Preparing Veterinarians for Success

AAVMC Conference - Workshop
March, 2020

Summary of faculty input on how emerging technologies will affect veterinary practice, education & research.

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Introduction:

The WHO declared the global COVID-19 pandemic on March 11th, 2020. Three days earlier we held a workshop on the importance of emerging technologies to veterinary medicine. Now more than ever, the outcomes of this workshop are vital to the future of the profession. We encourage you to read, discuss and share this report, but more so to start implementing the change needed to propel our profession forward.

Executive Summary

Approximately 30 Deans, Associate Deans (primarily educational) and Faculty expressed concern about preparing students to function in an increasingly technology-enabled world. A future scenario of integrated veterinary care was used to introduce major trends in health and technology, although many of the individual elements already exist. Three participant groups (one for each of education, research and service) discussed ramifications and opportunities.

The **education** group focused on Day 1 competencies in three areas 1) telemedicine; 2) artificial intelligence and data; and 3) sensors. New veterinarians should either have the skills to assess the advantages and disadvantages of new technologies themselves, or be comfortable seeking input from external experts. As many students may have more experience with these technologies than faculty, curriculums that allow a flow of ideas between the two may be most effective.

The group that dealt with the impacts of new technologies on veterinary **services** reached consensus that the potential outcomes were dichotomous; they could be either positive or negative, depending on the actions of the veterinary profession. It is imperative that veterinarians engage in this space and take the lead in driving positive outcomes for veterinarians, veterinary practices and the animals they serve.

There is a long list of specific technologies and related processes that could **enable research** (e.g. virtual collaboration, crowdsourcing subjects, sharing data), or serve as a **subject for**

research (e.g. AI and medical records, educational innovations, the future role of the veterinarian).

A plenary brainstorming session generated ideas on next steps for implementation with the 30 attendees, which resulted in recommendations regarding teaching students and faculty development. These initial ideas represent a starting point for the AAVMC community to embark together on a journey of change.

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Category: Education: Future of innovation

Title: Preparing for success in the 21st Century: considering new models of service delivery, new flavors of research and day 1 competencies in health informatics to update our education, research and service missions.

Learning objectives:
1) participants will learn about and discuss major health and technology trends affecting veterinary medicine
2) participants will discuss and analyze the impact, ramifications and opportunities these afford for education, research and service missions
3) participants will create a path forward (next steps) for practical integration of these new technologies into their programs

Session description: Spend an hour with technology leaders and enthusiasts discussing how emerging trends and technologies (sensors, big data, AI, point-of-care testing, telehealth) will impact the future of veterinary practice and the ramifications for veterinary education and research. This will be an interactive and fast-paced session to grasp major trends, their consequences, and capture ideas for moving forward with implementation.

Action-oriented takeaway (one sentence): How to prepare new graduates to leverage emerging technologies for success in veterinary education, research and practice.

A glimpse of the future

The continuum of pet care starts with health monitoring and testing at home, progressing to teletriage and telediagnosis prior to the veterinary visit. The clinic visit is captured by AI voice assistants and combined with data from multiple sources for analysis and predictive analytics, freeing up the veterinarian's time for more interaction with the client and their pet. Any newly diagnosed conditions are added to the remote patient monitoring program, such as pain management after surgery or due to chronic conditions like arthritis. The overall goal is to improve our pets' healthspan, providing more years of healthy life.

For more details see 2019 Annual Report pages 4 - 8: https://www.popmatix.com/

1. Education

Technology has made us more connected than ever before and is changing the way we practice veterinary medicine. Effective use of these technologies begins with the appropriate education. In this session, participants were asked to develop a list of competencies that would prepare students for these technologies as they begin clinical practice.

The discussion centered around three technologies: 1) telemedicine; 2) artificial intelligence and data; and 3) sensors. New veterinarians should have a deep enough understanding of these technologies that they can recognize them in practice and implement new technologies when needed. This requires that new veterinarians either have the skills to assess the advantages

and disadvantages of new technologies themselves, or are comfortable seeking input from external experts.

Telemedicine was recognized as a unique solution to unique challenges and new veterinarians should understand how to take advantage of the benefits without succumbing to the pitfalls. Additionally, new veterinarians should also be able to develop a financial structure of telemedicine congruous with their practice.

As technology has driven the collection of more data, artificial intelligence (AI) has risen as an effective method of deriving meaning. When it comes to evaluating information emanating from AI analysis, new veterinarians should apply the same critical and evidence-based criteria that they are accustomed to using for conventional sources of information. Understanding the use and limitations of such data is vital. New veterinarians should use these new methods of data collection and analyses to approach the health of patients holistically.

Sensor technology can provide a continuous stream of data to both the client and veterinarian. Using a combination of clinical expertise and data methods, the new veterinarian should integrate sensor information into case management.

The participants developed competency statements that were also innovative in nature. For example, veterinarians should use technologies to create an environment so that clients can share their concerns about their pets' health more efficiently. Technology can be used in veterinary schools to help students assess their progress in learning the material. Students who are struggling would be identified and notified by an algorithm. In terms of patient care, clients treating their pets at home could receive feedback from an "at-home AI" and identify any errors in administration.

Competencies around technology in veterinary medicine ranged from assessing technologies for use in veterinary practice, to implementation, to innovative uses of technology for use in the clinic and for clients at home. Educating students about technology may require an innovative approach since, as was pointed out during the session, many students have more experience with these technologies than the faculty themselves. Curriculums that allow a flow of ideas between students and instructors may be most effective.

For detailed notes see Appendix I: Education

2. Practice

Participants were asked to identify the impact of emerging technologies for veterinarians, veterinary clients, and the role of veterinarians. Participants took three minutes for each question to identify individually as many impacts as they could in that time period. Participants then divided into 3 groups (one group per question) to synthesize the impacts and report their findings.

For clients, the findings were interesting in that impacts were seen to be dichotomous in the potential outcome. For every benefit of emerging technologies (i.e. increased knowledge and accessibility of care, potential for improved client connection and interaction with the veterinary healthcare team, improved efficiency and speed of veterinary care; decrease in unnecessary costs through triage and advice; improved access to second opinions; better experiences by avoiding the stress of office visits), there was a matching potential negative outcome (accessibility to technology as a barrier, decreased connection with veterinarians, poorer animal health outcomes as a result of clients self-treating their animals, potentially increased costs of veterinary care as a result of pressures to implement treatments).

For impact on the role of veterinarians, participants identified that memorizing factual knowledge will become less important, whereas competence in the use of technology and data, as well as knowing how to leverage and integrate them into practice will be more highly valued. Further, increased valuation of professional skills, such as communications and relationship building, and the ability for sense-making of the data generated from the technologies were predicted.

Finally, regarding impact on veterinarians, the predictions were divided into two categories: the impact on the veterinary business and the impact on the veterinarians personally. The predictions regarding veterinary business impact were predominantly focused on the ability of a veterinarian to be constantly at the center of the web of care, seeing more clients, more efficiently, and perhaps generating increased revenue. A potential outcome was a decrease in the total number of veterinarians needed by society as a consequence of the ability to leverage technology to serve more animals (certainly an outcome of technology use in production animal medicine). There was a recognized need for veterinary businesses to reevaluate pricing strategy when implementing these technologies.

Technology was seen as a significant benefit to the personal lives of veterinarians. It would provide more flexibility in modes of practice, telecommuting, and in fact, may attract different personalities to the profession, broadening diversity.

For detailed notes see Appendix II: Practice

3. Research

Participants were asked to contribute a list of technologies and related processes of interest to them and to discuss how they could either enable research or serve as a subject of research. This was a complex and challenging question as it cut across the other areas (education and service), included both physical and digital entities (e.g. medical records), as well as processes (e.g. AI analytics) and means of access (e.g. telehealth). Concerns and interests of the participants clustered around tele-everything (health, medicine, teaching, research), sources of

big data, AI analysis, student performance and education, clinical practice, new areas of research and the future role of the veterinarian.

There were questions about effective integration of technology into education, striking the right balance between technology and traditional methods, incorporating data mining into graduate student/resident education and determining the effect of the level of students' digital literacy on educational outcomes, all of which could be the subject of research.

Records of student performance, hospital records, and feeds from biosensors, biometric devices, point-of-of-care diagnostics, and real-time wireless exercise diagnostics are some of the many sources of big data that could be analyzed by AI (artificial intelligence). This in turn could inform veterinary education, research and practice in real time. It could lead to efficiencies by automating administrative tasks (e.g. by capturing voice and converting it to medical and billing terms) and facilitate personalized medicine by incorporating genomics and epigenomics.

"Tele" added a new dimension of possibilities for teaching (particularly timely in the face of an outbreak such as COVID-19), veterinary practice (making care more accessible due to distance or other impediments to travel) and veterinary research. Examples of the latter include using online surveys for research, using social media for disease surveillance or moderating behavior and crowdsourcing research (engaging citizens as the subjects of research, or asking them to participate in research as citizen scientists).

In addition to research on any of the subjects above, research could be conducted on how technology affects the human animal bond and how it will ultimately contribute to a changing role for the veterinary professional. Will the veterinarian have to develop additional skills, or might AI free up time from repetitive or data-intensive tasks, so veterinarians have more time to spend with their clients and patients.

For detailed notes see Appendix III: Research

4. Plenary

The plenary was a brainstorming session with the 30 attendees. These were their specific recommendations for next steps (we encourage you to add to them):

4.1 Teaching Students

Model what we expect in students by how we teach. Use technology more efficiently in the classrooms, instead of relying on Powerpoint lectures.

Build immersive case studies where the student is walking through a real scenario, and has to make decisions that influence what happens next. Need to make treatment plans in a safe environment. Need to value failures.

Give students experience working with data. CBVE competencies should strengthen research and scholarship emphasis. Admit students with a certain degree of skills, e.g. mathematics, or the ability to work with those who have these skills.

Veterinary schools should work directly with corporations to help provide experience for students with emerging technologies and models of service delivery.

4.2 Faculty Development/Support

Provide support for faculty so they can better use available technology, including advanced functions of existing software. Faculty should be able to demonstrate that technology is useful.

Create an innovation office to take the burden off faculty to make industry connections in technology. This takes a lot of resources and relationship building.

Production medicine may be more prepared. Consult with experts from production medicine.

References

Ouyang ZB, Sargeant J, Thomas A, Wycherley K, Ma R, Esmaeilbeigi R, Versluis A, Stacey D, Stone E, Poljak Z, and Bernardo TM. A scoping review of “big data”, “informatics” and “bioinformatics” in the animal health and veterinary medical literature. Invited paper for special Big Data issue of Animal Health Research Reviews, June 2019.

Ouyang ZB, Stone E, Poljak Z, Hodgson JL and Bernardo TM. Day 1 competencies in health informatics for new veterinarians. Manuscript in preparation for submission to JVME.

APPENDICES

Appendix 1: Education (student competencies)

- Compare/contrast the various telemedicine/telehealth applications for patients.
- At the end of the curriculum, a DVM graduate should be able to differentiate/analyze the validity of AI generated information.
- Identify different modalities for clients to share patient concerns.
- Use attendance/participation analytics to identify at-risk students (by students themselves).
- Assess the financial structure of telemedicine.
- Students should be able to assess the limits of remotely provided data.

- WBAT: web-based assessment tool
    - Define telemedicine.
    - Differentiate telemedicine from a regular appointment.
    - Assess if telemedicine is applicable for different scenarios.
- Integrate multiple sources of artificial intelligence technology/data to holistically assess patient wellness.
- Create safety nets in treatment plan leveraging at-home AI tech.
- Use AI platform to predict diagnosis ahead of visit.
- Interpret AI platform data to predict diagnosis/es and generate diag/trt plan.
- Review AI output to ensure accuracy of diagnosis and treatment plan.
- Explain various tele-technology modalities and how to incorporate them into daily practice.
- Demonstrate use of an AI technology to create problem list and differential diagnosis list.
- Interpret animal vital sensor data and correctly choose next steps for case management.
- Demonstrate ability to manage (simulated) case from pre-visit to post-visit.
- Review and maintain comprehensive electronic medical records.

Appendix II: Practice

Impact on clients

- Less likely to seek out veterinarian for care: Dr. Google.
- Could increase veterinary access for some (i.e. limited mobility) (convenience, ease).
    - Limited mobility clients could have access to better veterinary care.
    - Video imaging for those without transportation.
- Could decrease veterinary access for some (cost of electronics, lack of internet).
- Increase awareness of individual pet health and available services.
- Client access to patient records.
- Could decrease client connection with veterinarian (lack of human interaction).
- Could increase client interaction with veterinarian (immediate connectivity).
- Convenience of prescription fill/refill.
- Less willing to see a vet because can self-treat.
- Speed service up.
- Service available worldwide.
- Production facilities could be even more efficient.
- Clients will be more aware and involved in the health of their pets.
- More awareness of vet care needs.
- Constant reassurance possible.
- Less traumatic for office visits (more can be done at home).
- Clients get to use their phones for everything.
- Online education tools will lead to more informed clients.
    - Clients get used to using techs/nurses for routine care.
- Clients will be able to get a second opinion quicker/easier.

- Clients feel better served/more connected.
- Delivery of products quicker: prescriptions refilled automatically.
- Clients will value the convenience of just-in-time medications.
- Clients save money because of triage, i.e. avoid unnecessary visits.
- More difficult for small agriculture operations to remain viable/profitable.
- Pressures over what their animal needs.
- Pressures: diagnose and treat.

Role of vets

- Knowledge will be less important.
- More digital skills/data skills/critical thinking. May not need to be content expert.
- Decreased need for specialists. More treatment and surgery with GPs (high level skills).
- Consults shorter because more data collected outside of consult time.
- More intelligent use of data leads to better health outcomes.
- Knowledge less important than soft skills.
- Better at distinguishing relevant and irrelevant data.
- Focus on making sense of data for clients.
- More of a data management role.
- Need for more technological understanding/synthesis.
- Vets will be more digitally savvy.

Impact on vets

Personal/emotional

- Better work-life balance.
- May be attractive to different types of personalities.
- Allow more telecommuting opportunities for veterinarians.
- Vets are happier.

Business

- Allows vet to do more preventive care.
- May be able to see more clients/patients per day.
- Enables more 24-7 care options.
- May help with cost of staff/employees/reception.
- Vet constantly at center of web of care delivery.
- Fewer veterinarians will be needed to provide individual animal care.
- Increased usage of paraprofessionals to allow veterinarians to see more patients.
- Vets still have to work with client to customize treatments to needs and desires.
- Need change in pricing strategy.
- Veterinary retailing is protected from competition.

Appendix III: Research

Assignment:
List the technologies and processes that you are interested in or curious about, write them on stickies and put them on the master sheet (5 min)
How do various technologies serve as the subject of research? (5 min)
How can they enable research? (5 min)

Grouping of Post-it notes:

Education
- How to integrate technology most effectively into education.
- Students at same level of technology - effect on educational outcomes
- Balance of technology and traditional methods in education
- Incorporation of data mining in grad/resident education

Data sources
- biosensors/early detection
- in field/ clinical point of care diagnostics
- biometric devices
- wireless diagnostics during exercise
- hospital records

AI (artificial intelligence) to analyze data
- AI-assisted learning (student metrics)
- AI-assisted medicine
- bioinformatic analysis of hospital records to predict disease and assist clinicians with new areas of research

Practice/Application
- Using clinical “big data” to inform veterinary research and education directions
- Use of big clinical data to inform practice in real time
- Automate administration (voice-> computer)
- Personalized medicine, genomics, epigenomics

Research
- Definition of a doctor (DVM)
- Research into how tech enable/affects the human animal bond

Tele-
- Teleteaching by app
- Telehealth
- Telemedicine for remote locations