Master of Public Health

Integrative Learning Experience Report

Development of K-12 One Health Lesson Plans and Analysis of Kansas WebIZ and Essence Rabies Data

by

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submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

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Summary

One Health is important in approaching and solving many of the complex problems we face at present. For instance, antimicrobial resistance, zoonotic diseases, and global warming are all issues that are complex and require an interdisciplinary viewpoint to approach them. Integrating One Health earlier in a student's education is imperative in adopting this approach where the health and well-being of humans, animals, and the environment are interconnected. It encourages students to collaborate and embrace this interconnectedness well before entering their undergraduate or graduate studies where topics and majors tend to be siloed. Therefore, the primary focus of my first project with Kansas Department of Health and Environment was developing One Health lesson plans for students in kindergarten through 12th grade, that will be accessible to all teachers on the Kansas Department of Health and Environment website.

Furthermore, one complex issue that a One Health approach can be helpful in tackling is rabies. Rabies is a fatal zoonotic disease and one that is still prevalent across the globe, especially in developing countries. The US is one example where a One Health approach has proved successful, where the number of human rabies cases are rare. Aspects of this approach that have been deemed successful include rabies surveillance, animal vaccination, and human Post-Exposure Prophylaxis. Hence, the second and third project I was involved in at Kansas Department of Health and Environment focused on analyzing rabies data from PEP administration and animal-bite hospital visits using Kansas WebIZ and ESSENCE surveillance systems. The data obtained from both projects were shared at a vaccination conference and Kansas Department of Health and Environment data and epidemiology presentation to build awareness around rabies within the state of Kansas.

Subject Keywords: One Health, Lesson Plans, Rabies, ESSENCE, WebIZ

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Chapter 1 - Literature Review

One Health is not a new concept, and it is one that has been around for some time; however, for some, One Health is a term many people have not heard of before, which can often make it difficult to narrow to one single definition (Evans & Leighton, 2014). One definition that has emerged for One Health is “an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent” (Adiasmito et al., 2022). A One Health approach helps to break down the walls that separate human, animal, and environment to build an interdisciplinary approach to health.

Over the years, the importance of One Health has become known with the increase in human population, increase in zoonotic diseases, antimicrobial resistance, and the negative impact humans have made on the environment, which directly and indirectly affect the aforementioned areas (Evans & Leighton, 2014). This approach is important to tackle areas such as zoonotic diseases, antimicrobial resistance, disease prevention, health improvement, and health promotion among many others. Integrating One Health earlier in education is a crucial step towards embracing this approach, helping students become more collaborative and embrace the interconnectedness between humans, animals, and the environment. In an article by Villanueva-Cabezaz et al. (2022), the authors advocate for the integration of One Health earlier in education versus in post-graduate studies. They argue that incorporating a One Health approach after undergraduate studies and in more defined areas, such as veterinary medicine and medicine, can impede fully embracing One Health, because they are already siloed to their specific fields. An example of One Health curriculum being incorporated earlier on in education was in the undergraduate curriculum at the University of Melbourne in 2018. Students at the University of Melbourne must study topics outside their own degree program. These One Health topics challenged students’ perceptions, encouraged complementary methods to approach problems, encouraged systems thinking, and encouraged collaboration among students (Villanueva-Cabezaz et al., 2022). We do not want to continue isolating roles and positions, but rather embrace and encourage collaboration from the beginning. Therefore, a grant was written by the Kansas Department of Health and Environment (KDHE) to create One Health lesson topics to share across Kansas, in K-12 classrooms, which covers kindergarten through 12th grade, to increase exposure of a variety of One Health topics to students.

I had the pleasure of working alongside Dr. Erin Petro (DVM, MPH), and many others at KDHE and other organizations to create these lessons. Dr. Erin Petro graduated with a Doctor of Veterinary Medicine (DVM) from Oklahoma State University College of Veterinary Medicine. She later went back to pursue a master's in public health (MPH) from Kansas State University. Dr. Erin Petro has had a diverse public health background including working as an active-duty air force public health officer, working as an epidemiologist for the Jackson County Health Department, and currently serving in the Minnesota Air National Guard taking on a similar public health officer role as in the air force and working as the State Public Health Veterinarian at KDHE.

Furthermore, as mentioned above, a One Health approach is important for approaching infectious diseases. Most of the emerging and known infectious diseases are zoonotic, transmitted from animals (Acharya et al., 2020). A zoonotic disease with a high mortality rate that is a global health concern is rabies. According to the World Organization for Animal Health (WOAH), the mortality rate for rabies is nearly 100% in both humans and animals. Approximately 55,000 people die from rabies each year across the world (Acharya et al., 2020). In one study by Gan et al., investigating the global burden of rabies in 1990 versus 2019, researchers found that the worldwide incidence rate of rabies decreased from 45.99 cases per 10,000,000 person years to 18.45 cases per 10,000,000 person years. The researchers also found that areas with a lower sociodemographic index had a higher incident rate of rabies compared to countries of higher sociodemographic index, at 48.70 cases per 10,000,000 person years and 0.14 cases per 10,0000,000 person years, respectively (Gan et al., 2023). Rabies is endemic in many Asian and African countries, except for areas that have not shown signs of dog rabies cases and areas that have been declared rabies free (Acharya et al., 2020).

Moreover, one area where rabies has a high incidence rate, at 1.21 cases per 100,000 person years in 2019, is Nepal (Gan et al., 2023). To work towards managing rabies, Nepal implanted a control program including a guideline for rabies vaccines; however, the guideline is heavily focused on human Post-Exposure Prophylaxis (PEP), not considering all other areas that play a role including animal rabies/vaccination. This revealed to researchers that focusing on just one piece to the puzzle is not an effective approach to managing rabies (Acharya et al., 2020). In North America, rabies is an example of a zoonotic disease where a One Health approach can be effective in managing it (Vercauteren et al., 2012). In the 20th century, a national rabies control effort was established which intertwined these different areas, including veterinary and human medicine, public health, and wildlife biology (Vercauteren et al., 2012). Today, and since the adoption of taking a One Health approach to rabies, human rabies cases

in the U.S. are rare, with about one to three occurring per year (Centers for Disease Control and Prevention [CDC], 2021). According to the CDC, the ten-year incidence of rabies from 2009 to 2018, was 25 human cases. However, there are still hundreds of thousands of animals undergoing rabies testing and 30,000 to 60,000 individuals receiving Rabies Post-Exposure prophylaxis (PEP) each year (CDC, 2021). Per the CDC, PEP is, like mentioned above, a Post-Exposure Prophylaxis regiment that consists of two parts: the first is a human rabies immune globulin and a single dose of rabies vaccine given on day one of exposure. Then, a rabies vaccine is given again on days three, seven, and 14 (CDC, 2021). Therefore, even though we have made progress, there is still room for improvements to be made. The key elements needed to work towards eradicating rabies include focusing on rabies surveillance and control, domestic animal vaccination, and human PEP. With that being said, the second and third project I was a part of was an analysis of rabies immunization data using the Kansas WebIZ (KSWebIZ), an immunization registry system used by doctors and health clinics administering rabies vaccines, and the Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE) database, a hospital-based surveillance system that captures emergency room visits. These are two forms of surveillance that the United States uses to help track rabies data from both immunization administration and rabies-related emergency room visits.

Chapter 2 - Learning Objectives and Project Description

My Applied Practice Experience (APE) took place at KDHE and began in September 2022 and ended in July 2023. My APE consisted of three parts: creating One Health lesson plans for Kansas kindergarten through 12th grade students, a Rabies WebIZ data analysis project, and an ESSENCE rabies data project. The first project I was involved in was creating One Health lesson plans for K-12 students across Kansas, with the plan to pilot them in the Fall and display them on the KDHE website for all teachers to access (Appendix 1 and 2). The second project I had the opportunity to be a part of involved data analysis of PEP administration across the state of Kansas using the KSWebIZ database. These analyses were shared at a rabies vaccination conference in June 2023 to provide county health departments information relating to rabies data throughout Kansas (Appendix 4). This information included the number of doses administered per month over the 5-year-span, demographic data including doses by age, sex, and funding source, and number of doses administered by county. The third project involved exploring data exported from ESSENCE to examine the burden of animal bites in hospitals, find the number of rabies cases, and determine the amount of PEP administered in emergency rooms (Appendix 5). My responsibilities, aside from participation in the projects, included attending biweekly meetings with Dr. Petro, where I was able to provide updates on the status of my project and receive guidance, direction, and feedback on my final product. Secondly, I had weekly meetings with Stephanie Lindemann, an advanced epidemiologist at KDHE, where I shadowed and worked alongside her for the WebIZ data analysis project. I also met with a team of epidemiologists weekly and then once a month to discuss and collaborate on the ESSENCE project.

Furthermore, I had the opportunity to sit in on monthly Project/Budget update meetings led by Beth Gunsalus, the K-12 Education and Outreach Project manager leading the One Health lesson plan grant, where I was able to learn more about the grant and the work I was contributing to. The grant consisted of three components: the One Health lesson plans, a mobile lab, and a museum exhibit. I also had the opportunity to attend the monthly Centers for Disease Control and Prevention One Health Updates. These meetings included partners, individuals, and nongovernmental members that came together to collaborate and share information or updates on projects and research they have been working on. These meetings allow individuals from all fields to gain a better understanding of disease, specifically SARS-COV-2 and its impact on humans and animals. It was an interesting experience listening in on these monthly calls and learning more about an area of One Health I am not too familiar with. It was also interesting to

learn more about research that scientists have been conducting across the country, specifically with COVID. Lastly, I had the opportunity to attend a few meetings with KDHE, where the whole department came together to discuss the events that happened that day and any calls, they received that day. It was interesting to be able to observe these meetings and be exposed to how things work at the health department.

Objectives for Field Experience:

- Develop One Health Lesson plans with the topics of the Human-Animal Bond and Spread of Infectious Diseases for K-12 students under the CDC Grant for Public Health Emergency Response: Public Health Crisis.
- Collaborate with an advisory team to decide on course of action for lesson plans, choose a template that all members can use for their lesson plans, and create a timeline for the project to ensure plans were completed before the end of the grant.
- Work with a team of epidemiologists to analyze emergency room data from hospitals across Kansas using ESSENCE.
- Work alongside an epidemiologist to analyze and interpret KSWebIZ rabies data that will later be shared at a rabies vaccination conference.

Chapter 3 - Results

Before starting the project, I was able to discuss with Dr. Petro the goals of the One Health Lesson plan grant. I was given the chance to sit in on an advisory committee where we could choose topics that would be the most impactful in the classroom. The advisory committee was also tasked with deciding on a timeline to have the lesson plans completed to satisfy the grant. The major topics included a history of One Health, Spread of Infectious Diseases, One Water One Health, Human-Animal Bond, Natural Disasters and One Health, Global One Health, Air Quality/Pollution, Handwashing, and Comparative Health. The advisory team then went on to decide what areas each member would work on.

The topics I was assigned included the Human-Animal Bond and Spread of Infectious Diseases. Most of the daily lesson plan work involved researching the two topics and looking for ways to adapt the content to make it more comprehensible yet engaging for students of all ages. The first lesson included a hands-on activity demonstrating disease spread in a population in

addition to a case study examining a salmonella outbreak. The case study was a significant contribution because of the history behind it in Kansas. I was connected to a retired KDHE environmental lawyer, Marvin Stottlemire, who worked with Steve Paige, the epidemiologist responsible for identifying the source of the salmonella outbreak in Kansas in the 1980's, He was able to share more information about the process behind identifying the source and the law that was established because of this case that banned the sale of small turtles due to salmonella contamination. I incorporated this real-world example into the lesson for students to explore while honoring the work of a previous epidemiologist (Appendix 1). The second lesson plan highlighted the benefits and drawbacks to the human-animal bond and the history of the bond. It was important to highlight the pros and the cons to this relationship to help build awareness around the consequences of both (Appendix 2).

The goal was to complete the lesson plans by the Spring 2023 Semester to send them to Wichita State University (WSU). We partnered with WSU on the lesson plan portion of the grant, and their role was to help facilitate our meetings and edit the final product. It was important that the lesson plans from each team member were cohesive before making them available to the public. Once the editors from WSU completed the editing for each lesson, I met with them to review the product and ensure no aspects were missing. I was able to create two elementary, three middle school, and three high school lesson plans, which will be available on KDHE's website in summer/early fall 2023.

The goal for the One Health lesson plans is to pilot the lessons in Fall 2023 in classrooms across Kansas. The advisory team plans to create an introductory video explaining the goal and purpose of these lesson plans to catch the interest of potential educators to pilot them. Once these lessons are piloted, the teachers chosen will be given the chance to provide feedback about how the lesson went in their classrooms so any changes can be made for the future. These lesson plans will also be housed on the KDHE website, where any teacher can access and incorporate them into their classrooms.

The second project I played a role in was the Rabies WebIZ Project. I was given the opportunity to shadow and work alongside Stephanie Lindemann (MPH), an epidemiologist at KDHE, as she worked through the data analysis of the project. To conduct the analysis, Stephanie extracted rabies vaccination data over a period of five years, from 2018 to 2022, in Kansas from WebIZ and imported it into a Statistical Analysis Software system (SAS). The data imported into SAS included a unique patient id, vaccination date, vaccination code, age, gender, patient zip, patient county, funding source, and vaccination type, which include rabies immune globulin and rabies vaccine. From there, Stephanie walked me through the different coding used

in SAS to “clean up the data,” where any duplicate entries and pre-determined exclusions were deleted, making it easier to analyze the data. The exclusions included in the analysis consisted of patients that were 18 years old or older that received only 2 days of rabies vaccine on days zero and three. This was an exclusion criterion because it would be impossible to differentiate between previously vaccinated patients that are receiving the two doses for PEP after an exposure and unvaccinated patients that started the vaccination series and did not continue. This discontinuation of the vaccination could be because they did not complete the schedule or because the animal tested negative for rabies, either which we did not have the information for during the analysis.

From these steps, we were able to extract data using SAS for the number of doses per month over year over the five-year period, doses administered by sex, doses administered by age group, doses administered by funding source, and doses administered by region. Stephanie also showed me how to do a similar data analysis using Microsoft Excel, more specifically Pivot tables. I was then given the opportunity to use the data exported from WebIZ and imported into Microsoft Excel to work with Pivot tables to analyze the data on my own (Appendix 3). I was responsible for creating the data tables for the variables mentioned previously for further analysis. In each of the extracted data sets, the doses were further divided into rabies immune globulin and rabies vaccines to show a more accurate count of both for the analysis. As can be seen in figure 3.1, doses typically increase over the summer months, and there is a sharp increase shown in the summer months of 2021 as well as 2022. For doses administered by sex in table 3.1, there is a slightly higher number of males receiving the vaccine compared to females. In table 3.2, doses administered by age group, the 19- to 29-year-old age group showed a higher number of doses administered compared to the other age groups. In table 3.3, data revealed a greater number of doses of vaccine being administered to individuals with private insurance versus public. Lastly, as can be seen in table 3.4, the Northeast region of Kansas produced a higher number of vaccine administration, and it also happens to be the metro area. It is important to note that further statistics and analysis would need to be performed to confirm the results as statistically significant.

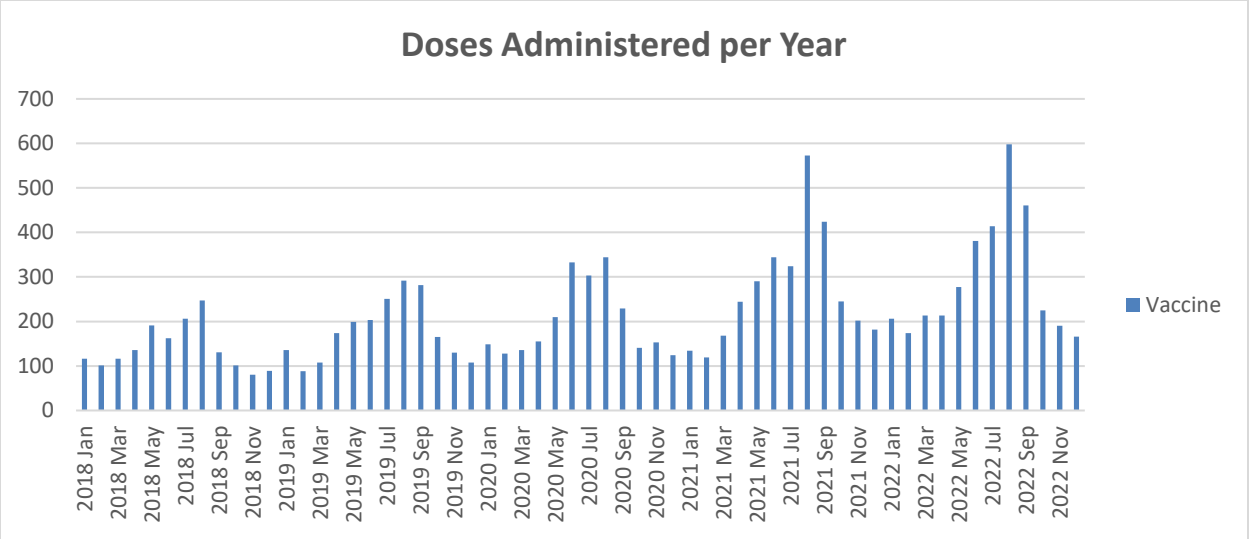

Figure 3.1 Graph of Doses Administered by Month per Year

Table 3.1 Number of Doses Administered by Sex

Doses Administered by Sex			
Sex	**Vaccination Type**		
	Rabies Immune Globulin	**Rabies Vaccine**	**Total**
Male	697	7231	7928
Female	672	5738	6410
Total	1369	12969	14338

Table 3.2 Doses Administered by Age Group

Doses of Rabies Vaccine and Immune Globulin Administered by Age Group			
Age Group	**Vaccination Type**		
	Rabies Immune Globulin	**Rabies Vaccine**	**Total**
0 to 9 years old	137	1803	1940
10 to 18 years old	175	1688	1863
19 to 29 years old	273	3084	3357
30 to 39 years old	254	2054	2308
40 to 49 years old	151	1279	1430
50 to 59 years old	155	1305	1460
60 to 69 years old	104	981	1085
70 years or older	120	775	895
Total	1369	12969	14338

Table 3.3 Vaccines Administered by Funding Source

Funding Source by Vaccination Type			
Funding Source	**Vaccine Type**		
	Immune Globulin	**Rabies Vaccine**	**Total**
Private	177	5334	5511
Public	0	342	342
Total	177	5676	5853
Frequency Missing = 8485			

Table 3.4 Doses of Rabies Vaccine and Immune Globulin Administered by Region

Doses of Rabies Vaccine and Immune Globulin Adminstered by Region			
Region	**Vaccine Type**		
	Rabies Immune Globulin	**Rabies Vaccine**	**Total**
Northeast Kansas	621	6168	6789
Southeast Kansas	60	431	491
North Central Kansas	79	967	1046
South Central Kansas	403	2407	2810
Northwest Kansas	25	419	444
Southwest Kansas	33	195	228
Total	1221	10587	11808
Frequeny Missing = 2530			

Stephanie presented the data we obtained from the analysis at a vaccination conference in June 2023 with health care officials across Kansas, which included the demographic data and best practices for vaccination (Appendix 4). A future goal is to create a map of high-risk areas using the county data we gathered from the analysis and overlaying that with a map of the rabies-positive animals throughout Kansas. The goal is to display this map on the KDHE website for the public to have access to. Providing access to this information can help to provide a warning to individuals of the risks in their area and help control the amount of animal bites/PEP administered in those areas.

Lastly, the third project I was a part of was an analysis of ESSENCE data using multiple queries involving animal bite emergency department visits and Rabies PEP administration. According to the CDC, ESSENCE is a surveillance system that allows you to monitor and analyze syndromic data. The main areas we were exploring included the burden of animal bites in emergency departments, the number of rabies-related emergency department visits, and the number of patients receiving PEP. I had the opportunity to collaborate with a team of three epidemiologists from KDHE, including Stephanie from the previous project, Henri, and Gabe, and met with them on a weekly basis to discuss the project.

Furthermore, we used two queries, a code used to extract data from the surveillance system, one from the CDC and one written by another KDHE epidemiologist, that included data about animal bite emergency room visits. We examined data in ESSENCE using these queries which covered the dates of January 1, 2022 to December 31, 2022. I was responsible for analyzing about 300 of the data entries from hospitals across Kansas, where I recorded the number of emergency room visits that were a potential rabies exposure due to an animal bite and recorded if PEP was administered. The inclusion criteria for this project included cases that involved animal bites, which was used to determine the burden of animal bites in the emergency

department, even if the animal was vaccinated for rabies or was not a common reservoir of the rabies virus. Exclusion criteria specifically for the data involving PEP included those positive rabies cases that did not mention any form of immunization (Appendix 6).

Chapter 4 - Discussion

The overall goal of the first part of my APE was to create One Health lesson plans for a CDC Grant for Public Health Emergency Response. The purpose of the One Health Lesson plans included introducing and exposing K-12 students to One Health topics. This exposure helps create collaboration between students and helps them understand the interconnectedness between humans, animals, and the environment. These are key to tackling many of the complex problems we face today that require expertise in multiple fields. The One Health lesson plan portion of the grant took longer than expected, but we got a grant extension from the CDC to continue work as needed over the next year. Therefore, the goal is to pilot our lessons plans come Fall Semester 2023 in K-12 classrooms across Kansas. WSU and KDHE are working together to find teachers willing and interested in piloting these plans. These teachers will also be given the opportunity to provide feedback on the lessons via an evaluation tool. The feedback captured will be used to gauge the lesson plans' effectiveness and allow for changes that will better serve future teachers and students.The goal of the second project I was a part of was to analyze rabies immunization data within Kansas over five years. While we were able to achieve this goal, there were limitations that are important to mention. Limitations we experienced with the data analysis included underreporting in the WebIZ system. Reporting of rabies vaccinations was not required until July of 2020, so from 2018 to July 2020 the data was not representative of the actual count of rabies vaccinations during that time. A second limitation of the project was there many records that were incomplete. Some health care facilities did not include address information for the patient or address information for the administration site which affected the analysis for county information.

Furthermore, limitations that affected our data analysis and prevented us from being able to present data for schedule adherence included the inability to differentiate between individuals that were previously vaccinated and those that received the first two doses but did not complete the rest of the series of vaccinations. Reasons that may have led to this scenario include an animal testing negative for rabies or the individual not continuing with the series. Because of this limitation, we were not able to include individuals that only received two doses,

on days one and days three. Secondly, as of May 6, 2022, the Advisory Committee on Immunization Practices (ACIP) released new recommendations for Rabies Pre-Exposure Prophylaxis (PrEP) schedule which also made it difficult to perform the schedule adherence analysis. Per the CDC, the new recommendation laid out by the ACIP requires a two-dose PrEP schedule versus the original recommendation of a three-dose. Therefore, due to the limitations of the data we ultimately decided not to include this data in the overall analysis.

Furthermore, even with the limitations mentioned above, the data analysis is a vital component to share with others around the state of Kansas to highlight areas of importance or improvement needed in relation to rabies vaccinations. For instance, information on patient demographics can help to highlight individuals that may be at a higher risk of rabies contact. Further studies and data analysis would need to be conducted, but the information presented is a great starting point for discussion into these topics. Lastly, the vaccine county data gathered is beneficial in identifying higher rabies risk areas throughout Kansas. Displaying this information on KDHE's website can make it easily accessible for residents throughout Kansas to be alerted of these high-risk areas and consequently be more cautious around animals in those areas.

Lastly, the goal of the third project I played a role in was to analyze Kansas emergency room department data related to animal bites/rabies using the surveillance system ESSENCE. Like the previous project, there were limitations that came up throughout our work together. The first limitation involved the queries used to analyze. Initially, the queries chosen from ESSENCE included extra data entries that were not relevant to the goal of the project. For instance, the key words we were searching for in the surveillance system included terms like "animal bite," "rabies," and "bat." However, this also pulled emergency room visits that had descriptions with words containing those terms. While one of the epidemiologists was able to make a code that excluded any of those words containing the searchable terms, it took a while to get to the point of settling on the two queries we used for the analysis, which delayed the project. Furthermore, even with the exclusions, there were some irrelevant data entries present. For instance, there were quite a few entries of patients that were hit with baseball "bats" or that had a fall in a "bathroom" that were not excluded from the query, which required a bit more time to analyze and manually exclude from the analysis. In addition, another limitation included incomplete data entries because some health care facilities do not report chief complaints or triage notes and leave out ICD coding which could be helpful in identifying rabies vaccination administration. There were many emergency department visits that were classified as rabies positive cases, however, there was no mention of the patient receiving PEP. Therefore, these cases were classified as no for PEP administration even though the patient may have received the vaccine.

In the end, like the second project, the information from the project is still helpful in gaining more knowledge about animal bites, rabies, and PEP administration in Kansas. The next step of the project is to take the data gathered from each of the team members and explore more about the aforementioned areas to help reduce the burden of animal bites in hospitals and ultimately reduce the exposure to rabies. Due to time constraints, my contribution to the project ended with reviewing a portion of the overall data extracted from ESSENCE. However, the data I was able to review by hand along with the data from the team of epidemiologists I worked with was presented to KDHE at an Investigations, Data and Epidemiology in Action Presentation. The data analysis that was shared during the presentation included the distribution rabies-related emergency department visits by age group, distribution by sex, distribution by county, and the proportion of rabies-related emergency department visits associated with rabies vaccination.

Chapter 5 - Competencies

Table 5.1 Summary of MPH Foundational Competencies

Number and Competency		Description
3	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming, and software, as appropriate.	This competency was attained in the Rabies WebIZ project and ESSENCE project. In the first project, data was pulled from KSWebIZ and then analyzed in SAS as well as Microsoft Excel. Information such as doses administered per age group, county, sex, and funding source were highlighted as well as doses per month over a five-year period. In the second project, emergency room data was pulled from ESSENCE and then analyzed in Microsoft Excel. Information including the burden of animal bites visits, number of rabies-related emergency department visits, and the number of patients receiving PEP.

4	Interpret results of data analysis for public health research, policy, or practice.	This competency was attained in the Rabies WebIZ project as well, where the data mentioned above was used to find trends in demographic data and seasonality of rabies cases.
18	Select communication strategies for different audiences and sectors.	This competency was attained in the One Health lesson plan project where my job was to determine the best way to present One Health information, specifically on the spread of infectious diseases and the human-animal bond, to a wide age-range audience.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation.	This competency was attained in the One Health lesson plan project, where I had to take topics that can be highly scientific and technical and make it easily accessible and comprehensible for teachers and students.
21	Perform effectively on interprofessional teams.	This competency was attained in all three projects I was involved in. While working on the projects, I collaborated with professionals with many diverse backgrounds. These backgrounds included areas such as educators, Public Health veterinarian, epidemiologists, and project managers. To ensure the success of the projects, it was important to work effectively together as a team. It was interesting to be able to gain perspective from the many different areas of backgrounds that each team member brought to the projects.

Competency three involves different ways of analyzing quantitative and qualitative data and this was achieved during the WebIZ Rabies project. This project consisted of pulling rabies immunization data over a 5-year period, from 2018-2022. The data was then imported into the Statistical Analysis Software Version 9.4 (SAS), which was used to analyze the data allowing us

to observe the differences in age groups, sex, funding source, and doses administered per month. The data was also imported from SAS to Microsoft Excel, where charts and graphs were created to further understand the data. In the second project, we used two different queries, or codes used to extract data, to extract emergency room department visit data relating to animal bites and import the data into Microsoft Excel. From there, we were able to manually review the emergency room department data to gather information on the burden of animal-bite visits, the number of rabies-related emergency department visits, whether justified or not, and the number of patients receiving PEP at these visits.

Competency four highlights interpreting results of data analysis for public health practice. This competency was satisfied in the Rabies WebIZ project as well. I was able to work along-side an epidemiologist to analyze rabies vaccination data. This information was then presented at an immunization conference with other health departments and physicians to better understand rabies and rabies immunization trends throughout Kansas.

Competency 18 involves using different communication strategies based on the audience you are trying to reach. This competency was achieved during the lesson plan development project. The goal of creating the One Health lesson plans was to be able to share information on infectious diseases and the human-animal bond with a wide age-range audience. I had to take at times highly technical and scientific terminology and concepts and find different activities that would best communicate this information to students of all ages, including videos highlighting the spread of disease and the human-animal bond, class discussions, hands-on lab-type activities to simulate the spread of disease, or epidemiological type activities.

Competency 19 highlights using audience-appropriate communication in writing and presentation. This competency was addressed during the One Health lesson plan projects as well. When working with the advisory team and working on the lesson plans individually it was imperative to keep the audience in mind to ensure the ease of delivery of information. The audience that we were looking to reach not only included students, K-12, but the teachers that would be using the information in their classrooms as well. The goal was to make these One Health lessons easily accessible and comprehensible. I included background information on One Health; this included information on infectious diseases, the diverse ways diseases spread, pandemics, endemics, and epidemics, history of the human-animal bond, and benefits and drawbacks to the human-animal bond among many others.

Competency 21 involves working effectively with an interdisciplinary team. This competency was addressed in all three projects during my internship. On the One Health lesson plan project, I worked alongside an advisory team made up of educators, project managers, and

Public Health Veterinarians. It was interesting to be able to work with such a diverse team and gain perspective and direction from all areas of background when approaching these One Health Lesson plans. On the KSWebIZ and ESSENCE Rabies Project, I had the opportunity to work with multiple epidemiologists with wide ranges of backgrounds. I enjoyed learning more about their work and their approaches. Working with these different professionals further opened my eyes to the importance of taking an interdisciplinary approach which allows you to gain new insights and ideas about problems that you may not have had before.

Table 5.2 MPH Foundational Competencies and Course Taught In

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		
Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					x
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				
20. Describe the importance of cultural competence in communicating public health content		x			x
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			x
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	

Student Attainment of MPH Emphasis Area Competencies

Table 5.3 Summary of MPH Emphasis Area Competencies

MPH Emphasis Area:		
Number and Competency		**Description**
1	Pathogens/Pathogenic mechanisms	Evaluate modes of disease causation of infectious agents.
2	Host response to pathogens/immunology	Investigate the host response to infection.
3	Environmental/ecological influences	Examine the influence of environmental and ecological forces on infectious diseases.
4	Disease Surveillance	Analyze disease risk factors and select appropriate surveillance.
5	Disease Vectors	Investigate the role of vectors, toxic plants, and other toxins in infectious agents.

Knowledge of modes of disease causation of an infectious agent is key to preventing and managing disease, especially rabies. Through my course, DMP 850 Domestic Animals Immunology, I learned about how different infectious agents, whether that be a virus, bacteria, fungi, or parasite cause disease which helped lay the groundwork needed to understand the rabies virus. While it was not necessary to have this prior knowledge, it was helpful to be able to understand the background behind the virus when looking at immunization data. This

background knowledge was also helpful in developing lesson plans emphasizing disease spread.

The knowledge of immunology and the hosts response to infection, specifically adaptive immunity, is a key part of understanding how vaccination works. While not a key part of the projects I was a part of during my APE, I gained the knowledge needed about a host's immune response through my DMP 850 Immunology course. I learned about the diverse ways an animal's immune system reacted to different foreign pathogens, and symptoms that would develop because of the response. Even though the course was solely focused on domestic animal immunology, many of the symptoms and responses are similar, if not identical in humans.

When developing the human-animal bond and spread of infectious diseases lesson plans, I drew upon the knowledge of environmental and ecological influences on disease spread I gained from both my MPH 802 Environmental Health and DMP 710 Introduction to One Health courses. Climate change and urbanization among others can lead to greater interactions between humans and animals which are drivers for disease spread. These environmental and ecological influences can at times be seen in animals long before humans, therefore can identify disease sentinels. This was another big concept I learned about in my courses that I was then able to translate over into my APE when developing lessons for students.

Disease surveillance and risk factors are two big areas I learned in both my MPH 754 Introduction to Epidemiology and DMP 710 Introduction to One Health courses. I learned about the importance of disease surveillance for disease control and eradication of disease. One of the biggest concepts of disease surveillance taken away from these courses was the two diverse types; active and passive surveillance and the scenarios in which one would be used over the other. I had the opportunity to work on two projects involving disease surveillance using two different online databases: ESSENCE and WebIZ. ESSENCE and WebIZ are both programs that allow for disease tracking and tracking rabies immunizations respectively, which help to monitor rabies within any given state. These methods are an important part of being able to track and manage rabies cases throughout Kansas.

The fifth competency involves the role of vectors, toxic plants, and other toxins in infectious diseases which I was introduced to during my MPH 802 Environmental Health and DMP 710 Introduction to One Health courses. Throughout both courses, I gained a clearer understanding about vector-borne diseases, such as malaria, West Nile encephalitis, and Lyme disease. From my MPH 802 Environmental Health course I learned more about toxic plants and toxins, how they can build up over time in the environment, and how they can cause disease.

These courses laid the foundation I needed around these topics that I was able to translate over into my APE. These topics, specifically vectors, were an important part of my lesson plan development on the spread of infectious diseases. I was able to use the knowledge I gained on vectors/vector-borne diseases to create a lesson that shared the different mechanisms of disease spread.

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Appendix 1 – Spread of Infectious Diseases Lesson Plans

Appendix 1.1 - Spread of Infectious Diseases Elementary School Lesson Plan

LESSON NAME: Stop the Spread!

ONE HEALTH TOPIC

Spread of Infectious Diseases

GRADE LEVEL

Elementary School

STATE STANDARDS

ELA: W.K.2, SL.1.1, SL1.2, SL2.1, SL2.2
Science – K.ESS3.1
History – Standard 1 Choices Have Consequences

SUBJECT AREA


English Language Arts


Science


Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Define "germs" and understand their effects on humans.
- Identify the ways germs spread
- Identify ways to prevent the spread of germs

MATERIALS NEEDED:

Introduction

- Access to internet and video player/projector

***Where to Find Germs* Collage Activity**

- Magazines/Access to online images and printer
- Age-appropriate scissors
- Large piece of construction paper or poster board
- Glue

Other:

- Crayons
- Colored Pencils

LESSON INTRODUCTION:

This lesson will focus on what germs are, how they spread, and ways to prevent them from spreading.

Divide students into small groups of 2-3 students and ask them to share one thing that they already know about germs. Invite groups to share ideas with the larger classroom group.

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LEARNING ACTIVITIES:

Activity Option #1: *(for younger grade levels)*
(Meets Standards SL.1.1, SL.1.2, SL.2.1, SL.2.2, K.ESS3.1, and Choices have Consequences)
View read along video "Germs, Germs, Germs" https://www.youtube.com/watch?v=Bqozl-9WYqM&t=71s&ab_channel=StoriesForKids with the students that explains what germs are and the different ways they spread from one to another. *Running Time 00:04:02*

Following the video, engage students in a class discussion regarding what they saw/heard. Sample questions include:

- What are germs?
- Where can we find germs?
- What are ways germs can spread?
- What are ways that germs can get into our bodies?
- What are some things we can do to protect ourselves from germs?

Activity Option #2: Draw or Color a Picture of a Germ
(Meets Standards W.K.2, SL.1.2, SL.2.2)

- Ask students to draw or color a picture of what a germ looks like.
- Have students write 1-2 sentences or a paragraph about what they learned about germs in the lesson. Questions in Activity #1 may be used as a guide.

Activity Option #3: Create a Collage
(Meets Standards W.K.2, SL.1.1, SL.1.2, SL.2.1, SL.2.2, K.ESS3.1, and Choices have Consequences)

- Ask students to create a collage using pictures from magazines or online photos that are examples of where germs may be hiding. Examples might include gardens/dirt, garbage cans, toilets, human hands, tables, etc.
- Engage students in a discussion related to their ideas and pictures.

Activity Option #4: Word Search Vocabulary Lesson
(Meets Standards SL.1.2 and SL.2.2)

- Ask students to complete the "Staying Well" Wordsearch puzzle as part of a vocabulary lesson. *See the supplemental handout entitled Staying Well Wordsearch.*

ASSESSMENT:

Create an age-appropriate rubric for evaluating collages.

Check the number of words located in the Wordsearch puzzle.

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RESOURCES:

Centers for Disease Control and Prevention – Introduction to Epidemiology: Section 8 Concepts of Disease Occurrence
https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section8.html#:~:text=The%20triad%20consists%20of%20an,a%20source%20to%20that%20host.

Germ Coloring Pages: bit.ly/3Zi2eqU

Mayo Clinic – Causes of Infectious Diseases
https://www.mayoclinic.org/diseases-conditions/infectious-diseases/symptoms-causes/syc-20351173#:~:text=Infectious%20diseases%20commonly%20spread%20through,someone%20who%20isn't%20infected.

Videos

Sesame Street in Communities: *What are Germs?*
https://www.youtube.com/watch?v=ACDLuToE0UI&ab_channel=SesameStreetInCommunities
Running Time: 00:02:13

Sid the Science Kid – The Jim Henson Company: *Germs!*
https://www.youtube.com/watch?v=ghLkwSlWSXw&ab_channel=TheJimHensonCompany
Running Time: 00:03:17

WonderGrove Kids: *Germs, Germs, Germs*
https://www.youtube.com/watch?v=uMbCZfb5k3M&ab_channel=WonderGroveKids
Running Time: 00:03:20

Learn Bright: *Germs for Kids | Learn all about bacteria, viruses, fungi, and protozoa*
https://www.youtube.com/watch?v=z6n-37RTKRo
Running Time: 00:09:39

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Appendix 1.2 – Spread of Infectious Diseases Middle School Teacher Notes

Teacher Notes: Spread of Infectious Disease (MS)

This lesson is an introduction to the spread of infectious diseases. **Infectious diseases** are diseases caused by microorganisms that we can't see with the naked eye, which are also called pathogens. **Zoonotic diseases** are diseases that are spread between animals and people. Many of the sick days we see are due to infectious diseases, like the common cold and influenza. These pathogens that infect us can include bacteria, viruses, fungi, or parasites.

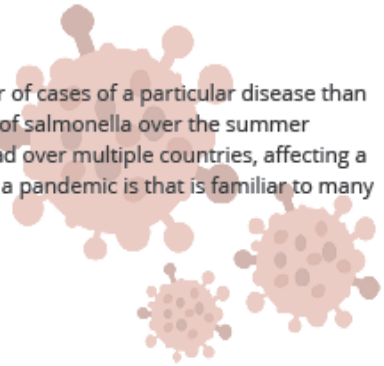
Infectious diseases can spread in several ways. The first is via **direct contact** (or person to person) like if someone coughs or sneezes on someone else. In relation to direct contact, a person can be **asymptomatic**, show no signs of disease or illness, and still be able to spread the disease to another person. A second way disease can spread is via **indirect contact**, like touching a doorknob that has been contaminated by germs. Two other ways disease is transmitted is through contaminated **food or water**. Lastly, diseases can be transmitted from a **vector** (carrier) to a human. For instance, diseases like Malaria or Lyme disease are transmitted to humans via mosquitos and ticks respectively.

The microorganisms that cause disease can change and adapt over time, which can lead to a resistance to once effective treatments. This is what we call **antimicrobial resistance**, which is a serious issue the world faces today. This is also why it is important to know whether a disease is caused by bacteria or a virus, to ensure antibiotics are being prescribed correctly.

The **disease triad** is a model that can help to understand how diseases spread. The disease triad has three corners:

- The "agent" which is the microorganism that causes the disease.
  - These can be germs, bacteria, virus, fungi, or parasites.
- The "host" which is the organism that is exposed to and harbors the disease.
  - This can be an animal or human
- he "environment" which is the surroundings and conditions that allow for the disease to spread.
  - Temperature
  - Dry or wet areas
  - Seasons

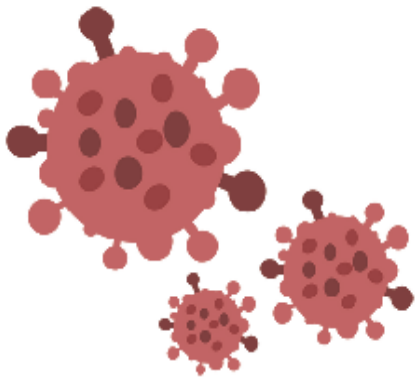
An **outbreak** or epidemic is a sudden increase in the number of cases of a particular disease than what is typical in an area. An example would be an outbreak of salmonella over the summer months in Kansas. A **pandemic** is an epidemic that has spread over multiple countries, affecting a much larger population of people. A most recent example of a pandemic is that is familiar to many is COVID-19.



Page 1

Activity #2 Instructions:

- Gather enough plastic cups for the entire class and number each one. Fill all but one with distilled water to the halfway point.
- For the last cup, make a saturated solution of baking soda in water by adding baking soda to distilled water, while mixing or stirring, until no more will dissolve. Let it sit and then add to last cup. Note the number of the cup with the baking soda.
- You will need Phenolphthalein for this activity. If you don't have access to this, you can prepare your own using red cabbage. Here are the steps to prepare using red cabbage:
  - Boil a half of a head of red (purple) cabbage in a large pot of distilled water. Strain out the cabbage and keep the water. The water should turn purple. Refrigerate any portion that you do not use immediately. This can be kept refrigerated for 1-2 days.



Appendix 1.3 – Spread of Infectious Diseases Middle School Lesson Plan

LESSON NAME: Stop the Spread!

ONE HEALTH TOPIC

Spread of Infectious Diseases

GRADE LEVEL

Middle School

STATE STANDARDS

ELA: SL.6.1, SL.7.1, SL.8.1
Science: MS-LS2-2
HGSS: Choices have Consequences

SUBJECT AREA

Science
English Language Arts
Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify ways disease spread from person to person
- Differentiate between direct and indirect disease transmission
- Identify ways to prevent the spread of disease

MATERIALS NEEDED:

Direct Contact Disease Transmission

- Notecards
- Pens/pencils
- *Optional: Glogerm gel or oil and UV light*

Indirect Contact Disease Transmission

- Plastic cups
- Distilled water
- Indicator (phenolphthalein or cabbage water)
- *Optional: Vinegar*

Community Response

- Paper and pen/pencil

LESSON INTRODUCTION:

Divide students into small groups of 2-3 and ask them to think back to the most recent time that they were sick. In their small groups, they will discuss:

- What were your symptoms?
- How long were you sick?
- How do you think you got sick?
- What are some things that you did that helped you feel better?

Following the discussion, ask for volunteers to share what they heard with the class.

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LEARNING ACTIVITIES:

Utilizing information from the supplemental material titled, *"Teachers Notes"*, share background information and terms with students so they gain a better understanding of how diseases spread.

Activity Option #1: Direct Contact Disease Transmission

(Meets Standards SL.6.1, SL.7.1, SL.8.1, MS-LS-2, Choices Have Consequences)

- Give each student a notecard and have all students number off 1-12.
- Ask students to walk around the room, stopping to high-five (or air high-five) other students as they pass each other. Each time they high-five someone, they will write each other's numbers down on their notecards. When all students have had a chance to gather numbers from at least five of their classmates, ask students to sit down.
- Choose a number from 1 to 12 and inform students that if they have the number you chose on their card, they have become infected with an illness. Ask students with that number on their cards to raise their hands to gain a clear picture of the number of students that were infected.
    - *Alternative option - Incorporate the use of Glogerm:* Instead of numbering students and choosing a number at random, choose one student to be "infected" (use the Glogerm). To keep the identity hidden, have other students apply something with similar consistency on their hands (such as unscented lotion or hand sanitizer). At the end of the activity, use a UV light to show which students have been "infected" and reveal who the original "infected" person was.
- As a class, discuss the concept of direct transmission and asymptomatic transmission. Invite students to turn to a partner and discuss their answers to the following questions:
    - What diseases or sicknesses do you think spread this way?
    - What could you do to help stop the spread?
- Following partner discussion, ask students to use terms they learned from this lesson to write a paragraph on their notecard answering the following questions:
    - Think of the last time you were sick. How do you think you got sick (how did it spread)?
    - Who else did you spread the sickness to?
    - If this sickness ended up being a part of an outbreak, what are some measures that could be taken to help stop the spread?

Activity Option #2: Indirect Contact Disease Transmission

(Meets Standards SL.6.1, SL.7.1, SL.8.1, MS-LS-2, Choices Have Consequences)

Teacher instructions (complete prior to the beginning of the activity):

- Gather enough plastic cups for the entire class and number each one. Fill all but one with distilled water to the halfway point.
- For the last cup, make a saturated solution of baking soda in water by adding baking soda to distilled water, while mixing or stirring, until no more will dissolve. Let it sit and then add it to the last cup. Note the number of the cup with the baking soda, as it will be the "infected" cup.
- You will need Phenolphthalein for this activity. If you don't have access to this, you can prepare your own using red cabbage. Here are the steps to prepare using red cabbage:
    - Boil half of a head of red (purple) cabbage in a large pot of distilled water. Strain out the cabbage and keep the water. The water should turn purple. Refrigerate any portion that you do not use immediately. This can be kept refrigerated for 1-2 days.

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LEARNING ACTIVITIES, cont.:

Activity Option #2: Indirect Contact Disease Transmission, continued

(Meets Standards SL.6.1, SL.7.1, SL.8.1, Science: MS-LS-2, and Choices Have Consequences)

Day of the activity:

- Without revealing who has the "infected" cup (the one with the baking soda mixture), give each student one of the numbered cups.
- Invite students to walk around the room and visit four of their classmates (one at a time).
    - With each visit, ask students to mix the liquid in their cups by pouring all of the liquid from one cup into the other, and then pouring half of the liquid into the empty cup. A demonstration of this transaction could be helpful.
    - *Note: The cup represents air particles or a vehicle (inanimate object) for disease transfer*
- Once each student has made contact with four of their classmates, ask them to stand in a line with their cups. Explain to them that you have an indicator (phenolphthalein or cabbage water) that will change color in the presence of acids and bases.
    - If using phenolphthalein: For this activity, those that are infected will have solutions that turn pink. (In acids, phenolphthalein will be colorless, while in bases, it will turn pink.)
    - If using cabbage water: For this activity, those that are infected will have solutions that turn blue-green. (In acids, cabbage water will change from purple to pink, while in bases it will change from purple to a blue-green color).
- *Optional Step – Incorporating "Vaccines"*
    - Before adding the indicator to each of their cups, choose a few students (by cup number) to receive a "vaccination" for this particular disease. Add 20 mL of vinegar to their cups, and let them know that they have been vaccinated. Note that typically, vaccinations occur before encountering a disease, but for the purposes of this activity, the "vaccination" occurred after exposure
- Go down the line and add a few drops of the indicator to each of the cups. Invite all "infected" students to move to one side of the room. Record the number of "infected" students on the board and have students determine which student was the source of the infection (their solutions will be a much brighter pink or blue-green).

After the activity, discuss the following with students:

- Go over the numbers with the students, including the total number of students, the number of infected students at the start, and the total number now infected.
- How this model reflects many real-world situations with disease spread.
- How this model differs from some real-world situations (If you get a cold, does everyone in your family also get a cold every time? Why not?)
- What diseases or sicknesses do you think spread this way? What could you do to help stop the spread?
- Other ways infectious diseases can spread (vector, water, food)
- Ways communities may respond to outbreaks of infectious diseases.
- When an outbreak happens in a community, what questions would you ask that could help you stop the spread of the sickness (e.g. How many people are sick? Where are the people getting sick? What are the symptoms? How long are people sick for? Who needs to know about this?)

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LEARNING ACTIVITIES, cont.:

Activity Option #3: Community Response *(Meets Standards SL.6.1, SL.7.1, SL.8.1, Choices Have Consequences)*
Engage students in a brief discussion on ways communities may respond to outbreaks of infectious diseases.

Have students write a paragraph answering the following:

- Imagine the disease from the activity is considered to be an outbreak in your community. What questions would you ask that could help you stop the spread of sickness? Explain why you would ask those questions.
    - Examples: How many people are sick? Where are the people getting sick? What are the symptoms? How long are people sick for? Who needs to know about this?

ASSESSMENT:

Create an age-appropriate rubric for participation and writing activity.

RESOURCES:

National Geographic – "There's an Outbreak!"
https://www.nationalgeographic.org/lesson/theres-outbreak/print/ *(Note: The first activity was adapted from this site and there are many other great activities and ideas available here)*

Centers for Disease Control and Prevention – Introduction to Epidemiology: Section 8 Concepts of Disease Occurrence
https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section8.html#:~:text=The%20triad%20consists%20of%20an,a%20source%20to%20that%20host.

Mayo Clinic – Causes of Infectious Diseases
https://www.mayoclinic.org/diseases-conditions/infectious-diseases/symptoms-causes/syc-20351173#:~:text=Infectious%20diseases%20commonly%20spread%20through,someone%20who%20isn't%20infected.

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Appendix 1.4 – Spread of Infectious Diseases High School Teacher Notes

Teacher Notes: Spread of Infectious Disease (HS)

This lesson is an introduction to the spread of infectious diseases. **Infectious diseases** are diseases caused by microorganisms that we can't see with the naked eye, which are also called pathogens. **Zoonotic diseases** are diseases that are spread between animals and people. Many of the sick days we see are due to infectious diseases, like the common cold and influenza. These pathogens that infect us can include bacteria, viruses, fungi, or parasites.

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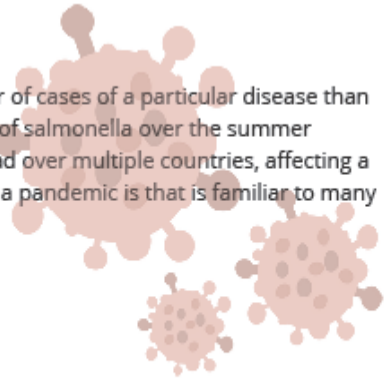
The microorganisms that cause disease can change and adapt over time, which can lead to a resistance to once effective treatments. This is what we call **antimicrobial resistance**, which is a serious issue the world faces today. This is also why it is important to know whether a disease is caused by bacteria or a virus, to ensure antibiotics are being prescribed correctly.

The **disease triad** is a model that can help to understand how diseases spread. The disease triad has three corners:

- The "agent" which is the microorganism that causes the disease.
  - These can be germs, bacteria, virus, fungi, or parasites.
- The "host" which is the organism that is exposed to and harbors the disease.
  - This can be an animal or human
- he "environment" which is the surroundings and conditions that allow for the disease to spread.
  - Temperature
  - Dry or wet areas
  - Seasons

An **outbreak** or epidemic is a sudden increase in the number of cases of a particular disease than what is typical in an area. An example would be an outbreak of salmonella over the summer months in Kansas. A **pandemic** is an epidemic that has spread over multiple countries, affecting a much larger population of people. A most recent example of a pandemic is that is familiar to many is COVID-19.



Page 1

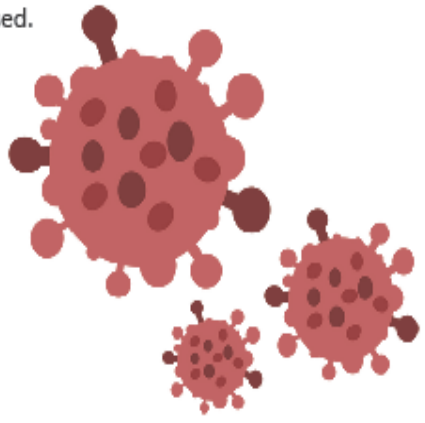
"What Happened to Jack Activity" Instructions:

- Divide students into groups of 4 and provide each group with a copy of Part I of the "What Happened to Jack?" activity. In these groups, students will work to assume the role of an epidemiologist to determine the source of an outbreak. Students should work within the small group to answer Questions 1 & 2 of the activity.
- Once the small groups have completed Question 2, discuss Question 3 as a class.
- Next, distribute the handout "Possible Infectious Diseases and Symptoms Chart" and ask each small group to complete Questions 1 & 2.
- When ready, each group will request a set of envelopes from the teacher, one containing potential questions and the other containing their answers. (See list of Questions and Answers to be listed on premade index cards below.)
- Students will first open the envelope of Interview Questions and follow the instructions in Question 3.
- Utilizing the envelope containing the answers to the Interview Questions, each small group will follow the instructions in Question 4 to answer parts a. and b.
- Once the group has completed their "investigation", distribute Part II of the activity titled, "What is the Source?"

Lesson Wrap Up

Once students are done with the activity (Part I and Part II) engage the students in a discussion around what they found was the illness and the source. Call on groups to share their findings. Students should have found that Jack was infected with Salmonella and the source of infection was the little turtle his family owned as a pet.

During the 1970's, small turtles were a source of Salmonella infections in the U.S., especially in Kansas. A significant number of children were becoming infected with Salmonella. In 1975, the Food and Drug Administration banned the distribution of small turtles and there were many states, Kansas included, that banned the sale of them completely. This helped to prevent hundreds of thousands of cases of salmonellosis among children. However, as we can still see today, reptiles, turtles especially, are popular pets. But this increase in popularity has a consequence, and the number of reptile-related salmonella infections has increased.



Interview "Questions and Answers" (To be listed separately on index cards and kept in two separate envelopes – 1 full set per group).

Questions

1. What was Jack's temperature?
2. What did Jack's throat look like?
3. A swab was taken of Jack's throat. Is there strep throat causing bacteria present?
4. What was Jack's blood pressure?
5. Has Jack vomited in the past 24 hours?
6. Does Jack have shortness of breath?
7. Has Jack had diarrhea over the past 24 hours?
8. What was Jack's weight?
9. Does Jack have body aches?
10. What is Jack's height?
11. Has Jack taken any type of medicine over the past 24 hours?
12. What are some foods that Jack has eaten over the past couple of days?
13. Does Jack have a cough?
14. What is the weather like where Jack and his family live?

Answers

1. 102.3 degrees F
2. Jack does not have redness or white bumps in his throat.
3. There is no Streptococcus pyogenes (strep throat causing bacteria) present in the sample taken from Jack's throat
4. Jack's blood pressure is 120 over 80 which is a normal blood pressure.
5. Yes, Jack has vomited in the past 24 hours.
6. No, Jack does not have shortness of breath.
7. Yes, Jack has had diarrhea over the past 24 hours.
8. Jack weighs 44.8 pounds.
9. Jack does not have body aches.
10. Jack is 45 inches tall.
11. No, Jack has not taken any medication over the past 24 hours.
12. Yesterday Jack had Oatmeal, chicken tenders, macaroni and cheese, spaghetti, banana, and strawberries. Today, Jack has not eaten or drank anything.
13. No, Jack does not have a cough.
14. The weather has been a bit cold, and it has been raining off and on over the past few days.

Appendix 1.5 – Spread of Infectious Diseases High School Lesson Plan

LESSON NAME: Stop the Spread!

ONE HEALTH TOPIC

Spread of Infectious Diseases

GRADE LEVEL

High School

STATE STANDARDS

ELA: W.9-10.7, W.11-12.7
Science: LS4.C
HGSS: Standard 1 Choices have Consequences

SUBJECT AREA

- English Language Arts
- Science
- Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify the five ways diseases spread throughout a population.
- Define and provide an example of asymptomatic disease transmission
- Define and provide an example of vector-borne diseases
- Define "indirect" and "direct" transmission.
- Identify and provide examples of the disease triad.

MATERIALS NEEDED:

Introduction

- Access to the internet and video player/projector

***What's Happened to Jack?* Activity**

- Copies of Handouts:
  - Part 1: What Happened to Jack?
  - Possible Infections Diseases and Symptoms Chart
  - Part 2: What is the source?
- Premade Index Cards listing interview questions and answers, each on a separate card. One full set per group.
- Envelopes – two per group. One contains set of Question index cards, the other for Answers

LESSON INTRODUCTION:

View TEDEd video titled *"How Pandemics Spread"*.
https://www.youtube.com/watch?v=UG8YbNbdaco&ab_channel=TED-Ed *Running Time: 00:7:59*

Following the video, ask students to turn to a partner nearest them and discuss the following questions:

- What makes a "pandemic" different than an "epidemic"?
- Which facts surprised you the most?

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LEARNING ACTIVITIES:

Using information from the supplemental material titled, *"Teachers Notes"*, share background information and terms with students so they gain a better understanding of how diseases spread.

Activity Option #1: *What Happened to Jack?* *(Meets Standards LS4.C and Choices Have Consequences,)*
(See supplemental materials for handouts and instructions)
Students work in small groups of four to determine the type and source of illness in a small child.

Activity Option #2: Small Group Research Project *(Meets Standards W.9-10.7, W.11-12.7, and Choices Have Consequences)*
Students work in pairs or small groups to research an infectious disease of their choosing. Examples include plague, influenza, malaria, and tuberculosis. Questions to guide this research include:

- What is the history of the disease?
- How does the disease spread? Is it vector-borne?
- What steps were taken or could be taken to help stop the spread of this disease?

ASSESSMENT:

Use the provided rubric for the *What Happened to Jack* activity,

Create a rubric for the small group research project.

RESOURCES:

BioEd Online: Infectious Disease Case Study
https://www.bioedonline.org/lessons-and-more/lessons-by-topic/microorganisms/microbes/infectious-disease-case-study/

Centers for Disease Control and Prevention – Introduction to Epidemiology: Section 8 Concepts of Disease Occurrence
https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section8.html#:~:text=The%20triad%20consists%20of%20an,a%20source%20to%20that%20host.

Mayo Clinic – Causes of Infectious Diseases
https://www.mayoclinic.org/diseases-conditions/infectious-diseases/symptoms-causes/syc-20351173#:~:text=Infectious%20diseases%20commonly%20spread%20through,someone%20who%20isn't%20infected.

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

Appendix 1.6 – Infectious Diseases High School Case Study Activity

What Happened to Jack? (Part 1)

Jack is a healthy and active six-year-old that loves to play outside, especially now that it is fall. He loves to follow his older brother around and copy everything he is doing. They recently got a new turtle as a pet that they have been playing with non-stop. Jack also loves to have playdates with his friends that live a few houses down.

This morning when he woke up, Jack wasn't acting like his usual self. He was very upset, complained about having a stomachache and did not want to eat or drink anything. Jack's mother also noticed that he felt very warm. Jack's mother was very concerned because one of the neighbor's children that they went on a playdate with late last week had a bad cold. Based on this, Jack's mother decides to take him to the doctor just to be safe.

You and your teammates work as epidemiologists at an agency that helps doctors identify the source of illnesses like Jack's. Recently there have been a significant number of other cases of young children between the ages of 3-8 years old that went to the doctor with similar symptoms a few towns away . Therefore, you and your team have been hired to work with Steve Paige, a fellow epidemiologist and director at Kansas Department of Health and Environment, to investigate what is happening and ensure this isn't the beginning of an outbreak. However, before you can find the cause, you will need to identify what illness Jack has.

As a small group, answer the following questions:

1. Based on the information that you have so far, what do you think could be causing Jack's symptoms?

2. What are four questions that the team feels would be important to ask Jack's mother to help lead the doctors to a diagnosis and, ultimately, the source of illness?

As a class, discuss diseases and illnesses that you may have had in the past or know of that match the symptoms that Jack is displaying.

3. Based on this discussion, what are some possible diseases/illnesses that Jack may have?

What Happened to Jack? (Part 1 cont.)

The following chart lists common infectious diseases that are possible diagnoses for Jack. Your team will work to identify which of these is the most likely to be the one he is currently experiencing.

Infectious Disease	Symptoms	Causes	Treatment	How does it spread?
Influenza (Flu)	Headache Sore Throat Body Aches High Fever Diarrhea and/ or vomiting		Rest Stay hydrated May be prescribed antiviral medication	
Strep Throat	Headache Red and painful throat White patches on back of throat Stomach pain Fever		Rest Stay hydrated Prescription antibiotics	
Salmonellosis	Headache Chills Fever Stomach Cramps Diarrhea Vomiting		Rest Stay hydrated with extra fluids Antibiotics available for extreme cases	
Coronavirus	Headache Body aches Fever Sore throat Nausea or vomiting Diarrhea Shortness of breath		Rest Stay hydrated	

See Back for Next Steps

1. Complete missing elements of the chart by identifying the microorganism that causes each disease/illness and how it spreads. (Is it through direct or indirect contact? Is it food-, air-, or water-borne?)

2. Based on this information, what are some possible questions that the team thinks would be most important to ask Jack and his mother to help determine which illness he is experiencing?

3. Once you have your questions, ask your teacher for a set of question and answer index cards. Open the envelope labeled, "Questions" and review each question with your team. As a team, decide which of these questions would be most important to ask Jack and his mother and write down the number of each question.

4. Open the envelope labeled, "Answers", and find the answers that match the questions you have chosen to ask.

   a. According to your investigation, which illness does Jack likely have?

   b. Which sets of questions/answers were most helpful in identifying Jack's illness? Why?

What Happened to Jack? (Part 2: What is the Source?)

Now that you have identified Jack's illness, the next step is to identify the source.

Salmonella is a common bacterial illness, and this bacterium can be found in the intestines of both animals and humans and spreads via fecal-oral route. This means that the bacterium is shed in the stool of a host and enters the mouth of the next host by some means. It is primarily transmitted through contaminated food and/or water, but it can also be transmitted by direct contact with the animal.

Salmonella outbreaks are much more common in the summer months when the weather is warmer and there are more outdoor activities where food is not refrigerated, which is why your team has been brought in to investigate. You did a bit more digging and found many more cases of children with Salmonella throughout Kansas within just the past couple of weeks.

1. Given this information, identify a few additional questions that the team might ask Jack and his mother in order to get more information.

Your team decides to conduct an interview process and visit the homes of Jack and some of the other children. On the back of this handout are the notes that your team has gathered from these interviews and home visits. Study this information to find any clues as to what could be causing illness in these children.

2. Based on what you learned, what does the team think is the source of Jack's illness? Why?

Cases	Any contact with animals that pose a high-risk for salmonella such as cattle, pigs, or poultry?	Foods they've eaten over the 24 hours	What pets are in the home?	Anyone else in the home have the same symptoms?
Case # 1 (Jack)	No	Chicken tenders, macaroni & cheese, spaghetti, oatmeal, strawberries, banana	2 dogs, 1 cat, 2 little turtles	No
Case #2	Yes, visited grandparents' farm	Canned soup, pasta, tacos, waffles	1 dog	No
Case #3	No	Peanut butter & jelly sandwich, cereal, pasta, baked chicken	1 little turtle	No
Case #4	No	Oatmeal, salad, macaroni & cheese, tacos	2 cats, 1 little turtle	No
Case #5	Yes, visited a petting zoo	Pancakes, sandwich, tacos, jello	1 dog, 1 little turtle	No

Appendix 2 – Human-Animal Bond Lesson Plans

Appendix 2.1 Human-Animal Bond Teacher Notes

Teacher Notes: Human-Animal Bond

This lesson introduces the human and animal bond and the benefits it can bring to both humans and animals. Humans have been drawn to animals since the beginning of time. When the first tools were developed to draw, animals were one of the first things humans drew on walls.

The human-animal bond is a mutually beneficial and dynamic relationship between people and animals. This relationship is influenced by behaviors that are essential to the health and well-being of both humans and animals. The relationship influences both the psychological and physiological state of both animals and humans.

Animals can offer social support to humans, which is necessary for well-being. They can buffer stressful events, allow for better coping and adaptive behavior, and improve the health and survival of humans. Similar benefits can be seen in animals too. Many studies have been conducted where data reveals animals' positive benefits on human health, like reducing the risk of health issues.

However, it is also important to note that the human-animal bond can negatively impact humans and animals. An example could be in times of evacuation when pet owners do not want to leave their pets behind. This puts themselves and their animals in danger by staying in unsafe conditions. Another example could be a dirty and unkept environment with animals that could spread infectious diseases (hoarder that has animals at home).

Often referred to as sentinel species, animals can be used to identify risks by providing warning of a danger that humans may face. One famous example of disease sentinels is canaries in a coal mine. Miners used canaries to help detect carbon monoxide gas. A canary's breath is much more rapid than a human's, causing them to breathe more air. If carbon monoxide were in the air, they would become sick much faster than humans; therefore, the miners would know to leave the mine.

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Appendix 2.2 – Human-Animal Bond Elementary Lesson Plan

LESSON NAME: The Bond That Can't Be Broken

ONE HEALTH TOPIC

Human-Animal Bond

GRADE LEVEL

Elementary School

STATE STANDARDS

ELA: W.3.2, W.4.2 W.5.2, W.6.2, W.3.3, W.4.3, W.5.3, W.6.3
Science – LS2.A, LS2.D
History – Standard 1 Choices Have Consequences

SUBJECT AREAS

- English Language Arts
- Science
- Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify human and animal bonds and their benefit on both humans and animals
- Identify negative impacts that animal and human bonds have on each other
- Define disease sentinel
- Identify examples of disease sentinels in the past and present

MATERIALS NEEDED:

Lesson Introduction

- Access to the internet and video player/projector

Drawing and Describing the Human-Animal Bond

- Markers, crayons, or colored pencils

Canaries in a Coal Mine

- Copies of the article entitled *"Canaries in a Coal Mine"*
- Notebook paper
- Pen or pencil

Journal Entry (ELA and Social Studies)

- Notebook paper
- Pen or pencil

Mini Poster (Science)

- Magazines/Access to online images and printer
- Age-appropriate scissors
- Large piece of construction paper or poster board
- Glue

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LESSON INTRODUCTION:

View the following videos with students.

- *"**The Human-Animal Bond**" Running Time: 00:01:47*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *"**5 Unbelievable Cases of Human-Animal Bond**" Running Time: 00:06:58*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak

Following the videos, begin a class discussion about the human-animal bond. The following questions may be used to help guide discussion:

- What is the human-animal bond?
- What are the benefits of this relationship?

LEARNING ACTIVITIES:

Activity Option #1: Drawing and Describing the Human-Animal Bond (Meets standards W.3.3, W.4.3, W.5.3, W6.3, LS2.A, LS2.D, and Standard 1 Choices Have Consequences)
Have students create a picture of a pet or their favorite animal. Instruct them to write a paragraph (or words for the younger grades) about the relationship they have with that animal, how that animal makes them feel, what benefits they get from that relationship, and how they know how to interact with that animal.
Once students are finished, have them turn to their neighbors to share their pictures (or if they are in a group, take turns). Call on a few students to share with the entire class and write some of the responses on the board.
Continue discussing with the class the benefits as well as negative consequences of the human-animal bond and mention the different ways animals are present in our lives (e.g., law enforcement animals, therapy animals, etc.). **See reference material entitled *"Human-Animal Bond: Teacher Notes"* for details.**

Activity Option #2: Canaries in a Coal Mine (Meets standard 1 Choices Have Consequences)
Provide students with a copy of the paper entitled *"Canaries in a Coal Mine"*, and read the article together as a class. Invite students to turn to a partner or take turns in their groups and answer the following question:

- What are other animals that have been used or have helped us to identify dangers before they happen?

Activity Option #3: Write a Journal Entry (Meets standards W.3.2, W.4.2, W.5.2, W.6.2, W.3.3, W.4.3, W.5.3, W6.3, and Standard 1)

- Have students write 1-2 sentences or a paragraph about what they learned about the relationship between humans and animals.

Activity Option #4: Mini Poster (Meets standards LS2.A, LS2.D)

- Ask students to create a small poster using pictures and descriptions that summarize what they learned about the relationship between humans and animals, including the benefits and negative consequences, and animals as disease sentinels.

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

ASSESSMENT:

Create an age-appropriate rubric for evaluating journal entries.

Create an age-appropriate rubric for evaluating posters.

RESOURCES:

- *The Human-Animal Bond*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *5 Unbelievable Cases of The Human-Animal Bond*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak
- *Human-Animal Bond and One Health. Dr. Takashima*
  https://echo360.org/media/f5c6b726-faba-436f-87b6-e808f00ccb53/public

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

Appendix 2.3 – Human-Animal Bond Middle School Lesson Plan

LESSON NAME: The Bond That Can Never Be Broken

ONE HEALTH TOPIC
Human-Animal Bond

GRADE LEVEL
Middle School

STATE STANDARDS
ELA: W.7.7, W.8.7, W.7.8, W.8.8
HGSS: Standard 1 Choices have Consequences, Standard 5 Relationships between people, places, ideas, and environment are dynamic

SUBJECT AREA
English Language Arts
Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify human and animal bonds and their benefit on both humans and animals
- Identify negative impacts that animal and human bonds have on each other
- Define disease sentinel
- Identify examples of disease sentinels in the past and in future

MATERIALS NEEDED:

Introduction

- Access to the internet and video player/projector

***Small Group Research* Activity**

- Access to the internet and a computer/computer lab

***Poster* Activity**

- Magazines/Access to online images and printer
- Age-appropriate scissors
- Large piece of construction paper or poster board
- Glue

LESSON INTRODUCTION:

View the video "*Sentinels of the Sea*" with students to introduce the topic of disease sentinels. Note that the video is approximately 27 minutes long, but the first 3 minutes and 28 seconds summarize the concept well. If time permits, feel free to watch the entirety of the video with students.

Following the video, discuss the topic of disease sentinels. Use the following questions to help guide the class discussion:

- Are there other examples of disease sentinels you can think of? **(See teacher notes for example about canaries in coal mines)**
- Do you feel that using animals, such as canaries in mines to detect carbon monoxide, as disease sentinels is ethical? Why or why not?
- What are some potential consequences of the human-animal bond?

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LEARNING ACTIVITIES:

Activity #1: Small Group Research Project (Meets Standards W7.7, W8.7, W.7.8, W.8.8, Standard 1 and Standard 5)

Split students into five equal groups to research the following topics:

- Benefits (health, social, emotional) to humans from Human-Animal Bond
- Benefits (health, social, emotional) to animals from Human-Animal Bond
- Evolution of wolves/dogs: The history of the Human-Animal Bond
- Service dogs for PTSD, disaster relief, prisoner rehabilitation
- Law enforcement animals

Once students have had time to gather their research, invite them to present their findings to the class with either a poster or a PowerPoint presentation.

Activity #2: Written Assignment (Meets Standards W7.7, W8.7, W.7.8, W.8.8, Standard 1 and Standard 5)

Ask students to write a short summary of what they learned from their classmates' presentations and their own research. The following questions may be used as a guide:

- What are the benefits to humans from the human-animal bond?
- What are the benefits to animals from the human-animal bond?
- What are disease sentinels? Why are they important?

ASSESSMENT:

Develop an age-appropriate rubric for student presentations/posters, **or use the provided rubric as a guide.**

Develop an age-appropriate rubric for students' written assignments.

RESOURCES:

- *The Human-Animal Bond*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *5 Unbelievable Cases of The Human-Animal Bond*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak
- *Human-Animal Bond and One Health. Dr. Takashima*
  https://echo360.org/media/f5c6b726-faba-436f-87b6-e808f00ccb53/public
- *Sentinels of the Sea*
  https://www.youtube.com/watch?v=Ar4QpyQG1F4&ab_channel=ChangingSeasTV

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LESSON NAME: The Bond That Can Never Be Broken

ONE HEALTH TOPIC
Human-Animal Bond

GRADE LEVEL
Middle School

STATE STANDARDS
Science: MS-LS2-1

SUBJECT AREA
Science

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify human and animal bonds and their benefit on both humans and animals
- Identify negative impacts that animal and human bonds have on each other
- Define disease sentinel

MATERIALS NEEDED:

Introduction

- Access to the internet and video player/projector

***Small Group Research* Activity**

- Access to the internet and a computer/computer lab

***Mini Poster* Activity**

- Magazines/Access to online images and printer
- Age-appropriate scissors
- Large piece of construction paper or poster board
- Glue

LESSON INTRODUCTION:

View the video "*Sentinels of the Sea*" with students to introduce the topic of disease sentinels. Note that the video is approximately 27 minutes long, but the first 3 minutes and 28 seconds summarize the concept well. If time permits, feel free to watch the entirety of the video with students.

Following the video, discuss the topic of disease sentinels and highlight key points and terms (e.g., disease sentinels, animals warning against disease). **See the reference material entitled *"Human-Animal Bond: Teacher Notes"* for more information.** Use the following questions to help guide the class discussion:

- Are there other examples of disease sentinels you can think of?
- Do you feel that using animals, such as canaries in mines, as disease sentinels is ethical? Why or why not?
- What are some potential consequences of the human-animal bond?

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LEARNING ACTIVITIES:

Activity #1: Small Group Research Project (Meets standards MS-LS2-1)
Split students into five equal groups to research the following topics:

- Benefits (health, social, emotional) to humans from Human-Animal Bond
- Benefits (health, social, emotional) to animals from Human-Animal Bond
- Evolution of wolves/dogs: The history of the Human-Animal Bond
- Service dogs for PTSD, disaster relief, prisoner rehabilitation
- Law enforcement animals

Once students have had time to gather their research, invite them to present their findings to the class.

Activity #2: Mini Poster (Meets standards MS-LS2-1)
Ask students to create a small poster using pictures and descriptions that summarize disease sentinels and what they learned from their peer's presentations. The poster should include the main takeaways from each of the presentations.

ASSESSMENT:

Develop an age-appropriate rubric for student presentations, **or use the provided rubric as a guide.**

Develop an age-appropriate rubric for students' mini-posters, **or use the provided rubric as a guide.**

RESOURCES:

- *The Human-Animal Bond*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *5 Unbelievable Cases of The Human-Animal Bond*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak
- *Human-Animal Bond and One Health. Dr. Takashima*
  https://echo360.org/media/f5c6b726-faba-436f-87b6-e808f00ccb53/public
- *Sentinels of the Sea*
  https://www.youtube.com/watch?v=Ar4QpyQG1F4&ab_channel=ChangingSeasTV

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

Appendix 2.4 – Human-Animal Bond High School Lesson Plan

LESSON NAME: The Bond That Can't Be Broken

ONE HEALTH TOPIC

Human-Animal Bond

GRADE LEVEL

High School

STATE STANDARDS

ELA: W.9-10.7, W.11-12.7, W.9-10.8, W.11-12.8
HGSS: Standard 1 Choices Have Consequences, Standard 5 Relationships among people, places, ideas, and environment are dynamic.

SUBJECT AREAS

English Language Arts

Social Studies

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify human and animal bonds and their benefit on both humans and animals
- Identify negative impacts that animal and human bonds have on each other
- Define disease sentinel
- Identify examples of disease sentinels in the past and in future

MATERIALS NEEDED:

Introduction

- Access to the internet and video player/projector

***Small Group Research* Activity**

- Access to the internet and a computer/computer lab

LESSON INTRODUCTION:

Choose at least one of the following videos and view them with students.

- ***"Canaries in the Coal Mine"* TedTalk.**
  Running Time: 00:03:01
  https://www.youtube.com/watch?v=qm8NnL582uc&ab_channel=TEDxTalks
- ***"How Animal Disease Surveillance Protects Human Health: COVID-19 and Beyond".***
  Running Time: 00:10:20
  https://edhub.ama-assn.org/jn-learning/video-player/18713194

Following the video, discuss the topic of disease sentinels and highlight key points and terms (e.g., disease sentinels, animals warning against disease). **See the reference material entitled *"Human-Animal Bond: Teacher Notes"* for more information.** Use the following questions to help guide the class discussion:

- Are there other examples of disease sentinels you can think of?
- Do you feel that using animals, such as canaries in mines to detect carbon monoxide, as disease sentinels is ethical? Why or why not?
- What are some potential consequences of the human-animal bond?

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LEARNING ACTIVITIES:

Activity #1: Small Group Research Project (Meets standards W.9-10.7, W.11-12.7, W.9-10.8, W.11-12.8, and Standard 1 Choices Have Consequences)
Split students into six equal groups to research the following topics:

- Benefits (health, social, emotional) to humans from Human-Animal Bond and possible negatives
- Benefits (health, social, emotional) to animals from Human-Animal Bond and possible negatives
- Evolution of wolves/dogs: The history of the Human-Animal Bond
- Service dogs for PTSD, disaster relief, prisoner rehabilitation
- Law enforcement Animals
- Animals as Disease Sentinels

Once students have had time to gather their research and develop a presentation, invite them to present their findings to the class.

Activity #2: Written Assignment (Meets standards 1 Choices Have Consequences and 5 Relationships among people, places, ideas, and environments are dynamic)
Ask students to write a short summary of what they learned from their classmates' presentations and their own research. The following questions may be used as a guide:

- What is the human-animal bond and why is it important?
- What are some negative consequences to this bond?
- What is the importance of disease sentinels?

ASSESSMENT:

Develop an age-appropriate rubric for student presentations, **or use the provided rubric as a guide.**

Develop an age-appropriate rubric for students' written assignments.

RESOURCES:

- *The Human-Animal Bond*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *5 Unbelievable Cases of The Human-Animal Bond*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak
- *Human-Animal Bond and One Health. Dr. Takashima*
  https://echo360.org/media/f5c6b726-faba-436f-87b6-e808f00ccb53/public
- *History and Science of the Human-Animal Bond*
  https://todaysveterinarynurse.com/personal-professional-development/history-and-science-of-the-human-animal-bond/
- *Sentinels of the Sea*
  https://www.youtube.com/watch?v=Ar4OpvOG1F4&ab_channel=ChangingSeasTV

This project was funded by CDC Grant # NU90TP22155-01 Public Health Emergency Response: Public Health Crisis

LESSON NAME: The Bond That Can't Be Broken

ONE HEALTH TOPIC

Human-Animal Bond

GRADE LEVEL

High School

STATE STANDARDS

Science: LS4.D

SUBJECT AREA

Science

LEARNING GOALS/OBJECTIVES:

Students will be able to:

- Identify human and animal bonds and their benefit on both humans and animals
- Identify negative impacts that animal and human bonds have on each other
- Define disease sentinel
- Identify examples of disease sentinels in the past and in future

MATERIALS NEEDED:

Introduction

- Access to the internet and video player/projector

***Small Group Research* Activity**

- Access to the internet and a computer/computer lab

***Mini Poster* Activity**

- Magazines/Access to online images and printer
- Age-appropriate scissors
- Large piece of construction paper or poster board
- Glue

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LESSON INTRODUCTION:

Choose at least one of the following videos and view them with students.

- ***"Canaries in the Coal Mine"*** **TedTalk.**
  Running Time: 00:03:01
  https://www.youtube.com/watch?v=gm8NnL582uc&ab_channel=TEDxTalks
- ***"How Animal Disease Surveillance Protects Human Health: COVID-19 and Beyond".***
  Running Time: 00:10:20
  https://edhub.ama-assn.org/jn-learning/video-player/18713194

Following the video, discuss the topic of disease sentinels and highlight key points and terms (e.g., disease sentinels, animals warning against disease). **See the reference material entitled *"Human-Animal Bond: Teacher Notes"* for more information.** Use the following questions to help guide the class discussion:

- Are there other examples of disease sentinels you can think of?
- Do you feel that using animals, such as canaries in mines, as disease sentinels is ethical? Why or why not?
- What are some potential consequences of the human-animal bond?

LEARNING ACTIVITIES:

Activity #1: Small Group Research Project (Meets standards LS4.D)
Split students into five equal groups to research the following topics:

- Benefits (health, social, emotional) to humans from Human-Animal Bond
- Benefits (health, social, emotional) to animals from Human-Animal Bond
- Evolution of wolves/dogs: The history of the Human-Animal Bond
- Service dogs for PTSD, disaster relief, prisoner rehabilitation
- Law enforcement animals

Once students have had time to gather their research, invite them to present their findings to the class.

Activity #2: Mini Poster (Meets standards LS4.D)
Ask students to create a small poster using pictures and descriptions that summarize disease sentinels and what they learned from their peer's presentations. The poster should include the main takeaways from each of the presentations.

ASSESSMENT:

Develop an age-appropriate rubric for student presentations, **or use the provided rubric as a guide.**

Develop an age-appropriate rubric for students' mini-posters, **or use the provided rubric as a guide.**

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RESOURCES:

- *The Human-Animal Bond*
  https://www.youtube.com/watch?v=WSEdpazmMek&t=1s&ab_channel=TheAnimalMuseum
- *5 Unbelievable Cases of The Human-Animal Bond*
  https://www.youtube.com/watch?v=CB6fWJZW5G4&t=87s&ab_channel=bodhispeak
- *Human-Animal Bond and One Health. Dr. Takashima*
  https://echo360.org/media/f5c6b726-faba-436f-87b6-e808f00ccb53/public
- *History and Science of the Human-Animal Bond*
  https://todaysveterinarynurse.com/personal-professional-development/history-and-science-of-the-human-animal-bond/
- *Sentinels of the Sea*
  https://www.youtube.com/watch?v=Ar4QpyQG1F4&ab_channel=ChangingSeasTV

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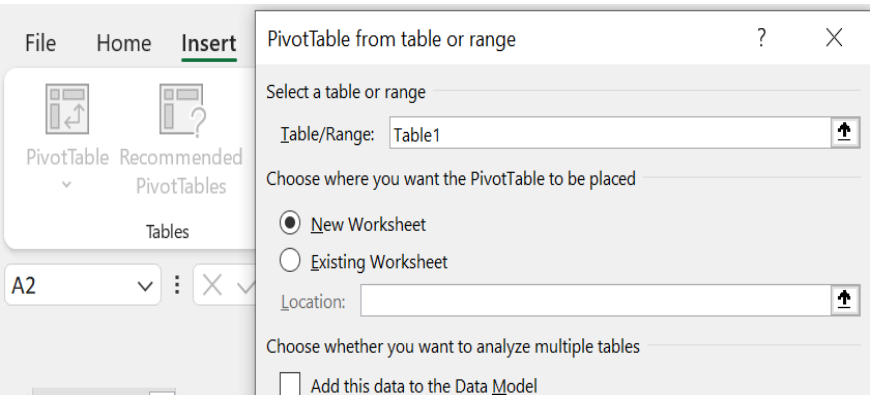
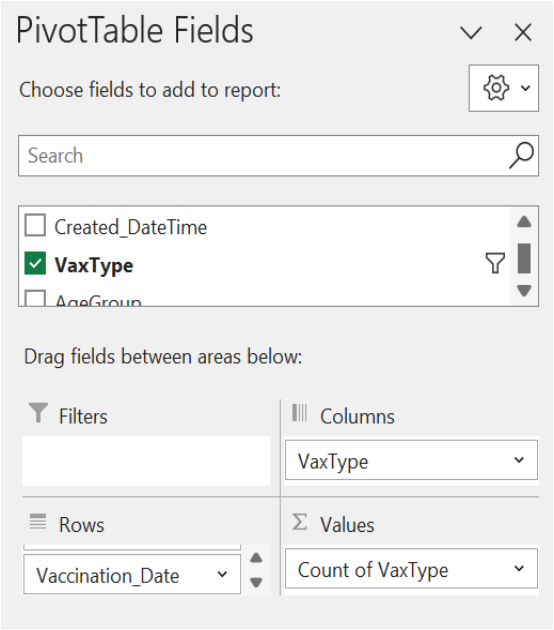
Appendix 3 – Procedure for Data Analysis and Table Creation using Pivot Table Function on Microsoft Excel Version 230

1. Export 2018 to 2022 rabies immunization data, including unique patient id, vaccination date, vaccination code, age, gender, patient zip code, patient county, funding source, vaccination type, age group, and region from KSWebIZ and import into SAS Version 9.4. Once in SAS, export data to Microsoft Excel.
2. Once the data is imported to Excel, click Insert and click Pivot Table. Then, click the option “from table/range”. A new box will pop up and ensure that Table 1 is selected in the box as the range and new worksheet should be checked in under the “choose where you want the PivotTable to be placed” section in the box (example below).



3. Once the new sheet opens, click on the Pivot Table fields section on the right side of the screen (example below). To create a table for the number of doses each month over the 5-year span, check in the boxes for vaccination type, vaccination date, and years. Ensure to click the drop-down arrow next to vaccination type, which will bring up a separate filter box. Uncheck “unknown” in the box and click “OK.” These steps should auto-populate all three fields into the rows section directly below the Pivot Table Fields. Click and drag the vaccination type from the rows section to the columns section and leave the years and vaccination date in the rows section as is. A table should begin to appear in the field to the left. Go back to the top to the “choose fields to add to report” section. Then, click and drag the vaccination type to the values section. This should automatically covert vaccination type to count of vaccination type. The table should be completed after this step.

4. To create a graph of the data, click insert from the top bar and click recommended charts. Click on the columns cluster option and then click “OK.” This will display the years, months, and count of vaccination in a clustered bar graph.



5. Repeat step three to create a table for doses administered by sex, doses administered by age group, doses administered by funding source, and doses administered by region.
    a. by checking the boxes for vaccination type and gender. Ensure to click the drop-down arrow next to vaccination type, which will bring up a separate filter box. Uncheck “unknown” in the box and click “OK.” Click and drag the vaccination type to columns section and leave sex in the rows section. Then, drag the vaccination type from the “choose fields to add to report” section to the values section to get the count of the vaccination type. The table should be complete after this step.
    b. For the doses administered by age group, ensure to check the boxes for vaccination type and the age group. Ensure to click the drop-down arrow next to vaccination type, which will bring up a separate filter box. Uncheck “unknown” in the box and click “OK.” Then, click and drag the vaccination type to the columns section and leave the age group in the rows section. Click the vaccination type from the “choose fields to add to report” section and drag it to the values section to get the count of the type. The table should be complete after this step.
    c. For the doses administered by funding source, check the boxes for vaccination type and the funding source. Ensure to click the drop-down arrow next to

vaccination type, which will bring up a separate filter box. Uncheck “unknown” in the box and click “OK.” Then, click and drag the vaccination type to the columns section and leave the funding source in the rows section. Click the vaccination type from the “choose fields to add to report” section and drag it to the values section to get the count of the type. The table should be complete after this step.

d. For the doses administered by region, check the boxes for the vaccination type and the regions. Ensure to click the drop-down arrow next to vaccination type, which will bring up a separate filter box. Uncheck “unknown” in the box and click “OK.” Then, click and drag the vaccination type to the columns section below and leave the region in the rows section. Click the vaccination type from the “choose fields to add to report” section and drag it to the values section to get the count of the type. The table should be complete after this step.

Appendix 4 – Rabies Immunization Presentation (Presented by Stephanie Lindeman but data utilized in presentation was partially produced by my project)

Appendix 5 – Sample of ESSENCE Rabies Records Manual Review for 2022

Rabies Y/N	PEP Y/N	Notes if questionable	Zipcode	Sex	Age	Chief_Complaint_Combo	Diagnosis_Combo
Y	Y	bit by stray dog, getting next do	67135	Female	14	pt bit by stray dog 2 weeks ago needing 3rd rabies vaccination.;General medical	Z20.3 Contact with and (suspected) exposure to
Y	Y	pt went in for next dose of rabie	67135	Female	14	Patient states she is here for a rabies vaccine.;Vaccination	Z23 Encounter for immunization;Z23
Y	Y	Dog bite	67135	Female	14	Dog bite/scratch;Dog bite	A82.9 Rabies unspecified;Z23
Y	N		67217	Male	29	mother's cat attacked by dogs. pt rescued cat but cat bit his R hand and scratched	W55.01XA Bitten by cat initial encounter
Y	Y	racoon bite	67208	Male	17	Pt to the ER with c/o a bite from a racoon 3 days ago. Pt states the tooth of the	S83.92XA Sprain of unspecified site of left
Y	N	bat encounter, no mention of ra	67152	Female	13	Laceration on forehead left side of face when patient was hit in the head by a bat	S09.90XA Unspecified injury of head initial
Y	Y	pt receiving last dose of PEP, ca	67501	Female	13	Pt returning for 4th and final rabies vaccine after a previous cat bite.;General	Z23 Encounter for immunization
Y	Y	feral cat bite	67501	Female	13	Patient was bit on the 6th by a feral cat here for her third rabies shot.;Vaccination	Z23 Encounter for immunization
Y	Y	returning for vaccine series	67501	Female	13	pt being seen for repeat rabies shot. pt denies any issues.;General medical	Z23 Encounter for immunization
Y	Y	dog bite	67211	Male	15	Pt is here for rabies shot.;Contact with and (suspected) exposure to rabies	Z20.3 Contact with and (suspected) exposure to
Y	Y	pt getting 3rd rabies vaccine	67211	Male	15	needs 3rd rabies injection;Encounter for immunization	Z23 Encounter for immunization;Z23
Y	Y	pt getting rabies vaccine	67211	Male	15	here for rabies shot;Encounter for immunization	Z23 Encounter for immunization;Z23
Y	Y	dog bite	67211	Male	15	dog bite to left forearm at 0730;Open bite of left forearm initial encounter	Z23 Encounter for immunization;S51.852A
N	N	metal bat mentioned	67401	Male	25	pt arrives w reports bilateral arm pain following assault w a metal bat. reports	M79.601 Pain in right arm;M54.9 Dorsalgia
Y	Y	bitten by bat, last rabies vaccine	67205	Female	55	Pt to the ER for last rabies vaccine. Pt states she was bit by a bat and has	Z23 Encounter for immunization
Y	Y	bitten by bat, next rabies vaccin	67205	Female	55	Bit by a bat in St Louis Mo. Lives here came in for 2 vaccine. Reported no side	T14.8XXA Other injury of unspecified body region
N	N		67203	Female	66	Pt c/o shaking and chills. Hypertensive for EMS has not taken BP meds today. BSG	R68.83 Chills (without fever);E11.9 Type 2
Y	N	cat bite, no mention of vaccinat	67060	Female	71	Pt to the ER with c/o a cat bite to the left lateral lower leg. Pt states the cat is a	S81.852A Open bite left lower leg initial
Y	N	dog bite	67213	Male	35	Pt presents to triage via EMS for a dog bite. Onset of injury PTA. Pt knows dog	S51.852A Open bite of left forearm initial
Y	Y	pt returning for 3rd rabies vacci	67217	Male	14	pt presents for the third rabies vaccine.;General medical	Z23 Encounter for immunization
Y	Y	dog bite, returning for next rabi	67217	Male	14	Pt bitten by dog on Wed. Needs second rabies shot. No new problems. bite to left	Z23 Encounter for immunization
YY	Y	dog bite, returning for next rabi	67213	Male	11	Pt presents to ED for 2nd rabies shot after suffering a dog bite on wed.;Dog	Z23 Encounter for immunization
Y	N	unknown dog bite, no mention	67207	Male	55	right hand dog bite 3rd knuckle. per pt unknown rabies vaccine of dog.;Dog bite	S61.459A Open bite of unspecified hand initial
Y	Y	encounter for rabies vaccine	67110	Female	67	rabies vaccination;Encounter for immunization	Z23 Encounter for immunization;Z20.3
Y	Y	returning for rabies shot #3	67110	Female	67	rabies shot #3;Contact with and (suspected) exposure to rabies	Z23 Encounter for immunization;Z20.3
Y	Y	returning for rabies shot #2	67110	Female	67	Pt presents to ED today for her second dose of rabies shot. She reports no	Z23 Encounter for immunization;Z20.3
Y	Y	rabies shot	67110	Female	67	RABIES SHOT;Encounter for immunization	A82.9 Rabies unspecified;Z23
Y	Y	returning for last rabies vaccine	67056	Male	27	last rabies shot;Encounter for immunization	Z23 Encounter for immunization;Z23
Y	Y	rabies vaccine	67056	Male	27	rabies vaccine;Vaccination	Z23 Encounter for immunization

Appendix 6 – Rabies-related Emergency Department Visits Presentation (Presented by Henri Menger but data utilized was partially produced by my project)