One Health: Veterinary Involvement and Zoonoses in Humans

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One Health: Veterinary Involvement and Zoonoses in Humans

An Assessment of Veterinary Professionals and Zoonotic Disease Surveillance Systems

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Global Health Concentration
Acknowledgements

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Abstract

Introduction: As veterinarians are often first to identify zoonotic disease events in animals, their involvement in One Health should be facilitated and strengthened by support from zoonotic disease surveillance systems and health regulations specific to zoonotic disease surveillance.

Objectives: To identify relatable trends between the relationship of the number of active veterinary professionals and the incidence of zoonotic diseases in the developed countries of Australia, Brazil, Czech Republic, Denmark, Ireland, Israel, Netherlands, Spain, and the United States of America. Another objective was to illustrate potential barriers current health regulations place on veterinary contributions to One Health surveillance. Methods: Data were gathered using the World Animal Health Information Database (WAHID) operated by the World Organization for Animal Health. Graphical illustrations were created using Microsoft Excel. Correlation and univariate regression analyses were conducted for incidence of zoonotic disease and the veterinarian and animal populations. Three documents were sampled for qualitative analyses addressing international health regulations and programs relating to veterinary medicine. Main Findings: The magnitude of the regression coefficients showed that the number of veterinarians in a country accounts for more variance in zoonotic disease than the number of animals. The two variables accounted for 81% of the variance in zoonotic disease. The search of health regulatory documents for the inclusion of veterinary disease surveillance and prevention terms proved to be inconsistent. Conclusions: Strengthening the base of the One Health movement will be accomplished by standardizing prevention and surveillance education of competent public and private veterinary professionals.

Keywords: veterinarians, surveillance, zoonosis, disease outbreak, emerging pathogens
One Health: Veterinary Involvement and Zoonoses in Humans

Obtaining the most favorable health status for humans, the environment and the animals that interact with them, is a multidisciplinary effort that is still in the beginning stages of implementation. There have been multiple international endeavors to transition One Health from a novel ideal to an operative multifaceted program that can be disseminated from national to local public health.

One Health has in recent years become a well-known phrase across multiple disciplines. The One Health Initiative strives to improve the health and wellbeing of the global population through multidisciplinary approaches including the influences from animals and the environment. While One Health is a novel idea there have been disagreements about where the responsibility rests to make it operational, with what funding, when this should be accomplished by in terms of a timeline. Another query that has been presented is how the goals of the One Health Movement are to not only be reached but then translated to be implemented across multiple disciplines such as medical and veterinary medicine. It is imperative that the players who will have immediate interaction with these programs have an accurate understanding of One Health, its objectives and their roles in the event of a zoonotic disease outbreak.

Assessment and preparedness when dealing with zoonotic diseases or other animal related issues should not be separate as our health is concerned. There has been extensive evaluation on the effectiveness and outcomes concerning other well-known programs, such as vaccination campaigns, that have a strong Healthy People 2020 correlation but less in depth information on topics connecting our health with that of our animal counterparts. Human health is very much interconnected with the animal populations whether it is through food or companionship and not taking the proper precautions can prove detrimental to our health. With
that being said any effective One Health implementation program should weigh heavily on the first responders of any zoonotic disease event. Their involvement in the larger practice of public health should be facilitated and strengthened by support from zoonotic disease surveillance systems and health regulations specific to zoonotic disease surveillance.

**Statement of Purpose**

The purpose of this descriptive study was to identify relatable trends between the relationship of the number of active veterinary professionals and the incidence of zoonotic diseases in the high income countries of Australia, Brazil, Czech Republic, Denmark, Ireland, Israel, Netherlands, Spain, and the United States of America. With the objectives of One Health in mind, it was pertinent to examine the potential relationship between the number veterinarians, the animals they care for, and the subsequent effect on zoonoses in humans, as veterinarians are often the principal point of notification to a disease outbreak. Another objective of the study was to illustrate potential barriers that international health regulations may place on veterinary contributions to One Health surveillance.

**Research Questions**

There are two key research questions this project sought to address:

1) What trends exist between the number of veterinarians within a country’s health system, the incidence of zoonotic diseases and its animal population size?

2) How do current international health regulations facilitate or hinder the flow of interdisciplinary information as it relates to zoonotic disease outbreaks and veterinary professionals?

3) This work is based on the idea that all three pieces of the One Health concept (medical, veterinary, environmental) are equally important to its success.
There are a multitude of diseases that affect the human population worldwide. Many of these diseases either directly affect human health or indirectly affect the environment in which they reside or depend on for survival. Emerging diseases are still a pressing concern for human health and should not be considered a concept of the past as they are still a considerable economic burden (Jones et al., 2008). An emerging disease can be defined as a known agent infecting a new species, appearing in a new geographical location or an unknown disease making an appearance for the first time (Brown, 2004). While emerging diseases are not a new concept, the way they are linked to animal health and the environment is an ever evolving movement.

Many of the diseases that affect human health are zoonotic in origin as approximately 60% of all emerging infectious diseases are initiated by zoonoses (Jones et al., 2008). Zoonoses, as defined by the World Health Organization, are infections transmitted between animals and infect human hosts (Marano, 2004). Over the past twenty years, 75% of all emerging diseases that have occurred within the human population were the consequence of animal pathogens infecting the human population (Brown, 2004). These forms of transmission can occur by many different passageways with food being an important source of contamination. The relationship humans have with animals within their environment, whether as a companion or food source can potentially have an adverse effect on their health. A number of foodborne pathogens have animal reservoirs from which humans are them placed into contact with through handling or consumption (Tauxe, 1997). With the widespread use of antibiotics worldwide, there has been a growing resistance in the treatment of these foodborne pathogens causing the spread of those infections to grow worldwide (Tauxe, 1997). While many foodborne illnesses will illicit short
term illness there are larger long term health consequences in developing countries where complications arise due to malnutrition, diarrhea and weakened immune systems. *Salmonella, Campylobacter jejuni, Escherichia. coli, V. vulnificus* (Norwalk virus) and Ebola virus are some of the bacteria and viruses that can be readily contracted from contaminated animal food sources (Tauxe, 1997). With many of these bacteria the infected host animal will show no signs of illness and can live out its life without being negatively affected. For example Ebola virus is commonly contracted by the consumption of contaminated bush meat but it is not clear why this is a growing trend in multiple regions of Africa as public awareness of the virus is being raised (Brown, 2004). Some explanations point to the consumption of another species that came into contact with the originally infected meat also supporting the concept of interspecies zoonotic transmission (Brown, 2004).

**One Health Defined, Veterinary Influence**

The main focus of One Health is recognizing that the health of animals, humans and the environment are all interconnected and interdependent needing the cooperation of multiple disciplines to work together in the implementation of preventative health measures (One Health Initiative [OHI], 2011). With that in mind each discipline should also know its role in the prevention and response to events of zoonotic origins. One Health is built upon the principle of “One Medicine” first coined by veterinary epidemiologist Calvin Schwabe in the later part of the 1960s (Currier & Steele, 2011). The concept was initially founded on the knowledge that animal health and human health are too closely related to not be conjointly addressed. His work was then expanded on to include veterinary and human public health as it related to national and global health (Currier & Steele, 2011). Veterinary medicine and public health are key factors to the One Health concept. Veterinarians can many times be seen as first responders when it comes
to identifying a zoonotic disease outbreak as they come into contact with the animals firsthand (Osburn, Scott, & Gibbs, 2009). They also are involved in many national and local regulatory practices addressing food safety, biosafety, animal health and public health (Osburn et al., 2009). One Health provides an opportunity for these zoonotic first responders to work with physicians and other health professionals to develop comprehensive preventative and responsive plans that benefit our health to the greatest good.

While zoonotic diseases are not the only focus of One Health, they are a major driving force behind the implementation of One Health and the multitude of programs that have been instituted worldwide and domestically. Diseases such as West Nile Virus, Severe Acute Respiratory Syndrome (SARS) and Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) that continually threaten the global community can also be traced to a zoonotic root and are at the top of many international organizations’ lists as pertinent health concerns and significant economic burdens (Centers for Disease Control and Prevention [CDC], 2012).

While it is vital to the success of any One Health program for all involved disciplines to be working together with a clear process for communication experience suggests it is reasonable to put more responsibility on the veterinarians when it comes to bio surveillance. For example, in 1999 there was a major miscommunication between veterinarians, public health officials and medical professionals in response an extensive West Nile Virus outbreak here in the United States. Prior to the large disease outbreak in humans there were mass die-off of crows in the surrounding areas presenting some of the same symptoms that were later seen in humans (Kahn, 2006). Effective interdisciplinary communication could have decreased the identification time of the disease and the identification of its epidemiological trends. Events like this are not
uncommon, but due to the lack of communication and stress on bio surveillance on the veterinary level they will continue to happen until changes are made. One Health provides an ideological framework that normalizes this type of communication.

**Global Implications**

The One Health Movement concerns every nation that participates in the movement of people, agricultural products and animals (Osburn et al., 2009). There has been an overall positive international response to the One Health Movement (Osburn et al., 2009). Organizations across the globe have been actively attending meetings, implementing One Health related programs or have tasks forces in place to begin that process. One Health has gained the support of the United States Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), the World Bank, European Commission and the World Organization for Animal Health (OIE) (One Health Initiative [OHI], n.d.). In order to coordinate all efforts of the multiple organizations involved, the One Health Global Network was created in 2010 to act as a portal of information and a cooperation tool for current and future One Health programs and the organizations involved. The global network is coordinated by the One Health Global Network Task Group that is led by team members from the University of Edinburgh, the CDC and the US Department of State (OHI, n.d.). According to the Global Network Web Portal (One Health Global, 2012), the group’s main responsibilities will be to identify priorities and determine costs and other needs to move the network into action both internationally and locally. The Network itself was designed to act as the propelling force behind any One Health-related actions taken worldwide.
Local Limitations

In 2010 a summit was held in Stone Mountain, Georgia to discuss how to “Operationalize One Health” (CDC, 2012). At this meeting the decision was made that any power to make executive decisions concerning the One Health Initiative should be a joint effort and should not fall into the hands of any one institution (CDC, 2012). This was done in an effort to keep the movement fluid allowing all organizations to tailor any programs or further actions to their funding, global and public health needs. Currently there are many shortcomings to making One Health operational and many of these issues were discussed at length during the Stone Mountain meeting in 2010 (OHI, n.d.). An overall theme presented was in order for the One Health movement to be successful and to stay current there has to be constant collaboration and cooperation. Some of the critical drawbacks include minimal communication between agencies and disciplines in the midst of a disease outbreak, a mainly medically based approach to public health, the focus on current and not emerging zoonotic disease and the lack of connectivity between physicians and animal health as it relates to human health (CDC, 2012). While these are not the only draw backs they are the main issues that currently stand to be barriers in the implantation of any specified One Health related programs as it relates specifically to the communication between veterinarians and medical professionals.

World Animal Health Information Database (WAHID)

Communication between disciplines is an integral piece of One Health as is the consolidation of animal-human health related data. International zoonotic disease data has been combined and provided for public access by the World Animal Health Information Database (WAHID) was used for this research study (World Organization for Animal Health [OIE], 2012). The WAHID acts as a publically accessible portal to all data within the World Organization for
Animal Health’s (OIE) new World Health Information System (WAHIS). OIE is an international intergovernmental organization whose purpose is to improve animal health across the globe (OIE, 2012). The World Trade Organization (WTO) uses it as a reliable reference and as of 2013 it had a membership of 178 countries. With the continued partnerships between these multi-national organizations the goal is to increase the amount of quality and reliable data when it comes to zoonotic disease reporting. The significance of having this cohesively reported data has the potential to be the difference between an incident and an epidemic.

**Methods**

This study included a statistical analysis of the number of veterinary personnel and incidence of zoonotic disease and qualitative description of international health regulation keywords representing veterinary and zoonotic studies as a proxy for veterinary involvement in international surveillance. The subjects within this study included all reported veterinarians and para-veterinarians in the countries of Australia, Brazil, Czech Republic, Denmark, Ireland, Israel, Netherlands, Spain and the United States for the year 2010. The IRB exemption and author’s ethical training documentation for this study are found in Appendices A and B.

**Quantitative Methods**

**Data collection and data organization.**

Data provided publically by the World Animal Health Information Database (WAHID) were used for this study (OIE, 2012). The WAHID provides data by country, region, year and significant zoonotic disease events. The data can then be further segmented to examine animal population type and size, dates of disease outbreaks, incidence of cases, veterinarians and para-veterinarians\(^1\). The year 2010 was chosen for analysis because the reported data points for this year were the most current and complete for the countries of Australia, Brazil, Czech Republic,

\(^1\) A para-veterinarian is also known as a veterinary assistant or veterinary technician (OIE, 2012).
Denmark, Ireland, Israel, Netherlands, Spain and the United States of America. Analysis of the data used within this research study focused on veterinarians, para-veterinarians and the impact their numbers have on the zoonotic disease status of the countries selected. Countries of low, middle and high income statuses were selected in order to provide a more true representation of the distributions worldwide.

By using multiple Microsoft Excel Spreadsheets all collected data were separated and organized into groupings to be analyzed. For veterinarians and para-veterinarians the data for 2010 were queried for the selected countries to include all veterinarians in the country. The number of personnel was then entered on the spreadsheet for each country as well as the number of personnel per square kilometer (km). The data were then searched again to only show the number of veterinarians involved in governmental public health activities and again for veterinarians involved in academics or training institutions. In a separate query involving para-veterinarians the resulting data for para-veterinarians involved in food hygiene was entered into the spreadsheet in the same manner as the veterinarians including country, number of personnel and number of personnel per square km.

In a separate spreadsheet the animal populations for the selected countries were organized. Known zoonotic reservoirs for the diseases selected were searched for each country and organized within a table as well as the total animal population for the selected country. The selected animal reservoirs were birds, cattle, swine and sheep/goats. The animal reservoirs were then totaled for each country as well as the animal density for each reservoir within the country.

The same process was then used for querying and collecting the reported data of zoonoses in humans. The diseases chosen served to act as a sample of overall disease cases with each country. *Leptospirosis, Salmonellosis, Listeriosis, Campylobacteriosis, Botulism,*
Brucellosis and Escherichia coli O157 data was entered into the excel spreadsheet for each of the nine countries. Once the disease cases, not including deaths, were listed in excel total reported zoonotic cases were produced for each country. The disease rate per 100,000 was then organized in the same manner.

Variables

For veterinarians and para-veterinarians, the independent variables considered were: Country, Number of Veterinary Personnel and Number of Personnel per square km within Governmental Public Health, Academics, Training Institutions and Food Hygiene. The variables considered for the animal population of each country were the population size for birds, cattle, swine, sheep/goats and the total animal population. These species were selected based on their known influence on zoonotic disease transmission through either contact or consumption. The one-year incidence of zoonoses in humans for selected diseases was also included for each country based on disease cases and the disease rate per 100,000 people. The focused zoonotic diseases for this study were Leptospirosis, Salmonellosis, Listeriosis, Campylobacteriosis, Botulism, Brucellosis and Escherichia coli O157.

Statistical Analyses

Graphical illustrations of the data were created using excel. A multi-linear regression was also performed for the combined data of zoonotic cases, veterinarians and the animal populations. The independent variables in this study were the number of veterinarians and para-veterinarians within the country and, 2) the animal population within the respective countries. The dependent variables were measured as continuous.
Qualitative Methods

Three documents were sampled from the literature to be used in the qualitative analyses, each addressing international health regulations and programs relating to One Health and veterinary medicine. The documents were selected to differ in audience and intent but were unified in their critique of disease outbreak surveillance. The three documents were:


For this pilot content analysis, the documents were searched for the following key words: public health, veterinarian, veterinary, surveillance, zoonoses, zoonotic, veterinary public health and bio security. The keyword search was done using the word search function in Adobe Acrobat. All of the documents were searched using the same tool in order to provide an accurate snapshot. These key words were chosen to illustrate the inconsistencies and patterns of inclusion of veterinarians in respect to zoonotic disease outbreak surveillance systems. This illustration was included to show the incomparability of literature addressing veterinarians and their involvement in the prevention of and surveillance for zoonotic diseases. The terms appearing within titles were not excluded. The number of times each word or term appeared in each
document was recorded. These data were then compared visually to make general statements concerning content.

Results

Quantitative Results

Brazil, Spain and the United States had the highest number of veterinary personnel with the United States having the highest proportion overall (Table 1). The Netherlands number of veterinary personnel per square km was the greatest (0.1038 per square km; 4,309 total personnel). Spain had the greatest number of veterinarians involved in government related public health activities (4,365 personnel). Ireland, on the lower end of the spectrum, had only 62 veterinary personnel working in a public health capacity.

Table 1

*Veterinarians and Para-Veterinarians*

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Personnel</th>
<th>Number per square km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>11337</td>
<td>0.0015</td>
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<td>Brazil</td>
<td>99417</td>
<td>0.0117</td>
</tr>
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<td>Czech Republic</td>
<td>7625</td>
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<td>Denmark</td>
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<td>Ireland</td>
<td>3749</td>
<td>0.0533</td>
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<tr>
<td>Israel</td>
<td>1710</td>
<td>0.0823</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4309</td>
<td>0.1038</td>
</tr>
<tr>
<td>Spain</td>
<td>26538</td>
<td>0.0526</td>
</tr>
<tr>
<td>United States of America</td>
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<td>0.0168</td>
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</table>

<table>
<thead>
<tr>
<th>Country</th>
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<th>Number per square km</th>
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</thead>
<tbody>
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<td>United States of America</td>
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<td>0.0001</td>
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</tbody>
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Table 1

Veterinarians and Para-Veterinarians (Cont’d)

<table>
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<tr>
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<th>Number per square km</th>
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<tr>
<td>Czech Republic</td>
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<tr>
<td>Denmark</td>
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</tr>
<tr>
<td>Ireland</td>
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</tr>
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</tr>
<tr>
<td>United States of America</td>
<td>6425</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

The data for para-veterinarians were overall incomplete. There were only three countries (Australia, Spain, USA) that reported data on para-veterinarians working in a food hygiene capacity. Meaning, these para-veterinarians were involved either directly or indirectly in regulating the health of animals within the food supply. The United States had the greatest number of these personnel. Spain and the United States were two of the three countries with the greatest number of total veterinary personnel.

Veterinarians and Zoonotic Disease Outbreaks

In order to maintain consistency, six diseases were chosen that were presented in each of the nine countries (Figure 1). In 2010, Campylobacter, Salmonella and E. coli were the three most common causes of zoonotic disease cases. The United States had a total of 52,711 reported cases of zoonoses in humans due to Salmonella. This was exacerbated by a multi-state Salmonella outbreak of in 2010 causing the data from the United States to present the characteristics of an outlier.
Figure 1. Zoonoses in humans in 2010.

When the cases of zoonotic diseases were compared to the number of veterinary personnel in each of the countries there was an overall correlation in the number of zoonotic disease cases and an increase in veterinary personnel. The data points were plotted in excel and a best fit line was created to display the relationship (Figure 2). The line of best fit presented a negative slope with an $R^2$ value of 0.037.
Figure 2. Veterinarians and zoonotic disease cases.

Overall, as the number of veterinarians increased within a country the number of zoonotic disease cases decreased.

**Government Public Health Activities, Zoonotic Disease Cases**

The same analytical process was repeated for the number of veterinarians in a government related public health capacity and zoonotic disease cases in 2010 (Figures 3a, 3b). Again, as the number of veterinarians increased, there was a decrease in the number of zoonotic disease cases (Figure 3a). However, when a line of best fit was applied to the data it was not represented. There was a positive slope with the r value of 0.005. This can be attributed to the uncharacteristically large number of outbreaks within the United States due to the Salmonella
outbreak. This was accounted for and a separate figure (Figure 3b) was created excluding the United States.

Figure 3a. Veterinarians in government public health activities and zoonotic disease cases.

The United States acted as an outlier as there were an uncharacteristically high number of zoonotic disease cases due to a multi-state Salmonella outbreak in 2010. This non-representative character and its influence on the regression results led to its omission in the statistical analyses. Accounting for the outlier of the United States the trend line then presented a negative slope with an r value of 0.002. As the number of veterinarians in government related public health activities increased the number of zoonotic disease cases decreased.
Figure 3b. Veterinarians in government public health activities and zoonotic disease cases, minus the United States (outlier).

Veterinarians, Animal Reservoirs and Disease Cases

A multi-linear regression was performed using both the number of veterinarians and the animal population as independent variables. The number of veterinarians and the number of animals in a country were significantly associated with the incidence of zoonotic disease cases (Table 2). The magnitude of the regression coefficients showed that the number of veterinarians in a country accounts for variance in zoonotic disease than the number of animals. Together the two variables accounted for 81% of the variance in zoonotic disease.

Table 2

Coefficients Table for Multi-Linear Regression Model

<table>
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<th></th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
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<td>X Variable 2</td>
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<td>Adjusted R Square</td>
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<td>Significance F</td>
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</tr>
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</table>
Health Regulations and Zoonosis Awareness

A basic keyword search was done for the literature used within the literature review and to be discussed in further detail within the discussion section of this paper. The most recent International Health Regulations (WHO, 2008) was compared in a keyword search the Food and Agriculture Organization of the United Nation’s (FAO) surveillance compilation (FAO, 2011). The FAO document was entitled Challenges of Animal Health Information Systems and Surveillance for Animal Disease and Zoonoses addressed One Health, international zoonotic disease surveillance systems, veterinary medicine as well as public health.

Table 3.

Results of Keyword Search in Selected Documents

<table>
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The International Health Regulations (WHO, 2008) do not specifically address zoonotic disease, zoonoses or veterinarians. However, public health was an overall theme as the term (public health) appeared 173 times throughout the document. The FAO document was more extensive in the coverage of the topics discussed throughout this study. Veterinarians, zoonoses and surveillance were the main focus of the articles contained within the document and appeared 16, 75, and 571 times, respectively.
Discussion

Intention of Study, Review of Research Questions

This study was selective assessment of veterinary professionals, zoonoses in humans and zoonotic disease surveillance systems as they relate to One Health. The first objective of the study was to examine any relatable trends between veterinary personnel, zoonoses in humans and the animal population of the selected countries. Another objective of the study was to assess the state of international health regulations and disease surveillance systems as they related to One Health, prevention and veterinary involvement. The results showed an overall lower number of zoonotic diseases with higher numbers of veterinary professionals. The same true for zoonotic disease cases and veterinarians in government related public health activities when the presence of an outlier was accounted for. The United States acted as an outlier in this case as there was an uncharacteristically high number of zoonotic disease cases due to a multi-state Salmonella outbreak that year.

Overall there was fewer zoonotic disease outbreaks with higher numbers of veterinarians involved with public health. There was not adequate data presented by each of the selected countries to explore further the trends related specifically to zoonoses in humans para-veterinarians involved in food hygiene. While the countries selected were not representative of a particular type of health system they did serve as a sample of accessibility in respect to their complete data samples. In comparison, each of the countries selected were representative of relatively high incomes and good infrastructures. The countries selection was very limited but still served to act as a foundation to the idea that veterinarians are a pivotal starting point in the surveillance/prevention of zoonoses in humans. It also speaks to the capabilities of countries to increase their veterinary involvement if a prevention program were to be instituted. It is then
important to know the distribution of veterinary personnel and further assess their capabilities to participate in such programs. A high number of veterinarians will not be enough to implement a productive program but a diverse knowledge base within these personnel raises the probability.

The search of health regulatory documents for the inclusion of veterinary disease surveillance and prevention terms proved to be inconsistent (Table 2). The International Health Regulations of 2005 did not mention surveillance in respect to veterinarians or veterinary public health but focused solely on the World Health Organization’s role in the event of an outbreak specifically related to international trade. However, The Food and Agriculture Organization of the United Nations (FAO, 2011) released a document specifically targeting the challenges presented in surveying animal diseases and zoonoses amongst different surveillance systems. These documents extensively mentioned informative data, definitions, problems and solutions relating to One Health, zoonoses, veterinarians and public health. The document released in 2011 seems to be the leading source of collective information as it relates to the challenges facing the implementation of One Health ideas and veterinary involvement. As a whole there were also discrepancies in the terminology across the documents even when addressing the same ideas. Some of the challenges and successes facing these surveillance systems were notable to mention in further discussion as they had strong ties to veterinary medicine, One health and zoonotic disease surveillance.

**Impact for International Surveillance Systems**

There are many separate systems in place for disease surveillance and zoonotic disease prevention but there are also many differences among them as they relate to the involvement of veterinarians. There is an ongoing partnership between FAO, OIE and WHO to implement change and improvement to the existing surveillance systems worldwide (Granger, 2011).
Equipped with the knowledge of how influential veterinarians are as principal investigators, standards can be implemented system wide using practices that have proven to be successful. One way to begin this process is to standardize the accreditation of veterinary education or training programs to include surveillance training (Granger, 2011). By doing so, specific surveillance’ related information can be relayed early on to veterinarians outside of the government sector. The professionals are often greater in number within the private sector, have increased contact with companion animals and could then be effectively utilized in the event of an emergency if given the same foundation of surveillance information. Support in this effort is offered by the USDA’s National Veterinary Accreditation Program (NVAP) and the American Veterinary Medical Association (AVMA) (Granger, 2011). The AVMA is currently in the process of creating and implementing an International Organization of Standardization to address these issues (Granger, 2011). Standardization of education is viewed as an integral piece to the puzzle of solving dissimilarities amongst the accreditation programs (FAO, 2011). This also compliments OIE’s identification of some pathways to improvement through the performance of veterinary standards instrument (OIE, 2012). There are major gaps in the communication between the public and private sector, leaving way for much needed improvements lead by the ISO standards. Other anticipated improvements will reflect more intensive training in disease reporting and recognition as well as more comprehensive data collection for the surveillance of different disease symptoms (Abela & Schnitzler, 2011).

Other reporting systems that weigh heavily on the importance of veterinarians throughout this process include the Global Outbreak Alert and Response Network (GOARN) and the Global Early Warning and Response System for Major Animal Diseases (Pinto, Jebara, Chaisemartin, de La Rocque, & Abela, 2011). GOARN is another network coordinated by the WHO that
focuses on multidisciplinary support in response to an outbreak utilizing data from tools such as The Global Early Warning System (GLEWS) to create a coordinated response (Pinto et al., 2011). Another system used as a data collection tool in respect to zoonoses is the FAO’s Emergency Prevention System (EMPRES) which acts as a global online tool to disease outbreak information (Abela & Schnitzler, 2011). EMPRES is another system is also operated under the FAO. All of these systems have separate reporting platforms but rely on some of the same venues for data reporting. Whether the data originates from government, private, international, medical or veterinary sources the compilation of this data acts as the foundation to furthering the One Health notion.

**Limitations**

There were many limitations to this research study. The study was limited to information that was voluntarily reported to OIE and compiled by various countries on the World Animal Health Information Database (WAHID). Data points were selected based on availability and inclusiveness. The data from this study was based solely on the 2010 reports from the WAHID as for other years many data points were missing, speculated to be underreported or unclear and were excluded from the study. Initially countries more common to Public Health studies were chosen but their reported data was incomplete. With zoonotic outbreaks and veterinary personnel being the focus of the study the countries were selected based on the amount of reported information as it related to zoonotic disease cases. The study was also limited in the actual diseases chosen to focus on. These data points were also chosen based on the frequency they appeared in the available countries. The study was not able to cover larger pandemic events, such as H1N1, as the data was not readily available. The animal population reported was also limited in the data available. The animal reservoirs reported did not go into detail on the
classifications of the animals depicted in respect to companion animals, wild life or food production animals.

The study did not go in depth as to assess the content of each countries veterinary education programs as they related to One Health. The data set did provide adequate information on the breakdown of where the veterinarians were dispersed professionally as it related to the study but went no further into detail. In future study, that information could prove to be complimentary in comparing more intensive training or continuing education programs and the subsequent the rate of zoonoses in humans within those countries.

While the data reported in this study are useful in creating a descriptive analysis, more consistent reporting systems are needed to create a more complete picture to implement health regulations or One Health programs involving veterinarians.

Conclusions

Veterinarians are only a piece of the One Health puzzle, as One Health at its best would be a multidisciplinary system. However, studies such as this provide the foundation for further research into how to strengthen each piece of that puzzle. Every participant within the One Health system should not only be able to communicate with other participants, but also know how to efficiently carry out prevention and surveillance. Veterinarians should be utilized as the primary sources of important disease outbreaks that can affect the public health landscape. There are many surveillance systems in place that can ultimately facilitate this progression, but there are other challenges to zoonotic disease surveillance and the implementation of One Health programs. The lack of focus within International Health Regulations on zoonotic disease surveillance serves as a major barrier to identifying a country’s preparedness to handle an outbreak of zoonotic origin. There is also still a major deficit in voluntarily reported data
making policy studies and comparisons. While these barriers may slow progress, there is still forward progress in the overall implementation of One Health. For example, strengthening the base of the One Health movement will ultimately be accomplished by standardizing prevention education of competent public and private veterinary professionals. Coupled with revised reporting standards and health regulations specific to zoonotic diseases, current surveillance systems will be strengthened and can further benefit multidisciplinary communication.
References


*Emerging Infectious Diseases*, 3(4), 425-434.


Appendices

Appendix A - CITI Completion Report

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<th>Required Modules</th>
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For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered
Appendix B - IRB Exemption Certificate

RESEARCH INVOLVING HUMAN SUBJECTS

ACTION OF THE WRIGHT STATE UNIVERSITY
EXPEDITED REVIEW
Assurance Number: FWA00002427

SC# 5142

Title: 'One Health: Veterinary Involvement and Zoonoses in Humans'

Principal Investigator: Jasmine Cheeks, PI, MPH Student
Public Health
Community Health

The Institutional Review Board Chair has approved an exemption with regard to the use of human subjects on this proposed project.

REMINder: Federal regulations require prompt reporting to the IRB of any changes in research activity [changes in approved research during the approval period may not be initiated without IRB review (submission of an amendment), except where necessary to eliminate apparent immediate hazards to subjects] and prompt reporting of any serious or on-going problems, including unanticipated adverse reactions to biologicals, drugs, radioisotope labeled drugs or medical devices.

Signed Chair, WSU-IRB

Approval Date: April 10, 2013
IRB Mtg. Date: May 20, 2013
DATE: April 10, 2013

TO: Jasmine Cheeks, PI, MPH Student
    Public Health
    Community Health

FROM: B. Laurel Elder, Chair
      WSU Institutional Review Board

SUBJECT: SC# 5142

'One Health: Veterinary Involvement and Zoonoses in Humans'

At the recommendation of the IRB Chair, your study referenced above has been recommended for exemption. Please note that any change in the protocol must be approved by the IRB; otherwise approval is terminated.

This action will be referred to the Full Institutional Review Board for ratification at their next scheduled meeting.

NOTE: This approval will automatically terminate two (2) years after the above date unless you submit a "continuing review" request (see http://www.wright.edu/rsp/IRB/CR_sc.doc) to RSP. You will not receive a notice from the IRB Office.

If you have any questions or require additional information, please call Robyn Wilks, IRB Coordinator at 775-4462.

Thank you!

Enclosure
## Appendix C – List of Tier 1 Core Public Health Competencies Used in CE

### Domain #1: Analytic/Assessment
- Use variables that measure public health conditions
- Identify sources of public health data and information
- Recognize the integrity and comparability of data
- Identify gaps in data sources
- Adhere to ethical principles in the collection, maintenance, use, and dissemination of data and information
- Describe the public health applications of quantitative and qualitative data
- Use information technology to collect, store, and retrieve data
- Describe how data are used to address scientific, political, ethical, and social public health issues

### Domain #2: Policy Development and Program Planning
- Gather information relevant to specific public health policy issues
- Describe how policy options can influence public health programs
- Gather information that will inform policy decisions (e.g., health, fiscal, administrative, legal, ethical, social, political)
- Demonstrate the use of public health informatics practices and procedures (e.g., use of information systems infrastructure to improve health outcomes)

### Domain #3: Communication
- Communicate in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency

### Domain #4: Cultural Competency
- N/A

### Domain #5: Community Dimensions of Practice
- Recognize community linkages and relationships among multiple factors (or determinants) affecting health (e.g., The Socio-Ecological Model)
- Identify stakeholders
- Inform the public about policies, programs, and resources

### Domain #6: Public Health Sciences
- Retrieve scientific evidence from a variety of text and electronic sources
- Discuss the limitations of research findings (e.g., limitations of data sources, importance of observations and interrelationships)

### Domain #7: Financial Planning and Management
- N/A

### Domain #8: Leadership and Systems Thinking
- Describe how public health operates within a larger system
- Identify internal and external problems that may affect the delivery of Essential Public Health Services
- Describe the impact of changes in the public health system, and larger social, political, economic environment on organizational practices