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A look at the veterinary practitioner´s changing role and One Health

Émile Bouchard, DMV, MPVM

Professor and Associate Dean, Development, Communications and External Affairs, Faculty of Veterinary Medicine, University of Montréal, Saint-Hyacinthe (Québec), Canada

Abstract

This presentation will focus on veterinary medicine in the area of dairy herd health and the concept of One Health. I will first examine how the practice has evolved over time using a model proposed by the late Dr. Calvin Schwabe. I will also examine the current role of the bovine practitioner in ensuring herd health, especially regarding the collection of data for use in decision-making. Finally, I will look at what the future holds for the veterinarian in dairy practice. In general, the practice of veterinary medicine has evolved at different rates in different parts of the world. The tools used by veterinarians and the solutions proposed for medical issues also vary depending on the species and type of animal production. A variety of factors –historic, geopolitical, economic, and social –come together to determine the role of the veterinarian in any given country. The history and evolution of veterinary medicine have been the subject of numerous articles and books, many of which have focused on its relationship to human medicine and civilization. One thinker and researcher who has contributed greatly to our understanding of the evolution of preventive veterinary medicine is Calvin Schwabe. His ideas contributed to the concept of One Health. Dr. Schwabe was a veterinarian and professor at the University of California, where he founded the Department of Epidemiology and Preventive Medicine, now the Department of Medicine and Epidemiology.

The epidemiological revolution in veterinary medicine

Our profession, like any other, is influenced by advancements in science and technology, along with changing perceptions of ourselves and our view of the world. Schwabe published two pivotal papers on the subject: The current epidemiological revolution in veterinary medicine. Part 1 and the current epidemiological revolution in veterinary medicine. Part 2. Both appeared in the journal Preventive Veterinary Medicine, the first in 1982 and the second in 1993.

In these articles, Schwabe presents a model for understanding the evolution of preventive veterinary medicine. He used the concept of "disciplinary matrix" to represent the research-practice complex underlying disease management in preventive veterinary medicine. Inspired by the ideas of Thomas Kuhn, he defined disciplinary matrix as:

> "The complex of self-perceptions, assumptions, underlying theories, long and short-term goals, social and human motives, values and other beliefs, together with the infrastructures, strategies, tactics, techniques and other practices which members of any science currently share".
>
> Schwabe, 1982.

Schwabe identified five "normal" phases in the evolution of veterinary medicine based on knowledge of disease causality. These phases were accepted widely and were dependent on the knowledge and techniques that were available. Today's veterinarians will easily identify with the two most recent phases, IV and V.

(IV) Campaigns or mass actions (1884-1960). In this phase, the prevailing theory of disease causality is identified as "specific etiological agents" or infectious agents. The crises that lead to phase V were: Recognition of "problem herds" in campaigns, the demand for economic justification, insidious and "production type" diseases, and the special needs of intensive production units.

(V) Surveillance and selective actions (1960-). In this phase, the prevailing theory of disease causality is identified as "multiple interacting determinants (agents, hosts, environment, and management)".

Many of us are still familiar with phase IV and the fight against infectious agents. The medical sciences witnessed the introduction of antibiotics during this phase. This discovery had a lasting impact on both human and veterinary medicine and on associated research in these fields. This phase saw the rise of paradigms centred on, among other things, laboratory diagnosis, vector control, mass communication, mass treatment and education. The passage to a new phase happens when anomalies and crises arise.

> "A particular phase of normal veterinary science waned when its researchers and practitioners began to encounter anomalies with respect to their currently accepted disciplinary matrix".
>
> Schwabe, 1982.

This leads to the formation of new and more adapted paradigms that eventually supplant the old ones. This passage occurs naturally but gradually; while some of us are ready and prepared for the change, others face greater challenges, depending on the expertise available and where they practice. Schwabe noted that changes in activities and perceptions are typically slow to be recognized and that it takes time before they are accepted by a critical mass of researchers and practitioners.

> "As one normal veterinary science phase [supplants] another, those aspects of formerly dominant strategies, goals and infrastructures deemed to still possess value [are] retained, but subordinated to those of the new phase…, thus expanding the numbers of tactical permutations and combinations in the veterinarian's totally available armamentarium".
>
> Schwabe, 1982.

This predicted evolution/revolution in paradigm appears at different rates and to varying degrees in different parts of the world. Likewise, the role played by veterinarians in fulfilling national or regional needs varies depending on wealth, available technology, public awareness, education level of the population, and food production systems. However, whatever form the change takes, it is clear, that we always build upon previously acquired knowledge and that the successes of the previous phase are retained. While the emphasis shifts toward new paradigm solutions, the previous phase still exerts its influence. Note that it refers to veterinary practitioners, which are responsible for maintaining cohesion through paradigm shifts, such that the profession can continue to meet its objectives and fulfil its role.

> "I predict further, that improved productivity of animals will be as active an area of veterinary medicine-services delivery then, as are animal survival and health maintenance today".
>
> Schwabe, 1993.

The observations made by Calvin Schwabe in 1982 were based on changes that were already happening in veterinary practice and research. These changes were facilitated by developments in communication technologies and computer science. The introduction of computers has changed not only many aspects of our daily lives, but also the scientific approach in medicine. Statistics, modelling and information access have all been reshaped by the new technologies. Veterinary medicine is deeply involved in the epidemiological revolution, with risk assessment, evidence-based medicine and now modelling being applied to diagnosis and prevention. Change is happening at different levels of intervention, from the animal right up to the human population.

In 1993, Schwabe was critical of advances made at "herd-level practice," which he considered as "an ongoing form of field research (surveillance, with appropriate analyses of data) in relation with production". He blamed "insufficient communication between veterinarians trained in epidemiological diagnosis and those who are not". This problem still exists, although there has been considerable progress.

Decision making – Evidence based medicine – Big data

Faced with multiple risk factors for disease in a herd or population, decision makers must decide which factors to prioritize and how to minimize their effects. When prioritising, many factors have to be considered: herd productivity (economic), animal welfare, product quality, environmental impact and consumer opinion. Decision makers also need data to support their decision-making. With the aim of improving dairy herd performance, Canadian researchers and practitioners developed a database to store the health information of individual cows (Bouchard *et al.,* 1991). These data are used to generate information at both the herd and regional level. Data collected in such large databases can also be used to generate information through retrospective studies.

It is important to distinguish between data, information and knowledge. Stand-alone data like "25 Kg of milk" does not provide any information unless it is related to stage of lactation or some other value or state. Data and information relate to a specific situation, "Whereas knowledge comprises general statements about the world that are useful for explaining, predicting, or guiding future action… and is produced by the application of analytic methods on data and information." (Ida, 2016). Data analysis using epidemiological methods will give the information and knowledge needed to make decisions and practice evidence-based medicine. "In contrast, big data approaches rarely involve protocol-directed data collection but aim to maximize precision and external validity by the dictum of 'more data are better than better data'." (Ida, 2016). Both evidence-based medicine and big data contribute to enlarging and strengthening the knowledge base of clinical medicine.

Models derived from retrospective studies conducted on large populations are already used to predict the risk of an event for an individual or population. In human medicine, modelling is used to predict the risk of heart attack for a given patient based on information about known risk factors. In veterinary medicine, Bouchard (2003) used such an approach to evaluate expected first-service conception risk based on the prevalence of previously identified risk factors combined with their measured effects in dairy herds. Risk factors studied included lactation rank, dystocia, retained placenta, metritis, ovarian cyst, mastitis, lameness, production levels (three groups), and calving to AI interval (four groups).

Another example is Bates and Dohoo (2016), who used individual cow records to evaluate risk factors for mastitis. Their retrospective longitudinal cohort study included 18,162 cows from 30 commercial dairy farms on South Island, New Zealand. Risk factors studied were age, breed, and length of dry period, farm, herd size, yield and individual somatic cell count status 30 to 60 d before the end of the previous lactation, rainfall at calving, and number of calvings on the same day. The results of this study could be used to predict expected mastitis level in similar herds.

We need to stress how important it is for veterinarians and producers to collect and eventually combine health record data to obtain valuable information for use on the farm. The knowledge acquired from such data can be used in decision-making aimed at eliminating or reducing risk factors though targeted interventions in herd management. Collaboration with researchers is needed for data analyses related to the detection of causality, risk assessment, classification, prediction, modelling, and simulation.

Future – One Health, are we ready?

With increasing consumer awareness and demands, we are seeing an increase in regulation by governments, public organizations and industry. As a result, veterinary expertise, research and knowledge is increasingly being solicited. It is clear that responsibilities and duties must be shared within the veterinary profession and with other professionals. The traditional role of the veterinarian has expanded from simply attending to sick animals to encompass completely new areas of expertise. This specialization has been underway for some time now, such that today the American Veterinary Medical Association (AVMA) recognizes 22 veterinary speciality organizations comprising 41 distinct specialties. Note that not all of these specialty domains apply to farm animals. Most of the specialties in laboratory diagnosis are solicited in food animal production. Still, more communication between the bovine practitioners and the laboratory specialists is desirable for a better integration of the available laboratory diagnostic tests and the development of new ones.

In disease control and health management, decisions have to be made at different levels of organization. At each level, one or more decision makers are involved. Their goals will vary according to their responsibility and objectives, but clearly all decision makers have to be able to communicate effectively in order to be efficient in their interventions.

The concept of "One Health" was introduced almost a decade ago. (As mentioned earlier, "changes in activities and perceptions are typically slow to be recognized".) As more and more veterinarians work with other professions and scientific realities, they share knowledge and concerns. We now see more veterinarians in the public administration of not only animal, but also human, health. In my country, Canada, we have witnessed the establishment of a new university school of public health in which veterinarians are actively involved (ESPUM, University of Montreal). In addition, the latest veterinary faculty established in Calgary, Alberta is associated with a human medicine school. It integrated comparative health and biomedical research to strengthen the connections between human and animal medicine following the concepts of Virchow in the late 19th century and Schwabe by the end of the 20th century and committed to apply the One Heath concept. We also see veterinarians in the Public Health Agency of Canada. This continued and increasing presence of veterinarians in research and public health administration will lead to the creation of better links with veterinary practitioners and the more efficient management of public health.

> "The collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals and our environment".
>
> American Veterinary Medical Association, 2008.

Networking and animal health databases will gradually come to play an increasing role in the management of public health. In a world of increasing population density and rapid easy communication, veterinarians have to react quickly to get an accurate diagnosis and implement targeted actions. These actions will often need to take place at the farm level, as for example, in the case of pathogen control and the use of antibiotics.

> "Big data are a distinct "cultural, technological, and scholarly phenomenon" (Boyd) centered on the application of machine learning algorithms to diverse, large-scale data".
>
> Ida, 2016.

Basic and applied research have contributed greatly to making diagnostic tools increasingly precise and adapted to field use. However, it is important that we veterinarians also contribute to the development and application of new diagnostic tools like laboratory diagnostic tests. We need to establish stronger communication links between research centres, diagnostic laboratories and the field. The task of creating more efficient disease, production, and public health systems is a responsibility to be shared between producers, a variety of professionals, decision-makers and the public. It is a state of mind that requires continuous communication, effort, and education.

References

American Veterinary Medical Association (AVMA). Veterinary specialists: URL: www.avma.org/public/YourVet/Pages/veterinary-specialists.aspx

Bates AJ, Dohoo I. Risk factors for peri-parturient farmer diagnosed mastitis in New Zealand dairy herds: Findings from a retrospective cohort study. Prev Vet Med 2016; 127:70-76.

Bouchard E. Portrait québécois de la reproduction. Symposium sur les bovins laitiers. Centre de Référence en Agriculture et Agroalimentaire du Québec (CRAAQ). St-Hyacinthe: 1-12. 2003. URL : https://www.agrireseau.net/bovinslaitiers/Documents/Bouchard_Emile.pdf

Boyd D, Crawford K. Critical questions for big data. Information, Communication & Society 2012; 15:662-679.

Ida S. Two ways of knowing: big data and evidence-based medicine. Annals Intern Med 2016. 164(8):562-564.

News and Reports. Informatics: Making the most of 'big data' in veterinary practice and research. Vet Rec 2016; 178:385-386.

Nolen, SR. Legends: The accidental epidemiologist. Dr. Calvin W. Schwabe fathered a generation of veterinary epidemiologists. JAVMA news. July 2013. URL: https://www.avma.org/News/JAVMANews/Pages/130701m.aspx

Schwabe, CW. The current epidemiological revolution in veterinary medicine. Part I. Prev Vet Med 1982; 1:5-15.

Schwabe, CW. Veterinary Medicine and Human Health, 3rd ed. Williams & Wilkins: Baltimore, 1984, xix, pp 1–680.

Schwabe, CW. The current epidemiological revolution in veterinary medicine. Part II. Prev Vet Med 1993; 18(1):3-16.