

Veterinary Students' Attitudes on One Health: Implications for Curriculum Development at Veterinary Colleges

David Wong ■ Lori R. Kogan

ABSTRACT

One Health knowledge has been identified by the North American Veterinary Medical Education Consortium (NAVMEC) as a core competency for all graduating veterinarians. Many veterinary colleges, however, are still in the preliminary stages of exploring how best to incorporate One Health principles into their existing curricula. In February 2012, we conducted a survey among second to fourth-year Professional Veterinary Medicine (PVM) students at the Colorado State University College of Veterinary Medicine and Biomedical Sciences to assess One Health needs and attitudes. Out of 407 students, 93 (22.9%) completed the survey. Although 74.2% of respondents were very or somewhat familiar with the One Health Initiative, only 34.4% reported some level of involvement with One Health-related activities. Over 80% of respondents rated the One Health Initiative as very important for public health, wildlife health, and food-animal medicine or surgery; less than 30% rated the One Health Initiative as very important for equine medicine or surgery and small-animal medicine or surgery. The majority of respondents were very interested in educational activities involving inter-disciplinary interactions with both human and ecosystem health professionals. Our findings can help guide the development and implementation of One Health-focused curricula at veterinary colleges.

Key words: One Health, veterinary education, curriculum, inter-professional education

INTRODUCTION

Awareness and support for the One Health Initiative,¹ established by the American Veterinary Medical Association (AVMA) in April 2007, now reaches beyond the veterinary community.²⁻⁴ Interdisciplinary One Health practice is particularly critical for bridging human, animal, and ecosystem health professions when addressing complex issues such as zoonotic diseases, food security, and climate change. As of August 2012, over 45 organizations have officially endorsed the One Health concept, including the American Association of Veterinary Medical Colleges (AAVMC), the American Medical Association, the American Association of Medical Colleges, the Council of State and Territorial Epidemiologists, and the National Environmental Health Association.⁵

Despite broad support for One Health at an organizational and conceptual level, many One Health advocates are challenged with how best to translate One Health principles into practical programs and activities. In particular, establishing One Health training programs has been cited by the US Centers for Disease Control and Prevention (CDC) as a focus area essential for operationalizing One Health.⁶ Further, the North American Veterinary Medical Education Consortium (NAVMEC) identified One Health knowledge as a core competency for all graduating veterinarians in its 2011 inaugural report. The NAVMEC report recommends "that each college develop a plan to address One Health as it fits local/regional and/or global needs as defined by that college and its partnering institutions."^{7(p.29)}

Several veterinary colleges, particularly those that are located in a metropolitan area that also contains a medi-

cal college, have started to explore integrated educational models involving veterinary and human medical students as well as students from other allied health disciplines (e.g., public health, nursing, and pharmacy). For example, the College of Veterinary Medicine at the Western University of Health Sciences in Pomona, California is part of an innovative inter-professional education curriculum that brings students from all nine of the university's health disciplines together in small-group venues to discuss cases, improve understanding of other health professions, and to provide and promote a team approach to patient care and health care management.^{8,9}

Most North American veterinary colleges, however, are still in the early stages of identifying One Health needs and considering the feasibility of incorporating One Health principles and didactics into already crowded four-year curricula. To better define One Health needs, we conducted a One Health survey among second to fourth-year Professional Veterinary Medicine (PVM) students at the Colorado State University (CSU) College of Veterinary Medicine and Biomedical Sciences in Ft. Collins, Colorado.

METHODS

During February 2012, an online survey was made available to all second to fourth-year PVM students at CSU. Completion of the survey was voluntary, but students were encouraged to participate via a formal memorandum from the PVM Associate Dean. Students who completed the survey were also eligible to win two incentive prizes (valued at \$40 and \$35 US). The survey was developed as part of an interdisciplinary One Health sabbat-

Table 1: PVM students' familiarity and involvement with the One Health Initiative

	Very familiar	Somewhat familiar	Minimally familiar	Not familiar at all
Familiarity with One Health Initiative and its goals	26 (28.0%)	43 (46.2%)	21 (22.6%)	3 (3.2%)
	Much involvement	Some involvement	Minimal involvement	No involvement at all
Involvement in One Health-related activities	16 (17.2%)	16 (17.2%)	29 (31.2%)	32 (34.4%)

PVM = professional veterinary medicine

Table 2: PVM students' perceived importance of the One Health Initiative

Importance of the One Health Initiative in the following areas:	Very important	Somewhat important	Minimally important	Not important at all
Veterinary medicine	83 (89.2%)	9 (9.7%)	1 (1.1%)	
Human medicine	81 (87.1%)	11 (11.8%)	1 (1.1%)	
Ecosystem health	79 (84.9%)	12 (12.9%)	2 (2.2%)	

PVM = professional veterinary medicine

Table 3: PVM students' attitudes regarding the One Health Initiative

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The One Health Initiative will be a lasting health movement	37 (39.8%)	43 (46.2%)	13 (14.0%)		
There are many practical applications for the One Health Initiative and its concepts	58 (62.4%)	28 (30.1%)	7 (7.5%)		
The One Health Initiative has minimal support OUTSIDE of the veterinary profession	16 (17.2%)	26 (28.0%)	33 (35.5%)	16 (17.2%)	2 (2.2%)
The One Health Initiative has minimal support WITHIN the veterinary profession	1 (1.1%)	17 (18.3%)	29 (31.2%)	42 (45.2%)	4 (4.3%)
It will be important to integrate One Health concepts into my career/practice	37 (39.8%)	45 (48.4%)	11 (11.8%)		
The One Health Initiative is a passing fad	1 (1.1%)	2 (2.2%)	21 (22.6%)	42 (45.2%)	27 (29.0%)

PVM = professional veterinary medicine

tical^a and was approved by the CSU's Research Integrity & Compliance Review Board.

The survey included an introductory section on One Health, which was defined for respondents as the recognition that "human, animal, and ecosystem health are inextricably interconnected and should be addressed as one." The One Health Initiative was described as an AVMA vision to "encourage and ensure the acceptance of One Health and its associated activities by transcending institutional and disciplinary boundaries in order to improve collaboration between physicians, veterinarians, dentists, nurses, biologists, ecologists, and other health practitioners."

The survey included a mix of categorical and Likert-scale questions addressing student demographics, familiarity and involvement with the One Health Initiative, attitudes about One Health, and interest in potential changes to the PVM curriculum that might enhance One Health education and experiences. Survey data were analyzed in IBM SPSS Statistics (version 20).

RESULTS

Out of 407 students, 93 completed the survey for an overall response rate of 22.9%. Among those who reported graduating class, the response rate was 31 out of 138 (22.5%) second-year students, 45 out of 140 (32.1%) third-year students, and 15 out of 129 (11.6%) fourth-year students. Overall, 75 of the 93 (80.6%) respondents were female and the median age (estimated based on year of birth) was 28 years (range = 24–44 years). Although most of the respondents (66.7%) were residents of the state of Colorado, 15 other states of residence were reported.

Tables 1–3 show responses to questions about students' familiarity and involvement with the One Health Initiative as well as their attitudes on its importance. Although 74.2% of respondents were very or somewhat familiar with the One Health Initiative, only 34.4% reported either some or much involvement with One Health-related activities. Indicated in Table 2, most respondents agreed that the One Health Initiative is very important for veterinary medicine (89.2%), human medicine (87.1%), and

Table 4: PVM students' attitudes pertaining to the importance of the One Health Initiative for selected veterinary specialties

	Very important	Somewhat important	Minimally important	Not important at all
Small-animal medicine or surgery	27 (29.0%)	56 (60.2%)	9 (9.7%)	1 (1.1%)
Food-animal medicine or surgery	75 (80.6%)	16 (17.2%)	2 (2.2%)	
Equine medicine or surgery	21 (22.6%)	56 (60.2%)	15 (16.1%)	1 (1.1%)
Exotics	50 (53.8%)	37 (39.8%)	6 (6.5%)	
Public health	84 (90.3%)	7 (7.5%)	2 (2.2%)	
Wildlife health	79 (84.9%)	11 (11.8%)	3 (3.2%)	
Shelter medicine	39 (41.9%)	45 (48.4%)	9 (9.7%)	
Biomedical research	67 (72.0%)	23 (24.7%)	3 (3.2%)	
Veterinary laboratory medicine	54 (58.1%)	33 (35.5%)	6 (6.5%)	
Other	5 (5.5%)			

PVM = professional veterinary medicine

ecosystem health (84.9%). Provided in Table 3, 86% agreed or strongly agreed that the One Health Initiative will be a lasting health movement; however, 45.2% of respondents also agreed or strongly agreed that the One Health Initiative has minimal support outside of the veterinary profession.

Table 4 indicates respondents' rating of the importance of the One Health Initiative for different veterinary specialties. Respondents rated the One Health Initiative as very important for public health (90.3%), wildlife health (84.9%), food-animal medicine or surgery (80.6%), and biomedical research (72.0%). In contrast, only 22.6% and 29.0% of respondents rated the One Health Initiative as very important for equine medicine or surgery and small-animal medicine or surgery, respectively.

Table 5 indicates respondents' interest level in various educational experiences that might enhance One Health education and training. The top three choices that students reported being very interested in were interdisciplinary activities that bridged both human and ecosystem health: lectures and courses on One Health taught by an interdisciplinary team of health professionals (74.2%), inter-professional conferences for veterinarians, physicians, and ecosystem health experts (66.7%), and research opportunities with non-veterinary One Health practitioners (59.1%). Comparatively, fewer respondents reported being very interested in One Health educational activities where collaboration was limited to a single non-veterinary health profession—for example, lectures and courses on One Health taught only by physicians (46.2%), only by ecologists (39.8%), or only by biologists (32.3%).

DISCUSSION

Our survey results suggest that, although veterinary students are exposed to and are supportive of the One Health Initiative and its concepts, more efforts are needed to incorporate One Health training and activities into veterinary college curricula. Effective training and education of the next generation of health care professionals is critical if the holistic approach that One Health advocates is to gain further traction and become sustainable as a lasting health movement. One Health, by definition, requires buy-in and support from multiple health disciplines, with veterinarians and veterinary colleges as natural leaders of the initiative. Efforts to implement One Health within veterinary college curricula can inform the development of similar initiatives in human medical colleges, other health professional schools, and colleges of natural science. Among human health disciplines, competencies for inter-professional collaborative practice have recently been developed,¹⁰ but the focus has been on improving clinical care and reducing medical errors in health care settings and not on One Health principles.

Guidance on how best to modify veterinary college curricula and/or develop novel One Health-based educational modules is sparse. Our results suggest that veterinary students view the importance and relevance of One Health variably across veterinary specialties. Although One Health may make intuitive sense for population-based specialties like public health, wildlife health, and food-animal medicine or surgery, the relevance of One Health to more clinically-oriented specialties, such as small-animal and equine medicine or surgery, appears to

Table 5: PVM students' interest in One Health educational experiences*

	Very interested	Somewhat interested	Minimally interested	No Interest
Lectures and courses taught by:				
Physicians	43 (46.2%)	41 (44.1%)	6 (6.5%)	3 (3.2%)
Ecologists	37 (39.8%)	34 (36.6%)	19 (20.4%)	3 (3.2%)
Biologists	30 (32.3%)	43 (46.2%)	16 (17.2%)	4 (4.3%)
Interdisciplinary team of health professionals	69 (74.2%)	17 (18.3%)	5 (5.4%)	2 (2.2%)
Student exchange programs with:				
Human medical colleges	50 (53.8%)	31 (33.3%)	9 (9.7%)	3 (3.2%)
Schools of public health	48 (51.6%)	28 (30.1%)	15 (16.1%)	2 (2.2%)
Research opportunities with non-veterinary One Health practitioners	55 (59.1%)	18 (19.4%)	14 (15.1%)	6 (6.5%)
Networking opportunities with non-veterinary One Health practitioners	51 (54.8%)	31 (33.3%)	10 (10.8%)	1 (1.1%)
Interprofessional conferences for veterinarians, physicians, and ecosystem health experts	62 (66.7%)	23 (24.7%)	7 (7.5%)	1 (1.1%)
Health internships hosted by non-CVMBBS faculty	44 (47.3%)	29 (31.2%)	15 (16.1%)	5 (5.4%)
Access to One Health mentors who are non-veterinarians	42 (45.2%)	32 (34.4%)	14 (15.1%)	5 (5.4%)

PVM = professional veterinary medicine; CVMBBS = College of Veterinary Medicine and Biomedical Sciences

* Bold indicates the most common response for each proposed educational experience.

be less obvious to students. These data have important implications on potential approaches for developing One Health-based curricula. For example, one strategy could be for veterinary colleges to integrate One Health across all veterinary specialties (see section Vision and Recommendations, 6.1.3),^{7(p.33)} but to emphasize and primarily teach One Health principles in select population-based veterinary specialties. Such a focused approach could build a strong One Health foundation among veterinary students in areas where One Health is likely to already have faculty champions, possibly aiding initial implementation into veterinary curricula.

Another important finding from our survey is that veterinary students mostly view One Health as a broad movement with relevance not only for animal health, but also for human and ecosystem health. To fully appreciate the role of One Health in such a broad context, it is imperative that veterinary students receive instruction from health professionals outside the field of veterinary medicine. Our survey data suggest that, if interdisciplinary courses and activities were to be developed and offered at veterinary colleges, they would be well-received by most veterinary students. Ideally, such courses would be co-taught by health professionals from multiple health disciplines (vs. a single discipline) and would emphasize a team approach toward identifying solutions to cross-cutting health issues. Building collaborations and partnerships with early One Health adopters in non-veterinary fields (e.g., individuals, agencies, and/or university departments) is one strategy that veterinary colleges can

take to identify a cohort of health professionals willing to co-lead and develop these courses with veterinary faculty.

Our study has at least two limitations. First, the response rate was low but consistent with response rates for other non-mandatory surveys conducted among student populations. Because of this, our findings might not be representative of the entire CSU veterinary college student body, particularly among fourth-year students who had the lowest response rate. Although we cannot fully assess the differences between respondents and non-respondents, we do not believe our sample was biased toward pro-One Health students as approximately 25% of respondents were minimally or not at all familiar with One Health. Second, our survey was conducted with only PVM students at a single veterinary college. We advocate that similar One Health surveys be administered at other veterinary colleges to lend support for our data and to lead to more tailored and effective recommendations.

Given that One Health is often described as “the single most important new opportunity” for the veterinary profession,^{4(p.29)} further research and resources are needed to guide how One Health concepts and principles can best be incorporated into veterinary curricula. The AVMA, the AAVMC, and/or other professional advocacy organizations can be leaders in furthering this field, including playing a pivotal role in coordinating national One Health surveys with PVM students, faculty, practicing veterinarians, and other key stakeholders. It is also crucial for veterinary leaders to network with human health

leaders who are initiating college-specific inter-professional curricula and educate them on the One Health Initiative as well as the role that veterinarians working collaboratively with physicians and ecosystem health professionals can and should play in addressing the comprehensive health of individuals, families, and communities.

As veterinary curricula evolve to include One Health as a core competency and priority educational area, the NAVMEC report can serve as a roadmap that not only advocates for the importance of One Health but also the sharing of best practices and educational models among veterinary colleges (see section Vision and Recommendations, 6.3.1–6.3.3).^{7(p.36)} Ideally, such educational models should be shared broadly both with the veterinary medical education community and with One Health educational professionals in human medicine, ecosystem health, public health, and other fields.

ACKNOWLEDGMENTS

We thank Dr. Lance Perryman and Dr. Peter Hellyer for their support in conducting this survey at CSU. We also thank the following individuals who provided feedback on early drafts of our survey: Chuck Higgins, Meagan Kay, Karl Musgrave, and Margaret Wild.

NOTE

- a In October 2011, David Wong participated in a one-month, One Health mini-sabbatical at the Colorado State University College of Veterinary Medicine and Biomedical Sciences.

REFERENCES

- 1 American Veterinary Medical Association. One Health: a new professional imperative [Internet]. Schaumburg, IL: AVMA; 2008 [cited 2012 Aug 1]. Available from: https://www.avma.org/KB/Resources/Reports/Documents/onehealth_final.pdf.
- 2 One Health Office [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2012 [cited 2012 Aug 1]. Available from: http://www.cdc.gov/ncezid/dhcpp/one_health/index.html.
- 3 National League of Cities. National Municipal Policy and Resolutions. NLC Resolution # 2012–17—One Health Initiative [Internet]. Washington, DC: NLC; 2012 [cited 2012 Aug 1]. Available from: [http://www.nlc.org/documents/Influence Federal Policy/NMP/nlc-national-municipal-policy-book-2012.pdf](http://www.nlc.org/documents/Influence%20Federal%20Policy/NMP/nlc-national-municipal-policy-book-2012.pdf).
- 4 PhD in One Health [Internet]. Gainesville, FL: University of Florida Department of Environmental & Global Health; 2012 [cited 2012 Aug 1]. Available from: <http://egh.phhp.ufl.edu/academic-programs/doctoral-programs/phd-in-one-health/>.
- 5 One Health Initiative Supporters [Internet]. Sarasota, FL: Kahn-Kaplan-Monath-Woodall-Conti One Health Initiative Website; 2012 [cited 2012 Aug 1]. Available from: <http://www.onehealthinitiative.com/supporters.php>.
- 6 Operationalizing “One Health”: a policy perspective—taking stock and shaping an implementation roadmap, meeting overview. Atlanta, GA: Centers for Disease Control and Prevention; 2011 [cited 2012 Aug 1]. Available from: <http://www.cdc.gov/onehealth/pdf/atlanta/meeting-overview.pdf>.
- 7 Roadmap for veterinary medical education in the 21st century: responsive, collaborative, flexible—NAVMEC report and recommendations [Internet]. Washington, DC: North American Veterinary Medical Education Consortium; 2011 [cited 2012 Aug 1]. Available from: http://www.aavmc.org/data/files/navmec/navmec_roadmapreport_web_single.pdf.
- 8 Mackintosh SE, Adams CE, Singer-Chang G, et al. Osteopathic approach to implementing and promoting interprofessional education. *J Am Osteopath Assoc*. 2011;111(4):206–12. Medline:21562288
- 9 Interprofessional education (IPE) [Internet]. Pomona, CA: Western University of Health Sciences; 2012 [cited 2012 Aug 1]. Available from: <http://www.westernu.edu/interprofessional-about>.
- 10 Core competencies for interprofessional collaborative practice: report of an expert panel [Internet]. Washington, DC: Interprofessional Education Collaborative; 2011 [cited 2012 Aug 1]. Available from: https://www.aamc.org/download/186750/data/core_competencies.pdf.

AUTHOR INFORMATION

David Wong, MD, is a Pediatrician and Chief, Epidemiology Branch, National Park Service Office of Public Health, Albuquerque, NM 87106 USA. E-mail: david_wong@nps.gov. His research interests include applications of One Health, integrated surveillance, and cross-training initiatives for veterinarians and physicians.

Lori R. Kogan, MS, PhD, is Licensed Psychologist, and Associate Professor of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, 1601 Campus Delivery, Colorado State University, Fort Collins, CO 80523–1601 USA. E-mail: Lori.Kogan@colostate.edu. Her research interests include veterinary education, the human-animal bond, and outcomes assessment.