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Q Fever Associated with Exposure to a Kid, June, 2007

Unusual zoonotic disease can be prevented through proper education of animal breeders and their customers

Scott D. Bowden, MPH, Regional Epidemiologist, Region 7, Northern Kentucy Independent District Health Department

Background

On June 12, the Northern Kentucky Independent District Health Department (NKIDHD) received a phone call from the Environmental Director of Three Rivers District Health Department (TRDHD), reporting a case of Q Fever in a resident of that jurisdiction who was hospitalized. The Three Rivers Environmental Director provided NKIDHD with the hospital contact information and committed to identifying and locating the breeder who sold a goat to the case, since the animal was recognized as a potential course of exposure. The Regional Epidemiologist agreed to meet with the Environmental Director on June 14, 2007, for further investigation and contacted the Division of Epidemiology at the Kentucky Department for Public Health (KDPH) and the hospital where the patient was admitted.

Investigation

The index case was originally seen and admitted to a community hospital with a diagnosis of viral meningitis. The patient's initial onset of symptoms occurred around May 21, 2007. The patient was transferred to a referral hospital on June 3rd with a presentation of respiratory distress and bilateral infiltrates. A tracheostomy was performed soon after admission to the referral hospital. Based on a suspected diagnosis of Q fever and its usual incubation period of 2-3 weeks, it was estimated that the potential exposure likely ranged from April 30 – May 7, 2007. The patient was unable to be interviewed due to the tracheostomy and the overall condition. Upon the recommendation of an infectious disease physician, blood samples were taken at the hospital on June 12th to rule out legionellosis, ehrlichiosis, or other atypical pneumonias. The tests were sent to a reference laboratory in California where immunofluorescence assay (IFA) testing was also done for Q fever. The Regional Epidemiologist requested that convalescent sera be tested before the patient was released.

Several times during the week of June 11th, 2007, attempts were made to contact the patient's sister-in-law. She returned the calls on June 13th and was interviewed later that day by telephone. During the course of the interview, she indicated that the patient had purchased a baby goal at the beginning of April 2007. No other potential exposures were identified for the case patient.

On June 13, 2007, NKIDHD consulted with the State Public Health Veterinarian, who concurred that an epidemiological investigation of the breeder's residence should be conducted to determine the source of the disease and if anyone else had symptoms and/or potential exposure to the organism. On June 14th, two NKIDHD investigators visited the breeder's home. Several goats were seen in the front yard and a barn was noted on the premises. The team interviewed the breeder and learned that kidding normally occurs in the winter. Several kids had been sold within the past month. When asked about disposal of the afterbirth, the breeder indicated that the family dogs ate it. The breeder

(Continued on Page 2)

December Notes & Reports.....

was aware of the carrier state of Q fever in goats. Several other farms in the vicinity of the breeder's farm were noted to have new baby goats in their pastures. The investigators next visited the patient's residence. They did not find anyone at home, but noticed a young kid in the yard tied to a pole with a shelter. This was the goat described by the sister-in-law of the patient.

The following month, on July 12th, the sister-in-law of the patient called the Regional Epidemiologist with an update. The patient had been released from the hospital's long-term care center to recover at home. However, she reported that the patient's daughter had been seen and treated for Q fever on July 3rd and that the daughter had been feeding the baby goat by hand. A follow-up call the next morning to the referral hospital confirmed that the initial case was released, but no convalescent blood titer had been obtained. A separate call to the daughter's medical provider verified that she was seen on July 3rd with the symptoms of headache, neck and back pain without fever that had been present for approximately 2 weeks. Serum samples were taken and sent for IFA testing by the provider, but the daughter was presumptively diagnosed with Q fever and was treated with doxycycline (100 mg twice a day for 15 days). Convalescent titers were requested by NKIDHD for IFA testing and drawn at the private provider's office for both the patient and daughter on July 13th.

Lab Results

Serum blood test results from the index case were as follows: Phase I (for an explanation of the phases, see Discussion section below) Immunoglobulin G (IgG) 1:16, Phase I Immunoglobulin M (IgM) 1:256, and Immunoglobulin A (IgA) < 1:16, Phase II IgG 1:256 and IgM ≥ 1:1024 and IgA < 1:16. These results led to a presumptive diagnosis of acute Q fever. A convalescent titer on serum collected 3 weeks later confirmed the disease. Convalescent blood titers indicated a Phase II IgG 1:512 and an IgM of 1:512. Tests conducted to rule out other pathogens were all returned with negative results. Initial blood titers for the daughter of the index case were negative for Q fever. Convalescent blood titers showed inconclusive results for the daughter.

Discussion

Q fever is a zoonotic disease caused by *Coxiella burnetii,* a ricksettsial species of bacteria that is found globally. Q fever is a reportable disease in 24 states, including Kentucky. Since Q fever is not reported in some other states and countries, scientists cannot reliably assess worldwide incidence. Kentucky has approximately 10 cases of Q fever reported per year. Most are unconfirmed because the necessary acute and convalescent blood titers are not performed. In the U.S., Q fever outbreaks have often arisen from occupational exposures among veterinarians, meat processing plant workers, sheep and dairy workers, livestock farmers, and researchers at facilities housing sheep. While cattle, sheep, and goats are the primary reservoirs of *C. burnetii*, infection has been noted in a wide variety of other animals. Though abortion in goats and sheep has been linked to *C. burnetii infection, C. burnetii* does not appear to cause clinical disease in most animals.

Milk, urine, and feces of infected animals can transmit *C. burnetii*. During birthing, infectious organisms are shed in high numbers within amniotic fluids and the placenta. These organisms are resistant to heat, drying, and many common disinfectants, enabling the bacteria to survive for long periods in the environment. Human infection often occurs by inhalation of airborne barnyard dust contaminated by dried placental material, birth fluids, and excreta of infected herd animals. A small number of organisms may cause infection. Other modes of transmission to humans, including tick bites and human-to-human transmission, are rare. Although most patients become ill within 2-3 weeks after exposure, greater numbers of organisms can result in shorter incubation periods. Previous exposure provides lifetime immunity.

The clinical signs and symptoms of Q fever may include sudden onset with chills, retrobulbar headache, weakness, malaise, and severe sweats. There is a considerable variability in severity and duration; infections may be inapparent or may present as a nonspecific fever of unknown origin. Pneumonitis or pneumonia may be found on radiographic examination and abnormal liver function

(Continued on Page 3)

tests are common. Chronic Q fever manifests primarily as endocarditis and antecedent valvular disease predisposes a patient to this condition. A post Q fever fatigue syndrome has been described. Case confirmation is made through serololgy, isolation of the organism by culture (hazardous to laboratory workers), or demonstration of *C. burnetii* in a clinical specimen by detection of antigen or nucleic acid.

To serologically confirm Q fever, acute and convalescent blood titers are required to detect the presence of antibodies to *C. burnetii* antigens. The IFA is the most dependable and widely used method of confirmation. *C. burnetii* may also be identified in infected tissues by using immuno-histochemical staining and DNA detection methods. *C. burnetii* exists in two antigenic phases: Phase I and Phase II. This antigenic difference is important in diagnosis. In acute cases of Q fever, the antibody level to Phase II is usually higher than that to Phase I, often by several orders of magnitude, and generally is detected during the second week of illness. In chronic Q fever, the reverse is true. Antibodies to Phase I antigens generally require longer to appear, indicative of continued exposure to the bacteria. Thus, higher levels of antibody to Phase I in later specimens in combination with constant or falling levels of Phase II antibodies suggest chronic Q fever. Antibodies to Phase I and II antigens can persist for months and years after initial infection. Greater accuracy in the diagnosis of Q fever can be achieved by looking at specific levels of antibody classes other than IgG (specifically IgA and IgM). Combined detection of IgA and IgM, in addition to IgG, improves the specificity of the assays and provides better accuracy in diagnosis. IgM levels are helpful in determining a recent infection. In acute Q fever, patients will have IgG antibodies to Phase II and IgM antibodies to Phase I and II. Increased IgG and IgA antibodies to Phase I are often indicative of Q fever endocarditis. In this case, the patient met the case definition for Q fever - compatible clinical signs and serologic evidence of infection.

Laboratory confirmation of *C. burnetii* in the small goat was never performed because the kid was euthanized upon recommendation of a local veterinarian, before the Regional Epidemiologist and TRDHD personnel could intervene.

Because the etiology is often elusive, the key to disease investigations is the interview process, the inclusion in the process of any individual who might have information about the patient and their possible exposures, and appropriate laboratory testing. In this case, the investigation hinged on the interview of a sister-in-law of the case by the Senior Health Environmentalist of TRDHD. During this interview, the sister-in-law mentioned her brother-in-law's purchase of a baby goat in late May. The environmentalist astutely picked up on this key detail, providing a potential link to exposure.

Prevention and control efforts should be directed primarily toward those groups and environments where exposures usually occur. Intensive educational efforts and provision of literature should also target breeders who sell their livestock privately, in order to increase awareness, encourage prevention, and disseminate information and literature to their customers.

The following measures may be useful in the prevention and control of Q fever:

- Educating livestock breeders and encouraging education of their customers (the public) on sources of infection, prevention measures, and symptomatology.
- Educating livestock breeders on appropriate disposal of placentas, birth fluids, fetal membranes, and aborted fetuses at facilities housing sheep and goats.
- Restricting access to barns and laboratories used in housing potentially infected animals.
- Using only pasteurized milk and milk products.
- Vaccinating (where possible) individuals engaged in research with pregnant sheep or live *C. burnetii*.
- Quarantining imported animals.
- Ensuring that holding facilities for sheep and goats are located away from populated areas. Animals should be routinely tested for antibodies to *C.*

(Continued on Page 10)

DPH's Division of Prevention and Quality Improvement

New division to assist public health with planning, improvement, accreditation

Regina R. Washington, DrPH, Director,
Division of Prevention and Quality Improvement

In the fall of 2006, the Kentucky Department for Public Health (DPH) established and organized a new division, the Division of Prevention and Quality Improvement. The mission of this new division is to efficiently and effectively deliver programs and services, including chronic disease management, clinical and community education, promotion of quality improvement, employee health, health access, and staff education In addition, the branch develops and analyzes health risk behavior data to promote more healthier behaviors by Kentuckians.

The Division is comprised of four branches that serve as an umbrella to other activities across DPH. These branches include: Chronic Disease Prevention; Health Care Access; Education and Workforce Development; and Public Health Improvement. Primarily, the branches were strategically reorganized from other divisions within DPH in order to form the new division. The Public Health Improvement Branch is the combination of the former Public Health Nursing Section (Administration and Financial Management Division) and Adult and Child Health Improvement Division's Quality Assurance Team as well as the Occupational Nursing Section.

The Division's activities cover the spectrum of population-based and personal preventive health services. Listed below are descriptions of the programs housed within the new division:

- The Kentucky Diabetes Prevention and Control Program, located within the Chronic Disease Prevention Branch, aims to reduce the incidence rate for diabetes and to reduce the complications of those with this chronic disease. Six "Diabetes Centers of Excellence" were added in fiscal year 2007 to assist individuals diagnosed with diabetes to better manage their disease. Colorectal cancer is another area of emphasis for the Chronic Disease Prevention Branch. Kentucky's high burden for colorectal cancer can be impacted by increased screenings and the public's access to information.

- The Health Care Access Branch provides focus on primary care and the administration of federal grants and programs relative to primary care. Through these programs, approximately 150 additional physicians are serving Kentucky's medically-underserved population. The branch is also responsible for determining areas of Kentucky that meet health professional shortage area criteria and medically underserved area criteria.

- The Education and Workforce Development Branch coordinates all training programs, workshops, courses, and seminar conferences. The branch has observed a significant increase in the number of staff participating in on-line module learning and satellite programming as a result of leveraging technology and managing DPH's learning management system, TRAIN (TrainingFinder Real-time Affiliate Integrated Network).

- The Public Health Improvement Branch is responsible for the publication and maintenance of the Public Health Practice Reference (PHRP) and portions of the Administrative Reference. These documents are critical in assisting health departments to provide clinical and health education/promotion activities. The branch also provides technical and on-site consultation to health departments and DPH program management staff.

The Division of Prevention and Quality Improvement will work with other divisions within DPH, local health departments, and other public health system participants in the areas of continuous quality/performance improvement, strategic planning, and accreditation. Although a national accreditation instrument has yet to be formally approved, public health's leading associations have indicated accreditation is important to more fully developing and maintaining our public health system.

For further information, contact Dr. Regina R. Washington at (502) 564-3527, Ext. 3561 or email at Regina.Washington@ky.gov.

Dental Workforce Study Reinforces the Burden of Oral Disease on Kentucky

Study reveals uneven distribution and composition of dentists in Kentucky

Xiaowu Lu, PhD, Kentucky Oral Health Program
Julie McKee, DMD,
Kentucky Oral Health Program

Kentucky's Oral Health Program (KOHP) has many responsibilities, one of them being within the traditional public health role of surveillance, data collection, and analysis. KOHP underwrote a survey (*Kentucky Dental Provider Workforce Analysis: 1998*-2006) performed by the University of Louisville's School of Dentistry through the work of Melanie R. Peterson, D.M.D., M.B.A., John Williams, D.M.D., M.B.A., and Charles Mundt, M.A. This study reported on the dental manpower evaluation, as well as built a historical model of the state's dental workforce over the past decade. This analysis also included information such as the past training history, primary practice location, use of dental hygienists (scope of duties), retirement plans, mid-level dental staff utilization, and practice details (such as number of Medicaid patients served). It underscores the uneven distribution of dentists and shortage areas of dental workforce in Kentucky. This article illustrates the burden of oral disease and how it parallels the geographic and economic distribution of the state's dental workforce.

Oral Health Disparities

In recent years, Kentucky and West Virginia have taken turns in leading the nation in complete toothlessness (edentulism) based on the past few Behavioral Risk Factor Surveillance System (BRFSS) publications. The higher percentages of edentulism are found in our Appalachian region of the state (1).

Almost half of our 2 to 4 year-olds in the state have cavities (resulting from decay, or caries), and almost half of them need immediate dental care, but are not able to obtain it. At any point in time, there are about 4,500 3-year-olds with self-reported toothaches in Kentucky (2).

The Surgeon General's 2000 report entitled *Oral Health in America* states that the availability of dental practitioners that are willing to provide services is among the important determinants of oral health (3).

It is interesting to note that the study illustrates the need for dental professionals in Kentucky's rural areas, yet only five entire counties (Jackson, McCreary, Menifee, Todd, and Wolfe) are designated by the federal government as "Dental Health Professional Shortage Areas", and 18 other counties are designated as partial shortage areas. Additionally, there is a growing concern in Kentucky about having an inadequate future supply of dentists, especially in those rural areas and for disparate populations (4).

Geographic Misdistribution

Although there are 3,027 licensed dentists in Kentucky, only 2,350 are practicing in the state, which had a total population of 4,206,074 in 2006. The statewide rate of practicing dentists (5.6/10,000) who list their business address as Kentucky remains below the national average of 6.0 practicing dentists per 10,000 population (4).

According to the workforce analysis, there is an uneven distribution of dentists to population in the state. Dentists are more heavily concentrated in the metropolitan areas. There are about seven practicing dentists per 10,000 population in Kentucky's metropolitan areas, which is almost twice as many as the 3.8 practicing dentists per 10,000 in the more rural areas of Kentucky (4).

The uneven distribution can be further delineated through the geographic distribution of the number of practicing dentists per 10,000 in the five stratified survey districts of Appalachia (3.8), western Kentucky (4.1), northern Kentucky (4.6), central Kentucky (7.6), and Louisville Area (8.3) (Figure 1, page 6). The Appalachian mountain range, the agricultural western Kentucky area, and the northern Kentucky area are mostly rural and significantly lower in the number of practicing dentists per 10,000 population in 2006 (4).

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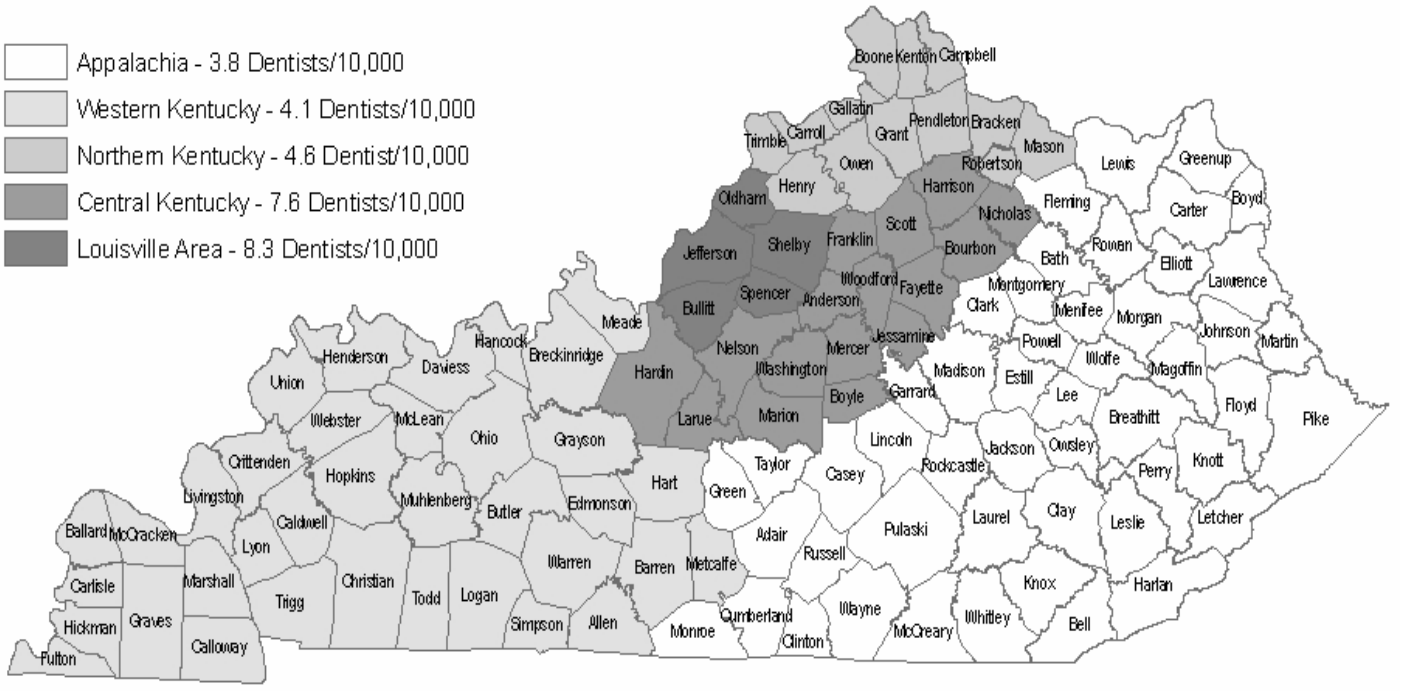
Not incidentally, this is where the greater burden of oral disease is prevalent among all age groups and access to dental care is a problem (2).

Figure 1. Kentucky Practicing Dentists by Stratified Survey Districts 2006



Dental Health Professional Shortage Areas (DHPSAs) are federally designated by Health Resources and Services Administration (HRSA) as areas having shortages of dental providers and may be *geographic* (a county or service area), *demographic* (low income population), or *institutional* (comprehensive health center, federally qualified health center, or other public facility such as a correctional facility). A total of 23 counties in Kentucky were identified as DHPSAs by HRSA, listed as either "partial" or "entire." The Appalachian District has by far the most DHPSAs (4) and not coincidentally, the most burden of oral disease relative to the edentulism (5) and children's caries rate in the area (2). Federally-designated Health Professional Shortage Areas become important criteria for qualifying for over 34 federal programs and funding. This designation may also be used as supporting documentation when communities recruit for needed health care providers.

Characteristics of Kentucky Dental Workforce

In 2006, Kentucky's Dental Workforce Study identified that approximately 1 in 4 Kentucky dentists was female and that female dentists are on the average 9 years younger than their male counterparts. Furthermore, the female dentist is more likely to practice in the metropolitan areas of Louisville and central Kentucky. The weighted average age for all practicing dentists in Kentucky was 49.7 years and an overwhelming number of Kentucky's practicing dentists are Caucasian (97%). The majority of dentists identify themselves as primary general practitioners. This mirrors the national composition of percentages of general dentists versus specialists. Kentucky's general dentists make up 84% of all of the state's dentists and 16% are specialists. At the national level, the percentage of general dentists is 80%, with 20% being specialists.

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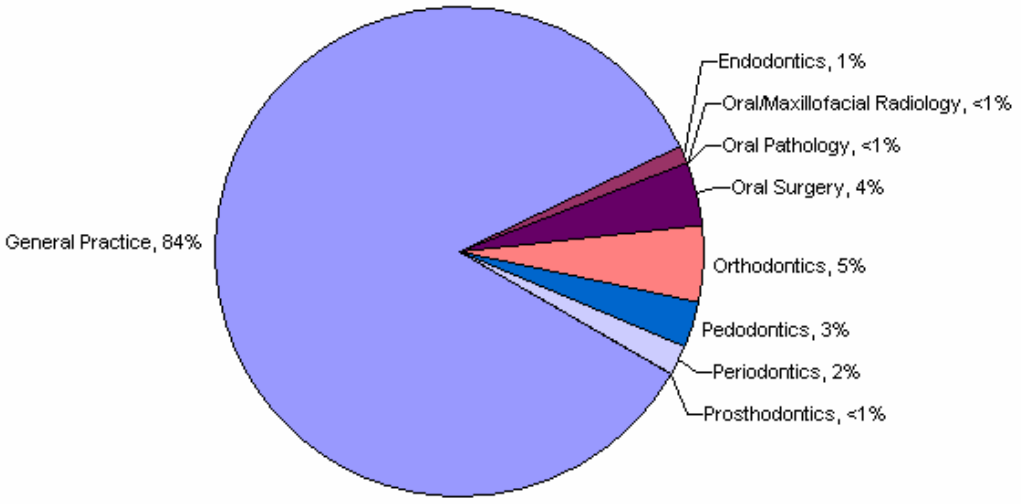
Figure 2. Characteristics and Training for Kentucky's Practicing Dentists, 2006



Medicaid Services by Dentists

Kentucky has more than half a million people, or about 15% of the population, eligible for Medicaid or Kentucky Children's Health Insurance Program (KCHIP) coverage for dental services. While Kentucky's practicing dentists reported that they are accepting new patients (96%), less than half report that they are serving Kentucky's Medicaid or KCHIP patients (45%) or are accepting any new Medicaid or KCHIP patients (39%). Only about 36% of the practicing dentists submitted Medicaid claims in 2006, according to the Kentucky Department for Medicaid Services. Most importantly, more than half (52%) of the Medicaid eligible patients are found in the Appalachia district, the state's most rural area and the one having the highest number of federally designated DHPSAs in Kentucky. This region also has less than half the density of dentists that metropolitan areas have.

Concerns for the Future

The overall graduate retention rate (i.e., those choosing to practice in Kentucky) from the University of Louisville and the University of Kentucky dental schools has been less than 50% since 2002. The report points out that Kentucky is exporting over 50% of its combined dental graduates to other states, which translates to only about 50 graduating dentists choosing to practice in Kentucky each year.

Furthermore, over 40% of the practicing dentists plan to retire within 10 years, with a higher expected retirement rate of 50% in the central Kentucky region. It is estimated there will be approximately 2,064 dentists, or a loss of 286 dentists, which translates into a 32% decrease in our state's dental workforce by 2016.

(Continued on Page 8)

Assuming 1) the current number of practicing dentists, 2) the attrition rate indicated by the workforce survey, 3) the average age of the Kentucky dentists, 4) the influx of 121 out-of-state dental school graduates each year, 5) the additions and retirements within the workforce, and 6) the 50 graduates from our in-state dental schools per year, the question will be whether the existing uneven distribution of the workforce will be exacerbated such that the metro areas continue to populate with dentists while rural areas continue to lose them (4).

The KOHP has many ongoing activities that address the multiple issues of oral health in the state, including those of the dental workforce. Community fluoridation and supplementation, varnish and sealant programs, and outreach services through the teaching universities and colleges are among the areas addressed and supported by the KOHP. The program's partners are numerous and include the Department for Medicaid Services, the local health departments, the medical and dental schools, the federal government, medical and dental societies, and coalitions.

In order to address the state's oral health issues, the KOHP works continuously to implement the "Statewide Oral Health Strategic Plan" that was finalized in 2006. Throughout the document are goals that address many areas of strategic initiatives relative to improving oral health, including advocacy, economic development, partnerships, collaboration, and workforce (6).

A well-distributed workforce is only one of many issues facing Kentucky relative to the state's oral health status. However, working with this report's findings along with the other state-wide programs that address oral health, Kentucky can move toward better health as a result of improved oral health through community programs, advocacy, and access to care.

For additional information, please contact the State Dental Director Dr. Julie McKee, Kentucky Oral Health Program at (502) 564-3246 Ext. 3774.

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Recently Moved?

Please send address changes to *KY Epi Notes* Editor at BarbaraJ.Fox@ky.gov or call (502) 564-6786, Ext. 4411.

Cases of Selected Reportable Diseases in Kentucky (YTD Through MMWR Week 44) Preliminary Totals*

DISEASE Jan 1-June 30	2007*	2006
AIDS**	172	114
Chlamydia	6582	6575
Gonorrhea	2596	2377
Syphilis (*Prim. & Sec.*)	49	58
Group A Streptococcus	35	34
Meningococcal Infections (Neisseria)	9	8
Haemophilus influenzae, invasive	2	4
Hepatitis A	19	31
Hepatitis B - acute	60	60
Hepatitis C - acute	23	30
E. coli Shigatoxin Positive (STEC)	101	81
Salmonella	488	368
Shigella	397	201
Tuberculosis	84	62
Animal Rabies	18	27
Legionella	43	29

VACCINE PREVENTABLE	2007	2006 YTD
Diphtheria	0	0
Influenza Isolates	732	499
Measles	0	0
Mumps	0	1
Pertussis	7	53
Polio	0	0
Rubella	0	0
Streptococcus Pneumoniae invasive	21	33
Tetanus	0	0

VECTOR-BORNE	2007 YTD	2006 YTD
Rocky Mtn. Spotted Fever	5	4
Lyme Disease	7	7
Ehrlichiosis	4	4
Tularemia	0	0
Arboviral Encephalitis	3	5
Malaria	7	3

NOTE: These should be considered preliminary totals.

***Lower numbers for 2007 may reflect a delay in reporting.**

****Does not include those who are only HIV positive.**

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William D. Hacker, MD, FAAP, CPE
Commissioner, Department for Public Health

Kraig E. Humbaugh, MD, MPH
State Epidemiologist and Director,
Division of Epidemiology and Health Planning

Barbara J. Fox, MS
Editor

(continued from page 3)

burnetii, and measures should be implemented to prevent airflow to other occupied areas.

- Counseling persons at highest risk for developing chronic Q fever, especially persons with pre-existing cardiac valvular disease or individuals with vascular grafts.

Though investigators were concerned about others who could have potential exposure to *C. burnetii* based on the number of farms in the area and baby goats observed in pastures, no additional cases were discovered. TRDHD provided the public with information about Q fever in an article provided to local newspapers and in a health department newsletter. Although this case was not bioterrorism-related, Q fever is a highly infectious Category B bioterrorism agent that is rather resistant to heat and drying. It can become airborne and inhaled by humans and a single organism may cause disease in a susceptible person. The agent can be developed for use in biological warfare and is considered a potential terrorist threat.

Conclusions

Though a diagnosis of Q fever was not confirmed by culture in this case, the signs, laboratory results, and epidemiologic evidence (recent exposure to a baby goat) are indicative of an acute human infection with *C. burnetii*. The evidence is less clear in the case of the daughter. No other potential exposures or cases were identified.

References

References are available and will be furnished upon request.