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Veterinary Pharmacist: Standing at the Bridge for One Health Medicine

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INTRODUCTION

One heath approach is a collaboration between professionals in human and veterinary sector to treat the zoonotic diseases. The concept of "One Health" was not widely accepted until now. Through their functions as service animals, food producers, study subjects, and disease vectors, animals had a reciprocal effect on human health, therefore keeping pets and other animals healthy ultimately benefited the people. A more recent development is the convergence on an ecosystem health approach, which acknowledges the importance of considering environmental elements in relation to human and animal health and the interdependence of human, animal and environmental well-being (Gyles 2016).

The One Health Medicine Initiative has been active since 2006 and is doing excellent work in the United States and around the world by supporting One Health through teaching, lobbying, and therapy. The mission of this programme is to encourage the use of an interdisciplinary, cross-sectoral strategy for reducing health risks caused by human, animal, and environmental interactions. The recent occurrence of zoonotic illnesses like SARS and Ebola, as well as the potential for a pandemic of influenza, have served to emphasize the global significance of One Health medicine and an ecosystem approach (Gyles 2016).

Establishment of Veterinary Pharmacy Specialty

In the United States, veterinary pharmacy is a relatively new specialty. About 50 years ago, reported literature highlighted first time the pharmacist's involvement in veterinary medicine and veterinary biological. Historically, the functions of veterinarians and pharmacists have complemented one another (Ceresia et al. 2009). The pharmacist's job was to manufacture and dispense pharmaceuticals for animals, while the veterinarian's role was to diagnose and recommend treatment. Historically, veterinary colleges have hired pharmacists who have specialization in animal health and are responsible for the selection of medications, as well as the management of stock and formularies. Pharmacists are the only health care providers who are required by the society to treat patients of all species, despite the fact that veterinary pharmacotherapy is rarely taught in pharmacy schools (Ceresia et al. 2009). According to scenario, the National Association of Boards of Pharmacy passed a resolution in 2014 which emphasized the need of availability of veterinary pharmacotherapy education at pharmacy institutes in collaboration with institutes of veterinary medicine to enhance the competency of pharmacists in dispensing medications for veterinary patients (Emm 2020).

Veterinary pharmacists, like other pharmacists in the United States, acquired their education from a programme accredited through the Accreditation Council for Pharmacy Education (ACPE). However, unlike a human pharmacist, veterinary pharmacist often chooses to gain additional training through a post-doctoral experience or a position in veterinary medicine. Although an increasing number of pharmacy schools are beginning to offer electives in veterinary pharmacy and these are still rather uncommon (Kristine et al 2020). The American Society of Health-System Pharmacists (ASHP) Residency Directory has 1456 post-graduate year 1 (PGY-1) pharmacy residencies as of June 16, 2020, with only five PGY-1 clinical residencies in veterinary pharmacy. The residencies in the clinical veterinary pharmacy is currently available at veterinary schools of Purdue University, North Carolina State University, Texas A&M University, the University of Wisconsin and the University of California, Davis. When it comes to train the pharmacists, University of California, Davis residency position is unique because it is a co-funded programme by the Food Animal Residue Avoidance Databank and has a focus on preparing the residents to be competent in food animal pharmacotherapy and relevant litigious issues. After completing their residency programmes, most veterinary pharmacists work in either a veterinary teaching hospital, an academic setting, in a hospital pharmacy, a compounding pharmacy, or in a community pharmacy (Emm 2020).

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Organizations of Veterinary Pharmacy

The Society of Veterinary Hospital Pharmacists (SVHP) is an organization responsible for licensing of veterinary pharmacists and has 153 members in comparison to an estimated 64,000 members of the American Pharmacists Association. About half of SVHP's membership works in veterinary colleges of various universities. The American College of Veterinary Pharmacists (ACVP) is another association of veterinary pharmacy which has 182 pharmacists with 468 student members. Because of their expertise in compounding of medicines, these members offer both human and veterinary pharmacy care (Kristine et al. 2020). Only 32 veterinary pharmacists in the United States have completed the requirements for board certification and passed the 5-part examination given by the International College of Veterinary Pharmacy (DICVP) to demonstrate their masters of veterinary pharmacotherapy. Although, veterinary pharmacists provide health care to a number of species, together with exotic animals, companion animals, equine and the food animals, there are no other board-certified veterinary pharmacists for treating the specific species except the members of DICVP (Kristine et al. 2020).

Role of Veterinary Pharmacist in One Health Medicine

The CDC's One Health effort, aim is "to attain optimum health outcomes by connecting the people, animals, plants, and their shared environment" which highlights the significance of veterinary pharmacists. The new coronavirus that caused a global pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a tragic but illustrative example of the significance of One Health Medicine (Emm 2020). The SARS-CoV-2, first described in late 2019 in Wuhan, China, has jumped from species most likely from bats, and now it is infecting humans and transmitting from person to person. The possible transmission of diseases between humans and animals was properly detected, when a tiger in the Bronx Zoo tested for coronavirus illness (COVID-19) and it was positive under a care of zookeeper who was afflicted with the virus. Since then, the fecal samples of an additional four tigers and three lions have been found to be infected with the COVID-19 virus (Kim et al. 2020, Huang et al. 2020).

As the world grapples with cross-species transmission issues, infection diagnosis, and guidelines for interacting with household pets, a health practitioner trained to provide treatment for both human and nonhuman species is a wonderful advantage. A research highlighting this gap indicated that veterinarians wanted more interprofessional engagement with pharmacists in order to better understand the zoonotic illnesses. With some household pets testing positive for COVID-19, veterinary pharmacists are also retrieving a lot of questions from pet owners about the medications they are giving to their animals. Because of their specialized training, they realized that felids were coronavirus reservoirs prior to the pandemic, therefore their vulnerability to COVID-19 should come with no surprise (Root et al. 2013, Yoo and Yoo 2020). Despite the fact that canines are not generally thought to be at high risk of contracting coronaviruses since virus do not multiply very rapidly, more research has been required to determine the risk after a small number of canines tested positive for antibodies. Particularly in the context of community pharmacies, veterinary pharmacists are in a prime position to engage in two-way communication with clients, educating them on the potential impacts of COVID-19 on their pets and the ways in which they can mitigate these risks (Yoo and Yoo 2020).

Stewardship of the human food supply also includes the work of veterinary pharmacists, who ensured the absence of medicines in animal food and their meat or the presence of medicine should be below the level of federal threshold for pharmaceuticals in food. The National Institutes of Health hires veterinary pharmacists to ensure that laboratory animals are receiving a best pharmaceutical care. Veterinary pharmacists also have engagement in government settings to monitor and prevent the spread of animal-vector borne diseases that pose a risk to human health (such as leptospirosis, tick borne diseases, cat scratch fever, West Nile virus or rabies)

Involvement of Veterinary Pharmacist in Drug Discovery and Development

According to the International Conference on Harmonization (ICH), the first step in medication development in the United States is to conduct chronic toxicological testing on rodent and non-rodent animals, typically healthy rats and beagle dogs (Emm 2020). Animal experiments to determine efficacy were crucially significant during COVID-19 due to the need for viable therapy choices and the contradictory nature of the available evidence. After discovering that COVID-19 replicates in the soft palate, tonsils and nasal turbinate of ferrets, the specie was proposed as a natural animal model for the virus (Seah and Agrawal 2020; Daly 2020). The coronaviruses are known to affect a broad variety of animals, including exotic and domestic felines. During a pandemic, when information is scarce, natural animal models can be invaluable in determining the clinical application of innovative medicines by evaluating their efficacy in parallel. Data from pharmaceutical firms is available to help veterinarians to treat their patients as, under ICH guidance, medications looking for FDA approval undergo pharmacokinetic research in animal models. In 2018, the Kansas State University and the University of Missouri, Kansas City established a joint initiative called 1 Data to address this gap in the market and has been serving as a central repository to provide information on human and animal health. For the

purpose of accelerating the development of medications for both humans and animals, as well as answering critical concerns that arise during the zoonotic outbreaks of COVID-19, this partnership aims to obtain animal and human data from a wide range of sources (Emm 2020).

Veterinarians treating animals could benefit from the knowledge of a veterinary pharmacist who is familiar with where to discover relevant animal pharmacokinetic data and its potential implications for public health. The FDA Emergency use authorization (EUA) of certain medications, including remdesivir, the best treatment of COVID-19, is also being tested against the Ebola virus before it was given the EUA. This drug has also shown promising results against other coronaviruses in animal studies, including Middle Eastern respiratory disease and severe acute respiratory syndrome (Ison et al. 2020). The EUA allowed doctors to start using a medicine in humans despite having limited data from clinical trials and animal research. Veterinary pharmacists are a valuable resource due to their ability to generalize from studies conducted on animals to human therapeutic practice. Due to a total lack of N-acetyl transferase in canid species, experimental drugs requiring acetylation during phase II metabolism are predicted to exhibit high toxicity in research dogs. An invaluable contribution that a veterinary pharmacist may make to a pharmaceutical company in creating a medicine would be to explain that toxicity has happened due to changes in metabolism, rather than pharmacological failure (Mealey 2019).

Role of Pharmacist in Climate Changes

People's health has been significantly impacted by anthropogenic global warming because of the increased severity and frequency of extreme weather measures and the resulting increase in air pollution. More than a quarter of all deaths around the world are attributed to cardiovascular disease, stroke, lung cancer, and chronic respiratory disease, all of which are exacerbated by greenhouse gas (GHG) emissions. The World Health Organization forecasts that between 2030 and 2050, this climate change will cause a further 250,000 fatalities annually as a result of hunger, malaria, diarrhoea, and heat stress. Annually, air pollution causes about 20,000 early deaths in Canada. It is particularly challenging for children, the elderly, and people with chronic illnesses to cope with life. The sector responsible for providing health care services is a substantial source of greenhouse gases. Canada's health care system contributes 4.6% to national GHG emissions, which is on par with the UK's (3%-4%), Australia's (7%), and the US's (9%-10%). Public hospitals (22%), pharmaceuticals (21%), and medical services (13%) are all significant contributors to greenhouse gas emissions in Canada's health care sector. Three-quarters of all greenhouse gas emissions from the healthcare sector come from drugs, both legally and illegally obtained (Roy 2021).

About, 90 percent of these pollutants originate from upstream economic activity like producing energy or pharmaceuticals or operating transportation systems. Manufacturing, sourcing, delivery, disposal (through incineration), packaging, and use contribute to the GHG emissions associated with pharmaceuticals during the course of a drug's life cycle (Roy 2021). The carbon footprint of the UK National Health Service (NHS) has been significantly increased by the use of metered-dose inhalers (MDIs) and gaseous anaesthetics (2% and 4%, respectively). In comparison to carbon dioxide, the hydrofluoroalkane propellants used in MDIs are more hazardous and damage the environment by 3350 times more than CO_2. It has been calculated using data from the United Kingdom that the CO_2 emissions produced by a single patient's inhalers over the course of a year (12 controller inhalers at 19 kg CO_2 equivalent each and 3 salbutamol inhalers at 28 kg CO_2 equivalent each) are the same as those produced by driving a car up to 3,200 kilometers. Soft mist inhalers (e.g., Respimat) and dry powder inhalers (DPIs) emit less than 1 kg of CO_2 equivalent per inhaler, while these emissions are between 10 and 37 times higher. The anaesthetic gases responsible for greenhouse gas emissions include desflurane, which is 2540 times more harmful than CO_2, and nitrous oxide, which is less hazardous than desflurane but nevertheless used in large quantities across the healthcare industry. When compared to desflurane, the greenhouse gas emission profile for sevoflurane is seven times more favorable (Singleton et al. 2018).

In addition, medications are ingested and have detrimental effects on human health, human fetuses, and wildlife after entering water systems via drug production effluent, human excrement, and incorrect disposal. The global impact of pharmaceutical GHGs can be mitigated through measures such as reducing overall usage (through rational prescribing, deprescribing, and not storing), selecting less carbon-intensive goods (using DPIs), and ensuring correct disposal through incineration. When it comes to energy efficiency, transportation, and purchasing practices, the NHS is ahead of the curve. The carbon footprint of health and social services has decreased by 19% between 2007 and 2017 due to their efforts to cut carbon emissions. Key initiatives proposed by the health care sector to support a healthy world include leadership committed to environmental health, an immediate reduction in GHG emissions, and the procurement of sustainable products and resources, especially pharmaceuticals. In addition, the World Health Organization promotes the use of alternative energy sources, public transit, and active transportation methods like bicycling and walking as alternatives to automobile use to lessen the impact on the environment (Roy 2021).

Pharmacists, as highly respected members of the medical community and as potential movement leaders, are in a prime position to advance environmental protection. Large pharmaceutical carbon footprints highlighted the importance of pharmacists. For patient health and safety across the world, pharmacists can take the following steps.

1. Replace MDIs with DPIs or soft-mist inhalers if medically feasible. The National Health Service (NHS) has included a carbon footprint consideration into an asthma patient choice assistance for inhalers. In addition, teach patients how to effectively use their inhalers to cut down on waste (Roy 2021).
2. Improve the medication efficiency through rational and thoughtful prescribing. It has been estimated that 202 tonnes of greenhouse gas emissions may be saved if medicines are being used according to the recommendations of the National Institute for Health and Care Excellence guideline (Roy 2021).
3. Promote the use of inhaled anaesthetics that produce less carbon dioxide, such as sevoflurane instead of desflurane when necessary, and limit the overuse of nitrous oxide (Roy 2021).
4. Teach people under your supervision and in other fields how to safely dispose of medications, especially MDIs (i.e., return to the pharmacy for incineration) (Roy 2021).
5. Spread knowledge about health care sustainability to patients and medical staff.
6. Urge top-level administrators, policymakers, and medical and environmental groups to make sustainable healthcare a top priority (Roy 2021).
7. Create a community environmental group. Health Care without Harm (https://noharm.org/), Global Green and Healthy Hospitals (https://www.greenhospitals.net/), Safer Pharma (https://saferpharma.org/), and My Green Doctor (https://www.mygreendoctor.org/) are just few of the online resources available to help with this initiative. All over Canada, a number of hospitals and other medical facilities are participating in these environmental friendly programmes (Roy 2021).
8. Evaluate current habits to observe where you can make changes, such as using a bike or walking to work, holding virtual meetings with patients or coworkers, or reducing your paper use and switching to digital journal subscriptions (Roy 2021).

Conclusion

In the future, an increase in the number of qualified veterinary pharmacists may result in a workforce prepared to respond to one health concerns. Veterinary pharmacists are an underutilized resource and should cooperate with industrial and academic institutions to create treatment options and answer all inquiries about zoonotic diseases. More veterinary pharmacy residencies are required to address this need in healthcare system. Veterinary pharmacists can help answer problems about zoonotic disease by recognizing species differences, analyzing drug repurposing, collaborating in therapeutic research, and can address climate concern.

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