A descriptive investigation and analysis of the 2012 outbreak of *B. pertussis* in Douglas County, KS

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Masters of Public Health, Infectious Disease Emphasis

Contents

Abstract

The purpose of this report is to present and describe the events which occurred during the 2012 pertussis outbreak in Douglas County, KS. Pertussis, commonly known as whooping cough, is a vaccine-preventable disease. The Lawrence-Douglas County Health Department investigated 305 reported cases and over 900 case contacts. Douglas County experienced the highest incidence in Kansas with a rate of 130.4/100,000 persons. 146 cases were deemed confirmed or probable. This report reviews the management of the disease in Douglas County, vaccination status of reported individuals, a cost estimation of preventative measures, and provides a summary of epidemiological events. Recommendations, based on CDC Public Health Preparedness Capability 13, are included for future outbreak events. These recommendations range from modification of the current reporting tool to encouraging a regular staff meeting.

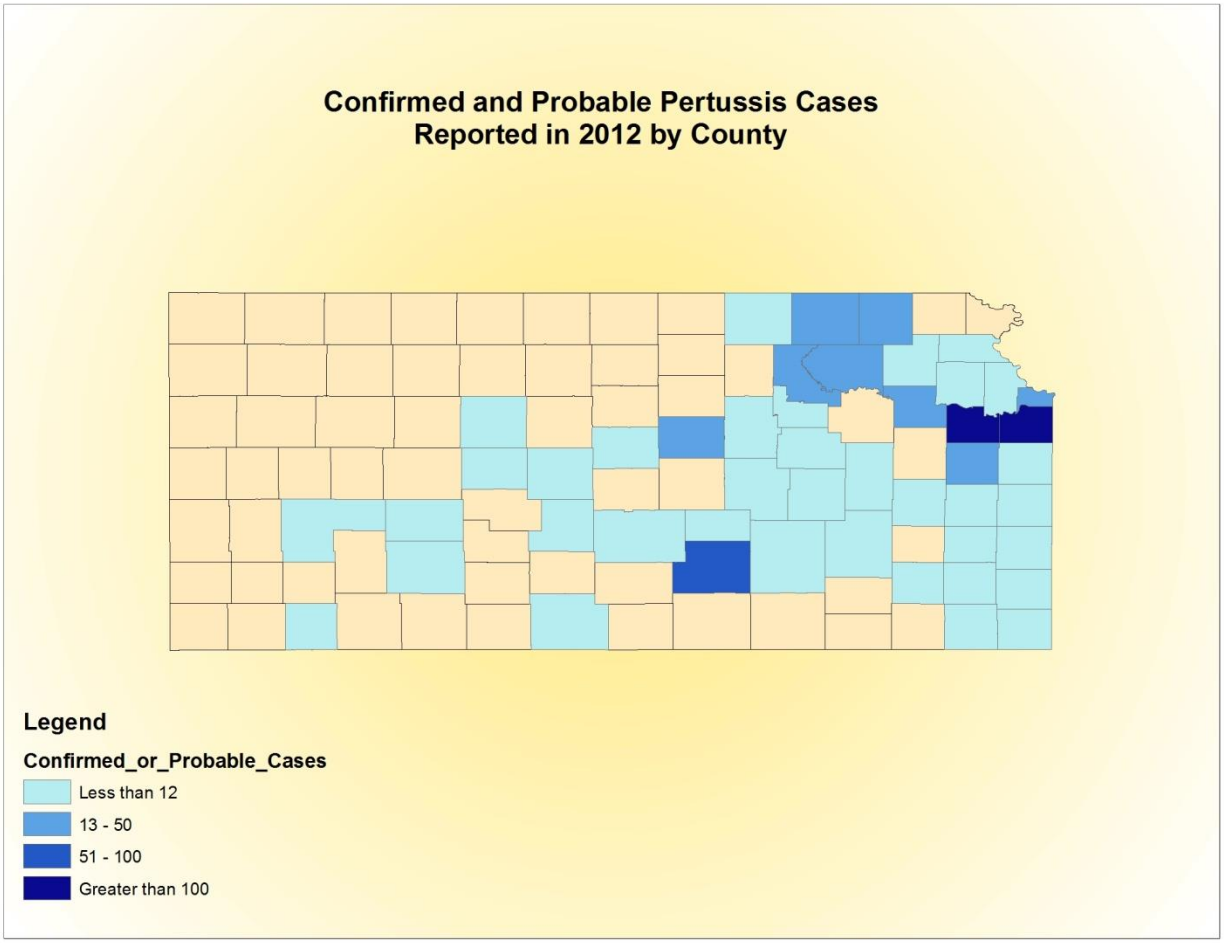
Introduction and Background

Pertussis, commonly referred to as 'whooping cough', is the one of the few remaining vaccine-preventable diseases still endemic in the United States (Centers for Disease Control and Prevention, 2012). In 2012, the United States experienced an outbreak of pertussis with incidence rates not seen since pre-vaccination program years. Douglas County, located in northeastern Kansas just west of the Kansas City Metropolitan Area, experienced the second highest incidence rate of pertussis of all counties in Kansas (behind Johnson County). The outbreak continued into the first several weeks of 2013.

Forty-nine states reported increases in incidence in 2012. The national incidence for 2012 has been defined as 13.4/100,000 persons (Centers for Disease Control and Prevention, 2013), the highest national incidence since 1955 (Schnirring, 2013). Kansas, along with nineteen

other states, exceeded this national incidence. Kansas investigated 1,912 reported cases in 2012. 864 of these had laboratory or clinical confirmation resulting in a state incidence of 25.5/100,000 persons (Centers for Disease Control and Prevention, 2013). Figure 1 represents confirmed and probable case totals by county. The two darkest-shaded counties represent Douglas County and Johnson County. In the south, Sedgwick County is also identifiable.

Figure 1: Confirmed and Probable Cases by County



This historically significant outbreak of pertussis, combined with a modern electronic surveillance system, provides a unique opportunity to study the disease. The purpose of this report is to present the disease investigation and the epidemiological analysis of the 2012 pertussis outbreak in Douglas County. Recommendations for future disease investigations by the

Lawrence-Douglas County Health Department (LDCHD) are included. This report, in part, satisfies the requirements for a Masters of Public Health degree from Kansas State University.

The Lawrence-Douglas County Health Department serves Douglas County, a population of 112,000 (United State's Census Bureau, 2013). Included in LDCHD's jurisdiction are the cities of Lawrence, Eudora, and Baldwin. The communicable disease staff of the health department, consisting of three public health nurses, investigated 305 reported cases of pertussis and over 900 potential case contacts in 2012.

The etiologic agent of pertussis is the gram-negative bacteria *Bordetella pertussis*. An individual with pertussis presents with a persistent cough ($\geq$ 2 weeks), minimal fever, and a characteristic 'whoop' sound upon inspiration after a coughing attack (paroxysms) (Kansas Department of Environment & Health, 2012) (Centers for Disease Control and Prevention, 2013). Historically referred to as 'the hundred day cough', an individual may endure symptoms for 6 to 10 weeks. The disease progresses as displayed in Figure 2. An individual who acquires pertussis or is vaccinated against pertussis does not receive lifelong immunity. A 2005 study reported immunity from an infection to last between 4 and 20 years and immunity from vaccination to last between 4 and 12 years (Wendelboe, Van Rie, Salmaso, & Englund, 2005).

Pertussis is transmitted from person to person by aerosolized droplets (from coughing). The disease is not zoonotic; humans are the only known reservoir. Despite vaccination efforts, pertussis continues to remain endemic in the United States. Prevalence of pertussis has, for the most part, decreased in the United States since the introduction of the DTP vaccine. This trend is a result of improved hygiene, health practices, and vaccination. Reported incidence is highest among infants less than one year of age (Centers for Disease Control and Prevention, 2012).

Infants less than six months of age are not vaccinated and are at highest risk. The disease is generally transmitted by older family members (Tomovici, et al., 2012).

The following products will be generated from the available data:

-a summary of events which occurred during the outbreak, including a statistical breakdown,

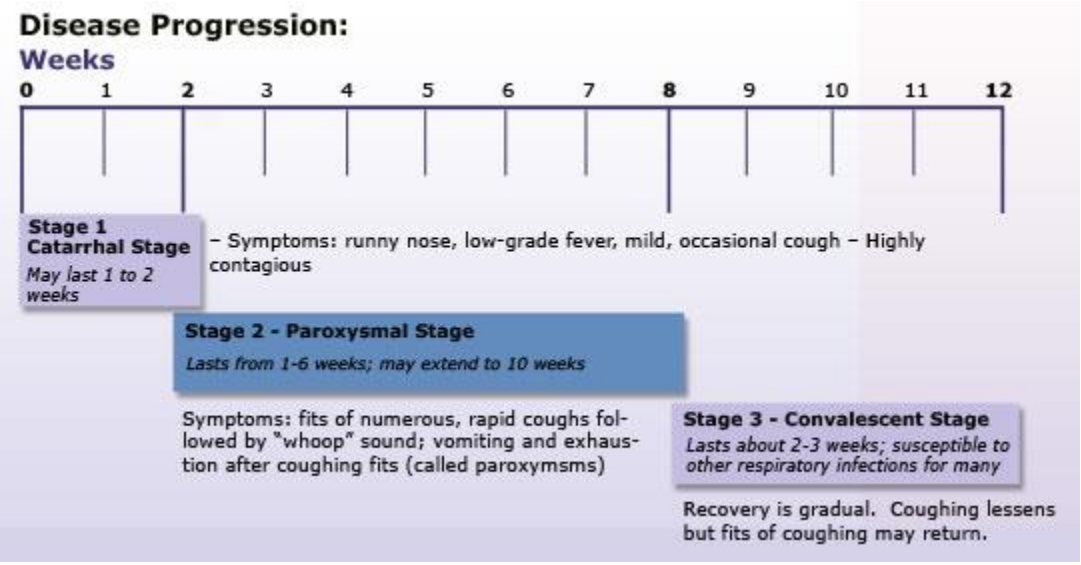
-a cost estimation of preventative measures for the outbreak,

-vaccination percentage among the reported population,

-a review of reporting methods, and

-recommendations for future outbreak events.

Figure 2: Retrieved from CDC.gov (Centers for Disease Control and Prevention, 2013)



Initiation of Investigation

No formal disease investigation was declared by either LDCHD or the Kansas Department of Health and Environment (KDHE) in 2012. Rather, the county and state health

departments continued standard operating procedure. The communicable disease staff investigated and reported cases according to normal procedures. A formal investigation of the events began on January 15, 2013. The investigation was initiated by the director of clinic services at LDCHD for the purposes of preparing an After Action Report.

The communicable disease staff was aware of an impending outbreak due to media coverage of pertussis events in other areas of the country. Johnson County, bordering Douglas County to the east, began seeing a significant spike in case load in mid-April 2012. Douglas county did not experience similar numbers until late August 2012.

Investigative and Analytical Methods

The LDCHD communicable disease staff, consisting of three public health nurses, is responsible for investigating all cases of reportable disease in Douglas County. The county uses the state-run EpiTrax tool to report gathered information to the state surveillance system. KDHE aggregates all county data and reports this to the Centers for Disease Control and Prevention (CDC). All interviews with cases are conducted over the phone. The staff completes the form in Attachment 1 for each case. The fields on this form represent the data available to the investigator for each patient.

Surveillance of pertussis can be complicated by various factors. An individual is typically most infectious during the catarrhal stage (Figure 1), where few symptoms are present (Centers for Disease Control and Prevention, 2013). The perceived severity and consequence of the disease can also hinder reporting. The surveillance system in Kansas is a passive one and generally relies on individuals to seek treatment. A physician then reports the case. An exception to this are school nurses who sometimes notify the local health department of potential cases.

The communicable disease staff must assign a Case Status to each reported case. KDHE reviews the gathered data for each patient and assigns their own Case Status. For the purposes of this investigation, the KDHE Case Status is used. This was determined after a review of KDHE's *Pertussis Investigation Guidelines* and consultation with a state epidemiologist (Neises, 2013).

Cases are identified as 'Not a Case', 'Suspect', 'Probable', and 'Confirmed'. In summary, 'Probable' cases are clinically confirmed while 'Confirmed' cases are confirmed by laboratory testing. Probable and confirmed cases are both reported to CDC, factored into incidence rates, and carry the same weight (Kansas Department of Environment & Health, 2012). Attachment 3 contains an excerpt from KDHE's *Pertussis Investigation Guidelines* with a more thorough description of each Case Status.

The last data pull for information included in this report was February 6, 2013. This allowed adequate time for investigations of cases reported in 2012 to be completed. Prior to the investigation, a thorough literature review of investigation guidelines at the local, state, and federal levels was completed. Included in the literature review were previous outbreak reports produced by academia and government organizations. In addition, participating parties were contacted and interviewed. State and local epidemiologists were interviewed and also assisted in data collection and feedback. Only cases reported in 2012 are included. Access to EpiTrax was granted under supervision of a LDCHD employee.

Cost estimation was conducted and adjusted for inflation to 2012 levels. Assessment of reporting methods and management of the investigations was addressed through a hotwash (a meeting with the purpose of evaluation) with the communicable disease staff on January 29, 2013. The CDC Public Health Preparedness Capability 13: Public Health Surveillance and

Epidemiological Investigation was used to assist in evaluation (Centers for Disease Control and Prevention, 2011). Internal documents were reviewed to determine if requirements were met. Various staff members were consulted as well. Completion of the CDC assessment is valuable for the health department and can be used for accreditation. A participant feedback form (Attachment 4) was distributed prior to the meeting. The data obtained from EpiTrax was downloaded as a .csv file and opened in Microsoft Office Excel 2007. In Excel, sorting, aggregating, and filtering of the data was conducted as necessary. Any cases falling out of the Douglas County jurisdiction were removed from the study.

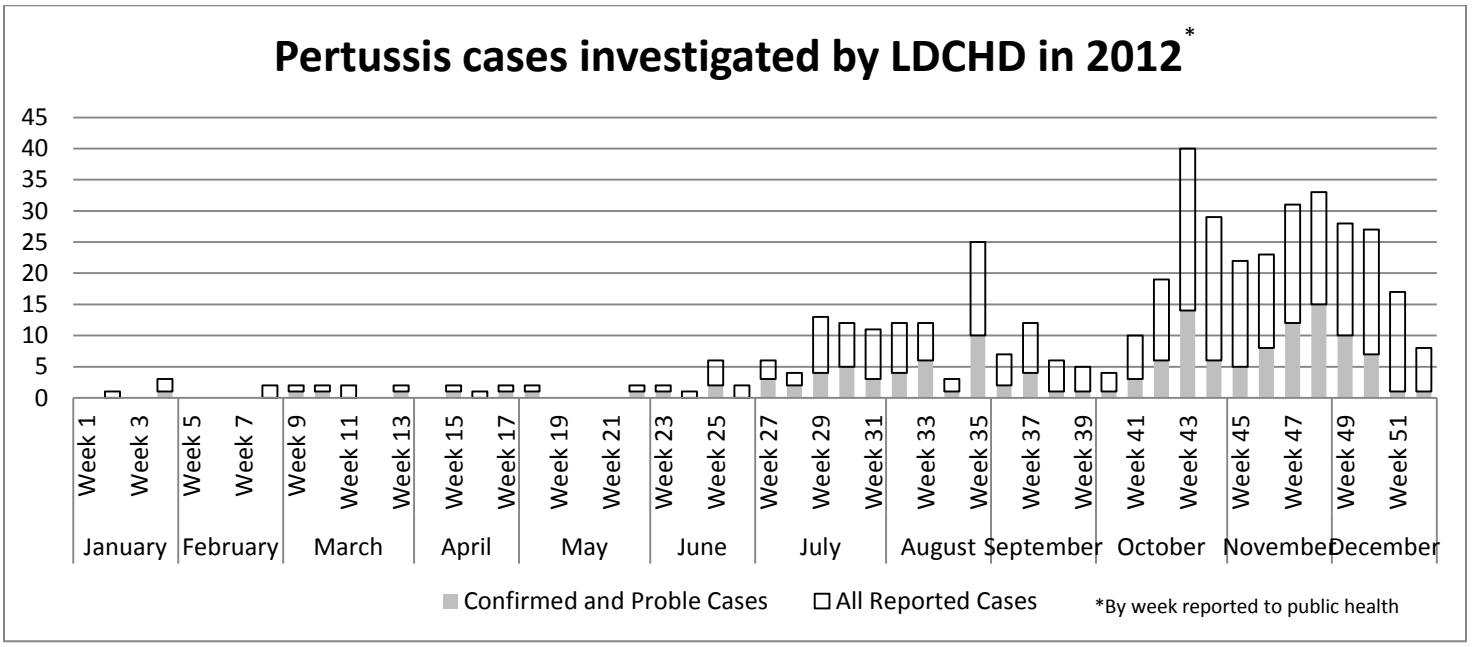
Statistical tools used in this paper include IBM's SPSS and Microsoft Office Excel 2007 with the Data Analysis add-on.

Results

Summary of Epidemiological Events:

Of the 305 investigated cases in Douglas County, 146 were confirmed or probable. This results in a calculated county incidence rate of 130.4/100,000 persons. The state and county were unable to provide historical data for the county beyond 2011 which included both confirmed and probable cases. The CDC was not contacted for this data. To give some understanding of the expected caseload for 2012, internal records reveal that eighteen cases (9 confirmed, 9 probable) were identified in 2011. Prior to that, no known After Action Report or media event documents an outbreak of pertussis in Douglas County in the past decade.

Figure 3: Epidemiologic Curve for Outbreak



Sporadic cases occurring in the first six months of 2012 suggest that *B. pertussis* was circulating in the community and region prior to the outbreak designation. One school outbreak of pertussis was officially identified by KDHE. Baldwin City experienced the first cluster of pertussis. A cluster of cases occurred at a youth summer camp in July. In October, Baldwin City experienced a rash of cases across the school district. A review of patient data reveals contacts occurred between the cases. All cases occurred within 42 days of each other. The event ranged from October 12 to November 5 when the last cases were reported. The Baldwin City School District event included eight confirmed or probable cases and 34 patient contacts. All confirmed and probable cases were among individuals who were up-to-date on their vaccinations.

The outbreak officially designated by KDHE occurred at a Lawrence private school. The suspected index case of this event is a teacher who was not up-to-date on vaccination. Cough onset was reported in mid-October. The teacher was not reported until early November. A student was also reported in early November with a cough onset of two weeks prior. Both the

student and the teacher continued to attend school. The last reported case was in early December. Transmission occurred in the classroom. Students in the class continued to spread the disease to siblings and other contacts. Five confirmed and probable cases were connected with this outbreak. Eight additional contacts were associated.

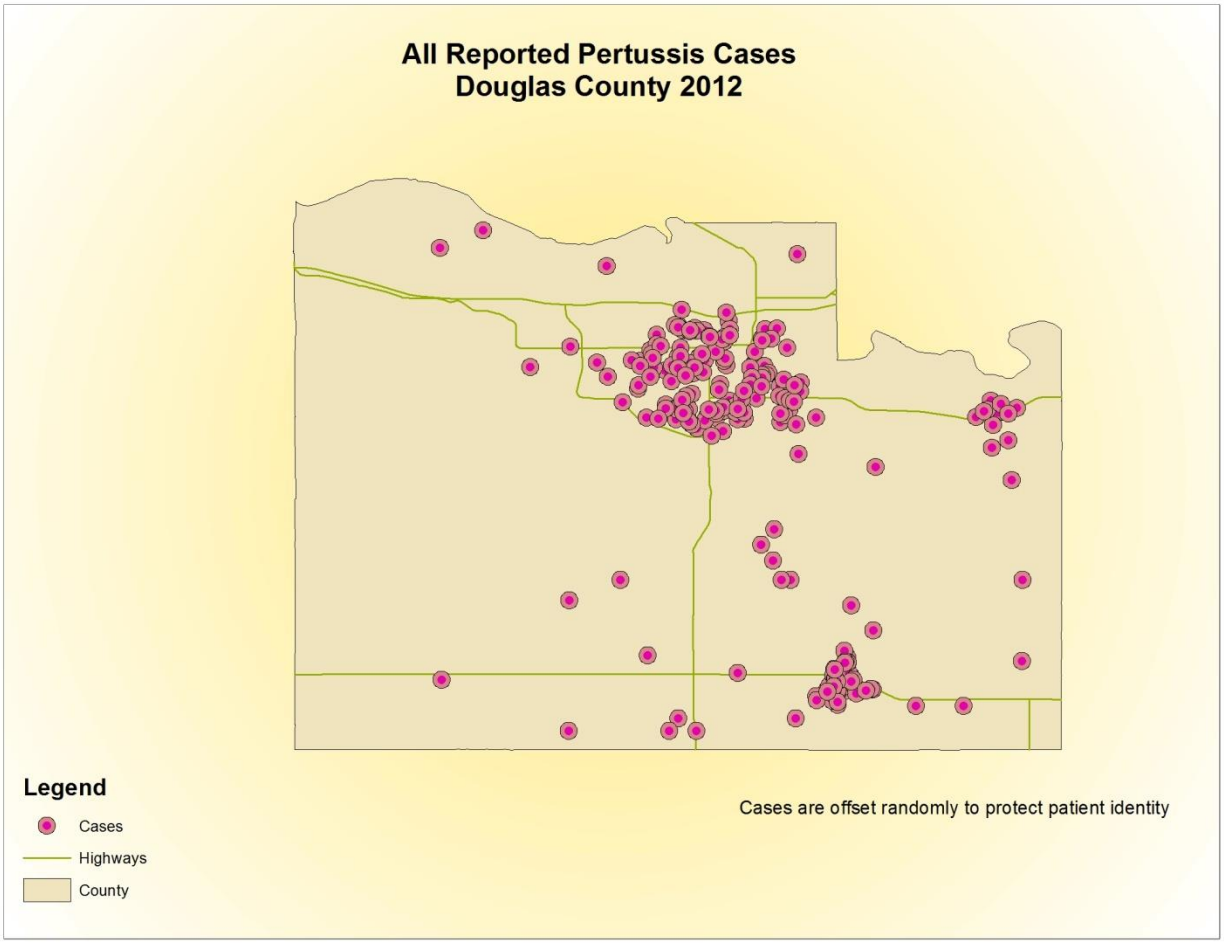
Outbreaks where spread was limited to family members and one household were categorized as household outbreaks. These events are likely to be common as transmission risk in households can be as high as 80%. Several factors affect transmission rates including vaccination status, type of contact, age, and preventative treatment (Guris, 2000). Ten (10) household outbreaks were identified when reviewing cases. These identified outbreaks include 23 confirmed or probable cases and 2 suspect cases. In addition, 162 contacts were identified in correlation with household outbreaks. 110 of these contacts are connected to two cases who worked as healthcare workers. No documented spread resulted from their work contacts. Of the 23 confirmed or probable cases, 15 were up-to-date on pertussis vaccinations--a vaccination percentage of 65.21% among infected individuals associated with household outbreaks. An accurate calculation of the attack rate among households is not possible as the total number of individuals in each household is not recorded.

Table 1 displays the frequency distribution of pertussis among age groups in Douglas County during the 2012 outbreak. To protect privacy of patients, values less than six are masked. Figure 4 is a map of all reported cases in Douglas County. Cases are randomly offset on the x and y axis to protect patient identity. Clusters are consistent with large population centers (cities and towns).

Table 1: Frequency Distribution by Age Group

Age Group	Confirmed and Probable Cases	All Reported Cases	Proportion
0-4 years	27	70	.386
5-9 years	34	81	.420
10-14 years	36	62	.581
15-19 years	10	22	.455
20-24 years	N/A	11	N/A
25-29 years	N/A	N/A	N/A
30-34 years	6	8	.750
35-39 years	8	9	.889
40-44 years	N/A	7	N/A
45-49 years	N/A	N/A	N/A
50-54 years	N/A	N/A	N/A
55-59 years	N/A	N/A	N/A
60-64 years	N/A	N/A	N/A
65-69 years	N/A	N/A	N/A
70-74 years	0	N/A	0
75-79 years	N/A	N/A	0
80-84 years	N/A	N/A	N/A
85+ years	N/A	N/A	N/A

Figure 4: Reported Cases in Douglas County



Management of the Outbreak by LDCHD

The participant feedback form distributed to the communicable disease staff (Attachment 4) was returned by 50% of participants (two). The goal of 'reducing the spread of disease' was identified. Participants did not believe this goal was achieved. Participants believed that their contribution to the exercise was appropriate for their position. Participants also believe that the incident allowed for proper demonstration of the department's disease investigation capabilities. A greater diversity of disciplines (e.g. analysts) could have been included. Participant responses are summarized in Table 2.

Table 2: Summary of Participant Feedback Survey

Strengths	1) Quick initiation of cases 2) Thorough initial investigation 3) Flexibility of staff 4) Strong working relationship with KDHE and school nurses
Weaknesses	1) Follow-up in a timely manner 2) Consistent follow-up on uncertain cases 3) Lack of regular meetings (no formal declaration of ICS)
Notes to the evaluator (Observations possibly not recorded)	1) Consistency/bias of interviewers regarding importance of investigations and follow-up 2) Inadequate staff 3) Improper training 4) Physician response early in the outbreak
Suggested Improvements	1) Increase staff cross training 2) Improve consistency in charting 3) Use DIGs more accurately 4) Have back-up CD nurses 5) Routine training
Resources needing reviewed, revised, or developed	1) Add more individuals who can access EpiTrax 2) Train additional nurses for CD team 3) Consider training reviews
Additional Comments	1) Training during an incident is not as effective as training prior to an incident 2) The headsets were a nice addition.

During the hotwash on January 29, 2013, the events of the outbreak were reviewed. Notes are available in Attachment 5. There was consensus that staff shortage was an important issue and the caseload exceeded expectations. One explanation for the caseload is that all reported cases required investigation, even those with negative laboratory tests (Kansas Department of Environment & Health, 2012). A trigger point was never officially identified in Douglas County. The Incident Command System was never activated (Colson, 2013)

The communicable disease staff understood that pertussis would impact Douglas County. Johnson County was experiencing a large case load earlier in the year. To preempt the outbreak, the staff reviewed the disease investigation guidelines outlined by KDHE. A triaging flowchart

was provided for high priority cases and contacts (Kansas Department of Health and Environment, 2012). High priority individuals were defined as pregnant women, babies less than one year of age, and un-immunized and under-immunized persons. A meeting was held with school nurses prior to the school year. The school nurses were encouraged to review staff and student vaccination records.

The staff does not meet regularly due to a heavy workload. Two nurses spent the majority of October through December conducting communicable disease investigations. This resulted in a significant strain on resources (Colson, 2013). The responsibility of disease investigation is rotated among the nurses while other staff generally attend to clinic duties.

Interns and other clinic nurses were used at times to assist in follow-up interviews with patients. Due to the case definitions of pertussis, follow-up interviews were necessary for many cases to determine if the patient had been coughing for over two weeks. The current system for tracking cases consists of a binder with various sections. One section is for new cases which still need to be contacted and another is for cases requiring follow-up. Priority is given to contacting cases within 24 hours of being reported to LDCHD. The staff achieved this performance measure 93.8% of the time[1]. Measuring follow-up proved more difficult. Due to the different circumstances surrounding individual cases, follow-up is not always required. It was noted during the hotwash that follow-up required attention. A review of some longer case investigations confirms this; 35 investigations (11.5%) took 20 days or longer to complete. The mean case investigation length for 2012 was 8 days, the median was 7 days (range: 0 to 42). No performance measure exists for case investigation duration.

[1] 'Date of Interview' - 'Date Reported to LHD'

CDC's public health preparedness capability 13 was determined an appropriate evaluation tool for the management of the pertussis outbreak. The complete tables and forms completed for this exercise can be viewed in Attachment 2. These evaluations typically rely on the Incident Command System. One can establish a baseline and measure progress with such reviews. Recently, measurement and public health have received much publicity from the Bill and Melinda Gates Foundation (Gates, 2013).

Some performance measures applied only at the state level and were not applicable to this evaluation. These are indicated in the tables of Attachment 2. With the 24/7 reportable disease hotline, it is a rarity that local health departments receive cases prior to KDHE. Several of the Resource Elements and Tasks require "written plans". While LDCHD may be doing several of these actions, written plans may not exist. This can be an issue when staff turnover occurs. The lack of these plans accounts for several 'incompletes'. Under Function 3, Task 3 was assigned a partial completion due to the inconsistencies with follow-up mitigation throughout the outbreak. Task 4.1 was assigned a partial completion due to the lack of communicable disease team meetings during the event. While major issues were addressed, they were with KDHE and not documented. While it is standard practice in the health department to prepare After Action Reports, detailed guidelines as to their contents are not available. No established time frame is available for when action should be taken on recommendations (Function 4, Planning Resource Element 1). A cumulative score was not assigned to the health department, nor would the evaluator be confident assigning one. Rather, specific areas which might benefit from review were highlighted.

Vaccination Status

Of the 305 investigated cases, 71.8% were reported as vaccinated. 15.7% were not vaccinated or had an unknown vaccination history. The remaining 14.3% were left with a blank vaccination field. The unknown and blank vaccinations fields cannot be interpreted and are removed from the sampling. Using Fielding et al.'s methods of determining vaccine efficacy ((1-odds ratio) where odds ratio is: vaccine rates of actual cases divided by vaccine rates of uninfected) TDaP and DTaP vaccine efficacy for Douglas County was estimated at 16% (Effectiveness of seasonal influenza vaccine against pandemic (H1N1) 2009 virus, Australia, 2010., 2011). Significance was not determined. What is unique with this method is that only those who sought treatment were included. This is likely to have skewed the vaccine efficacy rate. Recent articles on acellular pertussis vaccination have reported high efficacy rates (greater than 90%) of the vaccine (Ward, et al., 2005).

No significant correlation between gender and either the likelihood of being reported or the likelihood of being diagnosed exists in the obtained data. There was no significant difference between the vaccinated and unvaccinated group mean-age. Sample size was not large enough to determine differences in race.

Cost Analysis

An estimated cost of case and preventative treatment associated with the outbreak is $12,189. This is based off of the raw cost (total cost absorbed by both the patient and insurance) of a 5-day 500 mg azithromycin regiment[2], multiplied by the number of patients (251) and contacts (331) who were reported as receiving preventative antibiotic treatment. In addition, 29 patients received a second round of antibiotics. An additional 143 contacts were encouraged to receive treatment and are not included. Vaccination cost is not included as there is no efficient

[2] Obtained from Lawrence pharmacies. Total cost to patient/insurance for z-pack.

method to aggregate the cases and contacts who received a TDaP for prevention. No additional vaccines or emergency shipments were required for the county. The cost of PCR laboratory testing is estimated at $16,555 (Hart, 2013). The cost of surveillance and man-hours from LDCHD dedicated to pertussis is estimated at $13,365[3]. The total estimated cost for additional public health surveillance, testing and prevention for the outbreak in Douglas County is $42,110. Costs of cultures and serologic assays are negligible[4]. A 2005 study of 2,518 hospital admissions of patients with pertussis in the U.S. revealed a mean cost of $9,130 (median $4,600, range $520 – $507,697) per person/per stay (O'Brien & Caro, 2005). Reported in 2002 U.S. dollars, when adjusted for inflation this amounts to a mean of $11,652 (median $5,870) in 2012[5]. In Douglas County, six individuals were hospitalized though only two were deemed to be probable pertussis cases.

Limitations of the Study

Recently, surveillance systems similar to the one described in this report have been questioned as valid data sources for research (Herrett, Thomas, Schoonen, Smeeth, & Hall, 2009). In an effort to ensure the validity of data from health administration systems, guidelines similar to STROBE, are being prepared (Setting the record straight: developing a guideline for the reporting of studies conducted using observational routinely collected data, 2013). STROBE guidelines are criteria and standards used for epidemiological research. The EpiTrax system is primarily meant to deliver the required information to the CDC. All other fields are supplementary.

[3] Estimated 495 hours multiplied by the average hourly wage of the communicable disease staff
[4] Only two cultures and serologic assays were run on cases.
[5] http://www.bls.gov/data/inflation_calculator.htm

A review of the data revealed many inconsistencies in data entry. This study also relies on those with pertussis to see a physician. It is likely that several cases in Douglas County remain undiagnosed and unreported.

Conclusion/Discussion

From Figure 3, the outbreak began in July as an increasing number of cases were reported. These sporadic cases were enough to keep pertussis circulating in the community until the school year began in which the surge in caseload really began. Pertussis spreads primarily in institutional settings such as schools (Centers for Disease Control and Prevention, 2013).

Inconsistencies in data entry severely limited the validity of the data. The sample size for vaccination status was greatly reduced due to a number of blank fields. One must remember that the primary purpose of this database is for surveillance and not for research purposes.

Origins of the outbreak are unknown. It is likely the disease was endemic in the community prior to 2012. The high incidence of pertussis in 2012 is considered unusual. Risk factors which might explain larger outbreaks are being explored by academia and the CDC alike.

Several potential reasons exist for the increased incidence in pertussis. The CDC is currently investigating a number of leads (Centers for Disease Control and Prevention, 2013). One possible reason is that surveillance activities and awareness of pertussis have improved leading to a more accurate diagnosis of existing cases. Vaccination rates are often cited as a reason for the outbreak (Salzberg, 2012). Current vaccination rates have not been identified as the cause by the CDC at this time. DTaP, the pertussis vaccine for children, has been incorrectly associated with autism, SIDS, and other developmental disorders (National Research Council,

2003). In early 2013, vaccine resistant strains of *B. pertussis* were isolated in the United States (Schnirring, 2013). This will continue to be investigated in ongoing outbreaks.

Research has been done on the long term efficacy of the TDaP and DTaP vaccines. A 2012 article reports that each year after vaccination is associated with in decreased efficacy of the vaccination and increased odds of contracting pertussis (Misegades, et al.). Children receive the last DTaP shot between their fourth and sixth birthdays. Consistent with this research, Table 1 reveals that the highest proportion of infected individuals to reported cases comes from those aged 10-14. KDHE school vaccination requirements require a student to receive a TDaP between grades 7 and 10 (Kansas Department of Health and Environment, 2012). Despite this, vaccination is still encouraged and 'remains highly effective' (Shapiro, 2013). Examining this age group in future studies might indicate the benefice of an earlier TDaP booster. As of March 2011, the federal Advisory Committee on Immunization Practices had not released guidelines for the recommended frequency of TDaP boosters in adolescents and adults (California Department of Public Health, 2011). Further queries returned no updates regarding these recommendations.

Recommendations for future disease surveillance activities

Attachment 2 includes select tables from the After Action Report and analysis of CDC defined Public Health Preparedness Capabilities. In this section, only the final proposed recommendations are provided from the analysis of Capability 13 and information gathered during the outbreak investigation are provided. The reader is encouraged to review Attachment 2 for further information. These recommendations should be read with the understanding that the author is still a candidate for a MPH.

One might assume that large scale disease outbreaks are a rarity in Douglas County. From 2003-2012, three infectious disease outbreaks have occurred which require community intervention. In 2003, a cryptosporidiosis outbreak occurred. In 2006, a mumps outbreak at the University of Kansas occurred. The most recent outbreak to occur is the 2012 Pertussis outbreak. Events like these have occurred in the past and can be expected to occur in the future.

Table 3: Recommendations Overview

Capability	Function/Task #	Recommendation	Resource Element	Primary Responsible Agency
Public Health Surveillance and Epidemiological Investigation (#13)	1	Generate Media and external document reporting guidelines similar to KDHE	Planning	LDCHD
Public Health Surveillance and Epidemiological Investigation (#13)	1	Review data reporting requirements Standardized Data Entry (Measure 1)	Planning	LDCHD/KDHE
Public Health Surveillance and Epidemiological Investigation (#13)	3	Written plans for analyzing data (Planning Resource Element 3).	Planning	LDCHD
Public Health Surveillance and Epidemiological Investigation (#13)	3.3	Improved Organizational Structure to Track Follow-Up Cases	Equipment and Technology	LDCHD
Public Health Surveillance and Epidemiological Investigation (#13)	3	EpiTrax Training/Review	Staff and Training	KDHE/LDCHD
Public Health Surveillance and Epidemiological	4.1	Regular Communicable	Staff and Training	LDCHD

Capability	Function/Task #	Recommendation	Resource Element	Primary Responsible Agency
Investigation (#13)		Disease Meeting		

Standardized Data Entry (Priority)

Standardized data entry among case investigators is a priority recommendation. The recommendation was encouraged through participant surveys, the hotwash, and through the evaluator's analysis of data. Capability 13 stresses accurate collection of data. To demonstrate the need for standardized data entry at the Lawrence-Douglas County Health Department, consider the following inconsistencies. Of 140 school-aged children (6-17), 112 were recorded as being associated with a school. The vaccination status field was left blank for 14.3% of all investigated cases. The patient reporting agency field was only filled out in 45 instances (14.75%) leaving insufficient data for auditing purposes. The cities of Baldwin City, Lawrence, and Lecompton were each identified in at least two different ways. Blanks are not appropriate responses for fields as they cannot be interpreted.

The United States Department of Health and Human Services (HHS) encourages standardization of both data entry and data gathering (ways in which questions are asked) (Wallace & Brunson, 2009). Standardizing data would greatly improve the quality of the data collected on reportable diseases. For all businesses, efficiency can be improved with proper data management and reporting techniques (talend, 2012). This recommendation is not specific for pertussis but for all communicable disease and clinic work conducted at LDCHD. This process would make the data more valuable and useable by other groups, health entities, and researchers. Data can be more easily aggregated, sorted, and analyzed when properly formatted. A more

complete data set would also help to measure vaccination status in the community. The use of communicable disease data is one way in which LDCHD can prepare sub-county level data sets.

Methods exist to identify and solve some of these issues. Data is gathered by staff via telephone interviews. Telephone interviews are an efficient method of gathering data. Routine staff training should address how data is entered (talend, 2012) (Wallace & Brunson, 2009). Self-populating fields or drop down lists would also help to reduce disparity and error. Commonly entered values should be identified the same way by all parties. Fields should be reviewed so that there is no potential for confusion. Reducing the number of investigators is another, less practical, option. Another option supported by HHS would be performance reviews (Wallace & Brunson, 2009). With EpiTrax, it is possible to identify which investigator is responsible for which case. A pattern in data entry errors could be recognized through this method.

Improved Organizational Structure to Track Follow-up Cases

At the Lawrence-Douglas County Health Department, cases are currently managed using a binder with various sections. Priority is given to newly reported cases which still need to be contacted. Behind the new reported cases exists a follow-up section. These are cases which require a follow-up interview due to a variety of circumstances. The patients may not have been available for an interview earlier or perhaps they did not meet the clinical case definition ($\geq$ 2 weeks coughing) at the time of the initial interview. The mean case investigation length for 2012 was 8 days, the median was 7 days. The nearness of the mean and median indicate that there were few extreme outliers.

No performance measure exists for case investigation duration. Due to the different circumstances surrounding individual cases, investigation length is expected to vary. Despite this, a more efficient method for tracking follow-up status should be adopted. While a rarity,

investigations dating back to June, July, and September have yet to be concluded in EpiTrax. Thirty-five (11.5%) of investigations took 20 days or longer to complete.

A simple list in Excel allows one to sort entries based on the last day contacted. Investigators can set up reminders in EpiTrax or sort based on investigation status to assist. More frequent review of cases would also help to improve follow-up.

Modification and Training for EpiTrax

With the advances in technology and reporting, we are able to manage more data and quickly identify disease. The addition or modification of fields in EpiTrax (Attachment 1) would help to identify areas of potential transmission. This type of information is important for a disease such as pertussis as it has high transmission rates in institutional settings. Currently, fields leave much to interpretation of the investigator. When three different investigators are entering data it can be problematic when attempting to find correlations. A 2011 AAR on pertussis clusters highlighted the fact that EpiTrax was still being adapted by the communicable disease staff (Grubbs, 2011).

Currently the form has an exposed setting field. The intention was that schools, workplace, or other possible places of exposure be selected here and then entered in a self-populating 'exposed setting specific' field. Unfortunately, lack of training with the EpiTrax tool for local health departments has led to varied interpretation on how this field is used. Staffing issues at KDHE has limited the ability to provide training. One case in Douglas County had this field filled out appropriately. Proper training from KDHE may alleviate this concern and satisfy this recommendation.

Regular Communicable Disease Meeting

With three investigators covering a surge in caseload, a regular communicable disease meeting would be beneficial to address issues during the incident. Including a medical investigator from KDHE via tele-conference during times of outbreak would provide another resource as well. Addressed in the hotwash, this would allow time for investigators to share observations regarding specific events. Such meetings could also help staff to identify potential areas of high incidence. KDHE follows a similar model among epidemiologists and meets for a short while each day to review cases. This method allows each epidemiologist to be familiar with current investigations. Unless a group or one individual regularly reviews all cases, it is difficult to assess the outbreak at a larger scale. During the pertussis outbreak, the staff did not meet regularly and treated the caseload like a typical event. Events need to be reviewed as a group or by one individual to properly assess what is occurring in the community.

Time may be an issue at LDCHD. The communicable disease staff is also responsible for staffing the clinic. When caseloads are high and the clinic is busy it can be very difficult to find a time to meet. Despite this, the staff is encouraged to be creative. The current meeting time is 8:30 in the morning on a Tuesday. An in-person meeting may not be necessary . An accurate summarization of each investigator's work via writing or voice recording may be sufficient.

In addition to regular meetings, establishment of the incident command system early in the outbreak would benefit the outbreak management and investigation. From an AAR report prepared in 2006 over a mumps outbreak managed by LDCHD and Watkin's Health Center:

> "An important lesson learned was that [the ICS] team was very valuable and need to be established earlier in the outbreak." (Kansas Department of Health and Environment, 2006, p. 11)

The ICS can be modified to apply to various events and scales. It provides accountability to participants and can assist with planning stages and allocations of resources.

Cross-Training of Staff

The Lawrence-Douglas County Health Department currently employs public health nurses that are not associated with the communicable disease team. In the hotwash, the possibility of cross-training these staff members was addressed. These staff members could assist in managing the case load during slow clinic hours. Additional staff would be used to manage follow-up interviews. Cross-training of staff is recommended given that data entry procedures are standardized among the staff. However, additional investigators run the risk of introducing more disparity in the data set.

Due to recent changes in investigation guidelines, this recommendation is not a priority. Caseload is unlikely to approach outbreak levels in the near future. It is advisable to have a plan in place should incidence of any disease increase dramatically again. From the hotwash and participant surveys, having back-up CD nurses prepared will assist during times of high case load.

Potential for future research

The author of this paper has been communicating with KDHE and Dr. Raghavan of KSU and intends to pursue future research on this pertussis outbreak in Kansas. The parties will

conduct spatial and temporal analysis of pertussis cases across the state. The intent is to produce a publishable paper which will assist in advancing knowledge on the epidemiology of pertussis.

Acknowledgements

The following individuals assisted in the production of this document:

-The communicable disease staff of LDCHD, notably Kathy Colson,

-Charlie Bryan, Preparedness Coordinator, LDCHD,

-Daniel Neises, Senior Epidemiologist, KDHE,

-Kevin Kovach, Epidemiologist, Johnson County Health Department, and

-Vince Romero, Analyst, LDCHD.

-Masters of Public Health Advisory Committee

-Dr. Stephan Chapes, Major Professor, KSU, Department of Biology

-Dr. Robert Larson, KSU, School of Veterinary Medicine

-Dr. Mary McElroy, KSU, Department of Kinesiology

Michael Banfield, author, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Attachment 1: Pertussis Supplemental Reporting Form

Kansas
Department of Health and Environment

Pertussis Supplemental Reporting Form

INTERVIEW

EpiTrax #_____ Interviewer Name:_____

Number of Call Attempts:_____ Follow-up Status: ☐ Interviewed ☐ Refused Interview ☐ Lost to Follow-Up*

Date of Interview (must enter MM/DD/YYYY): _____

*At least three attempts at different times of the day should be made before considered lost to follow-up.

Respondent was: ☐ Self ☐ Parent ☐ Spouse ☐ Other, *Specify*:_____

DEMOGRAPHICS

County: _____ Birth Gender: ☐ Male ☐ Female Date of Birth: _____ Age: _____

Hispanic/Latino Origin: ☐Yes ☐No ☐Unknown

Race: ☐ White ☐ Black/African American ☐ American Indian/Alaska Native ☐ Asian ☐ Native Hawaiian/Other Pacific Islander ☐ Other_____ ☐ Unknown

CLINICAL

What date did you start to have symptoms of illness? Onset Date:_____ Onset Time:_____

Did you recover? ☐ Yes ☐ No ☐ Unknown If Yes, Recovery Date: _____ Time Recovered:_____AM/PM

Were you hospitalized? ☐ Yes ☐ No ☐ Unknown If Yes, Hospital Name:_____

Days Hospitalized _____ Admit Date: _____ Discharge Date: _____

Died? ☐Yes ☐No ☐Unknown If Yes, Date of Death:_____

Are you pregnant? ☐Yes ☐No ☐Unknown If Yes, Expected Delivery Date: _____

Did you receive antibiotics for this illness? ☐Yes ☐ No ☐ Unknown

1st Medication Name	Date started first antibiotic:	Number of days first antibiotic actually taken:
☐ Erythromycin (incl. Pediazole) ☐ Cotrimoxazole (bactrim/septra) ☐ Clarithromycin/Azithromycin ☐ Tetracycline/Doxycycline ☐Amoxicillin/Penicillin/Ampicillin/Augmentin/Ceclor ☐ Other/specify_____ ☐ Unknown		
2nd Medication Name	Date started second antibiotic:	Number of days second antibiotic actually taken:
☐ Erythromycin (incl. Pediazole) ☐ Cotrimoxazole (bactrim/septra) ☐ Clarithromycin/Azithromycin ☐ Tetracycline/Doxycycline ☐Amoxicillin/Penicillin/Ampicillin/Augmentin/Ceclor ☐ Other/specify_____ ☐ Unknown		

Attachment 2: Preparedness Capability 13 Review

This section of the report reviews the performance of the Public Health and Healthcare Preparedness Capabilities demonstrated during this incident. In this section, observations are organized by Capability, associated Functions and Tasks, and Performance Measures if available. Resource Elements for each function are also evaluated. Each Function is followed by related observations, which include supporting documentation, analysis, and recommendations.

PREPAREDNESS CAPABILITY: CAPABILITY 13 - PUBLIC HEALTH SURVEILLANCE AND EPIDEMIOLOGICAL INVESTIGATION

Capability Description: Public health surveillance and epidemiological investigation is the ability to create, maintain, support, and strengthen routine surveillance and detection systems and epidemiological investigation processes, as well as to expand these systems and processes in response to incidents of public health significance.

The hierarchy of CDC capabilities are as follows:

Capability

- Functions
  - Tasks
  - Performance Measures
- Resource Elements
  - Planning Resource Elements
  - Skills and Training Resource Elements
  - Equipment and Technology Resource Elements

Function 1: Conduct public health surveillance and detection			
Function Description: Conduct ongoing systematic collection, analysis, interpretation, and management of public health-related data to verify a threat or incident of public health concern, and to characterize and manage it effectively through all phases of the incident.			
Task/Observation Keys		**Status**/Task Completed	
1	Engage and retain stakeholders, which are defined by the jurisdiction, who can provide health data to support routine surveillance, including daily activities outside of an incident, and to support response to an identified public health threat or incident.	Fully ☒ Partially ☐ Not ☐ N/A ☐	
2	Conduct routine and incident-specific morbidity and mortality surveillance as indicated by the situation (e.g., complications of chronic disease, injury, or pregnancy) using inputs such as reportable disease surveillance, vital statistics, syndromic surveillance, hospital discharge abstracts, population-based surveys, disease registries, and active case finding. (For additional or supporting detail, see Capability 6: Information Sharing)	Fully ☒ Partially ☐ Not ☐ N/A ☐	
3	Provide statistical data and reports to public health and other applicable jurisdictional leadership in order to identify potential populations at-risk for adverse health outcomes during a natural or man-made threat or incident.	Fully ☒ Partially ☐ Not ☐ N/A ☐	
4	Maintain surveillance systems that can identify health problems, threats, and environmental hazards and receive and respond to (or investigate) reports 24/7. (For additional or supporting detail, see Capability 6: Information Sharing)	Fully ☒ Partially ☐ Not ☐ N/A ☐	
Performance Measure: Proportion of reports of selected reportable diseases received by a public health agency within the jurisdiction required time frame		N/A*	Numerator: Denominator:
Status of Function 1 based on the assessments of the associated Tasks: ☒ Infrastructure Fully in Place -- Fully Evaluated and Demonstrated ☐ Infrastructure Fully in Place --Not Fully Evaluated and Demonstrated ☐ Infrastructure Not Fully in Place ☐ No Infrastructure in Place			

*Unable to accurately calculate. Due to methods of reporting, no consistent entries exist to determine this measure. Applicable to KDHE, not local health departments.

Function 1: Conduct public health surveillance and detection	
Function Description: Conduct ongoing systematic collection, analysis, interpretation, and management of public health-related data to verify a threat or incident of public health concern, and to characterize and manage it effectively through all phases of the incident.	
Planning Resource Elements	**Requirements met**
P1: (Priority) Written plans should document the legal and procedural framework that supports mandated and voluntary information exchange with a wide variety of community partners, including those serving communities of color and tribes.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: State regulations require reportable diseases be reported to the health department. Voluntary information exchange exists between school nurses and the health department.
P2: (Priority) Written plans should include processes and protocols for accessing health information that follow jurisdictional and federal laws and that protect personal health information via instituting security and confidentiality policies.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Internal HIPAA policies in accordance with state and federal HIPAA regulations address this.
P3: (Priority) Written plans should include processes and protocols to gather and analyze data...	Yes ☐ No ☐ Incomplete ☒ N/A ☐ Note: Data is gathered and analyzed by the CD team. A Communicable disease table is complied monthly for the county. No written plans address this but it has become routine practice.
P4: (Priority) Written plans should include procedures to ensure 24/7 health department access (e.g., designated phone line or contact person in place to receive reports) to collect, review, and respond to reports of potential health threats	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: KDHE 24/7 reporting line is available.
P5: (Priority) Written plans should include processes and protocols to notify CDC of cases on the Nationally Notifiable Infectious Disease List within the time frame identified on the list, including immediate notification when indicated. Electronic exchange of personal health information should meet applicable patient privacy-related laws and standards, including state or territorial laws. These include the Health Insurance Portability and Accountability Act, the Health Information Technology for Economic and Clinical Health Act, and standards from the National Institute of Standards and Technology and the Office of the National Coordinator for Health Information Technology of the U.S. Department of Health and Human Services. Plans should include procedures to move to electronic case notification using CDC's Public Health Information Network Case Notification Message	Yes ☐ No ☐ Incomplete ☐ N/A ☒ Note: KDHE is responsible for reporting to CDC.

Mapping Guides.	
P6: Written plans should include a process to conduct surveillance if the primary notifiable surveillance system (i.e., electronic system) is disrupted during an incident. The process should describe not only electronic back-ups, but also how surveillance will be conducted if no electricity or electronic infrastructure is available or in place.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Paper forms are available. Surveillance is dependent on reporting from physicians and laboratories. Emergency communication guidelines exist.
Skills and Training Resource Elements	
S1: (Priority) Public health staff conducting data collection, analysis, and reporting in support of surveillance and epidemiologic investigations should achieve, at a minimum, the Tier 1 Competencies and Skills for Applied Epidemiologists in Governmental Public Health Agencies.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Epidemiology staff consists of public health nurses. Previous AARs and epidemiologic investigations satisfy these competencies.
Equipment and Technology Resource Elements	
E1: (Priority) Have or have access to health information infrastructure and surveillance systems that are able to accept, process, analyze, and share data for surveillance and epidemiological investigation activities.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: EpiTrax, reportable disease regulations, school nurses, KDHE, etc.
E2: Have or have access to a system compatible with the National Electronic Disease Surveillance System.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: EpiTrax
E3: Have or have access to equipment that may be necessary to ensure the electronic management and exchange of information (e.g., laboratory test orders, samples, and results) with hospitals, doctor's offices, community health centers, and poison control centers	Yes ☒ No ☐ Incomplete ☐ N/A Note: EpiTrax, email

Function 1: Conduct public health surveillance and detection

Function Description: Conduct ongoing systematic collection, analysis, interpretation, and management of public health-related data to verify a threat or incident of public health concern, and to characterize and manage it effectively through all phases of the incident.

Analysis

Strengths

- A good working relationship with KDHE and school nurses allows the county surveillance system to function appropriately. (Task 1)

- Access to EpiTrax addresses numerous reporting needs.

Areas for Improvement

- Privacy guidelines currently do not exist for reporting to the media and external parties. Examples of this would be KDHE's reporting guidelines where the numerator must be greater than 5 and the denominator must be greater than 10,000.

- The performance measure requires another reported field in order to accurately calculate. (Performance Measure 1)

- Written plans for analyzing data do not exist (Planning Resource Element 3). While this is currently accomplished on a regular basis, in the event of staff turnover continuation of analytics could prove problematic.

Function 2: Conduct public health and epidemiological investigations

Function Description: Identify the source of a case or outbreak of disease, injury, or exposure and its determinants in a population (e.g., time, place, person, disability status, living status, or other indices) to coordinate and report the summary results of the analysis to jurisdictional and federal partners, as appropriate.

Task/Observation Keys		**Status**/Task Completed
1	Conduct investigations of disease, injury or exposure in response to natural or man-made threats or incidents and ensure coordination of investigation with jurisdictional partner agencies. Partners include law enforcement, environmental health practitioners, public health nurses, maternal and child health, and other regulatory agencies if illegal activity is suspected.	Fully ☒ Partially ☐ Not ☐ N/A ☐
2	Provide epidemiological and environmental public health consultation, technical assistance, and information to local health departments regarding disease, injury, or exposure and methods of surveillance, investigation, and response.	Fully ☐ Partially ☐ Not ☐ N/A ☒
3	Report investigation results to jurisdictional and federal partners, as appropriate. (For additional or supporting detail, see Capability 6: Information Sharing)	Fully ☒ Partially ☐ Not ☐ N/A ☐

Performance Measure: Percentage of infectious disease outbreak investigation reports that contain all minimal elements* – Numerator: Number of infectious disease outbreak investigation reports generated containing all minimal elements – Denominator: Total number of infectious disease outbreak investigation reports generated * 'All minimal elements' interpreted as being accepted by KDHE.	100%	Numerator: 305 Denominator: 305

Status of Function 2 based on the assessments of the associated Tasks:

☒ Infrastructure Fully in Place -- Fully Evaluated and Demonstrated
☐ Infrastructure Fully in Place --Not Fully Evaluated and Demonstrated
☐ Infrastructure Not Fully in Place
☐ No Infrastructure in Place

Function 2: Conduct public health and epidemiological investigations	
Function Description: Identify the source of a case or outbreak of disease, injury, or exposure and its determinants in a population (e.g., time, place, person, disability status, living status, or other indices) to coordinate and report the summary results of the analysis to jurisdictional and federal partners, as appropriate.	
Planning Resource Elements	**Requirements met**
P1: (Priority) Written plans should include investigation report templates that [contain... minimal] elements.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Available in physical form and through EpiTrax.
P2: Written plans should include processes for how and when the jurisdiction will conduct investigations of health incidents (e.g., infectious disease outbreaks, injuries, and other incidents) and environmental public health hazards. Depending on the investigation, a plan will include at minimum the following information:	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: KDHE's reporting guidelines for disease and injury are established and followed. Internal documents are maintained.
P3: Written plans should include processes and protocols for conducting investigations in coordination with other governmental agencies, key stakeholders, and organizations that support populations at-risk for adverse health outcomes	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Available through the Douglas County Bio Incident Annex - 2012 and Disease Containment SOG.
P4: Written plans should include memoranda of understanding or other letters of agreement authorizing joint investigations and exchange of epidemiological information with law enforcement and other agencies, as well as defined roles for each participating agency.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Available through Douglas Counties Disease Containment Plan.
P5: Written plans should include a procedure to ensure that jurisdictional public health departments are provided a uniform set of jurisdictional health-related data associated with potential exposure to diseases, exposures, or injury conditions. (For additional or supporting detail, see Capability 6: Information Sharing)	Yes ☐ No ☐ Incomplete ☐ N/A ☒ Note: Responsibility of KDHE.
Skills and Training Resource Elements	
S1: (Priority) Maintain staffing capacity to manage the routine epidemiological investigation systems at the jurisdictional level as well as to support surge epidemiological investigations in response to natural or intentional threats or incidents.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: While the staff was able to manage the increased communicable disease caseload, additional staff or training may have relieved much of the pressure.

Equipment and Technology Resource Elements	
E1: Have or have access to jurisdictional health monitoring systems (electronic and/or paper, if applicable) needed to monitor health status , including criteria for reporting health events and criteria/processes for maintaining and/or contributing to population health registries.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: EpiTrax and physical forms are available.
E2: Have or have access to electronic databases or registries of ill, exposed, and potentially exposed persons; these systems should be capable of developing Public Health Investigation Reports (See Function 1: Planning Resource Element for Additional or Supporting Detail) as warranted, utilizing information from clinical, environmental, and/or forensic samples, and utilizing lab and disease tracking data. – Databases or registries should include protocols to protect personal health information in conformity with jurisdictional and federal law and via instituting security and confidentiality policies (For additional or supporting detail, see Capability 6: Information Sharing)	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: EpiTrax and AVR

Function 2: Conduct public health and epidemiological investigations

Function Description: Identify the source of a case or outbreak of disease, injury, or exposure and its determinants in a population (e.g., time, place, person, disability status, living status, or other indices) to coordinate and report the summary results of the analysis to jurisdictional and federal partners, as appropriate.

Analysis

Strengths

- The health department works well with community partners during investigations. (Task 1)

- Good communication with KDHE ensures proper and timely reporting once entered into EpiTrax (Task 3).

Areas for Improvement

- Additional staff or overtime funding could improve investigation capabilities. Time should be allowed for review of data and communication among staff (Resource Element S1).

- This exercise did not require quarantines or mandated isolation (asides from school abscences). An exercise should be prepared to exercise Function 2 , Task 1 in full.

Function 3: Recommend, monitor, and analyze mitigation actions

Function Description: Recommend, implement, or support public health interventions that contribute to the mitigation of a threat or incident as well as monitor the effectiveness of the interventions.

Task/Observation Keys		**Status**/Task Completed	
1	Determine public health mitigation, including clinical and epidemiological management and actions to be recommended for the mitigation of the threat or incident based upon data collected in the investigation and on applicable science-based standards outlined by Morbidity and Mortality Weekly Report, control of Communicable Diseases Manual, Red Book of Infectious Diseases or, as available, a state or CDC incident annex	Fully ☒ Partially ☐ Not ☐ N/A ☐	
2	Provide information to public health officials to support them in decision making related to mitigation actions. (For additional or supporting detail, see Capability 6: Information Sharing)	Fully ☒ Partially ☐ Not ☐ N/A ☐	
3	Monitor and analyze mitigation actions throughout the duration of the public health threat or incident. (For additional or supporting detail, see Capability 2: Community Recovery, Capability 5: Fatality Management, Capability 7: Mass Care, Capability 8: Medical Countermeasure Dispensing, Capability 11: Non-Pharmaceutical Interventions, and Capability 14: Responder Safety and Health)	Fully ☐ Partially ☒ Not ☐ N/A ☐	
4	Recommend additional mitigation activities, based upon mitigation monitoring and analysis, throughout the duration of the incident, as appropriate.	Fully ☐ Partially ☐ Not ☐ N/A ☒	
Performance Measure: Proportion of reports of selected reportable diseases for which initial public health control measure(s) were initiated within the appropriate time frame – Numerator: Number of reports of selected reportable diseases for which public health control measure(s) were initiated within an appropriate time frame – Denominator: Number of reports of selected reportable diseases received by a public health agency		93.8%	Numerator: 286 Denominator: 305

Status of Function 3 based on the assessments of the associated Tasks:

☐ Infrastructure Fully in Place -- Fully Evaluated and Demonstrated
☐ Infrastructure Fully in Place --Not Fully Evaluated and Demonstrated
☒ Infrastructure Not Fully in Place
☐ No Infrastructure in Place

Function 3: Recommend, monitor, and analyze mitigation actions	
Function Description: Recommend, implement, or support public health interventions that contribute to the mitigation of a threat or incident as well as monitor the effectiveness of the interventions.	
Planning Resource Elements	**Requirements met**
P1: (Priority) Written plans should include protocols for recommending and initiating, if indicated, containment and mitigation actions in response to public health incidents. Protocols include case and contact definitions, clinical management of potential or actual cases, the provision of medical countermeasures, and the process for exercising legal authority for disease, injury, or exposure control. Protocols should include consultation with the state or territorial epidemiologist when warranted. (For additional or supporting detail, see Capability 8: Medical Countermeasure Dispensing and Capability 11: Non-Pharmaceutical Interventions	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Available through Douglas County's Disease Containment Guidelines as well as through various KDHE resources.
P2: Written plans should include procedures for monitoring actual performance, and document actions and outcomes using tools such as data reports or statistical summaries consistent with Morbidity and Mortality Weekly Report and other criteria.	Yes ☐ No ☒ Incomplete ☐ N/A ☐ Note: State guidelines for reportable disease require certain criteria and performance measures be met. Specific goals and evaluations of performance do not appear typical.
P3: Written plans should include procedures to utilize health-related data and statistics from programs within the jurisdictional public health agency to support recommendations regarding populations at-risk for adverse outcomes during a natural or intentional threat or incident. (For additional or supporting detail, see Capability 1: Community Preparedness)	Yes ☐ No ☒ Incomplete ☐ N/A ☐ Note: Within the Communicable Disease team, written plans do not exist.
Skills and Training Resource Elements	
S1: (Priority) Public health staff participating in epidemiological investigations should receive awareness-level training with the Homeland Security Exercise and Evaluation After Action Report process.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: All staff are required to take ICS-100 and ICS-700 courses. Though agency scorecard reports less than %60 of all LDCHD staff have completed these requirements.

Function 3: Recommend, monitor, and analyze mitigation actions
Function Description: Recommend, implement, or support public health interventions that contribute to the mitigation of a threat or incident as well as monitor the effectiveness of the interventions.
Analysis
Strengths - Time to make initial contact with reported cases is very good.(Performance Measure) - Staff training and familiarization with the Incident Command System assists evaluation process.
Areas for Improvement - Follow up on mitigation strategies and suspected cases lacks an appropriate measure. The final interview date in not appropriate as a measure. The final interview date and the necessity of it is heavily dependent on the duration of the cough when the patient is reported. The current organizational system uses physical papers and follow-up can be dependent on current case load. -Performance evaluations of mitigation activities might benefit the staff over time. Evaluations provide a measure of what works and what does not work. -Ensure CD team members have completed and are knowledgeable of ICS policies (Resource Element S1).

Function 4: Improve public health surveillance and epidemiological investigation systems		
Function Description: Assess internal agency surveillance and epidemiologic investigation both during and after an incident and implement quality improvement measures that are within jurisdictional public health agency control.		
Task/Observation Keys		**Status**/Task Completed
1	Identify issues and outcomes during and after the incident.	Fully ☐ Partially ☒ Not ☐ N/A ☐
2	Conduct post-incident/post-exercise agency evaluation meeting(s) including all active participants (e.g., law enforcement, volunteer agencies, clinical partners or environmental regulatory agency) to identify internal protocols and deficiencies that require corrective actions in areas such as programs, personnel, training, equipment, and organizational structure	Fully ☒ Partially ☐ Not ☐ N/A ☐
3	Develop an After Action Report/Improvement Plan.	Fully ☒ Partially ☐ Not ☐ N/A ☐
4	Communicate recommended After Action Report Improvement Plan corrective actions to public health leadership.	Fully ☐ Partially ☐ Not ☐ N/A ☒
Status of Function 1 based on the assessments of the associated Tasks: ☐ Infrastructure Fully in Place -- Fully Evaluated and Demonstrated ☒ Infrastructure Fully in Place --Not Fully Evaluated and Demonstrated ☐ Infrastructure Not Fully in Place ☐ No Infrastructure in Place		

Function 4: Improve public health surveillance and epidemiological investigation systems	
Function Description: Assess internal agency surveillance and epidemiologic investigation both during and after an incident and implement quality improvement measures that are within jurisdictional public health agency control.	
Planning Resource Elements	**Requirements met**
P1: (Priority) Written plans should include procedures to communicate the improvement plan to key stakeholders (including groups representing at-risk populations) and to implement corrective actions identified in the improvement plan.	Yes ☐ No ☐ Incomplete ☒ N/A ☐ Note: Douglas *County Bio Incident Annex - 2012 V. sections E* and *F* require the completion of AAR and CAP and the implementation of recommendations but do not list specific timelines, responsibilities, or communication strategies.
P2: Written plans should include procedures to re-engage local public health agencies and key stakeholders and at-risk populations, as applicable, after the acute phase of a threat or incident to ensure that the jurisdiction's plans and response reached all necessary populations.	Yes ☐ No ☐ Incomplete ☐ N/A ☒ Note: Not evaluated with this incident.
Skills and Training Resource Elements	
S1: Public health epidemiology staff should have awareness-level training of quality improvement processes and techniques.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: Previous AARs and hotwashes communicate awareness-level training of improvement process and techniques.
S2: Have access to individual(s) trained to meet competencies for a Public Health Informatician as defined in Competencies for Public Health Informaticians to contribute to information sourcing, use, and reuse for surveillance and epidemiologic analysis.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: KDHE
Equipment and Technology Resource Elements	
E1: Have or have access to electronic or paper-based tools for data collection, management, and analysis, including methods for collecting, managing, and analyzing data electronically.	Yes ☒ No ☐ Incomplete ☐ N/A ☐ Note: State run reporting tool EpiTrax and AVR. Excel. An analyst is available at the health department. Paper based tools are available.

Function 4: Improve public health surveillance and epidemiological investigation systems
Function Description: Assess internal agency surveillance and epidemiologic investigation both during and after an incident and implement quality improvement measures that are within jurisdictional public health agency control.
Analysis
Strengths - The staff has demonstrated a solid understanding of improvement methods. Close communication with KDHE helps to address reporting issues. The hotwash and participant feedback forms were valuable and well-received among staff. (Task 2)
Areas for Improvement - The CD team did not meet on a regular basis during the outbreak. Doing so could have helped to identify issues with the investigation. (Task 1) - Reporting the Improvement Plan to stakeholders is not outlined. Follow through on agreed upon recommendations is not outlined.

Supporting Documentation:

- Pertussis (Whooping Cough) Investigation Guideline
- Lawrence-Douglas County Health Department Community Disease Containment Standard Operating Guide
- Douglas County Bio Incident Annex - 2012
- Participant Feedback Forms - 2012 Pertussis Outbreak - Douglas County
- Flowchart for pertussis investigations in counties with high incidence 8/7/2012
- Incident Hotwash Notes - collected 1/29/2013

Attachment 3 - KDHE Case Definitions for Pertussis

Much of the following is summarized from KDHE's *Pertussis Investigation Guidelines*. The full guidelines are available from http://www.kdheks.gov.

Diagnosis and Reporting

Laboratory confirmation by culture, considered the 'gold standard' is only appropriate within the first two weeks of cough onset. Culture has very good specificity and acceptable sensitivity when collected within two weeks. One can identify the strain and conduct resistance testing with isolated cultures (Centers for Disease Control and Prevention, 2012). Identification of the circulating strains can be invaluable in an outbreak investigation, particularly if resistant strains are circulating. Polymerase chain reaction (PCR) samples must be obtained within 3 weeks of cough onset in vaccinated individuals. PCR testing is very sensitive but has varying specificity. DNA targets are not standardized among laboratories. Many labs, including KDHE (Tatti, Sparks, Boney, & Tondella, 2011) (Hart, 2013), test for the IS*481* gene which is present in other *Bordetella* bacteria and is present with multiple copies in *B. pertussis*, potentially allowing for false positives (Centers for Disease Control and Prevention, 2012). As a result, 'negative PCR tests do *not* rule out the possibility of pertussis.' (Kansas Department of Environment & Health, 2012, p. 3) Results must be interpreted on a case by case basis. As of January 1st, 2013, this procedure has changed. Negative laboratory tests are no longer investigated in Kansas without first meeting the clinical criteria. Serology tests are not appropriate for diagnostic testing in Kansas. Serologic assays are being developed to assist in diagnosis at later stages of the disease (Centers for Disease Control and Prevention, 2012) (Kansas Department of Environment & Health, 2012).

The case definitions, established by the CDC in 1997 and obtained from KDHE's *Pertussis Investigation Guidelines* (p. 2), are as follows:

'**Clinical Description for Public Health Surveillance:** A cough illness lasting ≥ 2 weeks with one of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting, without other apparent cause (as reported by a health professional).

Laboratory Criteria for Case Classification: Isolation of *Bordetella pertussis* from clinical specimen; OR, Positive polymerase chain reaction (PCR) for *B. pertussis*.'

Case classifications, established by the CDC and obtained from KDHE's *Pertussis Investigation Guidelines* (p. 2), are as follows:

'**Confirmed:** A case that is culture positive and in which an acute cough illness of any duration is present; OR a case that meets the clinical case definition and is confirmed by positive PCR; OR a case that meets the clinical case definition and is epidemiologically linked directly to a case confirmed by either culture or PCR.

Probable: Meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case.

Suspect: A case, not meeting the confirmed or probable case classifications, who has a clinical syndrome compatible with pertussis without other apparent cause such as: cough of > 7 days, paroxysmal cough of any duration, cough with inspiratory whoop, cough associated with apnea in an infant, or cough in a close contact of pertussis case.'

Attachment 4: Participant Feedback Form

The following document was provided by KDHE and used for the hotwash with the LDCHD Communicable Disease Team on January 29th. The form was returned by 50% of participants.

PARTICIPANT FEEDBACK

PART I: RECOMMENDATIONS AND CORRECTIVE ACTIONS

1. Based on the incident response, list the top 3 strengths and/or areas that need improvement.

2. Is there anything you saw in the incident response that the evaluator(s) might not have been observed or record?

3. Identify the corrective actions that should be taken to address the issues identified above. For each corrective action, indicate if it is a high, medium, or low priority.

4. Describe the corrective actions that relate to your area of responsibility. Who should be assigned responsibility for each corrective action?

5. List the applicable equipment, training, policies, plans, and procedures that should be reviewed, revised, or developed. Indicate the priority level for each.

PART II: EVENT RESPONSE ASSESSMENT

Please rate, on a scale of 1 to 5, your overall assessment of the incident relative to the statements provided below, with **1** indicating **strong disagreement** with the statement and **5** indicating **strong agreement.**

Assessment Factor	Strongly Disagree				Strongly Agree
The response was well structured and organized.	1	2	3	4	5
The documentation provided during the incident was useful in preparing for and responding to assigned tasks.	1	2	3	4	5
Participation in the incident response was appropriate for someone in my position.	1	2	3	4	5
The response team included the right people in terms of level and mix of disciplines.	1	2	3	4	5
This incident response allowed my agency/jurisdiction to demonstrate and improve priority capabilities.	1	2	3	4	5
After this incident, I believe my agency/jurisdiction is better prepared to deal successfully with future incidents of this nature.	1	2	3	4	5

PART III: PARTICIPANT FEEDBACK

Please provide any recommendations on how this incident response or future responses could be improved or enhanced.

Attachment 5: Hotwash Notes

Notes provided here are from the January 29th hotwash. Originally written down, they have been typed up here.

Hotwash - 2012 Douglas County Pertussis Outbreak

Participants present: Kathy Colson, Carolyn Ball, Shirley Grubbs

January 29th, 8:30 a.m.

Recorder: Mike Banfield

Participants in event:

Kim Ens - Director of Clinic Services, LDCHD

Kathy Colson - Clinic Coordinator/Communicable Disease Nurse, LDCHD

Shirley Grubbs - Communicable Disease Team Leader, LDCHD

Carolyn Ball - Communicable Disease Nurse, LDCHD

Carol - Follow-up, Public Health Nurse, LDCHD

Ashley C. - Follow-up, Public Health Nurse, LDCHD

Jena Callen - Medical Investigator, KDHE

Participating Organizations:

Lawrence-Douglas County Health Department

Kansas Department of Health and Environment

Douglas County Private Physicians

Lawrence Memorial Hospital

USD 497 - Lawrence Public Schools

USD 348 - Baldwin City Public Schools

USD 491 - Eudora Public Schools

Douglas County Day Care Facilities

Funding Organizations: No external funding was provided. Staff was paid on the regular budget. Minimal additional overtime.

Strengths: 1) Flexibility of staff and scheduling. 2) Strong working relationship with KDHE (Jena Callen, Medical Investigator) and school districts 3) The investigation was on a familiar disease 4) Paid close attention to the performance measure, initiated contact within 24 hours 5) Team works very well together despite no formal meetings, good working relationship

Weaknesses: 1) No formal incident response 2) No regular meetings 3) Inconsistent data entry 4) Timely follow-up was lacking (as a result of case overload)

Staff mentions that they frequently got caught up in workload. An EpiTrax issue proved time consuming as all contacts needing to be upgraded to cases required repeated data entry.

Preparedness activities/training prior to event: 1) Contacted KDHE prior to beginning of school year 2) In August, a school nurse meeting was held, pertussis was discussed. Nurses were encouraged to review immunization records of students and staff. 3) Letters were sent to physicians regarding reporting guidelines.

Lessons Learned from previous outbreaks: Participants in the outbreaks were more relaxed as time went on, did not feel responsible for spread of disease. Allowed a relationship to develop between KDHE and other counties. Physicians should be notified and updated of the event early on to ensure cooperation.

Areas of Improvement: Would like to see some funding set aside for future outbreaks (e.g. overtime staffing). More training. Possibility of using interns to ease call load.

Recommendations for Improvement: Improve charting consistency, use of incidence response system (ICS), increase staff cross training

Attachment 6: Other activities preformed to satisfy MPH degree requirements

Action	Courses Addressed
Employment for the National Agricultural Biosecurity Center: Prepared documents on various zoonotic disease and have addressed the capabilities of various countries to address zoonotic disease outbreaks and biosecurity.	-Biol 670 -Biol 730 -Kin 818 -DMP 770 -Geog 508 -DMP 844 -DMP 754 -FDSCI 730 -DMP 815
Internship with the Lawrence Douglas County Health Department: Through one summer internship and one semester internship, I've completed over 500 hours of unpaid work for the LDCHD. Work includes the following: -Completed various mapping requests for information, grant applications, etc. -Evaluated current GIS capabilities and limitations -Prepared and organized GIS files for future staff use. Identified sources. -Identified vulnerable populations and population estimates of those groups in the county -Produced access to healthy foods maps; evaluated a model using convenience stores as distributors of fresh produce -Analysis of clinic schedule: identified time slots and days of week most likely to be missed, reported to Sue -Internal audit on clinic pregnancy procedures (were the right people being referred to the appropriate programs) -Analysis of clinic pregnancy data: patient demographics, etc. -Worked on a series of Health Indicator Briefs with Vince. -Prepared some educational materials on GIS for Vince and Charlie -Pertussis outbreak review	-Biol 670 -Kin 818 -DMP 770 -Geog 508 -FDSCI 730 -HMD 720 -DMP 815 -STAT 701 -STAT 705 -DMP 840 -DMP 806 -DMP 754
Volunteer work with the Flint Hills Community Clinic: Work as a CNA and Greeter	-KIN 818
Volunteer for the Riley County Health Department Flu Vaccination Clinic: Worked several dates checking people in for vaccinations.	-DMP 754 -KIN 818 -BIOL 670
KSU Graduate Student Council Health Insurance Representative: Work includes attending GSC meetings and relaying changes to the graduate health insurance to the council. Also responsible for setting up webinars and meetings. Addressing student concerns should they exist.	-HMD 720 -KIN 818