The Blue, the Green, and the Toxic:

Knowledge, Attitudes, and Practices of Physicians and Veterinarians Regarding Harmful Algal Blooms

Karin Moser

Kansas State University

Master's in Public Health Field Experience Conducted at:

Kansas Department of Health and Environment

Bureau of Epidemiology and Public Health Informatics

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Abstract

Worldwide, 60% of cyanobacteria, or blue-green algae samples contain harmful toxins that could lead to adverse health effects in both humans and animals. When these bacteria proliferate they are known as Harmful Algal Blooms (HABs). Between June 1and October 1, 2011, there were 13 human and 7 animal cases of HAB-related illnesses in the state of Kansas. Since the inception of the Harmful Algal Bloom monitoring program in 2010, the Kansas Department of Health and Environment (KDHE) has worked to improve various aspects of the program. One aspect of the program which was identified as needing improvement was the reporting of human and animal illnesses related to HABs. A knowledge, attitudes and practices survey was created and sent electronically and through the mail to a random sample of Kansas licensed physicians and veterinarians (700 physicians, 796 veterinarians) to determine the success of the public health messaging campaign performed by KDHE to increase reporting of HAB-related illnesses. It was determined that while diagnosis of HAB-related illness increased from the summer of 2010 to the summer of 2011, the reported awareness before and after the messaging campaign did not change significantly among these health care professionals. Therefore, it was concluded that increased efforts (such as television news broadcasts, social networking, and radio station broadcasts) could be made by KDHE to educate physicians, veterinarians and the general public about where and when HAB- related illness can be reported to KDHE.

Keywords: cyanobacteria, blue-green algae, Harmful Algal Bloom, public health

Chapter One: Survey as a Public Health Research Instrument

There are many ways to perform public health research today. One of the most common methods utilized by epidemiologists and public health professionals is through the use of surveys. There are many questions that must be answered before a survey can be utilized for research. Is it a cross-sectional survey used to gather information on a population at a single point in time? Or is it a longitudinal survey used to gather data over a period of time. How will the survey be distributed? Who is the target population and what is the best way to get a representative sample population? What are the different sources of bias for a survey? What are some ways to control bias? The following will attempt to answer some of those questions.

According to Floyd Fowler, Jr, Survey Research Methods (pp 80-83, 2009), Internet questionnaires have low costs, require very little staff, and have a potential for high speed returns. Also, asking batteries of similar questions may be more acceptable to the respondents in an Internet format and not having to respond to a person (as would occur in an interview) allows respondents to be more honest. Additionally, more complex skip patterns can be put in place that may not be possible in a paper survey. Self-administered surveys, such as Internet questionnaires, allow the respondent to complete the survey at their leisure. Some disadvantages of Internet questionnaires are that respondents are limited to Internet users, a valid email address must be utilized to ensure receipt, and there is no way to ensure cooperation. Mail out questionnaires have very similar advantages as those of an Internet questionnaire in that cost is low, staff required is low and it allows respondents to complete the survey at their leisure. An additional advantage of a mail procedure is that it allows the survey administrator to reach a widely dispersed sample that may not be reachable through other means such as the Internet. Disadvantages of a mailing procedure include the need of valid mailing addresses to ensure

receipt and lack of cooperation as many individuals need an incentive to take the time to not only fill out the survey but also use a stamp to send the survey back, especially if there is no funding for return envelopes.

Simple random sampling has the highest probability of giving a survey administrator the most representative sample of their target population. Unfortunately, random sampling is difficult at times because it is so laborious. If the list is too long, or if it is not pre-numbered, or if it is not computerized, then many man hours will have to put into it to make it ready for random sampling (Fowler, pp23-34, 2009). Therefore, other sampling techniques such as systematic and stratified sampling are employed by public health professionals to determine their sample populations. Systematic sampling is performed by creating a fraction in which the numerator is the number needed in the sample and the denominator is the number in the target population. The result of this calculation is what is used to systematically select participants from the target population for the random sample. Stratified samples are created to reduce the normal sampling variation, thereby producing a sample that is more likely to look like the total population than a simple random sample. Stratification can only be performed if the survey administrator has additional information about the target population that they can use to stratify the sample and therefore requires a more complete list of the sample frame.

There are numerous sources of bias in a survey and they all depend on how the survey sample population was selected, how the survey was designed and distributed, and how the questions are worded. The main types of bias that will be discussed on here are selection bias, such as non-response bias, and information bias, as well as recall and ascertainment bias; all of which fall under systematic error. Without the appropriate field of data to compare the target population to the random sample it is possible to have selection bias, in which there is a

systematic bias in who is invited to participate in the survey versus who is not selected. Nonresponse bias occurs when the non-responders for a study differ significantly from the responders. Information bias leads to a misclassification either by errors related to exposure status (differential) or unrelated to exposure status (non-differential). Recall bias is when the exposed population is more likely to recall certain aspects more clearly then the unexposed population. Someone who has actually experienced an event is more likely to recall all of the details before, during and after the event versus someone who was not in the event and therefore had no real need to recall the detailed information. Another form of information bias that can greatly affect public health surveys in particular is ascertainment bias. This bias occurs when more cases or exposures are being detected because the researcher is now looking for them or there is a more accurate test available now and in the past they may not have looked for the cases at all or had the ability to find them.

Systematic error, and therefore all of the biases previously mentioned, can be controlled by increasing the internal and external validity of the study. The internal validity is "the degree to which the results of an observation are correct for the particular group of people being studied". External validity, also known as generalizability, is "the extent to which the results of a study apply to people not in it". It is impossible to have external validity if there is not internal validity to a study and all sources of systematic error threaten internal validity (Bonita, R. Beaglehole, R., Kjellstrom, 2006).

Chapter Two: Survey of Kansas Physicians and Veterinarians

Purpose

The purpose of this study was to assess physicians' and veterinarians' knowledge, attitudes, and practices regarding the diagnosis of Harmful Algal Bloom (HAB)-related illnesses in Kansas.

Background and Significance

Cyanobacteria, refers to an organism that reflects some characteristics of bacteria as well as algae, therefore they are also termed blue-green algae. The World Health Organization's (WHO) *Guidelines for Safe Recreational Water Environments*, and its 2009 addendum, identified at least 46 species of cyanobacteria that have been known to show toxic effects in vertebrates. Worldwide, 60% of cyanobacterial samples contain harmful toxins that could lead to adverse health effects in both humans and animals (World Health Organization [WHO], Chapter 8.1). The first documented case of a lethal intoxication of livestock after drinking water from a lake heavily populated with cyanobacteria was published in the 1800's Since then, recorded cases have included sheep, cattle, horses, pigs, dogs, fish, rodents, amphibians, waterfowl, bats, zebras, rhinoceroses and even humans (WHO, Chapter 8.4). In the United States, toxin producing blooms of cyanobacteria, known as Harmful Algal Blooms (HABs) have been associated with both human and animal illness in 36 different states.

The exact cause of Harmful Algal Blooms (HABs) is unknown. Many believe that human activities (e.g., agricultural runoff, inadequate sewage treatment, runoff from roads) have led to excessive fertilization (eutrophication) of many water bodies (WHO, Chapter 8.0). This has led to the excessive proliferation of algae and cyanobacteria in fresh water. Also, certain conditions such as warm, dry, weather can cause cyanobacteria to proliferate. Unfortunately, warm, dry,

weather also coincides with a period of time when people are enjoying outdoor activities such as spending time on recreational bodies of water. This poses a serious health risk to both humans and animals if they are exposed to a HAB during recreational activities. Exposure can occur via ingestion, inhalation and/or dermal contact with a toxin producing bloom. In humans, symptoms include headaches, malaise, skin rashes, eye irritation, vomiting, diarrhea, respiratory distress and possibly death. Animals usually present with malaise, vomiting, diarrhea, respiratory distress, jaundice, convulsions, and even death. As scientists are uncertain as to what really causes HABs to form and produce toxins, it is very difficult to predict or prevent them. It is impossible to determine how long a bloom will last or how much toxin it may or may not produce. The Kansas Department of Health and Environment (KDHE) samples public use lakes and reservoirs only in response to complaints of human or animal illness, or visual sighting of possible blue green algae by the public or lake officials. The 2010 KDHE Blue-Green Algae Response Plan, which was in place during the summer of 2011, defined "Public waters" as:

> "*Those waters that are referred to as reservoirs, community lakes, state fishing lakes and/or are waters managed or owned by federal, state, county or municipal authorities and all privately owned lakes that serve as public drinking water supplies or that are open to the general public for primary or secondary contact recreation. Primary contact recreation includes those activities that the body is immersed to the extent that some inadvertent ingestion of water is probable. This use shall include activities such as: boating, mussel harvesting, swimming, skin diving, waterskiing, jet skiing and windsurfing. Secondary contact recreation includes any activity which the ingestion of surface waters is not probable. These uses shall include activities such as: wading, fishing, trapping and hunting."*

KDHE receives HAB- related illness reports only when a physician, veterinarian, or citizen voluntarily reports it to KDHE (passive surveillance). Once a possible bloom or HAB-related illness has been reported, an investigation begins and the lake is tested to confirm the presence of cyanobacteria as well as any toxins that the HAB may be producing. Depending on the sampling results, KDHE makes recommendation for posting either a Public Health Advisory or Public Health Warning.

KDHE recommendations are based off of WHO recommendations for establishing warnings and advisories for recreational use (WHO, Chapter 12). During the summer of 2010, KDHE did not have a HAB response policy in effect. However, in response to an increasing number of citizen complaints of public lake conditions and a number of animal illness reports, KDHE developed the response plan in August of 2010. In 2011, Public Health Advisories were issued if laboratory analysis indicated the presence of between 20,000 and 100,000 blue green algae cells per milliliter of water sampled or a microcystin toxin level of less than 20µg/L (Hunt, Eberhart-Phillips, and Mitchell, 2010). Public Health Warnings were issued if laboratory analysis indicated the presence of at least 100,000 cells per milliliter of water sampled or a microcystin toxin level greater than or equal to 20µg/L. A Public Health Warning was also issued when visible cyanobacteria surface accumulations were present at swimming beaches or other areas.

In Kansas, 22 of 26 state parks are adjacent to federal and state reservoirs with an estimated 6,100,000 visits to these parks in 2011. During the summer of 2010, as there was no HAB policy in place, human and animal HAB-related illnesses were not maintained in any database. In 2011, 26 Kansas lakes in 19 counties were confirmed with HABs. Between March 18, 2011 and October 31, 2011, 16 lakes were under a Warning status and there was one lake closure. There were 13 human cases of HAB-related illness between June 1st and October 1st

2011, 7 of which were confirmed and 2 were hospitalized. Among the confirmed cases, age ranged from 17 to 63 years and individuals demonstrated symptoms such as eye and upper respiratory irritation, rash, and gastrointestinal upset. During the same time period, there were 7 cases of animal HAB-related illnesses, 1 of which was confirmed and 5 died. All 5 deaths were canines and were exposed to the same reservoir. Cases ranged from 40 to 60 lbs. (18 to 27 kg). Clinical signs began two to four hours after exposure exhibiting gastrointestinal upset (such as vomiting and diarrhea), lethargy, staggering, and seizures (Trevino-Garrison et al, 2011).

Scientific Merit

Since the inception of the Harmful Algal Bloom monitoring program in 2010, KDHE has worked to improve various aspects of the program. One aspect of the program which was identified as needing improvement was the reporting of human and animal illnesses related to HABs. Program activities that centered around this goal included the dissemination of information through a number of media outlets and letters to Kansas healthcare professionals including physicians and veterinarians. Prior to the 2011 season, a blue-green algae webpage on the KDHE website was created and made available to the public. This webpage included links to submit HAB human and animal illness forms, photographic examples of blue-green algae and non blue-green algae, as well as a map highlighting Kansas counties with current Advisories/Warnings. In May 2011, Dr. Moser, Secretary of KDHE, sent a letter to Kansas physicians through the Kansas Academy of Family Physicians (Appendix A) describing the symptoms of HAB-related illness and made them aware of different avenues for reporting such illnesses (Moser, 2011). Dr. Garrison, the State Public Health Veterinarian, in cooperation with Dr. Van der Merwe from the Kansas State University Diagnostic Laboratory, wrote a similar letter (Appendix B) to Kansas veterinarians which was distributed via the Kansas Veterinary

Medical Association in July 2011 (Treveino- Garrison and Van der Merwe, 2011). As part of the program evaluation process, KDHE identified the need to evaluate the success of these outreach activities in increasing public awareness about HAB-related illness reporting. The current study surveyed Kansas physicians and veterinarians to evaluate the success of this campaign.

Specific Aims

The specific aims of this study were: 1) to determine the number of physicians and veterinarians in Kansas making diagnoses of HAB-related illnesses in the summer of 2010 and in the summer of 2011, 2) to determine the number of physicians and veterinarians in Kansas who remembered receiving public health messaging about HABs from the KDHE prior to the summer of 2011, 3) to determine whether the public health messaging about HABs from KDHE influenced diagnostic practices, 4)to assess whether physicians and veterinarians in Kansas were aware of Advisories/Warnings related to lake conditions in their area, 5) to assess attitudes among Kansas physicians and veterinarians regarding recreational water monitoring by state public health and environment agencies.

Study Design

Sampling and Study Sites

A random sample was generated from two professional licensure registries using an online random sample calculator (Custom Insight). For the physician sample, anticipating a 50% response rate at a 95% confidence interval, it was determined that 350 respondents were needed; therefore a sample of 700 licensed physicians were randomly selected from the list of 841 Kansas licensed physicians. For the veterinary sample, also anticipating a 50% response rate at a 95% confidence interval, it was determined that 398 respondents were needed; therefore a

sample of 796 veterinarians were randomly selected from the list of 1178 Kansas licensed veterinarians. The sampling site was the entire state of Kansas.

Study Population, Data Sources, and Study Period

Physicians for the survey were selected by obtaining licensure lists from the Kansas Board of Healing Arts (KBHA). The physician licensure list from the KBHA included only active Doctors of Medicine (MD) and Doctors of Osteopathic Medicine (DO) in general practice and/ or pediatrics as of January 20, 2012. The veterinarians for the survey were selected by obtaining licensure lists from the Kansas Board of Veterinary Examiners (KBVE), which periodically provides licensure lists to the Kansas Department of Health and Environment Division of Health Care Finance (KDHE DHCF), and a membership list from the Kansas Veterinary Medical Association (KVMA). A list of currently licensed veterinarians as of January 2012 from the KBVE website was used to update the list from KDHE DHCF that was only current to August 2011. Because the list from KDHE DHCF did not include a field of email addresses for the veterinarians, the membership list from the KVMA was also used to update contact information with email addresses.

Exclusion Criteria

Prior to comparing the KVMA membership list to the KDHE DHCF registry, all KVMA members with a membership status of "Associate", "Cancelled", "Graduate", or "Inactive" were removed from the list and were not included in the final KDHE DHCF registry. All physicians and veterinarians on their respective licensure registries with a practice address outside of the state of Kansas were removed from the target population prior to obtaining the random sample.

Survey Methodology

The physician survey consisted of 29 multiple choice and free text questions while the veterinary survey consisted of 31 multiple choice and free text questions (Appendix C and Appendix D). All questions were similar between the two surveys except for an additional two questions in the veterinary survey that inquired on the type of species in which HAB-related illness had been diagnosed or suspected in 2010 and in 2011.

During the first round of distribution, the survey was administered via Survey Monkey using available email addresses from the random sample. A total of 1,110 (667 physicians and 443 veterinarians) emails were sent to Kansas physicians and veterinarians. Individuals were given two weeks to follow the link in the email to complete the survey online. A reminder email, with survey link included, was sent two days before the deadline. All respondents to the online survey remained entirely anonymous.

To increase the response rate, a second round of surveys was distributed. This round included a paper survey, as well as information on how to fill out the survey online, that was distributed through the mail to all physicians and veterinarians with physical addresses. All addresses were confirmed as valid addresses using a Geographic Information System (GIS) or by Internet research. Prepaid return envelopes were enclosed to ensure the return of as many completed surveys as possible. A total of 1456 (695 physicians and 761 veterinarians) surveys were mailed to Kansas physicians and veterinarians. Individuals were given two weeks to complete the survey, either via paper copy or online, and surveys that arrived in the mail up to three weeks after the date of distribution were included in the analysis.

Between the two rounds of the survey, each one of the 1496 health care professionals in the random sample were contacted (700 physicians, 796 veterinarians). Those physicians and

veterinarians that provided both an email address and a street address received both the email and the mail out survey while others received one or the other, depending on the contact information that was provided on the licensure lists. Those individuals who had previously received the email survey from round one and had completed the survey online were asked to return the written survey from the second round with the words, "Previously completed online" written across the top. This helped to ensure that individuals from the first round of survey distribution did not submit a second survey during the second round.

Data Analysis

For each question in the survey, counts and frequencies were calculated. Calculation of frequencies took into account the skip patterns in the survey. Also, post-stratification weighting was not performed as there was no evidence to indicate that there was a difference is the distribution of sex, age or region of practice in Kansas (Northwest, Northeast, Central, Southwest, Southeast) between the random sample population and the target population (Table 1). Therefore, all frequencies presented represent the unweighted frequency.

Hypothesis testing was performed to determine if the difference between two proportions was statistically significant. The null hypothesis is that there is no difference. If the calculated p-value was less than the significance level of 0.05, the null hypothesis was rejected and it was determined that there was a statistically significant difference between the two proportions.

Results

In the first round of survey distribution, which was the online distribution only, of the physicians, 53 completed the survey, 28 were returned as invalid addresses, 2 chose not to participate, and 584 did not respond. Of the veterinarians, 56 completed the survey, 87 were returned as invalid addresses, and 300 did not respond. The response rate for physicians was

8.3% and for veterinarians it was 15.7% for a total response rate of 11.0%. In the second round of survey distribution, which included both paper copy and online responses, of the physicians, 122 completed the survey, 5 had previously completed the survey online, 1 was deceased, 1 moved out of state, 31 were returned as invalid addresses, and 535 did not respond. Of the veterinarians, 235 completed the survey, 7 had previously completed the survey online, 2 were deceased, 1 sold their practice, 3 chose not to participate, 18 were returned as invalid addresses and 495 did not respond. For the second round, the response rate improved for physicians to 18.6% and veterinarians to 32.2% for a total response rate of 25.7%.

Between the two rounds, every Kansas physician and veterinarian in the random sample was contacted (700 physicians, 796 veterinarians). When both rounds were combined, the physician response rate was 27.6% and the veterinary response rate was 42.9% for an overall response rate of 35.5%.

The responders from the mail out survey (n=355) were significantly different from the non-responders (n= 1101) based on region of practice in Kansas. The two regions that were significantly different were the Northeast and the Southeast. The Northwest, Southwest, and the central regions did not differ significantly (Table 2).

Of the physicians who responded to the survey and provided data, 27.4% worked in a family practice, 29.7% worked in a pediatric office, and the rest worked in more specialized areas (Table 3). Physicians reported seeing 1 to 10 patients per day (18.3%), followed by 35.4% seeing 11 to 20, 29.1% seeing 21 to 30, 4.6% seeing 31 to 40, and 1.1% reportedly seeing more than 40 patients per day. Considering the number of years in practice, 28.6% of physicians reported to have been in practice for 1 to 10 years, 20.0% for 11 to 20 years, 22.9% for 21 to 30 years, 13.1% for 31 to 40 years, and 3.4% for 41 to 50 years. The number of physicians in the

practice ranged from 1 to 250 with 69.7% reporting between 1 and 10 physicians. The majority of physician respondents (50.3%) were male with 40.6% being female. The majority of physicians were between the ages of 31 to 40 (25.1%) and 51 to 60 (26.3%). (Table 3).

Of the veterinarians who responded to the survey and provided data, 49.8% worked in a companion animal exclusive practice, and the remainder worked in more specialized areas of veterinary medicine (Table 4). Type of practice was defined according to the American Veterinary Medical Association (AVMA) 2012 species categories listed under private clinical practice. The numbers of patients seen per day by the respondents were categorized by the type of practice they reported working in. For those respondents who reported working in a companion animal exclusive practice a majority reported see 1 to 10 patients per day (32.1%) or 11 to 20 (56.4%). Considering the number of years in practice 22.0% reported to have been in practice 1 to 10 years, 19.6% for 11 to 20 years, 27.8% for 21 to 30 years, 21.3% for 31 to 40 years, 4.1% for 41 to 50 years, and 0.3% for more than 50 years (Table 4). A majority (54.3%) of respondents reported to have 1 to 2 veterinarians in their practice. There were more male veterinary respondents (59.8%) then there were female (36.8%). The majority of the respondents ranged from age 31 to 40 years (19.6%), 41 to 50 years (19.9%), and 51 to 60 years (28.2%) (Table 4).

Comparing number of physicians and veterinarians in Kansas making diagnoses of HAB-related illnesses in the summer of 2010 and in the summer of 2011: The number of physicians and veterinarians that reported suspecting or diagnosing HAB-related illnesses increased significantly from 2010 (2010 HAB Illness) (4.1%) to 2011 (2011 HAB Illness) (14.4%) ($p=<.0001$) (Table 5). There was no significant difference between HAB-related illness suspected or diagnosed among physicians compared to veterinarians.

The majority of physicians and veterinarians who reported suspecting or diagnosing HAB-related illness in 2010 (2010 Report) reported that they were not aware that they could report the illness to KDHE (36.8%) or they simply did not report the illness at all (73.7%). In 2011, there were similar results (2011 Report) in that a majority was not aware that they could report to KDHE (33.3%) or simply did not report (42.4%). There was no significant difference in reporting when comparing physicians to veterinarian in either 2010 or 2011.

In the summer of 2010, 4 physicians reported suspecting or diagnosing HAB-related illness (2010 HAB illness), 2 of which stated that the exposure occurred at a public body of water (2010 Exposure Location). However, only one physician reported the illness to KDHE (2010 Report) (Table 6). This individual reported the HAB-related illness to KDHE by calling the KDHE EpiHotline on the phone (Method of Reporting). Although there were 15 veterinarians who reported suspecting or diagnosing HAB-related illness (2010 HAB Illness) (53.3% in canines and 46.7% in bovines) (2010 Species) there were no veterinarians that reported illness to KDHE (2010 Report). Four of the 15 veterinarians who reported suspecting or diagnosing HAB-related illness stated that the exposure occurred in a public body of water (2010 Exposure location) (Table 7).

Of the physicians who responded, in the summer of 2011, there were no physician reports to KDHE regarding suspected or diagnosed cases of HAB-related illness. There were, however, 11 physicians who had suspected or diagnosed HAB-related illness in patients (2011 HAB Illness), 9 of which stated that the exposure occurred in a public body of water (2011 Exposure location) (Table 6). There were 5 veterinarians who reported that during the summer of 2011 they had reported HAB related illness to KDHE (2011 Report). A total of 22 veterinarians reported in the survey that they had suspected or diagnosed HAB related illness (2011 HAB

Illness) (81.8% in canines, 22.7% in bovines) (2011 Species) and 13 were reported to have been exposed in a public body of water (201 Exposure Location) (Table 7). All 5 veterinarians who reported to KDHE in 2011 reported the illness by calling the KDHE EpiHotline on the phone (2011 Method of Reporting) (Table 5).

There were no physicians or veterinarians that responded to this survey that had reported HAB-related illness to KDHE using the Illness Reporting Form provided on the KDHE HAB webpage (2010 and 2011 Method of Reporting)(Table 5). Other avenues utilized by physicians and veterinarians to report suspected or diagnosed HAB-related illness in 2011 included local health departments, and the Kansas State University Diagnostic Lab (2011 Method of Reporting)(Table 5).

When asked, "While taking a medical history, do you routinely ask your patients about their activities in recreational water bodies in the days prior to illness?" (Water Body History) the proportion of physicians and veterinarians that responded "yes" was 39.9% (Table 5). Therefore, the majority of physicians and veterinarians (54.5%) are not asking patients about their activities in recreational water bodies in the days prior to illness (Table 5). There was no significant difference between physicians and veterinarians as to whether they inquired or did not inquire about recreational activities while taking a medical history.

Determining the number of physicians and veterinarians in Kansas who remembered receiving public health messaging about HABs from the KDHE prior to the summer of 2011: Overall, 37.3% of physicians and veterinarians received the public health messaging sent from Drs. Moser, Garrison, and Van der Merwe prior to the summer of 2011 (Receipt of Email). There was no significant difference between physicians and veterinarians on whether they received the letter or did not receive the letter (Table 5).

Determining whether the public health messaging influenced diagnostic practices: Among those who received the public health messaging prior to the summer of 2011, 60.9% stating that "yes" the letter or email from KDHE assisted or otherwise influenced how they diagnosed patients (Influence of Email). Of those who were influenced (Why Effect), the main effects reported were that the letter and email increased awareness (34.9%), was a good reminder of signs and symptoms of HAB-related illness (31.1%), and increased knowledge regarding HABs (15.1%). Of those who received the letter but were not influenced (Why No Effect), the main reason reported was that they did not have any suspected cases (38.9%), and therefore it did not influence their diagnoses. There was a significant difference between physicians and veterinarians for this response. Only 10.0% of physicians stated this reason as to why they were not influenced by the letter while 50.0% of veterinarians stated this reason ($p= 0.03$) (Table 5). The remainder of the physicians stated that they were not influenced because they did not recall the letter while seeing patients (10.0%), saw no cases but it was a good reminder (10.0%), that the public health messaging was too general (10.0%), or they chose not to expound on their reason for lack of influence (Table 5).

Assessing whether physicians and veterinarians in Kansas were aware of Advisories/Warnings related to lake conditions in their area: The awareness of HABs and their adverse health effects increased significantly among physicians prior to summer of 2011 (Prior Health Awareness) to the summer of 2011 (2011 HAB Awareness) from 33.1% to 47.4% ($p=<0.0001$) and decreased significantly among veterinarians from 71.8% to 54.0% ($p=<0.0001$). During 2011, awareness of HAB public health Advisories/Warnings (2011 Messaging Awareness) was significantly different between physicians and veterinarians, 46.3% of physicians stated "yes" they were aware of Public Health Advisory or Warnings issued by

KDHE for a recreational water body in their county or the surrounding counties, while 61.5% of veterinarians responded that they were aware (p=0.0014) (Table 5). When asked how they had become aware of HAB-related illness in their county or the surrounding county prior to 2011 (Awareness Method), the top three awareness methods were television (46.8%), word of mouth (33.7%), and radio (26.3%) (Table 5). There was no significant difference between physicians and veterinarians who had become aware of HAB-related illness via the television. However, there was a significant difference between physicians and veterinarians who had become aware via the radio; 15.5% of physicians became aware via the radio while 29.2% of veterinarians had become aware via the radio. There was also a significant difference among those who had become aware via word of mouth; 17.2% of physician used this method while 38.3% veterinarians reported they had become aware of HAB-related illness via word of mouth (Table 5).

Assessing attitudes among Kansas physicians and veterinarians regarding recreational water monitoring by state public health and environment agencies: More than half (53.0%) of the physicians and veterinarians who responded to this survey and provided a response felt that KDHE's efforts for monitoring for HAB affected lakes were adequate (Support Monitoring). However, there was a significant difference between physicians (45.1%) and veterinarians (57.7%) (p=0.01) who felt that the monitoring efforts were adequate. Many of the physicians felt that efforts needed to increase (22.3%). Among the veterinarians, 24.1% felt that efforts needed to be increased. In regards to disease surveillance, or monitoring for HAB-related illness (Support Disease Surveillance), 55.6% of physicians and veterinarians felt the KDHE's efforts were adequate. There was a significant difference between physicians and veterinarians in regards to disease surveillance, 46.3% of physicians and 61.2% veterinarians (p=0.0017) felt that

the efforts were adequate. The remaining physicians who responded felt that efforts needed to be increased (26.3%), decreased (1.1%), or did not know (24.0%). Among the remaining veterinarians who responded, 24.7% felt that KDHE's efforts needed to be increased, 0.3% felt they needed to be decreased, and 11.3% veterinarians did not know.

Discussion

To evaluate the success of KDHE's outreach activities to increase public awareness about HAB-related illness reporting, five areas were evaluated: 1) HAB- related illness diagnosed and reported prior to the summer of 2011 and during the summer of 2011, 2) Receipt of public health messaging sent from Drs. Moser, Garrison, and Van der Merwe, 3) the influence of public health messaging, 4) the change in HAB and HAB Public Health Advisory/Warning awareness prior to the summer of 2011 and during summer 2011, 5) physician and veterinarians' opinions on KDHE's efforts toward monitoring and disease surveillance regarding HABs and HAB illness.

While the number of veterinarians who diagnosed or suspected HAB-related illness increased significantly, it is difficult to determine the exact cause for this increase. The increase in diagnoses could be due to an increase in HAB affected lakes or it could have been an increase in the prevalence of HAB-related illness. As there was no database to track HAB-related illness prior to the summer of 2011, comparison cannot be made based on prevalence. Another cause for the increase in diagnoses could be that 2011 was the first year that a HAB policy and response plan were in place and there was a database created to track the case investigations.

Among those who did suspect or diagnose HAB-related illness, most were not aware that they could report or simply did not report the illness to KDHE or any other organization. This highlights the need for more public health messaging informing physicians, veterinarians, as well as citizens, that if they suspect or diagnose HAB-related illness they can report it. Additionally,

those who did report the illness to KDHE utilized the EpiHotline rather than using the Human or Animal Illness Reporting Forms on the KDHE Harmful Algal Bloom (HAB) webpage. Whether or not these health care professionals knew that the Illness Reporting Form existed is unknown, but it can be concluded that more communication needs to be made regarding the different avenues of reporting.

That a majority (54.5%) of physicians and veterinarians do not ask patients and clients about their own or their pets' activities in recreational water bodies in the days prior to illness is disconcerting. Without a complete history, HAB- related illness could easily be misdiagnosed and therefore not reported. As the current surveillance systems are entirely based on passive surveillance, lack of reporting means lack of detection. If a HAB effected lake or a HAB- related illness is not reported to the state, then it will not be tested for cell counts or toxin levels and could lead to the potential health risk of many more individuals or animals. For this reason, it is even more crucial that increased messaging be performed to inform the public, as well as health care professionals, about the adverse health effects of HABs and the different avenues of reporting HAB affected lakes or HAB-related illnesses to the state.

The majority of physicians and veterinarians who responded to the survey did not receive or recall receiving the public health messaging from Drs. Moser, Garrison, and Van der Merwe. Therefore, it can be deduced that the route in which KDHE distributes the public health message needs to be altered. One way it could be altered is to increase the audience by broadening the scope of recipients. The message prior to the summer of 2011 was sent specifically to the Kansas Academy of Family Physicians and the Kansas Veterinary Medical Association. These professional organizations comprise a limited portion of the total number of physicians and veterinarians in the state. If the message could be sent using the active licensure lists (like those

used for this survey) that are available to the public, then KDHE would have the opportunity to reach a much larger population. Another way to reach more physicians and veterinarians with the messaging is by including registered nurses (RNs) and registered veterinary technicians (RVTs) as recipients. Just as office administrative staff are meant to screen calls for their office affiliates, RNs and RVTs are commonly used to screen information for the doctors they work for. Therefore if the message can be presented to the RNs and RVTs first, then they can present it to their doctors.

Regarding the influence of the letter, a majority of those physicians and veterinarians who received the letter or remembered receiving the letter were positively influenced by it. They stated that it increased awareness, reminded them of signs and symptoms of HAB related illness, and increased their knowledge regarding HABs. This is a good indicator that if a larger population can be reached, the public health message will have a good influence on awareness and could increase the proportion of physicians and veterinarians who report suspected or diagnosed cases of HAB-related illness to KDHE.

It is important to note, that though the overall population of physicians and veterinarians lacking awareness of the adverse health effects caused by exposure to HAB prior to 2011 was low (37.3%), 60% of those individuals were physicians. While the number of physicians that wer aware improved during the summer of 2011 to 47.4%, the majority (52.5%) were still not aware of HABs in their county or the surrounding county prior to or during the summer of 2011. The awareness of Public Health Advisories/ Warnings during summer of 2011 was significantly different between physicians and veterinarians, in which physicians were less aware than veterinarians. This demonstrates the need for public health messaging focused more toward physicians.

Finally, the majority of physicians and veterinarians responded in the survey that they felt that KDHE's efforts in monitoring and surveillance were adequate. Therefore, KDHE can focus on increasing education efforts rather than spending time and money on increased monitoring of lakes or disease surveillance among public recreational water body communities. Educational efforts should include how and when to report HABs and/or HAB related illness to KDHE as well as communication regarding where to look for up to date information on current Public Health Advisories and Warning in the state.

The most common way respondents were made aware of HAB-related illnesses in their county or the surrounding counties prior to 2011 was via television, followed by word of mouth and radio news reports. Therefore, it can be concluded that future messaging avenues be pursued through news reports, social networking, and radio station broadcasts. These messages can increase awareness regarding HABs while at the same time educating not only physicians and veterinarians, but also the general public about the different avenues available to report HAB affected lakes and HAB illness to KDHE. As there was a significant difference between physicians and veterinarians regarding messaging via word of mouth and the radio, in which physicians were less inclined to use word of mouth or the radio, then further messaging avenues should be utilized to target this population. They could include the newspaper as well as professional gatherings and continuing education courses as these were additional methods that physicians stated that they acquired their HAB awareness. A method that KDHE is currently working on to increase Advisory/ Warning awareness is through the Kansas Health Alert Network (KS-HAN). One has to enroll in this network to receive weekly updates on the current Advisories and Warnings in the state, but by increasing the number of physicians and

veterinarians enrolled in this program, KDHE can increase awareness about not only HABs but infectious diseases as well.

There were a number of strengths to this study. The sample was selected at random from lists that included all licensed physicians and veterinarians to reduce any selection bias and to lend confidence that the sample population was representative of the target population. Acquiring funding to administer the mail distribution (or second round) of the survey increased the response rate and decreased the likelihood of nonresponse bias. This was also accomplished by confirming the street addresses of those who were to receive the paper survey.

The study could have been improved by having more complete data on the target population, as extracted from the professional licensure registries. As the proper fields, such as age and sex, were not available to be analyzed, there is a possibility that the study population was not representative of the target population. However, when comparing region of the State that the practice was located in, the study population and target population were very similar; thus lending confidence that selection bias was not introduced when generating the random sample. The study did note a statistically significant difference in the region of practice between respondents and non-respondents. However, without more detailed information on respondents versus non-respondents, it is difficult to determine if there was a systematic reason why some people chose to respond while others did not. In future studies, knowing the sex, age, and county of all of the individuals in the target population would decrease the effects of nonresponse bias as the data could be weighed to make the results more generalizable.

Conclusion

Increased efforts need to be made by KDHE to inform the public, as well as physicians and veterinarians, about HABs. While the letters sent by Drs. Moser, Garrison and Van der

Merwe were minimally effective, increased efforts need to be made to educate the state of Kansas about HABs and different avenues of reporting HAB affected lakes or HAB-related illness. Encouraging physicians and veterinarians to include questions related to recent water activities and more questions regarding HAB-related symptoms while taking a medical history, especially during the warm, dry months of summer would positively impact health care professionals' ability to accurately diagnose HAB illness. Educational methods used should include television reports, social networking announcements, and/ or radio broadcasts as these methods were indicated as the top three mechanisms to increase HAB awareness among both physicians and veterinarians. By increasing awareness of reporting HAB affected lakes and HAB illness the awareness of HAB's adverse health effects increases, which will make people more cautious when entering public waters that look green and murky. Increased public health messaging regarding HAB reporting could eventually lead to decreased prevalence and a healthier Kansas.

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Tables and Figures

Table 1: Characteristics of target and sample populations, Kansas Veterinarians and Physicians

Variable	Random Sample (n = 1496)	Target Population (n = 2019)	p-value*
Region			
Northwest (n, %)	142 (9.5)	179 (8.9)	0.542
Northeast (n, %)	787 (52.6)	1065 (52.8)	0.907
Southwest (n, %)	106 (7.1)	144 (7.1)	1.000
Central (n, %)	314 (21.0)	422 (20.9)	0.943
Southeast (n, %)	112 (7.5)	153 (7.6)	0.912

*p-value calculated using WinEpi Differences among percentages. p- values less than 0.05 were considered significant.

Table 2: Characteristics of responders and non-responders from mail out distribution (round 2) of survey, Kansas veterinarians and physicians

Variable	Responders (n = 355)	Non-responders (n=1101)	p-value*
Region			
Northwest (n, %)	44 (12.4)	98 (8.9)	0.053
Northeast (n, %)	166 (46.8)	614 (55.8)	0.003
Southwest (n, %)	20 (5.6)	86 (7.8)	0.165
Central (n, %)	88 (24.8)	227 (20.6)	0.095
Southeast (n, %)	36 (10.1)	75 (6.8)	0.041

*p-value calculated using WinEpi Differences among percentages. p- values less than 0.05 were considered significant.

Table 3: Demographic characteristics of Kansas physicians responding to survey

Question	*Response*	*Frequency n (%)*
Type of Practice (n=175)	Family Practice	48 (27.4)
	Pediatric Office	52 (29.7)
	Other (please specify)	
	Allergist	3 (1.7)
	Oncology	2 (1.1)
	Emergency/Urgent Care	13 (7.4)
	Endocrinology	3 (1.7)
	Hospital	10 (5.7)
	Internal Medicine	5 (2.9)
	Multi-Specialty	7 (4.0)
	Neonatologist	3 (1.7)
	Orthopedics	2 (1.1)
	University Health Care	3 (1.7)
	Miscellaneous	7 (4.0)
Patients/day (n=175)	1 to10	32 (18.3)
	11 to 20	62 (35.4)
	21 to 30	51 (29.1)
	31 to 40	8 (4.6)
	>40	2 (1.1)
Years in Practice (n=175)	1 to 10	50 (28.6)
	11 to 20	35 (20.0)
	21 to 30	40 (22.9)
	31 to 40	23 (13.1)
	41 to 50	6 (3.4)
Number of Physicians in Practice (n=175)	1 to 10	122 (69.7)
	11 to 20	18 (10.3)
	21 to 30	7 (4.0)
	31 to 40	2 (1.1)
	41 to 50	0 (0.0)
	51 to 60	1 (0.6)
	160	2 (1.1)
	250	1 (0.6)
Respondent Sex (n=175)	Female	71 (40.6)
	Male	88 (50.3)
Respondent Age (n=175)	21 to 30	1 (0.6)
	31 to 40	44 (25.1)
	41 to 50	28 (16.0)
	51 to 60	46 (26.3)
	61 to 70	30 (17.1)
	>70	9 (5.1)
Zip code of the practice (n=175)	Regions	
	Northwest	16 (9.1)
	Northeast	76 (43.4)
	Southwest	8 (4.6)

	Central	53 (30.3)
	Southeast	11 (6.3)

Table 4: Demographic characteristics of Kansas veterinarians responding to survey

Question	*Response*	*Frequency n (%)*
Type of Practice (n=291)	FA exclusive	10 (3.4)
	FA predominant	26 (8.9)
	Mixed Animal	61 (21.0)
	CA predominant	28 (9.6)
	CA exclusive	145 (49.8)
	Equine	5 (1.7)
	Other	
	Retired	3 (1.0)
	Lab animal	2 (0.7)
	Zoo medicine	1 (0.3)
	Industry	2 (0.7)
Patients/day (n=291)	FA exclusive (n=8)	
	1 to 5	4 (50.0)
	50	1 (12.5)
	>100	2 (37.5)
	FA predominant (n=25)	
	1 to 25	22 (88.0)
	100+	3 (12.0)
	Mixed Animal (n=57)	
	1 to10	24 (42.1)
	11 to 20	26 (45.6)
	21 to 30	5 (8.8)
	>50	2 (3.5)
	CA predominant (n=25)	
	1 to 10	7 (28.0)
	11 to 20	13 (52.0)
	21 to 30	2 (8.0)
	>30	3 (12.0)
	CA exclusive (n=140)	
	1 to 10	45 (32.1)
	11 to 20	79 (56.4)
	21 to30	13 (9.3)
	31 to 40	3 (2.1)
	Equine (n=3)	
	1 to 4	2 (66.7)
	8	1 (33.3)
Years in Practice (n=291)	1 to 10	64 (22.0)
	11 to 20	57 (19.6)
	21 to 30	81 (27.8)
	31 to 40	62 (21.3)
	41 to 50	12 (4.1)
	51 to 60	1 (0.3)
Number of Veterinarians in Practice	1 to 2	158 (54.3)

(n=291)	3 to 4		89 (30.6)
	5 to 6		12 (4.1)
	7 to 8		9 (3.1)
	9 to 10		1 (0.3)
	>10		4 (1.4)
Respondent Sex (n=291)	Female		107 (36.8)
	Male		174 (59.8)
Respondent Age (n=291)	21 to 30		29 (10.0)
	31 to 40		57 (19.6)
	41 to 50		58 (19.9)
	51 to 60		82 (28.2)
	61 to 70		45 (15.5)
	>70		7 (2.4)
Zip code of the practice (n=291)	Regions		
		Northwest	33 (11.3)
		Northeast	145 (49.8)
		Southwest	20 (6.9)
		Central	50 (17.2)
		Southeast	34 (11.7)

Table 5: Overall Responses from Kansas Physicians and Veterinarians

Measure	*Response*	Physicians n (%)	Vets n (%)	p- value**	Overall n (%)
Prior Health Awareness (n=466)	No	105 (60.0)	69 (23.7)	<0.0001	174 (37.3)
	Yes	58 (33.1)	209 (71.8)	<0.0001	267 (57.3)
	I don't know	12 (6.9)	13 (4.5)	0.2670	25 (5.4)
*Awareness method (n=267)	Television news report	31 (53.4)	94 (45.0)	0.2567	125 (46.8)
	Radio news report	9 (15.5)	61 (29.2)	0.0358	70 (26.2)
	Brochures	5 (8.6)	5 (2.4)	0.0278	10 (3.7)
	Word of mouth	10 (17.2)	80 (38.3)	0.0026	90 (33.7)
	Other (please specify)				
	Education/Professional Training	2 (3.4)	26 (12.4)	0.0474	28 (10.5)
	Email	4 (6.9)	11 (5.3)	0.6405	15 (5.6)
	Literature	4 (6.9)	10 (4.8)	0.5260	14 (5.2)
	Newspaper	6 (10.3)	15 (7.2)	0.4380	21 (7.9)
	Internet	4 (6.9)	10 (4.8)	0.5260	14 (5.2)
	Personal Experience	5 (8.6)	9 (4.3)	0.1933	14 (5.2)
	Industry Announcements	5 (8.6)	14 (6.7)	0.6184	19 (7.1)
	Misc.	2 (3.4)	3 (1.4)	0.3153	5 (1.9)

2010 HAB illness (n=466)	No	168 (96.0)	268 (92.1)	0.0966	436 (93.6)
	Yes	4 (2.3)	15 (5.2)	0.1268	19 (4.1)
	I don't recall	3 (1.7)	7 (2.4)	0.6129	10 (2.1)
*2010 Report (n=19)	KDHE	1 (25.0)	0 (0.0)	0.1372	1 (5.3)
	Kansas Poison Control Center	0 (0.0)	0 (0.0)	-	0 (0.0)
	State Animal Health Department	0 (0.0)	0 (0.0)	-	0 (0.0)
	Department of Wildlife and Parks	0 (0.0)	0 (0.0)	-	0 (0.0)
	Was not aware that could report to KDHE	0 (0.0)	7 (46.7)	0.0854	7 (36.8)
	Did not report the illness	2 (50.0)	12 (80.0)	0.2260	14 (73.7)
	Reported to another organization (please specify)	0 (0.0)	0 (0.0)	-	0 (0.0)
2010 Method of Reporting (n=1)	Illness Reporting Form	0 (0.0)	0 (0.0)	-	0 (0.0)
	Email	0 (0.0)	0 (0.0)	-	0 (0.0)
	Phone	1 (100.0)	0 (0.0)	-	1 (100.0)
	Other (please specify)	0 (0.0)	0 (0.0)	-	0 (0.0)
2011 HAB Awareness (n=466)	No	76 (43.4)	116 (39.9)	0.4573	192 (41.2)
	Yes	83 (47.4)	157 (54.0)	0.1674	240 (51.5)
	I don't recall	16 (9.1)	11 (3.8)	0.0177	27 (5.8)
2011 Messaging Awareness (n=466)	No	73 (41.7)	94 (32.3)	0.0404	167 (35.8)
	Yes	81 (46.3)	179 (61.5)	0.0014	260 (55.8)
	I don’t recall	21 (12.0)	11 (3.8)	0.0007	32 (6.9)

Receipt of Email (n=466)	No	58 (33.1)	87 (29.9)	0.4699	145 (31.1)
	Yes	67 (38.3)	107 (36.8)	0.7458	174 (37.3)
	I don't recall	50 (28.6)	92 (31.6)	0.4957	142 (30.5)
Influence of Email (n=174)	No	10 (14.9)	26 (24.3)	0.1363	36 (20.7)
	Yes	42 (62.7)	64 (59.8)	0.7028	106 (60.9)
	Unsure	14 (20.9)	12 (11.2)	0.0807	26 (14.9)
	Decline to answer	0 (0.0)	5 (4.7)	0.0717	5 (2.9)
*Why no effect (n=36)					
	Did not recall letter when seeing patients	1 (10.0)	0 (0.0)	0.1020	1 (2.8)
	No one with the set of symptoms but was a good reminder	1 (10.0)	0 (0.0)	0.1020	1 (2.8)
	Too general	1 (10.0)	0 (0.0)	0.1020	1 (2.8)
	No suspected cases	1 (10.0)	13 (50.0)	0.0274	14 (38.9)
	Area not affected	0 (0.0)	2 (7.7)	0.3665	2 (5.6)
	Already aware	0 (0.0)	3 (11.5)	0.2628	3 (8.3)
	Not influenced but increased awareness	0 (0.0)	1 (3.8)	0.5319	1 (2.8)
*Why effect (n=106)					
	Increased awareness	12 (28.6)	25 (39.1)	0.2674	37 (34.9)
	Reminder of signs and symptoms	10 (23.8)	23 (35.9)	0.1881	33 (31.1)
	Increased knowledge regarding HABs	10 (23.8)	6 (9.4)	0.0429	16 (15.1)
	Asked more pointed questions during history	3 (7.1)	3 (4.7)	0.6007	6 (5.7)

	Will begin reporting	1 (2.4)	1 (1.6)	0.7689	2 (1.9)
Water Body History (n=466)	No	101 (57.7)	153 (52.6)	0.2843	254 (54.5)
	Yes	66 (37.7)	120 (41.2)	0.4549	186 (39.9)
	I don't recall	4 (2.3)	7 (2.4)	0.9451	11 (2.4)
2011 HAB illness (n=229)	No	39 (76.5)	155 (87.1)	0.0635	194 (84.7)
	Yes	11 (21.6)	22 (12.4)	0.0994	33 (14.4)
	I don't recall	1 (2.0)	1 (0.6)	0.3537	2 (0.9)
*2011 Report (n=33)	KDHE	0 (0.0)	5 (22.7)	0.0863	5 (15.2)
	Kansas Poison Control Center	0 (0.0)	0 (0.0)	-	0 (0.0)
	State Animal Health Department	0 (0.0)	2 (9.1)	0.3019	2 (6.1)
	Department of Wildlife and Parks	0 (0.0)	1 (4.5)	0.4750	1 (3.0)
	Was not aware that could report to KDHE	4 (36.4)	7 (31.8)	0.7916	11 (33.3)
	Did not report the illness	4 (36.4)	10 (45.5)	0.6181	14 (42.4)
	Reported to another organization (please specify)				
	Local health department	1 (9.1)	0 (0.0)	0.1508	1 (3.0)
	Came from known region already under watch		1 (4.5)	0.4750	2 (6.1)
	Kansas State University Diagnostic Lab		1 (4.5)	0.4750	3 (9.1)
2011 Method of Reporting (n=5)	Illness Reporting Form	0 (0.0)	0 (0.0)	-	0 (0.0)
	Email	0 (0.0)	0 (0.0)	-	0 (0.0)

	Phone	0 (0.0)	5 (100.0)	-	5 (100.0)
	Other (please specify)	0 (0.0)	0 (0.0)	-	0 (0.0)
Support Monitoring (n=466)	Adequate	79 (45.1)	168 (57.7)	0.0083	247 (53.0)
	Increased	39 (22.3)	70 (24.1)	0.6568	109 (23.4)
	Decreased	2 (1.1)	1 (0.3)	0.2790	3 (0.6)
	I don't know	52 (29.7)	42 (14.4)	<0.0001	94 (20.2)
Support Disease Surveillance (n=466)	Adequate	81 (46.3)	178 (61.2)	0.0017	259 (55.6)
	Increased	46 (26.3)	72 (24.7)	0.7004	118 (25.3)
	Decreased	2 (1.1)	1 (0.3)	0.2790	3 (0.6)
	I don't know	42 (24.0)	33 (11.3)	0.0003	75 (16.1)

* Answers to this question are not mutually exclusive. Respondents can answer multiple options at once.

** p-value calculated using WinEpi Differences among percentages. p-values less than 0.05 were considered significant.

Table 6: Physician HAB Illness Responses

Question Topic	Response Options	Frequency n (%)
2010 HAB illness (n=175)	No	168 (96.0)
	Yes	4 (2.3)
	I don't recall	3 (1.7)
2010 Exposure location* (n=4)	Public body of water	2 (50.0)
	Private pond	0 (0.0)
	I don't know	1 (25.0)
	Other (please specify)	0 (0.0)
2010 Report* (n=4)	KDHE	1 (25.0)
	Kansas Poison Control Center	(0.0)
	Department of Wildlife and Parks	(0.0)
	Was not aware that could report to KDHE	(0.0)
	Did not report the illness	2 (50.0)
	Reported to another organization (please specify)	(0.0)
2011 HAB illness (n=51)	No	39 (76.5)
	Yes	11 (21.6)
	I don't recall	1 (2.0)
2011 Exposure Location* (n=11)	Public body of water	9 (81.8)
	Private pond	0 (0.0)
	I don't know	0 (0.0)
	Other (please specify)	0 (0.0)
2011 Report* (n=11)	KDHE	0 (0.0)
	Kansas Poison Control Center	0 (0.0)
	Department of Wildlife and Parks	0 (0.0)
	Was not aware that could report to KDHE	4 (36.4)
	Did not report the illness	4 (36.4)
	Reported to another organization (please specify)	
	Local health department	1 (9.1)

* Answers to this question are not mutually exclusive. Respondents can answer multiple options at once.

Table 7: Veterinary HAB Illness Responses

Question	Answer options	Frequency n (%)
2010 HAB illness (n=291)	No	268 (92.1)
	Yes	15 (5.2)
	I don't recall	7 (2.4)
2010 Species* (n=15)	Canine	8 (53.3)
	Feline	0 (0.0)
	Bovine	7 (46.7)
	Equine	0 (0.0)
	Exotics (birds, turtles)	1 (6.7)
2010 Exposure location* (n=15)	Public body of water	4 (26.7)
	Private pond	11 (73.3)
	I don't know	0 (0.0)
	Private River	2 (13.3)
	Drainage area	1 (6.7)
2010 Report* (n=15)	KDHE	0 (0.0)
	Kansas Poison Control Center	0 (0.0)
	State Animal Health Department	0 (0.0)
	Department of Wildlife and Parks	0 (0.0)
	Was not aware that could report to KDHE	7 (46.7)
	Did not report the illness	12 (80.0)
	Reported to another organization (please specify)	0 (0.0)
2011 HAB illness (n=178)	No	155 (87.1)
	Yes	22 (12.4)
	I don't recall	1 (0.6)
2011 Species* (n=22)	Canine	18 (81.8)
	Feline	0 (0.0)
	Bovine	5 (22.7)
	Equine	1 (4.6)
	Other (please specify)	0 (0.0)
2011 Exposure Location* (n=22)	Public body of water	13 (59.1)
	Private pond	11 (50.0)
	I don't know	1 (4.6)
	Other (please specify)	0 (0.0)
2011 Report* (n=22)	KDHE	5 (22.7)
	Kansas Poison Control Center	0 (0.0)
	State Animal Health Department	2 (9.1)
	Department of Wildlife and Parks	1 (4.6)
	Was not aware that could report to KDHE	7 (31.8)
	Did not report the illness	10 (45.5)
	Reported to another organization (please specify)	
	Came from known region already under watch	1 (4.6)
	KSU Diagnostic Lab	1 (4.6)

* Answers to this question are not mutually exclusive. Respondents can answer multiple options at once.

Appendices

Appendix A: Abbreviations

AVMA	American Veterinary Medical Association
DHCF	Department of Health Care Finance
DO	Doctor of Osteopathic Medicine
GIS	Geographic Information System
HAB	Harmful Algal Bloom
KBHA	Kansas Board of Healing Arts
KDHE	Kansas Department of Health and Environment
KDWPT	Kansas Department of Wildlife, Parks and Tourism
KVMA	Kansas Veterinary Medical Association
MD	Doctor of Medicine
WHO	World Health Organization

Appendix B: Letter to Physicians

Curtis State Office Building
1000 SW Jackson St., Suite 540
Topeka, KS 66612-1367

Kansas
Department of Health & Environment

Phone: 785-296-0461
Fax: 785-368-6388
www.kdheks.gov

Robert Moser, MD, Secretary

Sam Brownback, Governor

May 23, 2011

Dear Health Care Professionals,

As the weather warms, Kansans will spend time engaging in outdoor recreation at our numerous public lakes. Unfortunately fun in the sun can expose individuals to health threats that may be taken for granted.

Cyanobacteria (blue-green algae) are prominent in Kansas waters, and under certain conditions harmful algal blooms will produce toxins that pose a health risk to people, with possible rapid symptom onset. During the months ahead we are asking for your help and heightened awareness.

Potential routes of exposure include ingestion, dermal contact or inhalation of airborne droplets containing toxins while swimming, boating and skiing. A large percentage of the public will report "allergic" type reactions after exposure, such as intestinal problems, respiratory problems, or skin irritations. If you have a patient presenting with these clinical symptoms, can confirm an exposure history to a body of water within a reasonable time period prior to symptoms, and have ruled out any other diagnoses, please consider this a suspect case and complete the "Algae Illness Reporting Form for Public and Medical Professionals" located at http://www.kdheks.gov/algae-illness/index.htm or call the Kansas Department of Health and Environment at 1-877-427-7317 to report any suspect case.

Exposure and Clinical Presentation

Route of Exposure	Symptoms/Signs
Ingestion	Malaise – Headache - Gastroenteritis - Hyper salivation Abdominal pain – Diarrhea - Vomiting Motor weakness - Respiratory and muscular paralysis Acute hepatitis - Kidney damage
Dermal	Rash – Hives - Skin blistering - Allergic reactions - Eye irritation
Inhalation	Upper respiratory irritation – Rhinitis - Possible allergic reaction

I appreciate your cooperation and assistance your input will allow us to help make the summer season fun and safe for all Kansans.

Sincerely,

Robert Moser

Robert P. Moser, MD - Secretary
Kansas Department of Health & Environment

Appendix C: Email to Veterinarians

Health Alert – Toxic blue-green algae

By

The Kansas Department of Health and Environment Requests Veterinarians Report Any Suspect Illness in Animals due to Blue-green Algae to KDHE at 1-877-427-7317.

Cyanobacteria (also known as blue-green algae) are prominent in Kansas waters and, under certain conditions, harmful algal blooms (HABs) will produce toxins that pose a health risk to people and animals. These blooms are an emerging public health issue in Kansas. In 2010 public health advisories or warnings were issued to public waters in seven counties due to high levels of cyanobacterial toxins. KDHE has received reports of at least two cases of human illness due to contact with HABs thus far during 2011.

Cyanobacteria and their toxins in freshwaters have been implicated in human and animal illness in at least 36 states in the United States. The greatest risk of adverse human health effects after exposure to cyanotoxins is through ingestion or inhalation of water and cyanobacterial cells during recreational activities such as swimming and skiing. Adverse health effects can vary and are dependent upon the type of toxin and route of exposure. Contact with high concentrations of cyanobacteria, independent of the level of toxins, may also cause adverse health effects. The most common complaints after recreational exposure include vomiting diarrhea, skin rashes, eye irritation and respiratory symptoms. These toxins have also been responsible for several deaths in dogs.

Cyanobacterial toxins can be classified into two categories; hepatoxoins and neurotoxins. The most common in Kansas is Mycrocystis species which produce hepatotoxins .Exposure occurs through ingestion or inhalation of water droplets; some animals may become ill after swimming in contaminated waters and grooming their coat after it dries. The first signs of poisoning in animals usually occur within 30 minutes of exposure and include vomiting and diarrhea. This is followed by progressively worsening signs of liver failure such as anorexia, lethargy and depression. Jaundice, abdominal swelling, and tenderness in the abdominal area may also be observed. Blood values of liver enzymes are typically very high. If an animal survives the initial phase of liver failure, neurological dysfunction secondary to liver failure is possible. If a neurotoxin is involved, neurological signs typically occur minutes to hours following exposure may include tremors, salivation, seizures, weakness and respiratory paralysis. Acute deaths are possible if the toxin dose is high.

There is no specific antidote available; treatment is aimed at early decontamination, control of symptoms, and supportive care. Inducing emesis can be beneficial prior to onset of clinical signs. Activated charcoal can be given, but efficacy is limited. Contaminated skin should be bathed, but protective clothing and gloves should be used by handlers to prevent skin contact. Hepatoprotectant drugs such as silymarin and s-adenosyl-methionine may be beneficial. Depending on the type and severity of neurological signs, they may be controlled with diazepam, phenobarbital or methocarbamol. Supportive treatment includes intravenous fluids and blood products, maintenance of normal body temperature, and a low quantity, high quality protein diet. The prognosis is poor in animals that develop severe liver failure.

Diagnosis in animals is usually based on clinical signs and the presence of cyanobacteria in water that the animal was in contact with. Identification of cyanobacteria in water, stomach contents, and hair coat

samples is available at most regional veterinary diagnostic laboratories, including the Kansas State Veterinary Diagnostic Laboratory (KSVDL) in Manhattan, KS. The laboratory can be contacted at 785-532-5678 to coordinate sample and specimen submission.

Animals often serve as sentinels for human illness therefore the Kansas Department of Health and Environment requests veterinarians report any suspect case of blue-green algae poisoning to the Epidemiology Hotline at 1-877-427-7317 (available 24 hours a day, 7 days a week). KDHE will investigate all suspect cases of blue-green algae poisoning in animals that involve public-use waters.

For more information, including current public health advisories and warnings, please go to our website at: http://www.kdheks.gov/algae-illness/index.htm.

By Dr. Ingrid Garrison, State Public Health Veterinarian (igarrison@kdheks.gov) and Dr. Deon van der Merwe, Chief of Toxicology, Kansas State University Veterinary Diagnostic Laboratory (dmerwe@vet.ksu.edu).

Appendix D: Physician Survey

Physician Knowledge, Attitudes, and Practices related to Harmful Algal Blooms

The Kansas Department of Health and Environment (KDHE) is sending this survey to Kansas physicians to collect some information regarding your knowledge, attitudes, and practices related to Harmful Algal Blooms. Your voluntary participation in this survey will take **less than 10 minutes of your time**.

Toxins from cyanobacteria, commonly referred to as blue-green algae have been associated with human illness and animal deaths in at least 36 states in the United States. In Kansas, during the warm summer months these bacteria can proliferate in recreational bodies of water to form Harmful Algal Blooms (HABs). HABs are more likely to occur during hot, dry weather, coinciding with peak recreational water use. Commonly referred to as blue-green algae toxicosis, HAB-related illness can present as headaches, malaise, skin rashes, eye irritation, vomiting, diarrhea, respiratory distress and even death.

This study has been reviewed and approved by Kansas State University and KDHE Institutional Review Boards (IRBs) and is not expected to pose any risk to participants. Results of this research may be published for scientific purposes, but no individual practice will be identified. If you would like to complete the survey online the link to the survey is as follows:

https://www.surveymonkey.com/s/HABDocSurvey

If you complete the survey online, please include the ID number located in the upper right hand corner of this page on the online survey.

If you have already completed this survey online, thank you for your participation. We ask that you please return this survey, using the provided prepaid envelope, with the words "already completed online" written across the top. This survey will close on Friday July 6, 2012. If you have any questions please contact me at KMoser@kdheks.gov or Dr. Farah Ahmed at fahmed@kdheks.gov.

1. Prior to the summer of **2011**, were you already aware of the adverse health effects caused by exposure to HABs?

    ☐ No (skip to #3)

    ☐ Yes

    ☐ I don't recall (skip to #3)

2. How were you made aware of HAB-related illnesses in your county or the surrounding counties? Check all that apply.

    ☐ Television news report

    ☐ Radio news report

    ☐ Brochures

    ☐ Word of mouth

    ☐ Other (please specify):_____

3. Based on your recall, in **2010**, did you suspect or diagnose any patients with HAB-related illnesses?

    ☐ No (skip to #8)

    ☐ Yes

    ☐ I don't recall (skip to #8)

4. In **2010**, approximately how many patients did you suspect or diagnose with illness or death related to HAB exposure?

    _____patients

5. Where did the exposure(s) occur? Check all that apply.

    ☐ Public body of water

    ☐ Private pond

    ☐ I don't know

    ☐ Other (please specify):_____

6. In **2010**, did you report the illness to KDHE or another organization? Check all that apply.

    ☐ Yes, I reported to KDHE

    ☐ Yes, I reported to the Kansas Poison Control Center

    ☐ Yes, I reported to Department of Wildlife and Parks

    ☐ I was not aware that I could report to KDHE

    ☐ No, I did not report the illness

    ☐ Yes, I reported to another organization (please specify):_____

7. Which method of reporting did you use? (If you did not answer "Yes, I reported to KDHE" in the previous question you may skip to #8)

   ☐ Illness reporting form found on the KDHE website

   ☐ An email to KDHE

   ☐ A phone call to KDHE EpiHotline

   ☐ Other (please specify):_____

. . . . . .

On May 23, 2011 Dr. Robert Moser, Secretary of the Kansas Department of Health and Environment (KDHE), sent out a letter (available upon request) to healthcare providers to alert them to signs and symptoms of HAB exposure. During the summer of **2011**, health care providers, as well as the public, were encouraged to report cases of HAB-related illnesses to KDHE.

8. During **2011**, were you aware of a HAB in a recreational water body in your county or the surrounding counties? A recreational water body can be any body of water that is used by the public for activities such as fishing, boating and swimming.

   ☐ No

   ☐ Yes

   ☐ I don't recall

9. During **2011**, were you aware of any public health Advisory or Warnings issued by KDHE for a recreational water body in your county or the surrounding counties?

   ☐ No

   ☐ Yes

   ☐ I don't recall

10. Did you receive the letter describing the health effects of HABs?

    ☐ No (skip to #12)

    ☐ Yes

    ☐ I don't recall (skip to #12)

11. Did the letter from KDHE assist you or otherwise influence how you diagnosed patients?

☐ No

Briefly explain why:_____

_____

☐ Yes

Briefly explain why:_____

_____

☐ Unsure

☐ Decline to answer

12. While taking a medical history, do you routinely ask your patients about their activities in recreational water bodies in the days prior to illness?

☐ No

☐ Yes

☐ I don't recall

13. Of the patients you saw in **2011**, did you suspect or diagnose any with a waterborne-related illness, such as Cryptosporidiosis and Giardiasis?

☐ No (skip to #20)

☐ Yes

☐ I don't recall (skip to #20)

14. In **2011**, approximately how many patients did you suspect or diagnose with illness, such as Cryptosporidiosis and Giardiasis, or death related to exposure to a recreational body of water?

_____ patients

15. Of those patients, did you suspect or diagnose any with illness or death related to HAB exposure?

☐ No (skip to #20)

☐ Yes

☐ I don't recall (skip to #20)

16. Approximately how many patients did you suspect or diagnose with illness related to HAB exposure?

_____patients

17. Where did the exposure(s) occur? Check all that apply.

☐ Public body of water

☐ Private pond

☐ I don't know

☐ Other (please specify):_____

18. Did you report the illness to KDHE or another organization? Check all that apply.

- ☐ Yes, I reported to KDHE
- ☐ Yes, I reported to the Kansas Poison Control Center
- ☐ Yes, I reported to Department of Wildlife and Parks
- ☐ I was not aware that I could report to KDHE
- ☐ No, I did not report the illness
- ☐ Yes, I reported to another organization (please specify):_____

19. Which method of reporting did you use? (If you did not answer "Yes, I reported to KDHE" in the previous question you may skip to #20)

- ☐ Illness Reporting Form found on the KDHE website
- ☐ An email to KDHE
- ☐ A phone call to KDHE EpiHotline
- ☐ Other (please specify):_____

20. Currently, KDHE samples public use lakes only in response to complaints of human or animal illness, or visual sighting of possible blue green algae by the public or lake officials. To what extent do you support efforts by KDHE and other state and local agencies with regard to monitoring recreational water bodies for HABs?

- ☐ I think the current level of HAB monitoring is adequate
- ☐ I think there should be increased monitoring
- ☐ I think there should be decreased monitoring
- ☐ I don't know

21. Currently, KDHE receives HAB- related illness reports only when a physician or veterinarian voluntarily reports it to KDHE (passive surveillance). KDHE follows up on these reports with disease investigation. To what extent do you support efforts by KDHE with regard to HAB-related disease surveillance?

- ☐ I think the current level of HAB surveillance is adequate
- ☐ I think there should be increased effort for HAB surveillance
- ☐ I think there should be decreased effort for HAB surveillance
- ☐ I don't know

The remaining questions are about you, the responder. If you are a part of a group practice, please only respond for yourself. We will use these demographic characteristics to aggregate responses so that no one individual, or practice, will be identified.

22. What type of practice do you work for?
    - ☐ Family Practice
    - ☐ Pediatric Practice
    - ☐ Other (please specify): _____
23. On average, how many patients do you see per day?_____patients per day
24. How many years have you been in practice?_____years
25. How many physicians are in your practice?_____physicians
26. Sex of the respondent
    - ☐ Female
    - ☐ Male
27. Age of respondent: _____years
28. City of the practice:_____
29. Zip code of the practice:_____

Thank you for participating in our survey. If you have any questions contact Karin Moser at KMoser@kdheks.gov or Dr. Farah Ahmed at fahmed@kdheks.gov.

Appendix E: Veterinary Survey

Veterinary Knowledge, Attitudes, and Practices related to Harmful Algal Blooms

The Kansas Department of Health and Environment (KDHE) is sending this survey to Kansas veterinarians to collect some information regarding your knowledge, attitudes, and practices related to Harmful Algal Blooms or blue-green algae toxicosis. Your voluntary participation in this survey will take **less than 10 minutes of your time**.

Toxins from cyanobacteria, commonly referred to as blue-green algae, have been associated with human illness and animal deaths in at least 36 states in the United States. In Kansas, during the warm summer months these bacteria can proliferate in recreational bodies of water to form Harmful Algal Blooms (HABs). HABs are more likely to occur during hot, dry weather, coinciding with peak recreational water use. Commonly referred to as blue-green algae toxicosis, HAB-related illness can present as malaise, skin rashes, vomiting, diarrhea, respiratory distress, jaundice and even death.

This study has been reviewed and approved by Kansas State University and KDHE Institutional Review Boards (IRBs) and is not expected to pose any risk to participants. Results of this research may be published for scientific purposes, but no individual practice will be identified. If you would like to complete the survey online the link to the survey is as follows:

https://www.surveymonkey.com/s/HABVetSurvey

If you complete the survey online, please include the ID number located in the upper right hand corner of this page on the online survey.

If you have already completed this survey online, thank you for your participation. We ask that you please return this survey, using the provided prepaid envelope, with the words "already completed online" written across the top. This survey will close on Friday July 6, 2012. If you have any questions please contact me at KMoser@kdheks.gov or Dr. Farah Ahmed at fahmed@kdheks.gov.

1. Prior to the summer of **2011**, were you already aware of the adverse health effects caused by exposure to HABs?

   ☐ No (skip to #3)

   ☐ Yes

   ☐ I don't recall (skip to #3)

2. How were you made aware of HAB-related illnesses in your county or the surrounding counties? Check all that apply.

   ☐ Television news report

   ☐ Radio news report

   ☐ Brochures

   ☐ Word of mouth

   ☐ Other (please specify):_____

3. Based on your recall, in **2010**, did you suspect or diagnose any HAB-related illnesses?

   ☐ No (skip to #9)

   ☐ Yes

   ☐ I don't recall (skip to #9)

4. In **2010**, approximately how many patients did you suspect or diagnose with illness or death related to HAB exposure?

   _____patients

5. What type of animal did you suspect or diagnose with illness or death related to HAB exposure? Check all that apply.

   ☐Canine

   ☐Feline

   ☐Bovine

   ☐Equine

   ☐Other (please specify):_____

6. Where did the exposure(s) occur? Check all that apply.

   ☐ Public body of water

   ☐ Private pond

   ☐ I don't know

   ☐ Other (please specify):_____

7. In **2010**, did you report the illness to KDHE or another organization? Check all that apply.

   ☐ Yes, I reported to KDHE

   ☐ Yes, I reported to the Kansas Poison Control Center

   ☐ Yes, I reported to State Animal Health Department

   ☐ Yes, I reported to Department of Wildlife and Parks

   ☐ I was not aware that I could report to KDHE

   ☐ No, I did not report the illness

   ☐ Yes, I reported to another organization (please specify):_____

8. Which method of reporting did you use? (If you did <u>not</u> answer "Yes, I reported to KDHE" in the previous question you may skip to #9)

   ☐ Illness reporting form found on the KDHE website

   ☐ An email to KDHE

   ☐ A phone call to KDHE EpiHotline

   ☐ Other (please specify):_____

On July 25, 2011 Drs. Ingrid Garrison, State Public Health Veterinarian (KDHE), and Deon van der Merwe (Kansas State Veterinary Diagnostic Laboratory) sent out an email (available upon request) to veterinarians through the Kansas Veterinary Medical Association to alert members to symptoms of HAB exposure in animals. During the summer of **2011** veterinarians, as well as the public, were encouraged to report cases of HAB-related illness or death to KDHE.

9. During **2011**, were you aware of a HAB in a recreational water body in your county or the surrounding counties? A recreational water body can be any body of water that is used by the public for activities such as fishing, boating and swimming.

   ☐ No

   ☐ Yes

   ☐ I don't recall

10. During **2011**, were you aware of any public health Advisory or Warnings issued by KDHE for a recreational water body in your county or the surrounding counties?

    ☐ No

    ☐ Yes

    ☐ I don't recall

11. Did you receive an e-mail describing the health effects of HABs?

- ☐ No (skip to #13)
- ☐ Yes
- ☐ I don't recall (skip to #13)

12. Did the letter from KDHE assist you or otherwise influence how you diagnosed patients?

- ☐ No

  Briefly explain why:_____

  _____

- ☐ Yes

  Briefly explain why:_____

  _____

- ☐ Unsure
- ☐ Decline to answer

13. While taking a medical history, do you routinely ask your clients about their pet's activities in a recreational water body in the days prior to illness?

- ☐ No
- ☐ Yes
- ☐ I don't recall

14. Of the patients you saw in **2011**, did you suspect or diagnose any with a waterborne-related illness such as Cryptosporidiosis, Leptospirosis, or Giardiasis?

- ☐ No (skip to #22)
- ☐ Yes
- ☐ I don't recall (skip to #22)

15. In **2011**, approximately how many patients did you suspect or diagnose with illness, such as Cryptosporidiosis, Leptospirosis, or Giardiasis, or death related to exposure to a recreational body of water?

_____ patients

16. Of those patients, did you suspect or diagnose any with illness or death related to HAB exposure?

- ☐ No (skip to #22)
- ☐ Yes
- ☐ I don't recall (skip to #22)

17. Approximately how many patients did you suspect or diagnose with illness or death related to HAB exposure?

    _____patients

18. What type of animal did you suspect or diagnose with illness to death related to HAB exposure? Check all that apply.

    ☐ Canine

    ☐ Feline

    ☐ Bovine

    ☐ Equine

    ☐ Other (please specify):_____

19. Where did the exposure(s) occur? Check all that apply.

    ☐ Public body of water

    ☐ Private pond

    ☐ I don't know

    ☐ Other (please specify):_____

20. Did you report the illness to KDHE or another organization? Check all that apply.

    ☐ Yes, I reported to KDHE

    ☐ Yes, I reported to the Kansas Poison Control Center

    ☐ Yes, I reported to State Animal Health Department

    ☐ Yes, I reported to Department of Wildlife and Parks

    ☐ I was not aware that I could report to KDHE

    ☐ No, I did not report the illness

    ☐ Yes, I reported to another organization (please specify):_____

21. Which method of reporting did you use? (If you did <u>not</u> answer "Yes, I reported to KDHE" in the previous question you may skip to #22)

    ☐ An email to KDHE

    ☐ A phone call to KDHE EpiHotline

    ☐ Other (please specify):_____

22. Currently, KDHE samples public use lakes only in response to complaints of human or animal illness, or visual sighting of possible blue green algae by the public or lake officials. To what extent do you support efforts by KDHE and other state and local agencies with regard to monitoring recreational water bodies for HABs?

    ☐ I think the current level of HAB monitoring is adequate

    ☐ I think there should be increased monitoring

    ☐ I think there should be decreased monitoring

    ☐ I don't know

23. Currently, KDHE receives HAB- related illness reports only when a physician or veterinarian voluntarily reports it to KDHE (passive surveillance). KDHE follows up on these reports with disease investigation. To what extent do you support efforts by KDHE with regard to HAB-related disease surveillance?

    ☐ I think the current level of HAB surveillance is adequate

    ☐ I think there should be increased effort for HAB surveillance

    ☐ I think there should be decreased effort for HAB surveillance

    ☐ I don't know

The remaining questions are about you, the responder. If you are a part of a group practice, please only respond for yourself. We will use these demographic characteristics to aggregate responses so that no one individual, or practice, will be identified.

24. What type of practice do you work for?

    ☐ Food animal exclusive: at least 90% of the contact.

    ☐ Food animal predominant: at least 50% of the contact.

    ☐ Mixed animal: at least 25% from companion animal and 25% from either food animal or equine.

    ☐ Companion animal predominant: at least 50% of the contact.

    ☐ Companion animal exclusive: at least 90% of the contact.

    ☐ Equine: Combination of equine predominant and exclusive where there is at least 50% contact with equines.

25. On average, how many patients do you see per day?_____patients per day

26. How many years have you been in practice?_____years

27. How many veterinarians are in your practice?_____veterinarians

28. Sex of the respondent

    ☐ Female

    ☐ Male

29. Age of respondent: _____years

30. City of the practice:_____

31. Zip code of the practice:_____

Thank you for participating in our survey. If you have any questions contact Karin Moser at KMoser@kdheks.gov or Dr. Farah Ahmed at fahmed@kdheks.gov.