anatomy laboratory, including experience of the instructors and how much instructor support a population of students will require. While the definition of “qualified anatomy educator” may differ between student populations being taught, more experienced faculty likely would provide more student support than senior students serving as teaching assistants. While facing a substantial shortage of anatomy educators, a guideline for appropriate staffing in the anatomy laboratory could help.
laboratories of both VET and HUM institutions would provide a goal for educators and administrators when identifying the required number of qualified anatomy educators to adequately instruct these populations.

**Anatomy Educator Backgrounds**

A similar percentage of VET and HUM educators did not have formal training in educational practices; the majority of educators obtained this experience from either professional development seminars, workshops, or coursework taken during their time as a graduate student. The importance of medical educators obtaining formal training in education, including through the attainment of a certificate or other documentation of this training, has been proposed within the HUM medical education community (Hatem et al., 2011), and specifically in the context of anatomy education (Rizzolo and Drake, 2008). It has even been demonstrated that VET-specific education training is beneficial towards VET educators over generic training in higher education (Silva-Fletcher and May, 2018).

One of the most notable findings from this study was the terminal degrees held by anatomy educators. Veterinary medical anatomy educators are far more likely to hold a clinical degree while very few HUM anatomy educators hold a comparable clinical degree. The factors driving this difference have yet to be studied, however, these findings beg to the question of the importance of a clinical degree when training students enrolled in a clinical program. This point should be further explored in the context of addressing the shortage of anatomy educators. It has been argued that clinicians, specifically surgeons, should be incorporated into the HUM curriculum (Haubert et al., 2011). If expectations at VET and HUM institutions shift to require or recommend that anatomy educators hold a clinical degree either instead of, or in addition to, the widely-held Ph.D., then this will only further limit the pool of educators “qualified” to teach anatomy to professional health students and will change the direction of how the next generation of anatomists are educated. Approximately the same percentage of VET and HUM anatomy educators held a Ph.D. degree, and the vast majority of these degrees were completed in scientific fields. The specific scientific fields of Ph.D. degrees held by anatomy educators (e.g. neurobiology, developmental biology, anthropology,
paleontology, etc.) were not explored in the current study at a granular level, limiting the authors’ ability to provide a clearer picture of the backgrounds of anatomy educators.

In summary, by identifying the numerous similarities at both HUM and VET medical institutions in their students, educators, overall curricula, and anatomy curricula, specifically, the authors believe anatomy educators may be best positioned to immediately provide the nucleus around which to develop collaborative efforts through IPE in a variety of topics. Moreover, as plans move forward to address the shortage of anatomy educators, these plans must also be inclusive of colleagues in other fields, such as veterinary medicine or dentistry. Data outlining the current veterinary anatomist educator population, as presented in this study, would be beneficial in developing such plans.

Future studies, in collaboration with VET anatomy colleagues, include exploring more of these differences in a qualitative way. As stated, the authors report that there are differences in degree types based on the institution in which the individual is employed (VET or HUM), but do not know why those differences exist. Therefore, exploring the reasoning behind why so many VET anatomy educators hold clinical degrees, and why VET institutions have been requiring applicants to hold a DVM or equivalent degree to apply for anatomy educator positions is warranted. In addition, further work would need to explore how educators who do not hold a clinical degree have obtained the ability to teach clinically relevant material.

Limitations of the Study

This study is not without limitations, including the reliance on anonymous questionnaire data. The items in the questionnaire could potentially be interpreted multiple ways, such as the definitions of “faculty” and “teaching assistants” when evaluating the number of instructors teaching anatomy courses. Another limitation to the study is the collection method of curricular analyses, interpretation of curricular structure within these various programs, and potential bias towards the institutions selected for the analyses. The data were collected off of publicly-facing institutional websites, which may not be up to date. However, these websites present matriculation data by year, therefore the authors were able to ensure that it was recently posted. In addition, while courses and curricula may undergo minor changes year to year, it is unlikely that major curricular changes would not have been
reflected on the websites, as these websites are commonly used for student recruitment purposes and therefore would be in the institutions’ best interest to keep them updated, especially regarding curriculum. While the authors developed a method of validation of these data, it is possible that others could interpret various components of the curriculum differently than the authors, such as whether a curriculum is integrated vs. isolated. However, any variation in these data are likely small and would be unlikely to significantly change the overall conclusions drawn from this study. Additionally, similar data obtained from both the questionnaire and curricular analyses (e.g. class size) mirrored each other, further indicating that large discrepancies are unlikely. Finally, institutions that house both a VET and HUM school may be inherently different that those that only house one or the other type of school.

CONCLUSION

This study demonstrates substantial similarities between VET and HUM medical programs, particularly with respect to anatomy education practices, underscoring the potential for collaboration and exchange between educators at both types of institutions with respect to curricular development and pedagogies. Notable differences were also identified that need to be explored further, such as differences in degrees held by anatomy educators, and preclinical coursework offered to both VET and HUM students. Benefits of highlighting the similarities between these two programs include the possibility to broaden collaboration through interprofessional education (IPE) activities and other curricular matters, including in the context of anatomy education.
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<td>University of Wisconsin-Madison School of Veterinary Medicine</td>
<td>University of Wisconsin School of Medicine and Public Health</td>
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**Table 1.** List of institutions that underwent more detailed curricular analysis.
ACKNOWLEDGEMENTS

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LITERATURE CITED


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FIGURE LEGENDS

**Figure 1.** Percentage of evaluated institutions with undergraduate coursework required for admission. VET, evaluated veterinary medicine programs (n = 21); HUM, evaluated human medicine programs (n = 21).

**Figure 2.** Class data at VET and HUM programs within institutions evaluated through curricular analyses. A, U.S. state residency status of applicants and matriculants; B, average matriculating class size; C, total number of applicants; and D, number of applicants per class seat. \(^a P < 0.01\). VET, evaluated veterinary medicine programs (n = 21); HUM, evaluated human medicine programs (n = 21).

**Figure 3.** Data from matriculating students compared between programs through curricular analyses. A, overall undergraduate grade point average (GPA), \(P > 0.05\); B, undergraduate science course GPA, \(P > 0.05\), and C gender distributions \(P < 0.001\) comparing percentage of females within each class. VET, evaluated veterinary medicine programs (n = 21); HUM, evaluated human medicine programs (n = 21).

**Figure 4.** Preclinical coursework required by evaluated institutions as evaluated through curricular analyses. VET, evaluated veterinary medicine programs (n = 21); HUM, evaluated human medicine programs (n = 21).

**Figure 5.** Anatomy curricular data as reported by questionnaire respondents (both U.S. and international respondents). A, Methods of teaching anatomy (i.e., dissection vs. prosection); and B, faculty-to-student ratios. VET = evaluated veterinary medicine programs (n = 17), HUM = evaluated human medicine programs (n = 47).

**Figure 6.** Anatomy educator backgrounds as reported by questionnaire respondents (both U.S. and international respondents). A, degree(s) held by VET anatomy educators; B, degrees held by HUM
anatomy educators; and C, experience and/or training in education and pedagogy by both types of educators. VET, veterinary medicine anatomy educators (n = 37); HUM, human medicine anatomy educators (n = 109); M.S., Masters of Science; B.S., Bachelor of Science; Ed.D., doctoral degree in education; D.V.M., doctor of veterinary medicine; B.V.Sc., Bachelor of Veterinary Science; Ph.D., doctoral degree in philosophy; M.D., doctoral degree in allopathic medicine; D.O., doctoral degree in osteopathic medicine; M.B.B.S., Bachelor of Medicine, Bachelor of Surgery.
PreClinical Courses

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Evaluated Institutions (%)