Pertussis Trends in Florida
Maria M. Giraldo Hernandez, MPH Candidate
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Epidemiology Department, USF College of Public Health

Background

Pertussis, also known as whooping cough, is a highly contagious bacterial disease caused by Bordetella pertussis and in its most severe manifestation it causes uncontrollable and violent coughing. When complications occur they may lead to pneumonia, seizures, broken ribs, encephalopathy, cerebral hypoxia, sub-conjunctival hemorrhage, and rectal prolapse (Wendelboe, et al., 2007). The reservoir for pertussis is humans, and the causal pathogen can be found in the respiratory tract. Pertussis is primarily transmitted through aerosol droplets from an infected host to a susceptible one (Brooks & Clover, 2006). The majority of cases are observed among infants under 6 months old who have not received the appropriate doses of the pertussis vaccine (DTaP). The source of infection are normally adults, primarily the mother, father, and siblings (de Greiff, et al., 2012). Seminole County has observed that reported cases of pertussis in infants tend to occur in Latino families, specifically among Mexican immigrants, who cohabitate with a large number of adults and children, so the infants are getting infected not necessarily by the parents, but by their extended family (aunts, uncles, and cousins). In 2012 the Centers for Disease Control reported a national incidence rate of 13.4 per 100,000. In Florida, the incidence rate of pertussis from 2002-2012 was 15.6 per 100,000 (Centers for Disease Control & Prevention, 2013).

Research Question

Are counties with a high density of Hispanics more likely to experience higher incidence rates of pertussis compared to counties with low Hispanic population density?

Do counties with high proportion of Mexican immigrants display a higher incidence of pertussis cases?

Female-headed households are more likely to be poorer than families headed by couples, and to cope with economic hardships, some of these women opt to live with non-nuclear family members (Tiendras & Angel, 1982) who are often the source of pertussis infections in infants.

Is female headship associated with pertussis?

Methods

• 2010 U.S. Census Tracts – Demographic Info
• 2002-2012 FL Department of Health – Pertussis
• 2012 FGDL – Migrant Camp Location

• Turn numbers into proportions – 2,934 observations in 65 counties
• Calculate incidence rates

• ArcGIS 10.1 – manipulate & analyze information
• Link data to create maps.

Results

• Figure 1: Prevalence of Pertussis in Florida by County & Proportion of Hispanics

Figure 1: shows the density of Hispanics per county compared to the incidence rates of pertussis by county. Note that for the purposes of this project a high incidence rate is considered anything greater than the national average of 13.1 cases of pertussis per 100,000 population. This map is not evidence of a correlation between pertussis and areas with a high density of Hispanics.

• Figure 2: Location of Migrant Camps and Incidence of Pertussis by County

Figure 2: represents the distribution of migrant camps in Florida and their relationship to pertussis incidence rates. It is clear migrant camps are more likely to be located in counties with an incidence rate of pertussis of 35 per 100,000 or higher. There is a cluster of migrant camps in Central Florida that touches the counties of Hillsborough, Polk, Highlands, and Osceola where the incidence rates are 27.3, 29.6, 15.18, and 35.0 per 100,000 respectively.

• Figure 3: Incidence of Pertussis by Zip Code in Hillsborough County in Relation to Migrant Camps

Figure 3: presents a closer look at Hillsborough County, showing the distribution of migrant camps and the incidence rates of pertussis by zip code. Once the incidence rate is broken down by zip code, it becomes higher. There is clearly a high incidence of pertussis East of Hillsborough County, where there is also a cluster of migrant camps. Geographically, these seem to be associated.

• Figure 4: Proportion of Hispanics in Florida by County in Relation to Pertussis Incidence and Migrant Camps

Figure 4: shows the proportion of Mexican populations in the state by county compared to pertussis incidence rates and the distribution of migrant camps. The location of migrant camps seem to be associated with high proportions of Mexican populations, but there are counties with high incidence rates of pertussis not explained by ethnicity or nationality, such as those located in the Florida panhandle.

Discussion

This sample of pertussis cases does not confirm or disprove an association between ethnicity and pertussis infections. The geographical analysis does not indicate a direct association between pertussis and being Hispanic or Mexican at the state level, but perhaps if this is looked at by county and zip code, the association becomes more linear, as seen in the example on Figure 2. This study had several limitations. Pertussis cases could only be traced back to a zip code, not an address, which made it impractical to perform a buffer analysis. There was no vaccination coverage data available, so this variable could not be controlled. Race and ethnicity data is self-reported, making it susceptible to information bias. The narrower the area of study becomes (from state to county to zip code) the more difficult it is to find a significant association as statistical power is lost. This study also had some strengths such as the availability of pertussis data in the last 10 years and the recentness of the U.S. Census data provide an accurate picture of state demographics. The future of this project involves having the pertussis data analyzed using a linear model in which additional confounders can be controlled and possible effect modifiers can be identified.

References


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