

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

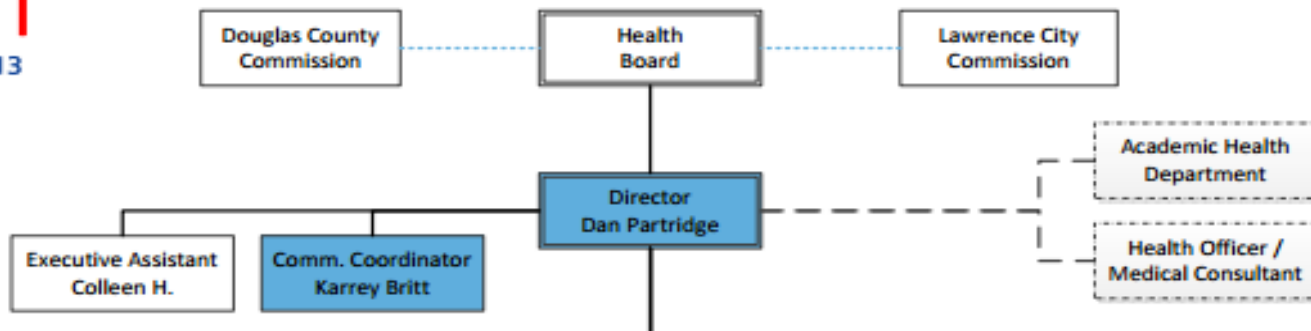
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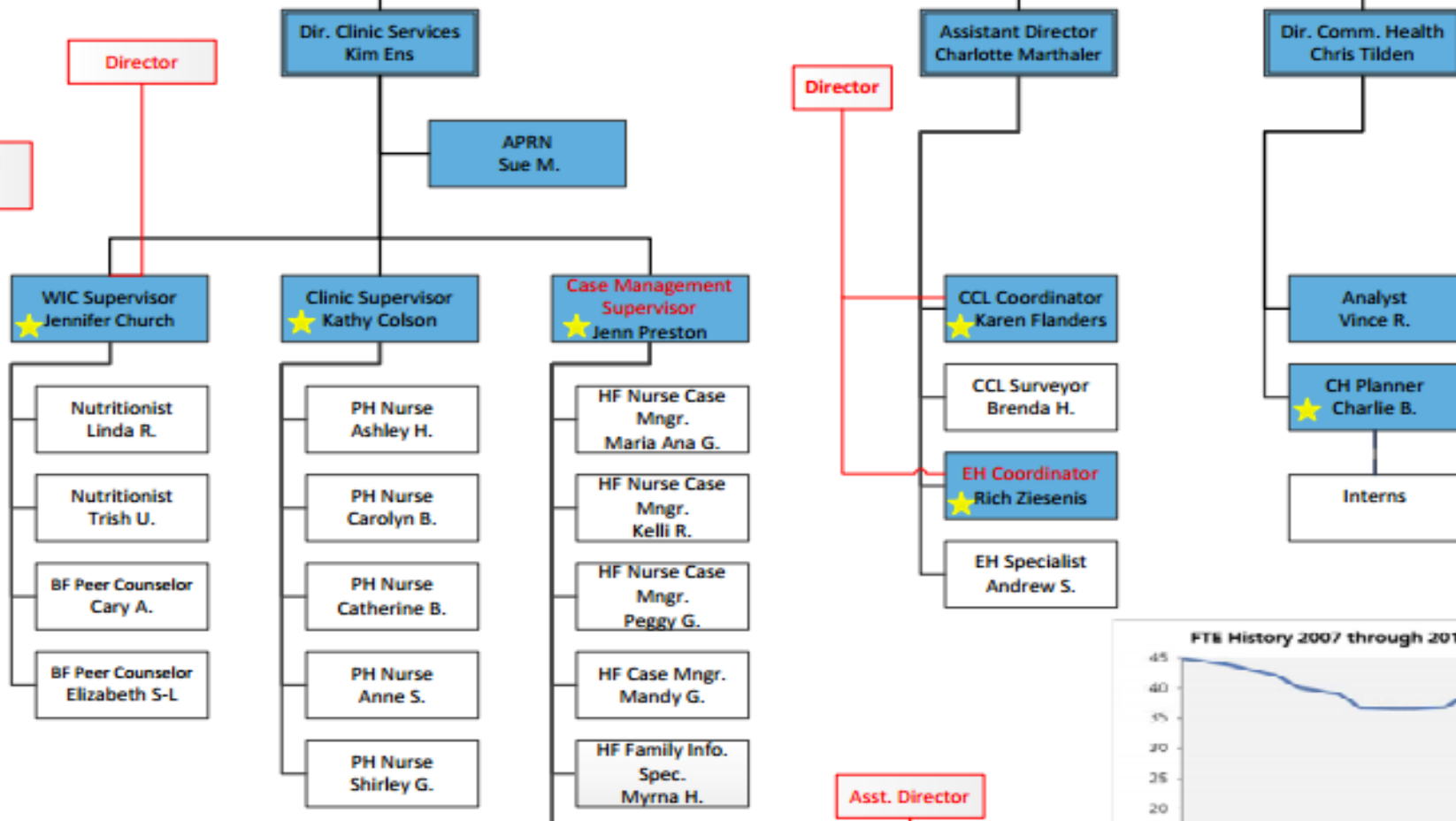
Lawrence-Douglas County Health Department

- Serves Douglas County
- A population of 112,000 people
- Employs approx. 45 staff members
- Provides a number of services to the community





Clinic
ices





Health department reports increase in whooping cough cases in Douglas County

By Karrey Britt on July 20, 2012

Health department investigating case of whooping cough at Quail Run

By Karrey Britt on August 21, 2012

Posted: Fri 5:43 AM, Oct 28, 2011 AA  

Updated: Fri 9:15 AM, Oct 28, 2011

Whooping Cough Outbreak In Northeast Kansas

LAWRENCE, Kan. (WIBW)-- Health officials in Northeast Kansas are dealing with an outbreak of whooping cough.

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Whooping cough cases persist in Douglas County

Whooping cough outbreak continues in Douglas County

By Adam Strunk on December 6, 2012

KANSAS STATE
UNIVERSITY

Task: Prepare an After-Action Report on Pertussis outbreak

- Assigned: January 9th, 2013
- Assigned by: Kim Ens, Director of Clinic Services, LDCHD
- Primary contacts:
 - Kathy Colson, Clinic Coordinator, LDCHD
 - Charlie Bryan, Community Health Planner, LDCHD
 - Daniel Neises, Senior Epidemiologist, KDHE

What is Pertussis?

Commonly known as ‘whooping cough’

- In China, known as the ‘hundred day cough’

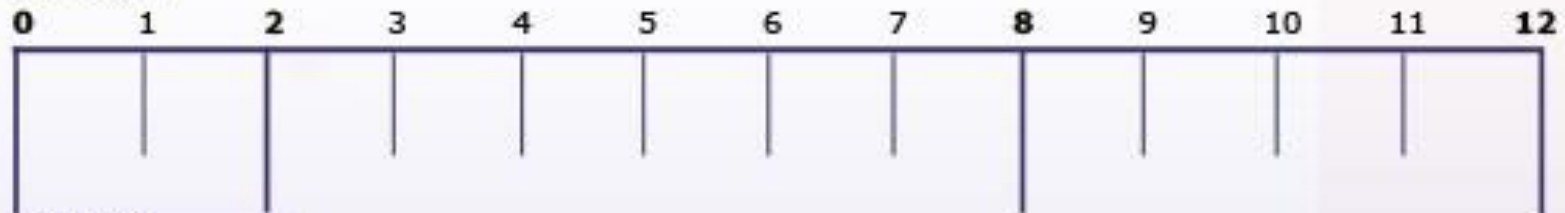
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- Vaccine Preventable!
- Still endemic in the United States
- Etiologic agent: *Bordetella pertussis*

Disease Progression

Disease Progression: Weeks



**Stage 1
Catarrhal Stage**
*May last 1 to 2
weeks*

- Symptoms: runny nose, low-grade fever, mild, occasional cough - Highly contagious

Stage 2 - Paroxysmal Stage

Lasts from 1-6 weeks; may extend to 10 weeks

Symptoms: fits of numerous, rapid coughs followed by "whoop" sound; vomiting and exhaustion after coughing fits (called paroxysms)

Stage 3 - Convalescent Stage

Lasts about 2-3 weeks; susceptible to other respiratory infections for many

Recovery is gradual. Coughing lessens but fits of coughing may return.

Retrieved from: cdc.gov

Case Definitions

- **'Clinical Description for Public Health Surveillance:** A cough illness lasting ≥ 2 weeks with one [other symptom]...as reported by a health professional'
- **Laboratory Criteria for Case Classification:** Isolation of *Bordetella pertussis* from clinical specimen; OR, PCR for *B. pertussis*.'
- From KDHE's *Pertussis Investigation Guidelines*, pg. 4

Case Status - Confirmed

- **Confirmed:**
 - Meets clinical case definition and is laboratory confirmed
 - By culture or PCR
- OR, is epi-linked to a confirmed case
- Reported to CDC

Case Status - Probable

- **Probable:** Meets the clinical case definition, is NOT laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case.
- During an outbreak: Cough of greater than 2 weeks

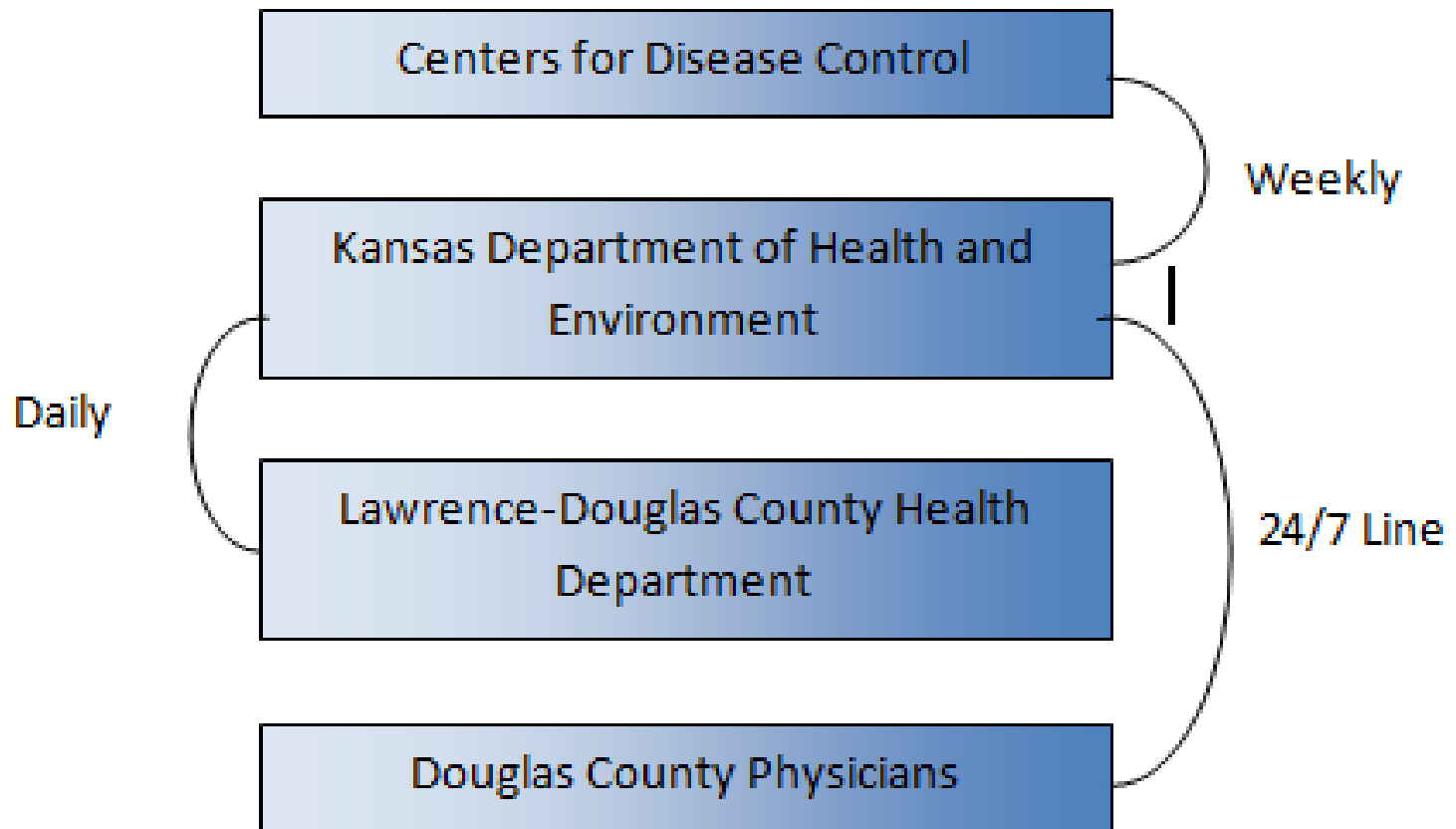
Pertussis Testing

Optimal Timing for Diagnostic Testing (weeks)



From KDHE's *Pertussis Investigation Guidelines*, pg. 3

Disease Reporting



Vaccination

DTaP

- Diphtheria, Tetanus, acellular Pertussis
- Received at 2, 4, 6, and 15-18 months. Again between 4-6 years.¹
- FDA approval in 1991
- Replaced DTP

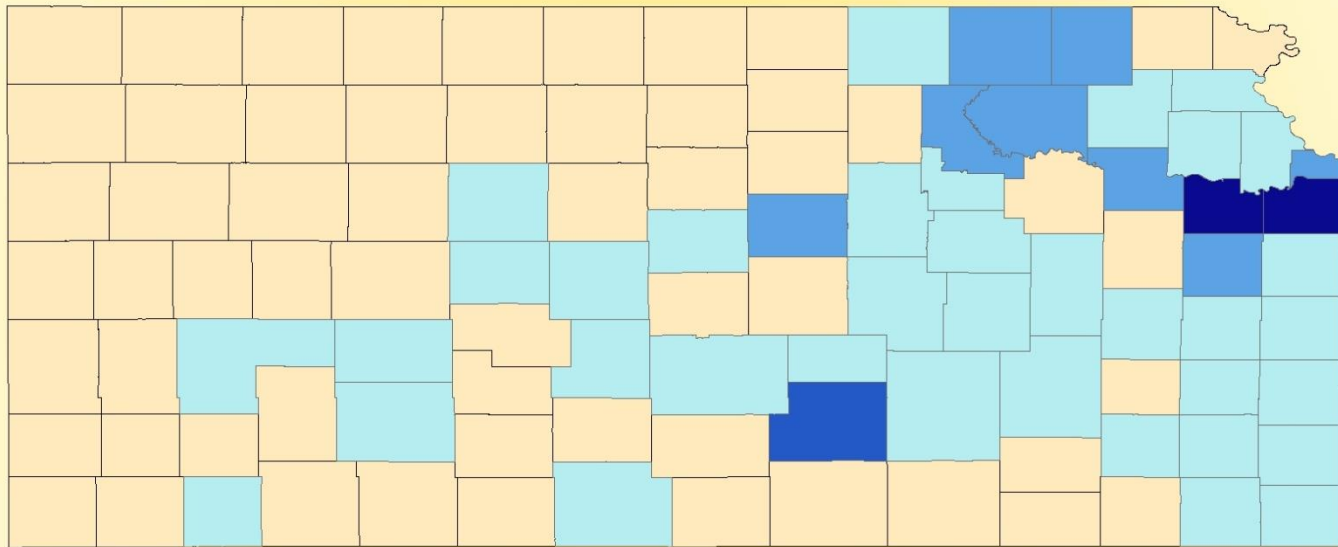
TDaP

- Tetanus, Diphtheria, acellular Pertussis
- Between grades 7-10²
 - NIH recommends age 11-12
- FDA approval in 2005
- No CDC recommendations for vaccination intervals
- Separate from Td vaccine

Scale of 2012 Outbreak – National and State

- Global outbreak
- Forty-nine states report increased incidence
- National incidence rate: 13.4/100,000 persons
- Kansas incidence rate: 25.5/100,000 persons
 - 1,912 investigated cases
 - 864 confirmed or probable

Confirmed and Probable Pertussis Cases Reported in 2012 by County



Legend

Confirmed_or_Probable_Cases



Scale of 2012 Outbreak – Douglas County

- 305 investigated cases in Douglas County
- Over 900 contacts
- Over 1% of Douglas County population involved
- Highest county incidence in the state at a rate of 130.4/100,000 persons
 - Baldwin City incidence rate: 43 cases per pop. of 4,569 = 941/100,000 people!

Goals

- Summarize events
- Present a cost estimation of preventative measures
- Determine vaccination status of reported population
- Review reporting methods/management of outbreak
- Provide recommendations for future outbreaks

Methods to Acquire Data

- Data source: EpiTrax
- Final data pull: February 6th, 2013
- Hotwash: January 29th, 2013
- Interviews:
 - Kathy Colson
 - Daniel Neises
 - Charlie Bryan



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 UnknownRace: 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/PMWere 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

1 st Medication Name	Date started first antibiotic:	Number of days first antibiotic actually taken:
<input type="checkbox"/> Erythromycin (incl. Pediazole) <input type="checkbox"/> Cotrimoxazole (bactrim/septra) <input type="checkbox"/> Clarithromycin/Azithromycin <input type="checkbox"/> Tetracycline/Doxycycline <input type="checkbox"/> Amoxicillin/Penicillin/Ampicillin/Augmentin/Ceclor <input type="checkbox"/> Other/specify _____ <input type="checkbox"/> Unknown		
2 nd Medication Name	Date started second antibiotic:	Number of days second antibiotic actually taken:
<input type="checkbox"/> Erythromycin (incl. Pediazole) <input type="checkbox"/> Cotrimoxazole (bactrim/septra) <input type="checkbox"/> Clarithromycin/Azithromycin <input type="checkbox"/> Tetracycline/Doxycycline <input type="checkbox"/> Amoxicillin/Penicillin/Ampicillin/Augmentin/Ceclor <input type="checkbox"/> Other/specify _____ <input type="checkbox"/> Unknown		

Inclusion Criteria

- All cases 'Reported to Public Health' between January 1st, 2012 and December 31st, 2012
- Jurisdiction: Douglas County
- Disease: Pertussis
- 'Probable' and 'Confirmed' cases assigned equal weight, reported to CDC

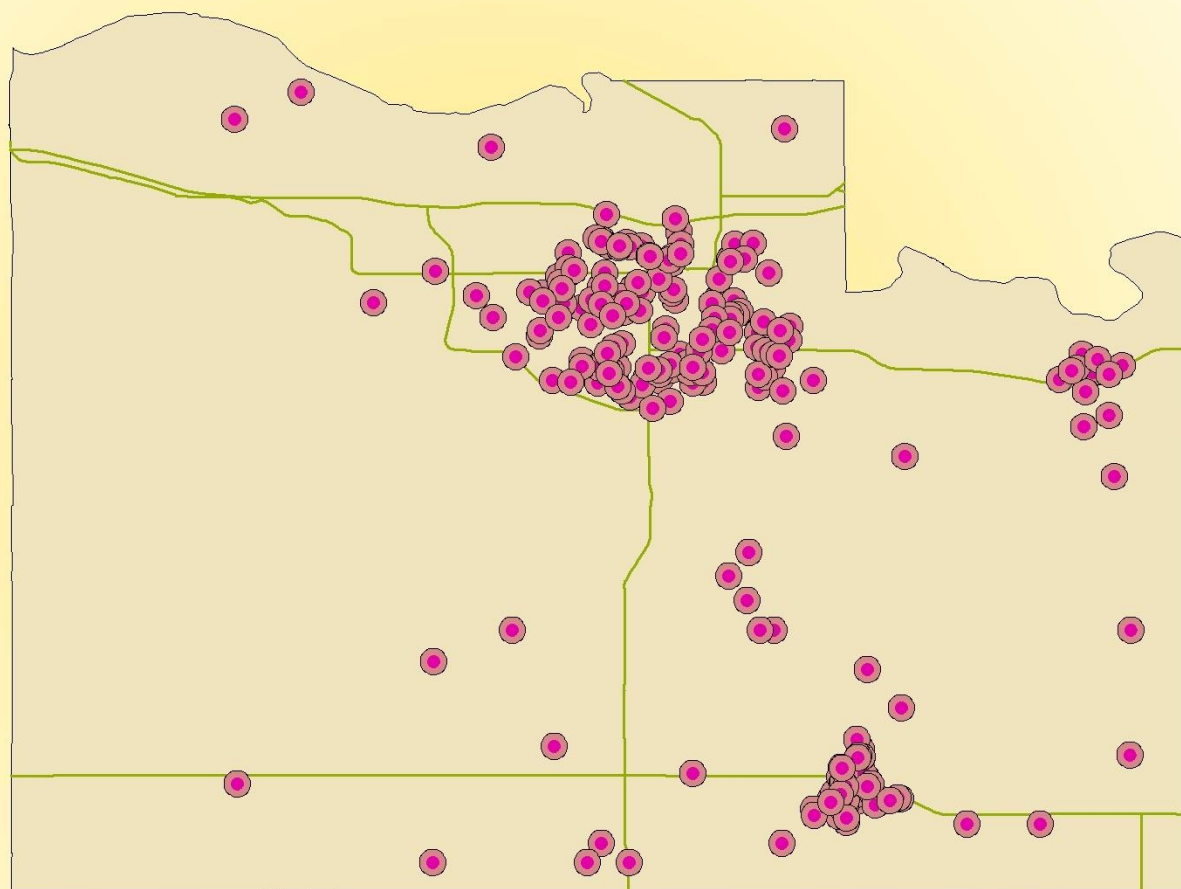
Outbreak Summary

- 305 reported cases
- 146 confirmed or probable
- Sporadic cases in the first six months of 2012
- Twelve events meet KDHE 'outbreak' criteria
 - Two School outbreaks
 - Ten (10) household outbreaks
 - One officially identified by KDHE

Age and Gender Statistics

- Mean reported age: 16.4 (median: 10 range: 0 – 80+)
- Mean confirmed or probable age: 18
 - (median: 11 range: 0 - 80+)
- Reported Females: 176
 - Confirmed or Probable Females: 85
- Reported Males: 126
 - Confirmed or Probable Males: 61

All Reported Pertussis Cases Douglas County 2012

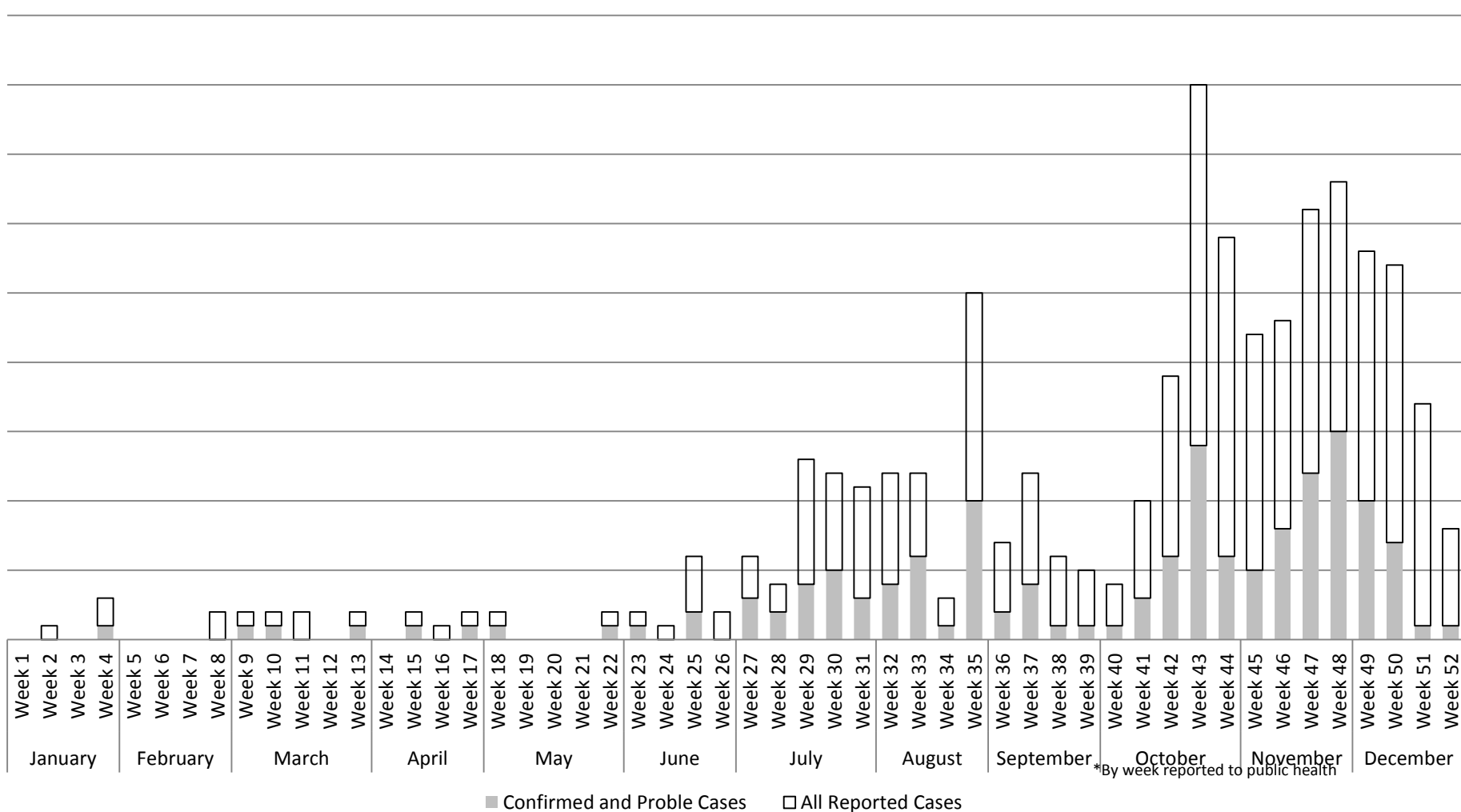


Legend

-  Cases
-  Highways
-  County

Cases are offset randomly to protect patient identity

Pertussis cases investigated by LDCHD in 2012*



*By week reported to public health

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

Values less than 6 are masked to protect patient privacy. All age ranges over 40 contained values less than 6.

Vaccination Status

- Of the 305 investigated cases:
 - 71.8% were reported as vaccinated
 - 15.7% were not vaccinated or had an unknown vaccination history
 - remaining 14.3% were left with a blank vaccination field
- Unknown and blank vaccinations fields cannot be interpreted and are removed from the sampling.
- 74% (108 of 146) of confirmed or probable cases vaccinated

Vaccine Efficacy

- Using methods outlined by Fielding et. al in *Effectiveness of Seasonal Influenza Vaccine against Pandemic (H1N1) 2009 Virus, Australia, 2010 (2011)*
- Vaccinated but confirmed or probable cases:
 - 108 of 146 cases (.7397)
- Vaccinated and not a case (controls):
 - 111 of 126 (.8809)
- Vaccine efficacy = $(1 - \text{Odds Ratio}) \times 100$

$$=(1 - .7397/.8809) \times 100 = \mathbf{16\%! \text{ But...}}$$

Vaccination Rates

Age Group	Vaccinated	All Reported Cases	Proportion
0-4 years	55	70	.786
5-9 years	70	81	.864
10-14 years	55	62	.887
15-19 years	16	22	.727
20-39 years	9	32	.237
40-59 years	9	24	.375
60+	4	15	.267

Cost Analysis

- Estimated cost of case and preventative treatment associated with the outbreak is \$12,189.
- Vaccination cost is not included
 - No additional or emergency vaccine shipments required for the county
- The cost of PCR laboratory testing is estimated at \$16,555
- The cost of surveillance and man-hours from LDCHD dedicated to pertussis is estimated at \$13,365
- Total estimated cost for additional public health surveillance, testing and prevention for the outbreak in Douglas County: \$42,110

Lawrence Private School

- Officially recognized by KDHE
- Suspected Index case: Teacher, not vaccinated
 - Cough onset: Mid-October
 - Reported: Mid-November
- Five confirmed and probable cases resulted
 - Eight additional contacts were associated

Baldwin City School District Outbreak

- Dates: October 12 – November 5
- Index case: unidentified
- Not officially recognized by KDHE
- Same age groups, all cases in same area and within 42 days of each other
- 8 confirmed or probable cases
 - 34 associated contacts

Household Outbreaks

- Characterized as outbreaks where spread was limited to a single household
- Ten (10) identified
- Twenty-three (23) confirmed and probable cases, 2 suspect cases
 - 8 under vaccinated (65% vaccination rate)
 - 162 contacts associated

Conclusions/Discussion

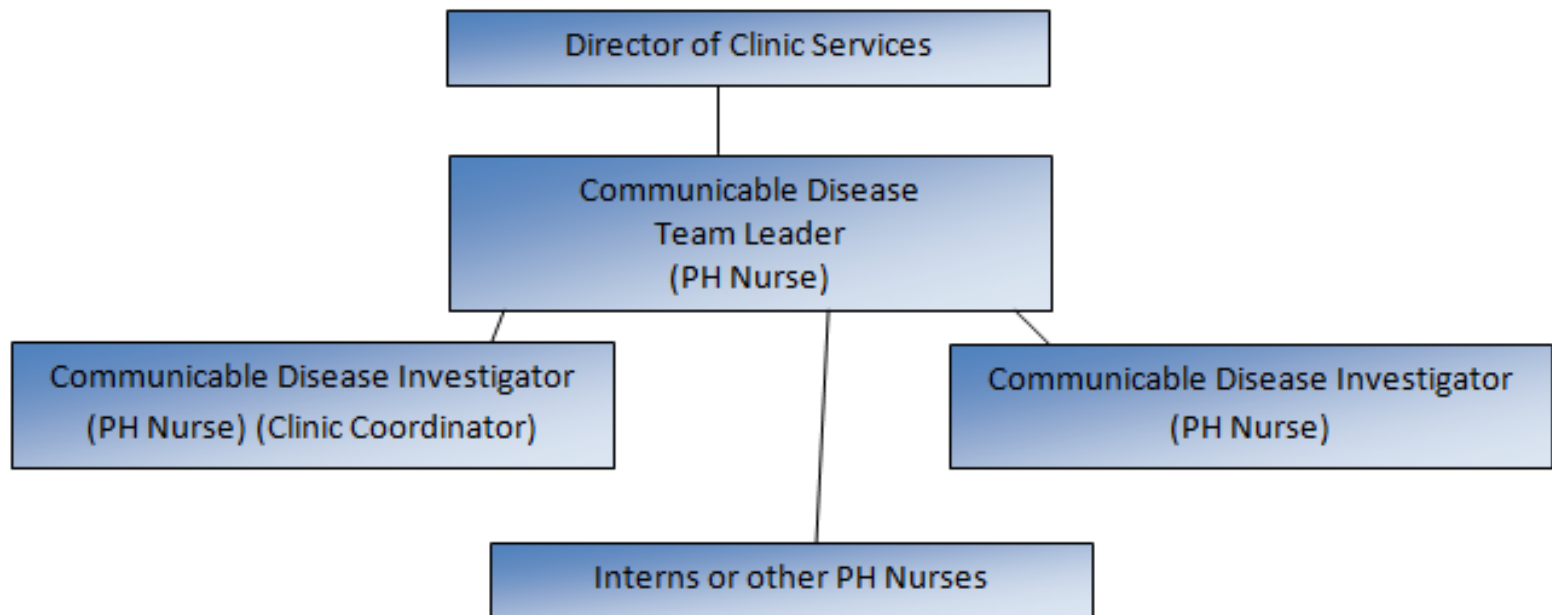
- Outbreak began in July
- Ongoing in December
- Inconsistencies in data entry severely limited the validity of the data
- Origins of the outbreak are unknown
- Potential reasons for high incidence

Limitations of the Review

- Primary purpose of EpiTrax is surveillance, not research
- Many inconsistencies in data
- Passive Surveillance system
 - Likely many cases in the county went unreported

Management of Outbreak by LDCHD

Led by the LDCHD Communicable Disease Team



Management of Outbreak by LDCHD

- Participant Feedback form distributed to LDCHD participants
- Hotwash on January 29th with Communicable Disease Team
- Trigger point of outbreak not identified
- Incident Command System not activated

Summary of Participant Feedback Form

Strengths	<ol style="list-style-type: none"> 1) Quick initiation of cases 2) Thorough initial investigation 3) Flexibility of staff 4) Strong working relationship with KDHE and school nurses
Weaknesses	<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1) Add more individuals who can access EpiTrax 2) Train additional nurses for CD team 3) Consider training reviews
Additional Comments	<ol style="list-style-type: none"> 1) Training during an incident is not as effective as training prior to an incident 2) The headsets were a nice addition.

Summary of Hotwash


- Caseload exceeded expectations
- Goal: ‘to reduce the spread of disease’
 - Achieved?: uncertain
- CD team did not meet regularly
- Two nurses spent the majority of October through December conducting communicable disease investigations
- Current case management method: Binder

LDCHD Management of Outbreak

- Contacting cases within 24 hours of being reported to LDCHD: 93.8% success
- Measuring follow-up: not possible quantitatively
 - 35 investigations (11.5%) took 20 days or longer to complete
 - mean case investigation length: 8 days (median: 7 range: 0 – 42)

LDCHD Management of Outbreak

- CDC PHEP Capability 13: Public Health Surveillance and Epidemiological Investigation Evaluated
- Evidence-based, released in 2011 for strategic planning purposes
- All 15 capabilities must be demonstrated every 5 years – KDHE agreement

- 
- ‘Without feedback from precise measurement...invention is doomed to be rare and erratic. With it, invention becomes commonplace.’
 - – Bill Gates, Bill and Melinda Gates Foundation Annual Letter 2013 (Paraphrase of Rosen)

Capability	Function/Task #	Recommendation	Resource Element	Primary Responsible Agency
Public Health Surveillance and Epidemiological Investigation (#13)	1	Media Reporting Guidelines		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)	1	Written plans for analyzing data (Planning Resource Element 3).	Planning	LDCHD
Public Health Surveillance and Epidemiological Investigation (#13)		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 Investigation (#13)	4.1	Regular Communicable Disease Meeting	Staff and Training	LDCHD

Standardized Data Entry (Priority)

- Encouraged through participant surveys, the hotwash, and through the evaluator's analysis of data
- Not specific for pertussis but for all communicable disease and clinic work conducted at LDCHD
- Routine staff training should address how data is entered
- Consider performance reviews

Improved Organizational Structure to Track Cases

- Current system of binder is unreliable, not reminders
- EpiTrax provides system for regular reminders
- Regular staff review of cases could also address this

EpiTrax Training

- Some fields are open to interpretation
- KDHE staffing issues have delayed training
- Only one case used the 'where acquired' field appropriately
- Proper training from KDHE may alleviate this concern and satisfy this recommendation.

Regular CD Team Meeting/ ICS

- Some way to address issues during the incident
- Quicker identification of clusters or outbreaks
- Be creative about meeting times
 - KDHE meets briefly each day
 - Review cases electronically each day
- "An important lesson learned was that [the ICS] team was very valuable and need to be established earlier in the outbreak." – 2006 Mumps AAR

Update on Outbreak

- Jan. 1st: Change in cases investigated
- As of March 26, 2013: 7 Confirmed or Probable in Douglas County
- Still increased incidence compared to 2011
- Data validity from LDCHD has improved ('where acquired' field primarily)

Potential for Future Research

- Spatial-temporal associations among cases currently being investigated for the 2012 outbreak in the state of Kansas
- State data provided by KDHE

Acknowledgements

- 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
- Supervisory Committee:
 - Notably: Dr. Stephan Chapes, Major Professor
 - Dr. Robert Larson
 - Dr. Mary McElroy

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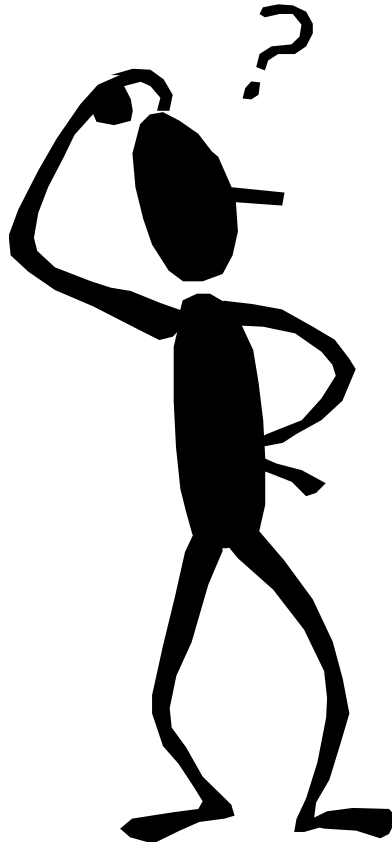
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Source

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Questions?



Action	Courses Addressed
<p>Employment for the National Agricultural Biosecurity Center:</p> <p>Prepared documents on various zoonotic disease and have addressed the capabilities of various countries to address zoonotic disease outbreaks and biosecurity.</p>	<p>-Biol 670 -Biol 730 -Kin 818 -DMP 770 -Geog 508 -DMP 844 -DMP 754 -FDSCI 730 -DMP 815</p>
<p>Internship with the Lawrence Douglas County Health Department:</p> <p>Through one summer internship and one semester internship, I've completed over 500 hours of unpaid work for the LDCHD. Work includes the following:</p> <ul style="list-style-type: none"> -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 	<p>-Biol 670 -Kin 818 -DMP 770 -Geog 508 -FDSCI 730 -HMD 720 -DMP 815 -STAT 701 -STAT 705 -DMP 840 -DMP 806 -DMP 754</p>
<p>Volunteer work with the Flint Hills Community Clinic:</p> <p>Work as a CNA and Greeter</p>	<p>-KIN 818</p>
<p>Volunteer for the Riley County Health Department Flu Vaccination Clinic:</p> <p>Worked several dates checking people in for vaccinations.</p>	<p>-DMP 754 -KIN 818 -BIOL 670</p>
<p>KSU Graduate Student Council Health Insurance Representative:</p> <p>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.</p>	<p>-HMD 720 -KIN 818</p>