The Current Burden of Chlamydia and Gonorrhea Infections in the Three Rivers Health District

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The Current Burden of Chlamydia and Gonorrhea Infections in the Three Rivers Health District

Donna Jordan, B.S.

Capstone/Service Learning Experience

Fall 2017
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Abstract:

**Background:** The proportion of Chlamydia and Gonorrhea in Douglas County, Nebraska is significantly higher than Nebraska and the U.S. Consequently, the Douglas County Health Department has initiated numerous programs to combat STIs. However, the prevalence of Chlamydia and Gonorrhea has sharply increased in recent years. Adjacent to Douglas County is the Three Rivers Health District, including Dodge, Saunders, and Washington Counties. Few studies have assessed the burden of Chlamydia and Gonorrhea in the Three Rivers Health District.

**Objectives:** The objectives of the study were to 1) Compare Chlamydia and Gonorrhea by age, gender, and ethnicity for Dodge, Saunders, and Washington Counties. 2) Compare the prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District to Douglas County, Nebraska, and the U.S. 3) Determine if the prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District significantly changed between 2012 and 2016.

**Methods:** A cross-sectional study was performed with data collected between 2012 and 2016 from the Three Rivers Health District (N=1102). Cases of Chlamydia and Gonorrhea were descriptively compared by age, gender, and ethnicity for each county. The prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District was compared to Douglas County, Nebraska, and U.S. with the Chi-Square test. The Cochran Armitage Test determined if the prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District changed significantly between 2012 and 2016.

**Results:** Most chlamydia cases were in the 15-24-year-old age group in Dodge (75%: 379/508), Saunders (70%: 88/127), and Washington Counties (69%: 65/94). Females were more likely to have Chlamydia in Dodge (79%: 399/508), Saunders (81%: 103/127), and Washington County (67%: 63/94).

Gonorrhea followed a different distribution pattern. Most cases in Dodge County were in the 20-24 (31%: 9/29:) and 30+-year (52%: 15/29) age groups; Likewise in Saunders County with 46% (5/11)
of Gonorrhea cases reported in 20-24-year-olds and 27% (3/11) in the 30+- year-olds. In Washington County, Gonorrhea was equally distributed by age. In Dodge County, females (48%: 14/29) and males (52%: 15/29) were equally likely to have Gonorrhea. Most Gonorrhea cases in Saunders County were female (83%: 8/11), and male in Washington County (67%: 6/9). Ethnicity, largely unreported, was not a valid determinant.

The odds of having Chlamydia in the Three Rivers Health District were significantly lower than Douglas County, Nebraska, or the U.S., respectively (OR=0.38, 95% CI: 0.33-0.44), (OR=0.58, 95% CI: 0.49-0.67) and (OR=0.51, 95% CI: 0.44-0.59). The odds of having Gonorrhea in the Three Rivers Health District was also significantly lower than Douglas County, Nebraska, and the U.S., respectively (OR=0.09, 95% CI: 0.33-0.44), (OR=0.58, 95% CI: 0.49-0.67), and (OR=0.14, 95% CI: 0.09-0.24).

The prevalence of Chlamydia in the Three Rivers Health District increased slightly from 182.6 cases per 100,000 to 201.5 cases from 2012 to 2016, a 10% increase (p=0.4). In comparison, the cases of Gonorrhea significantly increased during the same period from 10.3 cases per 100,000 to 16.6 cases, representing a 61% increase (p=0.0004).

**Impact of the Project:**

The study will assess the burden of Chlamydia and Gonorrhea infections in the Three Rivers Health District. If additional programs are warranted, the study will guide the expenditure of limited resources and personnel.

**Placement Site**

I conducted my service learning (150 hours) at the Three Rivers Public Department, in Fremont Nebraska. The Three Rivers Health Department empowers residents of Dodge, Saunders, and Washington Counties in Eastern Nebraska while promoting healthy living for the improvement of the
community. The services provided by the Health Department encompass a wide range of activities and include disease surveillance, emergency response, and health education. Special initiatives include attention to Colon Cancer, which is the leading cause of death in the tri-county area, and the VetSet Program, a pilot program focusing on the well-being of veterans. To promote health, especially among the disadvantaged Title X population, the Three Rivers Public Health Department has partnered with the Good Neighbor Community Health Center to offer clinical services to over 1,500 clients. The services provided by the joint venture include reproductive health, annual exams, birth control, and STI testing, as well as immunizations and tuberculin testing (Clinic Services, 2016). Other health education initiatives facilitated by the Three Rivers Health Department include a walking program in which participants earn a fitness tracker by attending every week, and bicycle safety fairs in which children receive new helmets.

Introduction

With Chlamydia and Gonorrhea reaching epidemic proportions, Douglas County, Nebraska is a previously reported “hot spot” for STIs (Islam, et al., 2013). The prevalence of Chlamydia and Gonorrhea in Douglas County is significantly higher than the State of Nebraska and the U.S. median. In 2015, the most recent year with comparable data, Douglas County Health Department (DCHD) reported 637.6 cases per 100,000 of Chlamydia compared to 422.9 cases per 100,000 for Nebraska and 478.8 cases per 100,000 for the U.S. (Figure 1). Gonorrhea is also more prevalent in Douglas County, with 196.5 cases per 100,000, compared to 90.5 cases per 100,000 for the state of Nebraska and 123.9 cases per 100,000 nationally in the U.S. (Figure 2).

Despite the expenditure of considerable resources and initiatives, the prevalence of Chlamydia and Gonorrhea in Douglas County has sharply increased in recent years. Between 2011 and 2015, the prevalence of Chlamydia increased by 7.4%, from 593.7 to 637.6 cases per 100,000 population (Figure
During the same period, except for 2012 and 2013, the number of cases of Gonorrhea in Douglas County has also steadily increased by 52%, from 168.6 to 255.6 per 100,000 population, (Figure 2) (STD Douglas County).

**Figure 1.** Comparison of incidence rates of Chlamydia infections in Douglas County, State of Nebraska and U.S., 2002-2016

**Figure 2.** Comparison of incidence rates of Gonorrhea Infections in Douglas County, State of Nebraska and U.S., 2002-2016
The increased prevalence of Chlamydia and Gonorrhea in Douglas County mirrors the increase of cases experienced at the national level. Between 2011 and 2015, the prevalence of Chlamydia increased overall in the U.S. by 5%, from 453.4 cases to 475.0 cases per 100,000 and Gonorrhea increased by 20%, from 103.3 to 123.9 cases per 100,000 (2015 Sexually Transmitted Diseases Surveillance, 2016).

Factors contributing to increased prevalence of Chlamydia and Gonorrhea:

The factors contributing to the increased prevalence of Chlamydia and Gonorrhea in Douglas County and nationwide are myriad. Increasingly unsafe sexual practices, growing resistance of Gonorrhea to antibiotics, changes in screening, testing, and reporting methods have contributed to an increase in the number of reported cases (Brittain, Childs, Duley, & al, 2016: 2015 Sexually Transmitted Diseases Surveillance, 2016). To combat the epidemic, DCHD has mounted a campaign to increase screening of at-risk-individuals. Initiatives include marketing to raise awareness and increased accessibility of screening sites through an outreach program at Metro Community College Campuses and area libraries (STD Outreach, 2017). Successfully, STI clinic visits have surged from 2,678 visits in 2011 to 5,188 in 2016, a 94% increase (STDs in Douglas County, 2017). Increased testing has led to the identification of a higher number of positive cases. Diagnostic testing has improved considerably in recent years with the implementation of Nucleic Acid Amplification Testing (NAAT). NAAT, which can detect a single copy of DNA or RNA in urine, is more sensitive than the swab and culture method that was previously employed. Moreover, NAAT may be used to test extra-genital sites that would have been missed in the past (Robert, Newhall, Papp, & et al., 2002: National Profiles, 2016). However, anecdotal evidence suggests that extra-genital sites are not routinely tested. In recent years, reporting methods have improved as well, with the advent of Electronic Reporting. By removing the human element, fewer results are misdirected (National Profiles, 2016). Beyond the changes in screening,
testing, and reporting practices, Chlamydia and Gonorrhea are becoming more prevalent (National Profiles, 2016).

*Traffic patterns between Dodge, Saunders, Washington Counties and Douglas County:*

Adjacent to, and forming the Northern and Western borders of Douglas County, Dodge, Saunders, and Washington Counties function as bedroom communities for the Omaha Metropolitan area, with a significant number of residents commuting to Douglas County daily for work, shopping, and recreation (Figure 3).

![Map of Dodge, Douglas, Saunders, and Washington Counties, 2017](image)

**Figure 3**- Map of Dodge, Douglas, Saunders, and Washington Counties, 2017

While difficult to accurately assess the number of commuters, traffic counts demonstrate the large number of residents traveling from Dodge, Saunders, and Washington Counties into Douglas County each day along I-680, Blair High Road, U.S. Hwy 6, and U.S. Highway 275 (**Table 1**). With increased traffic between the Three Rivers Health District and Douglas County, the transmission of Chlamydia and Gonorrhea may be more likely to occur.
### Table 1. 2014 Bi-Directional Traffic Counts at Select Locations

<table>
<thead>
<tr>
<th>Traffic Location</th>
<th>Vehicle Count - Both Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-680- From Fort St to Blair High Rd.</td>
<td>54,300</td>
</tr>
<tr>
<td>I-680 North East of Blair High Rd.</td>
<td>32,100</td>
</tr>
<tr>
<td>I-680 and Blair High Rd SB Ramps A-W</td>
<td>28,400</td>
</tr>
<tr>
<td>U.S 6 North of N-31 N Jct.</td>
<td>43,200</td>
</tr>
<tr>
<td>L28 East of US-275 Jct.</td>
<td>26,100</td>
</tr>
</tbody>
</table>

(Source: Traffic Report 2015 MAPA- Metropolitan Area Planning Agency)

Sexually transmitted diseases (STIs) are a significant source of morbidity in the United States, with the current overall total prevalence estimated as high as 110 million cases. Twenty million new cases of STIs are diagnosed each year (Fact Sheet-Reported STDs in the United States-2014 National Data for Chlamydia, Gonorrhea, and Syphilis, 2015). Significantly, $15.6 Billion is spent each year on direct health care to treat these STIs (Incidence, Prevalence, and Cost of Sexually Transmitted Infections In the United States, 2013). Chlamydia, the most frequently reported notifiable disease, is also the most commonly reported STI. In 2015, 1,526,658 cases, or 478.8 per 100,000 were reported, with the majority of cases occurring in 15-24-year olds. Gonorrhea, the second most frequently reported STI, also contributes heavily to the burden of disease, with 395,216 cases, or 123.9 cases per 100,000 diagnosed in 2015 (National Profiles, 2016). With symptoms typically occurring in only 10-15% of men and 5-30% of women with Chlamydia or Gonorrhea, the reported cases do not accurately convey the scope of the epidemic (Chlamydia Fact Sheet, 2016: Gonorrhea Gonococcal Infection (clap, drip), 2006). Symptoms for Chlamydia and Gonorrhea, when present, consist of burning upon urination, vaginal/penile discharge, or testicular pain and swelling in males. Rectal infections are characterized by pain, bleeding, discharge, and painful bowel movements (Chlamydia- Fact Sheet, 2016: Gonorrhea Fact Sheet, 2016).
Readily treatable with oral antibiotics, serious complications arise if Chlamydia and Gonorrhea are not diagnosed and treated. While men less frequently develop epididymitis or infertility, women are more likely to develop Pelvic Inflammatory Disease (PID). Specifically, 10-15% of women with Chlamydia will develop PID, and 20% of women with PID will become infertile, 9% will have an ectopic pregnancy, and 18% will experience excruciating chronic pelvic pain (STDs in Women and Children, 2012). Women infected with Gonorrhea experience the same sequelae, as well as fever and internal abscesses (Gonorrhea Fact Sheet, 2016). In both genders, but more often in women, untreated Gonorrhea may spread to the bloodstream and develop into septicemia (0.5%-3%). Septicemia, also known as Disseminated Gonococcal Infection (DGI), is characterized by skin lesions, arthritis, arthralgia, tenosynovitis, myocarditis, endocarditis, and meningitis (Ready-to-Use STD Curriculum for Clinical Educators, Gonorrhea Module, 2013). Chlamydia and Gonorrhea are also associated with numerous complications during pregnancy and after birth. Chlamydia may cause pre-term delivery, miscarriages, conjunctivitis or pneumonia in the newborn (Chlamydia- Fact Sheet, 2016). Gonorrhea may spread to the fetus during birth and cause blindness, joint infections, or life-threatening septicemia (Gonorrhea Fact Sheet, 2016). While many of the complications and sequelae resulting from Chlamydia and Gonorrhea infections are not common, owing in part to prenatal screenings, they warrant consideration given that more than 50% of all sexually active men and women will have an STI before age 25 (Statistics, 2017). Appendix A

With much of the attention focused on the STI epidemic in Douglas County, few studies have addressed the prevalence of Chlamydia and Gonorrhea in Dodge, Saunders, and Washington counties. Moreover, the available data is not current and does not include variables associated with Chlamydia, and Gonorrhea, such as age, ethnicity, and gender or address increasing prevalence.

Research Question and Objectives:
To address the knowledge gap “little is currently known about the prevalence of Chlamydia and Gonorrhea in Dodge, Saunders, and Washington Counties,” a cross-sectional study was conducted with data collected from NEDSS between 2012 and 2016 with the following objectives.


2. Compare the proportion of cases of Chlamydia and Gonorrhea in the Three Rivers Health District to Douglas County, the State of Nebraska, and U.S. data.

3. Compare the proportion of cases of Chlamydia and Gonorrhea within the Three Rivers Health District for the past five years (2012-2016) to determine if the prevalence is changing over time.

The impact of the research project:

This study will describe the prevalence of Chlamydia and Gonorrhea in Dodge, Washington, and Saunders Counties, the three counties served by the Three Rivers Health Department. As well as describing the overall prevalence and five-year trend, the research study will also garner information on age, ethnicity, and gender of individuals infected with Chlamydia and Gonorrhea. The information gained from the study will prove valuable to Three Rivers Health Department and will determine if additional funding and programs are needed to combat Chlamydia and Gonorrhea infections, and where to focus those resources. Three Rivers Health Department funding is derived from a combination of Federal Receipts, State Funds, Grants, and Fees for Service, and programs are carefully prioritized, based upon significance and impact of the program on the communities which they serve. The study may also serve as a basis for future research projects.

Research Methods

Study population and Sample size:
The study population comprised all males and females testing positive for Chlamydia and Gonorrhea and residing in Dodge, Saunders, and Washington Counties between 2012 and 2016. Zip codes, reported at the time of testing, determined the county of residence (Table 2). The data used for the cross-sectional study was de-identified before entry into the study to protect client confidentiality so self-reported zip codes were used to assign the county of residence. If the zip code was not given, the case was assigned to “County Not Specified.”

Table 2. United States Postal Service Zip Codes that are a part of Dodge, Saunders, and Washington Counties, Nebraska

<table>
<thead>
<tr>
<th>Dodge</th>
<th>Saunders</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>68025</td>
<td>68072</td>
<td>68002</td>
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<tr>
<td>68026</td>
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<td>68044</td>
<td>68649</td>
<td>68070</td>
</tr>
<tr>
<td>68057</td>
<td>68664</td>
<td>68068</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dodge</th>
<th>Saunders</th>
<th>Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>68003</td>
<td>68040</td>
<td>68002</td>
</tr>
<tr>
<td>68015</td>
<td>68041</td>
<td>68034</td>
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<td>68017</td>
<td>68042</td>
<td>68008</td>
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<tr>
<td>68018</td>
<td>68050</td>
<td>68070</td>
</tr>
<tr>
<td>68033</td>
<td>68065</td>
<td>68068</td>
</tr>
</tbody>
</table>

Data Source:

The data, sourced from the Nebraska Disease Surveillance System (NEDSS), included all positive STI samples collected between 2012 and 2016 from subjects living in the Three Rivers Health District. The variables of interest, self-reported during the intake process, included age, gender, ethnicity, address, and zip code.

Statistical Methods:

To provide an overview of STIs within the Three Rivers Health District, summary counts of Chlamydia, Gonorrhea, combined Chlamydia and Gonorrhea infections, Herpes Simplex and Syphilis were determined with University Version SAS 9.4 and reported for 2012 through 2016. Then, the summary counts of Chlamydia and Gonorrhea were compared by age group, gender, and ethnicity for Dodge, Saunders, Washington Counties, and County Not Specified. To compare the prevalence of Chlamydia and Gonorrhea in Three Rivers Health District to Douglas County, the State of Nebraska, and
the U.S., the Census Bureau’s 2015 intercensal population estimate was used to determine the prevalence ratio per 100,000 population, and Fisher’s Exact Test was used, with significance determined with \( p=0.05 \). Moreover, the odds ratio and 95% Confidence Interval for Chlamydia and Gonorrhea in the Three Rivers Health District, the State of Nebraska, and the U.S. were calculated with SAS 9.4 and compared. To determine if the prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District changed significantly between 2012 and 2016, prevalence was calculated for each year with the Census’s Bureau’s yearly population estimates, and the change in prevalence between 2012 and 2016 was tested with the Cochran Armitage test for trend.

**Results:**

Within the Three Rivers Health District, Chlamydia was most commonly observed (77%: 853/1101), followed by Herpes Simplex Virus (9%: 104/1101), Gonorrhea (6%: 61/1101), Syphilis (5%: 55/1101), and combined Gonorrhea and Chlamydia infections (3%: 28/1101) (**Figure 4**). Notably, almost as many cases of Syphilis as Gonorrhea were reported. Most often reported in MSM, the prevalence of Syphilis has increased each year since 2001-2002 and the STI has re-emerged as a growing concern (2015 Sexually Transmitted Diseases Surveillance, 2016).

![STIs in Three Rivers District, 2012-2016](image)

**Figure 4.** Comparing the number of STI infections in the Three Rivers Health District, 2012-2016
Chlamydia infections disproportionately burdened Dodge County. With 47% of the population (36,679) compared to 27% in Saunders (20,946) and 26% in Washington County (20,338), Dodge County accounted for 59% (508/859) of Chlamydia infections. Gonorrhea cases were equally distributed by population in Dodge (50%: 29/58), Saunders (19%: 11/58), and Washington Counties (15%:9/58).

Appendix B

Comparing Chlamydia and Gonorrhea by age, gender, and ethnicity for Dodge, Saunders, and Washington Counties:

The majority of Chlamydia cases were reported in the 15-24 year age group in Dodge (75%), Saunders (70%) Washington Counties (67%) and the County Not Specified (77%) (Figure 5). The comparability of results between counties was expected, given that the three counties are similar in age distribution, with the median age of residents in Douglas, Saunders, and Washington Counties respectively 39.4, 41.4, and 41.2 years of age (Intercensal Estimates, 2017).

![Chlamydia: Age by County, 2012-2016](image)

Figure 5. Summary Counts of Chlamydia by Age Category in Dodge, Saunders, and Washington Counties and County Not Specified, 2012-2016
In comparison to Chlamydia, Gonorrhea was most frequently reported in the 20 to 24 and 30+-age categories in Dodge and Saunders Counties and County Not Specified. Specifically, in Dodge County, 31% (9/29) of cases occurred in 20-24-year-olds and 52% (15/29) of the 30+-year olds. Saunders County and County Not Specified followed a similar pattern but with slightly more cases in the 20-to-24-year-old category. In Saunders County, 45% (5/11) of cases were 20-to-24 years of age, and 27 % (3/11) were 30+. In County Not Specified reported, 50% (5/9) were reported in the 20-to-24-year age category, and 33% in the 30+. Washington County differed in that cases of Gonorrhea were equally divided between the four age groups (Figure 6).

![Gonorrhea: Age by County, 2012-2016](image)

**Figure 6.** Summary Counts of Gonorrhea by age category in Dodge, Saunders, Washington Counties and County Not Specified, 2012-2016

As expected, females formed the majority of Chlamydia cases in Dodge (78%), and Saunders County (81%). While comprising the majority of cases, Chlamydia was slightly less often reported in females in Washington County (67%), and County Not Specified (61%) (Figure 7). The noted differences between Washington County and Dodge and Saunders Counties were somewhat unexpected, given that the number of males is equivalent to the number of females in the Dodge, Saunders, and Washington
Counties population, especially in the 15-24-year-old age category (Fact Finder). Females with Gonorrhea were the majority of cases only in Saunders County, 73%, and County Not Specified, 67%. In Dodge and Washington Counties, more men were diagnosed with Gonorrhea than women, respectively 52% and 67% (Figure 8).

**Figure 7.** Comparison of Summary Counts: Males and Females with Chlamydia in Dodge, Saunders, Washington Counties and County Not Specified, 2012-2016

**Figure 8.** Comparison of Summary Counts: Males and Females with Gonorrhea in Dodge, Saunders, Washington Counties and County Not Specified, 2012-2016
Compare the prevalence of Chlamydia and Gonorrhea in Three Rivers Health District to Douglas County, the State of Nebraska, and the U.S.:

In 2015, the most recent year in which comparable data was available, the prevalence of Chlamydia in the Three Rivers Health District (243.7 cases per 100,000 population) (190 reported cases/77,966 intercensal population estimate) was substantially lower than Douglas County (637.6), the State of Nebraska (422.9), or the U.S. (478.8) (P<0.001). Specifically, the odds of having Chlamydia in the Three Rivers Health District were significantly lower than Douglas County, Nebraska, or the U.S., respectively (OR=0.38, 95% CI: 0.33-0.44), (OR=0.58, 95% CI: 0.49-0.67) and (OR=0.51, 95% CI: 0.44-0.59).

The prevalence of Gonorrhea in the Three Rivers Health District was also considerably lower (17.9 cases per 100,000 population) (14 reported cases/77,966 population) than Douglas County (196.5), the State of Nebraska (90.5), or the U.S. (123.9)(p<0.001). Specifically, the odds of having Gonorrhea in the Three Rivers Health District was significantly lower than Douglas County, Nebraska, and the U.S., respectively (OR=0.09, 95% CI: 0.33-0.44), (OR=0.58, 95% CI: 0.49-0.67), and (OR=0.14, 95% CI: 0.09-0.24).

Appendix C

Compare the proportion of cases of Chlamydia and Gonorrhea within the Three Rivers Health District for the past five years (2012-2016) to determine if the prevalence is changing over time:

Compared to the U.S. which has experienced a pronounced upward trend during the study, the prevalence of Chlamydia in the Three Rivers Health District did not significantly change between 2012 and 2016 (p=0.4). During the first year of the study (2012-2013), the proportion of Chlamydia cases increased from 182.6 cases per 100,000 to 236.7 cases, a 30% increase. From 2013 to 2015, prevalence
remained steady and then decreased from 243.7 cases in 2015 to 201.5 cases, which represents a 17% decrease. Overall, the prevalence of Chlamydia cases in the Three Rivers Health District increased by 10% from 2012 to 2016 (Figure 9).

![Prevalence of Chlamydia by year](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Rivers</td>
<td>182.6</td>
<td>236.7</td>
<td>237.4</td>
<td>243.7</td>
<td>201.5</td>
</tr>
<tr>
<td>Douglas County</td>
<td>617.6</td>
<td>596.5</td>
<td>624</td>
<td>637.6</td>
<td>668.1</td>
</tr>
<tr>
<td>Nebraska</td>
<td>363.7</td>
<td>390.7</td>
<td>401</td>
<td>422.9</td>
<td>N/A</td>
</tr>
<tr>
<td>U.S.</td>
<td>453.3</td>
<td>443.5</td>
<td>456.1</td>
<td>478.8</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Figure 9. Comparison of prevalence of Chlamydia in Three Rivers Health District, Douglas County, the State of Nebraska, and the U.S., 2012-2016*

During the same time, amid substantial fluctuations, the Three Rivers Health District experienced an upward surge of Gonorrhea. The prevalence of Gonorrhea significantly increased from 10.3 cases per 100,000 to 16.6 cases, representing a 61% increase ($p=0.0004$) (Figure 10).
Figure 10. Comparison of prevalence of Gonorrhea in Three Rivers Health District, Douglas County, the State of Nebraska, and the U.S., 2012-2016

Discussion:

As expected, Chlamydia accounted for the majority of STIs in the Three Rivers Health District. Reported most frequently in females 15 to 24 years of age, little difference in demographics was noted between Dodge, Saunders, and Washington Counties, and County Not Specified. In comparison, the demographics associated with Gonorrhea varied considerably by county and did not follow the normal pattern of increased prevalence in males 20 to 29 years old and less frequently in females between 15 to 24 years of age. Instead, Females formed the majority of Gonorrhea cases in Saunders County and County Not Specified, and prevalence was highest in two age categories, 20-to-24-year-olds, and 30+. The reported differences between counties may be attributable to the extremely low number of Gonorrhea cases reported in Dodge (29), Saunders (11), Washington Counties (9), and County Not
Specified (9). The prevalence of both Chlamydia and Gonorrhea was significantly lower in the Three Rivers Health District than its surrounds (p<0.001). Compared to the Three Rivers Health District, Douglas County had 2.6 OR (95% CI: 2.3-3.0), the State of Nebraska had 1.7 OR (95% CI: 1.5-2.0), and the U.S had 2.0 OR (95% CI: 1.7-2.3) of having Chlamydia. Similarly, compared to the Three Rivers Health District, the odds of having Gonorrhea in Douglas County were 10.9 OR (95% CI: 6.7-17.7), the odds in the State of Nebraska were 5.1 OR (95% CI: 3.1-8.4), and the odds of having Gonorrhea in the U.S. were 6.9 OR (95% CI: 4.2-11.3).

Undoubtedly, age and ethnicity are factors involved with the lower prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District. As previously mentioned, Chlamydia is associated with females 15-to-24-year-olds, and Gonorrhea is associated with males 20 to 29 years of age and females 15 to 24 years of age. In comparison, the Three Rivers Health District population is advanced in years, with the median age of Douglas County 39.4 years, Saunders County 41.4 years, and Washington County 41.2 years (Intercensal Estimates, 2017). An older population is more likely monogamous, which in turn limits STI transmission, and less likely to be pregnant. During prenatal checkups, sexually active women are screened for STIs. As more women are screened, prevalence increases greatly as asymptomatic cases are diagnosed and reported. Ethnicity, unfortunately, did not prove a valid determinant in the study; only 82% of participants reported their racial group. While not reported with sufficient frequency to allow for conclusions, the ethnic composition of the Three Rivers Health District most likely played an important role in the significantly lower prevalence of Chlamydia and Gonorrhea. The underlying health district population as a whole is 95-97% European-American, and African-Americans are 5.9 times more likely to be diagnosed with Chlamydia and 9.6 times more likely to have Gonorrhea (Chlamydia-Fact Sheet, 2016: Gonorrhea-Fact Sheet, 2016).
While age and ethnicity are important determinants, their presence does not fully explain the significantly lower prevalence observed in the Three Rivers Health District. Other determinants, such as age of sexual debut, number of partners, and new partners in the past six weeks which are not reported in the surveillance database are most likely involved. Moreover, Chlamydia and Gonorrhea have not been perceived as a health threat, so the Three Rivers Health Department has devoted few resources beyond offering STI testing at the main location. In comparison, Douglas County, which has a significantly higher prevalence of Chlamydia and Gonorrhea, utilizes social marketing to raise awareness and offers outreach programs and multiple testing locations to increase testing. As more testing is conducted, and awareness is raised, the probability of detecting STIs increases. The majority of Chlamydia and Gonorrhea cases are asymptomatic, and increased testing detects cases that otherwise would not be reported.

Faced with new guidelines from the CDC which recommends screening of all sexually active women younger than age 25 and women over the age of 25 who are at increased risk, STI testing has become more commonplace. Between 2001 and 2015, STI screening in sexually active women increased from 23.1% to 47.4%. Whether attributable to more frequent testing, raised awareness or truly becoming more prevalent due to changes in sexual behavior, the reported number of Chlamydia cases has continued to climb. In the Three Rivers Health District, between 2012 and 2013, the prevalence of Chlamydia increased from 182.6 cases per 100,000 population to 236.7 cases per 100,000, stayed steady between 2013 and 2015, and then declined from 243.7 cases to 201.5 cases per 100,000. Overall, the prevalence of Chlamydia increased 10% (p=0.4). The increase in the number of reported Chlamydia cases was mirrored by the upward trend occurring nationally which also grew 10% during the same time, from 453.0 to 497.3 cases per 100,000.
Gonorrhea cases in the Three Rivers Health District have also increased significantly (p<0.001), although somewhat erratically. Between 2012 and 2013, the proportion of Gonorrhea cases increased from 10.3 cases per 100,000 to 16.7 cases, dropped to 12.8 cases in 2014, fluctuated upward to 17.9 cases in 2015, and dropped to 16.6 cases in 2016. Overall, the number of Gonorrhea cases increased by 61% during the study. Nationally, amid fluctuations, the prevalence of Gonorrhea increased from 106.7 cases per 100,000 to 145.8 cases, representing a 37% increase (2016 Sexually Transmitted Diseases Surveillance, 2017). The upward trend in Gonorrhea may be indicative of growing antibiotic-resistance (Antibiotic-Resistant Gonorrhea, 2017). Since 2012, a dual-antibiotic approach consisting of ceftriaxone and azithromycin has been needed to treat uncomplicated Gonorrhea. However, recently azithromycin-resistant strains have been isolated amid concerns of Gonorrhea becoming the next “Super Bug.” Drug trials are underway to develop new antibiotics (Rice, Shafer, Ram, & et al., 2017).

Limitations of the Study:

The study was subject to several limitations. The cross-sectional study design, while easily implemented with existing data, did not explain the lower prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District. The data from the NEDSS database was collected by multiple entities for their use and did not include valuable determinants such as condom use, number of sex partners, new partners in the past six weeks, education level, and income. The demographics that were collected were self-reported and were somewhat incomplete, with 16% of zip codes and 80% of ethnicities missing. Moreover, with surveillance data, only positive results were reported. Without the total number of STI screenings performed, it is not possible to determine if the reported prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District is truly lower than Douglas County, the state of Nebraska, and the U.S., or if residents are screened less often which would, in turn, lead to a lower prevalence.
**Recommendations for Future Projects:**

The Three Rivers Health Department should continue surveillance of STIs. The proportion of cases in the health district is significantly lower than Douglas County and the State of Nebraska but is trending upward. Gonorrhea, while reported in extremely low numbers, appears to be in the process of developing resistance to current antibiotic regimes and may emerge as the next “super bug”. Syphilis has re-emerged as a health threat, especially in the MSM population. Ongoing surveillance will facilitate the implementation of cost effective, timely interventions such as social marketing and educating at-risk populations. Suggestions for future studies include repeating the study with data which has not been de-identified to determine if the prevalence of Chlamydia in Dodge County is truly higher than Saunders and Washington Counties. If interventions are needed, it is more cost effective to focus on specific high-risk populations. Moreover, the actual number of cases of Chlamydia and Gonorrhea may be significantly higher in the Three Rivers Health District than reported, especially if residents are screened at lower rates. Additional studies are needed to further examine the prevalence of Chlamydia and Gonorrhea in the Three Rivers Health District.

**References:**


Service Learning Reflection:

My Service Learning took place with the Three Rivers Health Department in Fremont Nebraska. The Three Rivers Public Health Department promotes healthy living and empowers residents of Dodge, Saunders, and Washington Counties in Eastern Nebraska. The services provided by the Public Health Department encompass a wide range of activities and include emergency response, disease surveillance, and health education. Special initiatives include promoting colon cancer screenings, bicycle safety by distributing helmets and conducting bicycle rodeos, car seat checks, and offering flu immunizations and TB testing. To further promote health, especially in the disadvantaged Title X population, the Three Rivers Public Health Department offers clinical services to over 1,500 clients for reproductive health, including annual exams, birth control, and STI testing. Funding for the Health Department comes from a variety of sources, including federal and state monies, grants, and fees for service.

In 2016, the Health Department set the goal of becoming accredited by the Public Health Accreditation Board (PHAB). Accreditation is voluntary, and measures the Health Department’s performance against set standards. Accreditation serves to improve the quality and performance of the Health Department, and therefore improve the health of the population served. Public Health Departments that have gone through accreditation report that it identifies strengths and weaknesses, improved accountability and transparency, and strengthened internal and external partnerships. Public Health Departments also benefit by inclusion within grant announcements and gaining recognition as being accredited. The Health Department started the process by completing a Community Health Assessment (CHA), one of the ten core functions of Public Health. The CHA is designed to assess the overall health of the community served by the health department and stakeholders such as agencies and non-profit hospitals. Data was collected from numerous sources, including the Behavioral Risk Factor Surveillance System (BRFSS), Nebraska Crime Commission, Nebraska Department of Education,
and the U.S./American Community Survey. The final comprehensive document serves as the basis for the Community Health Improvement Plan (CHIP), which is a long-term, systematic action plan to collaboratively improve community health, and prioritize initiatives.

The Three Rivers Public Health Department completed the CHIP portion of accreditation in May 2016 by collecting information gathered at three focus group meetings sponsored by local community hospitals. Focus group attendees were invited from the medical community, local businesses, and non-profit groups. At each focus group meeting, the health data from the CHA was presented, and a Forces of Change Exercise was conducted to identify trends and factors affecting the health of community members. Following the Force of Change Exercise, focus group attendees prioritized key issues to guide decisions for the next three to five years. While group members from Dodge, Saunders, and Washington Counties identified different issues, all representatives prioritized health education, obesity, and mental health.

The next step in the accreditation process is Strategic Planning which involves completing necessary documentation according to the Standards and Measures guidelines. Twelve domains are covered within the manual, specific to each of the ten core Public Health services, management, and governance. Three Rivers Health Department is currently in the process of gathering documentation for Domain Two, and has various projects in different stages of completion. (Appendix E). My Service Learning Project involved assisting staff members to complete and edit standard 2.1.1, “Creating a Disease Surveillance Protocol and Investigation Guideline Using CDC Report Forms and NE DHHS investigation guidelines”. The document serves as the basis by which disease surveillance and investigations are conducted.

When I arrived at the Three Rivers Health Department, I was given a tour of the facility, introduced to the staff, and given a desk to use while I was there. Celeste Reker, my preceptor,
explained the project. I was writing and consolidating the disease investigation guidelines by using a variety of resources, including different web pages on the Three Rivers Health Department intranet, the NE Department of Health web site, NEDSS, and the CDC website. Celeste started the document by listing the notifiable diseases and had written several protocols. After the orientation process, I was given autonomy to complete the project. I started by sorting through the different resources to determine where the information was located, and I standardized the protocols to facilitate completion of the process (Appendix D). Once I finished writing protocols for the diseases that Celeste had listed, I checked for new listings from the Nebraska Department of Health and Human Services web page, and updated the document. The process of gathering and writing the documents necessary for accreditation is an on-going effort. Accordingly, at the end of the semester, I organized and turned the project over to the Three Rivers Coordinator.

The strengths I brought to the project were the organizational skills needed to consolidate data from a multitude of sources, and the ability to work independently. Apart from the orientation process, I essentially worked by myself with little or no interaction with the Three Rivers Health staff which was slightly disconcerting. I faced several challenges throughout the Service Learning Experience. Midway through the project, Celeste, my preceptor, accepted a different positon and the director of the Health Department, Terra Uhing, assumed the preceptorship. The change has been challenging because Terra is extremely busy managing the health department and has not responded to respond to my questions after I completed my Service Learning project. Apart from changing preceptors, the purpose of my Service Learning document changed, as well. The Three Rivers Health Department decided not to pursue accreditation due to the high fees associated with accreditation. The health department felt that the money would be better spent on more immediate projects that would benefit the community. So my surveillance document became a protocol for outbreak investigations instead. The other challenge I faced involved the logistics of traveling the long distance between my residence in Papillion and
Fremont, Nebraska. I overcame this challenge by mapping the location of the health department, and checking for snowy driving conditions. Moreover, it felt awkward to sit at the desk for the entire time that I was working on the surveillance document. I am normally multi-tasking, and moving around. I addressed this particular challenge by making a point of getting up every hour to get water or walk around for a few minutes.

I found the Service Learning project to be a great learning opportunity. I became familiar with NEDSS, and the steps involved with disease surveillance. I also gained a deeper understanding of health departments and how they function. Funding comes from multiple sources, including grants and fees for service, instead of the federal or state government as I had expected. I was also surprised by how closely the health department works with its stakeholders. Terra took great care to foster the relationships between the community and the Three Rivers Health Department. Projects undertaken by the staff are determined by the needs of the community. I also appreciated the versatility required of the staff in the smaller health department. The staff was cross-trained to cover multiple areas, took on additional responsibilities, and worked well as a team. The service learning experience gave me a better understanding of how health departments operate, and the importance of their stakeholders. Altogether, I found my time spent at the Three Rivers Health Department as a great learning experience.
Acknowledgements

I want to thank my committee members, Dr. Minhas, Elizabeth Lyden, Celeste Reker, and Terra Uhling for all of their guidance as I navigated my way through the Capstone/Service Learning Experience.

Thank you to Laura Vinson for helping me find my project and answering all of my few thousand questions.

Thanks to my family and co-workers who loved and supported me throughout the long process. It truly does take a village.
### Chlamydia and Gonorrhea Fact Sheet

<table>
<thead>
<tr>
<th>Disease</th>
<th>Causative Agent</th>
<th>Incidence</th>
<th>Present with symptoms</th>
<th>Symptoms</th>
<th>Sequelae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td><em>Chlamydia trachomatis</em></td>
<td>1,526,658 cases of Chlamydia documented in 2015, representing a 5.9% increase from 2014. (a)</td>
<td>Chlamydia is typically asymptomatic, with only about 10% of men and 5-30% of women experiencing symptoms (b)</td>
<td>Burning upon urination, vaginal discharge, and penile discharge, testicular pain and swelling. Symptoms associated with rectal infections are pain, bleeding, and discharge (b)</td>
<td>Men: Infertility. Women 10-15% develop pelvic inflammatory disease (PID). With PID, 20% of women may become infertile, 9% may have an ectopic pregnancy, and 18% may experience chronic pelvic pain (C)</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td><em>Neisseria gonorrhoeae</em></td>
<td>395,215 cases reported in 2015, a 12.8% increase from the previous year (a)</td>
<td>Gonorrhea is typically asymptomatic, with 10-15% of males and 20% of women exhibiting symptoms (d)</td>
<td>Painful urination, vaginal discharge, bleeding between periods, or green urethral discharge in men. Symptoms associated with rectal infection in both genders are discharge, rectal itching, soreness, bleeding, or painful bowel movements (e)</td>
<td>Without treatment, men rarely experience epididymitis or infertility. Complications are more severe in women and include PID, abdominal pain, fever, abscesses, chronic pain, ectopic pregnancies, or infertility (e)</td>
</tr>
</tbody>
</table>

\(a\) 2015 Sexually Transmitted Diseases Surveillance, 2016  
\(b\) Chlamydia- Fact Sheet, 2016  
\(c\) STDs in Women and Children, 2012  
\(d\) Gonorrhea Gonococcal Infection (clap, drip), 2006  
\(e\) Gonorrhea Fact Sheet, 2016
Comparing the number of STI infections in Dodge, Saunders, Washington Counties and County Not Specified
Appendix C

The prevalence of Chlamydia and Gonorrhea was significantly higher in Douglas County, Nebraska, and the U.S. compared to the Three Rivers Health District.

<table>
<thead>
<tr>
<th></th>
<th>Prevalence per 100,000</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Rivers</td>
<td>243.7</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Douglas County</td>
<td>637.6</td>
<td>2.6</td>
<td>2.3-3.0</td>
<td>p&lt;0.0001</td>
</tr>
<tr>
<td>Nebraska</td>
<td>422.9</td>
<td>1.7</td>
<td>1.5-2.0</td>
<td>p&lt;0.0001</td>
</tr>
<tr>
<td>U.S.</td>
<td>478.8</td>
<td>2</td>
<td>1.7-2.3</td>
<td>p&lt;0.0001</td>
</tr>
</tbody>
</table>

*Table 1. Chlamydia Prevalence and Odds Ratio in Three Rivers Health District, Douglas County, the State of Nebraska, and the U.S, 2015*

<table>
<thead>
<tr>
<th></th>
<th>Prevalence per 100,000</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Rivers</td>
<td>17.9</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Douglas County</td>
<td>196.5</td>
<td>10.9</td>
<td>6.7-17.7</td>
<td>p&lt;0.0001</td>
</tr>
<tr>
<td>Nebraska</td>
<td>90.5</td>
<td>5.1</td>
<td>3.1-8.4</td>
<td>p&lt;0.0001</td>
</tr>
<tr>
<td>U.S.</td>
<td>123.9</td>
<td>6.9</td>
<td>4.2-11.3</td>
<td>p&lt;0.0001</td>
</tr>
</tbody>
</table>

*Table 2. Gonorrhea Prevalence and Odds Ratio in Three Rivers Health District, Douglas County, the State of Nebraska, and the U.S, 2015*
### Appendix D - Progress Report on Documents Required for the Accreditation Process

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td>Creating a Disease Surveillance Protocol and Investigation Guideline Using CDC report Forms and NE DHHS investigation guidelines.</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Have one case review complete (Measles) and working on second Case Review - TB</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Document providing written report of a non-infectious environmental investigation</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.1.4.1</td>
<td>2 Examples of MOUs used for outbreaks - Most likely will use MOUs for open PODs</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.1.4.2</td>
<td>2 Examples of meeting minutes to demonstrate working with partners - One example is a past Disease Surveillance lunch. Second example is a flu press release</td>
<td>Done</td>
</tr>
<tr>
<td>2.1.5.1</td>
<td>Lab Services - Work with Alison</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.1.5.2</td>
<td>Tracking Log from 2015 and 20115</td>
<td>Done</td>
</tr>
<tr>
<td>2.1.5.3</td>
<td>Nebraska Public Health Laws that apply to notifiable/reportable diseases</td>
<td>Done</td>
</tr>
<tr>
<td>2.2.1</td>
<td>The investigation guidelines (2.1.1.) will also include protocols for health problems and hazards</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.2.2.1</td>
<td>Same as 2.2.1</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.2.2.2</td>
<td>Same as 2.2.1</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.2.2.3</td>
<td>Part of the EOP - Will get from Joel</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.2.3.1</td>
<td>Create a description of when we will use AAR. This most likely will come from the EOP as well</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.2.3.2</td>
<td>Work with group to create a list of significant events from last five years</td>
<td>Not Done</td>
</tr>
<tr>
<td>2.2.3.3</td>
<td>1 AAR is the measles example. One more is needed. Search through shared drive for one more</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.3.1.2</td>
<td>Call down list - Will Create</td>
<td>Not Done</td>
</tr>
<tr>
<td>2.3.1.3</td>
<td>MOUs for Emergency Response - Will get from Joel</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.2.1</td>
<td>Documentation of laboratory capacity - Work with Alison</td>
<td>Not Done</td>
</tr>
<tr>
<td>2.3.2.2</td>
<td>Same as 2.3.1.</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.2.3</td>
<td>Work with Joel and Alison to get environmental and human specimen list</td>
<td>Not Done</td>
</tr>
<tr>
<td>2.3.3.1</td>
<td>Surge capacity protocol - will get from Emergency Response</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.3.2</td>
<td>Same as 2.3.3.1</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.3.3</td>
<td>Part of the EOP - Will get from Joel</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.3.4</td>
<td>Schedule for emergency response exercises - Will get from Joel</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.3.5</td>
<td>Same as 2.3.3.1</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.4.1</td>
<td>Same as 2.3.3.1</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.3.4.2</td>
<td>Examples of joint exercises - one can be an emergency response exercise, the second may be flu on Call training</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.4.1.1</td>
<td>Part of EOP</td>
<td>Have - Coordinate with Others</td>
</tr>
<tr>
<td>2.4.1.2</td>
<td>Screen shot of web pages, telling people to contact us with a public health emergency 24/7. Needs to be added to the new surveillance web page</td>
<td>Not Done</td>
</tr>
<tr>
<td>2.4.1.3</td>
<td>Documentation of our after-hours calling service</td>
<td>Have-Coordinate with Others</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>2.4.2.1</td>
<td>One example of a HAN we did- measles will work</td>
<td>Done</td>
</tr>
<tr>
<td>2.4.2.2</td>
<td>Documentation of our calling list quarterly test</td>
<td>Have-Coordinate with Others</td>
</tr>
<tr>
<td>2.4.3.1</td>
<td>2 Examples of Spanish press releases or other public health info in Spanish through Health Literacy software</td>
<td>In Progress</td>
</tr>
<tr>
<td>2.4.3.2</td>
<td>Press Release Examples</td>
<td>Done</td>
</tr>
</tbody>
</table>
Appendix E

Format of the Disease Investigation Protocol

1. Report all cases to NEHHS after ___ days. Timeline to report cases to NEHSS (Immediately or 7 days)
2. 1.1.2. Enter Case report into NEDSS- Location of folder
3. 1.1.3. Create an investigation timeline
   a. Review case investigation-interview the case and others
   b. Record case demographics
   c. Determine exposure history
   d. Identify potentially exposed contacts and follow up with exposed cases
4. Control further spread
5. Assign appropriate case status and establish case definitions
   a. Probable case definition
   b. Confirmed case definition
6. Create notification
7. Managing special situations.