THE HEALTH OF LINN COUNTY, IOWA
A COUNTYWIDE ASSESSMENT OF HEALTH STATUS AND HEALTH RISKS

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Chapter 5 Infectious Disease

Introduction

While infectious diseases are not the leading causes of death in Linn County, Iowa, or the United States, they do cause major health and economic burden for the country. Every year, sexually transmitted diseases account for approximately $16 billion in medical costs, foodborne illnesses cost about $77 billion, and seasonal influenza about $87.1 billion\textsuperscript{18,19,20}. The contents of chapter 5 describe trends in infectious diseases, including HIV, sexually transmitted infections, respiratory diseases, enteric and waterborne disease, zoonotic disease and acute hepatitis B. Table 5.1 lists the number of cases and rate of reportable infectious diseases in Linn County. In 2015, the most common infectious disease was Chlamydia, with 1045 cases for an incidence rate of 479.9 cases of infection per 100,000 population. Shigellosis was the second most common due to the outbreak that occurred in May of 2015.

Table 5.1 Incidence of selected infectious diseases, Linn County, 2015

<table>
<thead>
<tr>
<th>Disease</th>
<th>Total Cases</th>
<th>Incidence Rate per 100,000</th>
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<td>Chlamydia</td>
<td>1045</td>
<td>479.9</td>
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<td>Pertussis</td>
<td>6</td>
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<td>Gonorrhea</td>
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<td>9.6</td>
</tr>
<tr>
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<td>6.0</td>
</tr>
<tr>
<td>Lyme</td>
<td>39</td>
<td>17.9</td>
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<td>E. Coli infection</td>
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<td>3.2</td>
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<td>Syphilis</td>
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<td>13.8</td>
</tr>
<tr>
<td>Tuberculosis</td>
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<td>0.0</td>
</tr>
<tr>
<td>Shigellosis</td>
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<td>130.0</td>
</tr>
<tr>
<td>West Nile Virus</td>
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<td>0.0</td>
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<td>*</td>
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<tr>
<td>Rabies</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Acute Hepatitis B</td>
<td>1</td>
<td>*</td>
</tr>
</tbody>
</table>

*Counts are too low to calculate a stable rate


HIV and Sexually Transmitted Infections

In 2016, the rate of syphilis, chlamydia and gonorrhea in Linn County was 680.7 cases per 100,000 population. This is greater than the state rate of 508.0 cases per 100,000 population. In Linn County, certain areas have higher rates of STDs than other areas. Figure 5.1 displays the rates by the 2010 Census Tracts, with the areas of higher rates of STDs colored red or orange.

Figure 5.1 All STD cases (chlamydia, gonorrhea, syphilis and HIV) per 1,000 population, Linn County, 2016

Source: Iowa Disease Surveillance System, Center for Acute Disease Epidemiology, Iowa Department of Public Health, Created by Linn County GIS on May 23, 2017
HIV and AIDS

**Linn County 2020 Goal**
Reduce the rate of HIV diagnoses among adolescents and adults. Healthy People 2020 has not identified a target setting method other than general reduction.

**Trends**
In 2016, the HIV incidence in Linn County was 9.0 cases per 100,000 population, an increase of 3.1 cases per 100,000 from 2015 (Figure 5.2), and the highest rate in the county since 2013 (7.9 cases per 100,000 population). HIV incidence in Linn County was higher than the state of Iowa (4.4 cases per 100,000 population) but less than the United States (12.3 per 100,000 population). While the rate of new cases is decreasing in the United States, it is increasing in Linn County. Likewise, the proportion of existing HIV cases or those currently living with HIV in Linn County has also increased in the last five years increasing from 68.3 cases per 100,000 in 2012 to 119.1 cases per 100,000 in 2016. The rate of people living with HIV in Linn County is similar to that of Iowa, but significantly less than the rate for the United States. In 2015, the rate of people living with HIV or AIDS in the United States was 362.3 people per 100,000, over 3 times the rate of Linn County (Figure 5.3).

Between 2001 and 2015, there were 13 deaths in Linn County related to HIV/AIDS only 2 of which occurred between 2011 and 2015. Due to the small number of deaths per year, a stable rate cannot be calculated for Linn County. However, from 2008 to 2010, Iowa has had significantly fewer deaths due to HIV than the national rate. The average death rate over the three-year period in Iowa was 1.0, which is significantly less than the rate of the United States of 7.8 per 100,000 population.
Figure 5.2 Rate of new diagnoses of HIV, Linn County, Iowa, and United States, 2007-2016

Source: IDPH HIV Surveillance Program, CDC NCHHSTP Atlas, CDC HIV Surveillance Reports
*Counts are too low to calculate a stable rate

Figure 5.3 Rate of persons living with HIV/AIDS in Linn County, Iowa, and United States, 2007-2016

Source: IDPH HIV Surveillance Program, CDC NCHHSTP Atlas, CDC HIV Surveillance Reports
Disparities

Age
Among all HIV diagnoses in Linn County from 2012 to 2016, approximately one third were less than 25 years old. Nearly two thirds of all diagnoses were less than 45 years old (Figure 5.4). However, the largest percent of new HIV diagnosis was among 45 to 54 year olds with 30% of the diagnoses being among this age group, followed by the 15 to 24 year age group with 25% of new cases of HIV.

Figure 5.4 Age at HIV diagnosis, Linn County, 2012-2016

Sex and Race
In 2016, there were more HIV diagnoses among men in Linn County and Iowa compared to females (Figure 5.5). The highest proportion of diagnoses in Linn County were also among white residents accounting for 70% of diagnoses, followed by black (25%), and Hispanic (5%) residents.
Risk and Protective Factors

Two of the most common ways HIV is transmitted is through vaginal or anal sex or sharing drug injection equipment. Among those in Linn County diagnosed with HIV in 2016, 40% were Men having Sex with Men (MSM), 40% had heterosexual contact, 10% had no identified risk (NIR) 5% were among injection drug use (IDU), and 5% were among those who indicate both MSM and IDU. The most significant increase in route of transmission was among those engaging in heterosexual contact increasing from 25% of cases in 2013 to 40% in 2016. This was not as significant of a change in Iowa. Another interesting difference is the increase in injection drug use making up a combined 10% of newly diagnosed cases in 2016 compared to 0% in 2013.

Figure 5.6 Risk factors among new diagnosis and persons living with HIV, Linn County and Iowa, 2016

Source: IDPH HIV Surveillance Program
Chlamydia

Linn County 2020 Goal
Reduce the proportion of adolescents and young adults with *Chlamydia trachomatis* to 371 per 100,000 population, a 10% decrease from 412 per 100,000 in 2010.

Trends
The incidence of Chlamydia has steadily increased in Linn County, Iowa and the United States. However, in 2016 Linn County exceeded the rate in both Iowa and the United States (Figure 5.7). Between 2000 and 2016, the rate of Chlamydia in Linn County increased from 317.0 cases per 100,000 population in 2000, to 545.9 cases per 100,000 population in 2016. During this time, a statistically significant increase occurred between 2000 and 2006, 2008 and 2010, and 2010 and 2011 followed by a statistically significant decrease in 2013 and increase in 2016. The continued increase in chlamydia rates may be a result of multiple factors, including expansion of screening activities, improvements in diagnostic testing, increased emphasis on the importance of reporting from providers and laboratories, and improvement in surveillance systems.\(^\text{21}\) Since chlamydia is often asymptomatic, infected individuals are often not identified, contributing to re-infection and continued spread of the disease. Improving chlamydia screening among at-risk individuals is necessary for slowing the increasing rate and reversing the upward trend.\(^\text{22}\)

Figure 5.7 Chlamydia rates in Linn County, Iowa and United States, 2000-2016

![Graph showing Chlamydia rates in Linn County, Iowa, and United States from 2000 to 2016]

Source: Iowa Reportable Sexually Transmitted Disease Data, IDPH


Disparities

Age
Young people, especially those between the ages of 15-24 years, have the highest rates of chlamydia infection in Linn County and nationally (Figure 5.8). However, the population with the highest incidence of Chlamydia infection is among those 20 to 24 years of age with a rate of 3303.7 per 100,000 population nearly 1.6 times greater than that among the 15 to 19 year old age group.

Figure 5.8 Chlamydia rate by age, Linn County, 2016

Source: Iowa Department of Public Health Sexually Transmitted Disease Program

Sex
In 2012, 70.2% of chlamydia cases in Linn County were among females. It is possible the percent of chlamydia diagnoses in females is higher than males due to asymptomatic women getting screened more frequently than asymptomatic men, and the actual distribution of disease is more balanced among males and females. Statewide data from the Iowa Infertility Prevention Project shows 75.3% of chlamydia tests were among females, but only 60.1% of positive chlamydia results were among females.23

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23 Iowa Infertility Prevention Project 2013 Final Summary. Includes from the State Hygienic Laboratory & Polk County Health Department
Race and Ethnicity

In Linn County, 60% of chlamydia cases were among whites and 27% among blacks. Hispanics comprise 5% of chlamydia cases in Linn County (Figure 5.9). Within the specific groups, the greatest proportion of unknown or other race (28%) were infected by Chlamydia in 2016 compared to whites (0.4%), blacks (3%), Hispanic (0.9%), two or more races (0.7%), Asian (0.2%), and Hawaiian/Pacific Islander (2%).

Figure 5.9 Race and ethnicity of Chlamydia cases, Linn County, 2016

Risk and Protective Factors

Chlamydia is an infection that is passed from one person to another through sexual contact. The sexual contact can be anal, oral or vaginal sex. Any sexually active person can become infected with chlamydia, but there are prevention methods to reduce the risk of being infected. Prevention strategies include: abstinence (not having sex), mutual monogamy (each sexual partner only has one partner), reduce number of sex partners, and use of a condom.
**Gonorrhea**

**Linn County 2020 Goal**
Reduce gonorrhea rate to 101 cases per 100,000 population, a 10% decrease from 112 cases per 100,000 in 2010.

**Trends**
In 2016, the gonorrhea rate in Linn County was 120.0 cases per 100,000 population (Figure 5.10). In Linn County, the gonorrhea rate decreased significantly between 2012 and 2014 decreasing from 107.0 to 49.0 cases per 100,000 population. However, the decrease in Gonorrhea cases was followed by a statistically significant increase in 2015 and 2016. Linn County typically exceeds the rate of Gonorrhea in Iowa; however, it falls below the United States. Between 2013 and 2016, the gonorrhea rate has increased in all three geographic locations.

**Figure 5.10 Gonorrhea rates in Linn County, Iowa and United States, 2000-2016**

![Gonorrhea rates graph](image)

*Source: Iowa Reportable Sexually Transmitted Disease Data, IDPH*

**Disparities**

**Age**
In 2016, 54% of gonorrhea cases in Linn County were among females and 46% were among males (Figure 5.11). Similar to chlamydia, young adults and adolescents are most commonly affected by gonorrhea with the majority of cases occurring among individuals 15 to 29 years of age. However, the highest incidence of gonorrhea in Linn County is among individuals 20 to 24 years of age with a rate of 465.0 cases per 100,000 population.
Race and Ethnicity
Blacks are disproportionally impacted by gonorrhea. In 2016, 42% of gonorrhea cases were among black residents, while the population only comprises 4.7% of the total county population. About one-half of all gonorrhea cases in Linn County in 2016 were among whites and 4% were among Hispanics (Figure 5.12).

Risk and Protective Factors
Similar to chlamydia, gonorrhea is spread through sexual contact. Therefore, risk factors and prevention methods for gonorrhea are similar to those of chlamydia. Prevention strategies include abstinence, mutual monogamy, reducing the number of sexual partners and condom use.
Syphilis

**Linn County 2020 Goals**
Reduce sustained domestic transmission of primary and secondary syphilis to 1.3 cases per 100,000, a 7% decrease from 1.4 cases per 100,000 in 2010.

**Trends**
Compared to chlamydia, gonorrhea, and other sexually transmitted diseases, syphilis is rare. However, in recent years syphilis has increased in Linn County, Iowa, and the United States (Figure 5.13). Between 2012 and 2016, the syphilis rate in Linn County increased from 3.3 to 9.5 cases per 100,000 population, respectively. While increasing, Linn County’s rate of syphilis is nearly 3 times less than the rate in the United States.

**Figure 5.13 Syphilis rates for Linn County, Iowa and United States, 2000-2016**

![Graph showing syphilis rates for Linn County, Iowa, and the United States from 2000 to 2016.](source)

**Disparities**

**Age and Sex**
Since there are few cases of syphilis reported annually in Linn County, in order to calculate stable rates by age, data from the years 2014 to 2016 were combined. Rates were not calculated for combined number of cases less than 5. In 2016, 76% of the primary and secondary syphilis cases were among men. Rates by age group were variable, with the highest rate of syphilis being among those 25 to 29 years of age at a rate of 35.0 cases per 100,000 population (Figure 5.14).
**Race and Ethnicity**

In Linn County, 86% of syphilis cases were among white and black residents (Figure 5.15). While 10% were among Hispanic residents.

**Risk and Protective Factors**

Syphilis is spread through sexual contact; as such, one must be sexually active to be at risk for infection. As with chlamydia and gonorrhea, the risk of syphilis can be minimized by mutual monogamy, reducing the number of sexual partners, and use of condoms.
Respiratory Diseases

Tuberculosis Disease

**Linn County 2020 Goals**
Reduce new cases of tuberculosis disease to 1.4 cases per 100,000 population, a 28% reduction from 1.9 cases per 100,000 in 2010.

**Trends**
In 2016, there were two cases of tuberculosis (TB) disease in Linn County, with 14 cases occurring between 2012 and 2016 (Figure 5.16). Due to the small number of TB cases in Linn County each year, the associated rates are unstable. Alternately, the rates in Iowa and the United States are adequate to assess. In 2016, the rate of TB in Iowa was nearly two times lower than the United States with a rate of 1.5 cases per 100,000 population in Iowa compared to 2.9 in the United States.

**Figure 5.16 Tuberculosis disease incidence rate, Linn County, Iowa and United States, 2007-2016**

Source: IDPH Tuberculosis Program, CDC
*Counts smaller than five cases were suppressed.

**Risk and Protective Factors**
Infection occurs through contact with the Mycobacterium Tuberculosis bacteria. Persons at risk of being infected with the bacteria are close contacts of people with tuberculosis disease, those residing in correctional facilities, those who are homeless, and people who have traveled to an area where tuberculosis is common. Tuberculosis is most common in countries of sub-Saharan Africa and some countries within Asia.²⁴

Pertussis

Linn County 2020 Goal
Reduce cases of pertussis among adolescents aged 10 to 19 years to 22.4 cases per 100,000, a 50% decrease from the 3-year average of 44.8 per 100,000 from 2009 to 2011.

Trends
Fluctuation can be noted overtime, with the significant increases from year to year signifying a cluster or outbreak of pertussis in a specific period. Such increases were seen in 2010 and 2012 with a rate of 40.1 cases per 100,000 population in 2010 and 136.3 in 2012 (Figure 5.). The most current rate in 2015 was 2.7 cases per 100,000 population, nearly a 51-time decrease from 2012. The pertussis outbreak of 2012 included 288 cases in Linn County and 48,277 cases nationwide.25

Figure 5.17 Pertussis rates in Linn County, Iowa, and United States, 2007-2016

Source: Iowa Disease Surveillance System, IDPH

Disparities

Age and Sex
In 2015, 50.9% of cases in Iowa were among females and 48% male. The largest portion of cases occurred among individuals 5 to 19 years of age, accounting for 56% of all cases in Iowa (Figure 5.17). Children aged birth to 4 years had the second highest proportion at 27% of all cases. The Linn County 2020 goal is to reduce pertussis in adolescents 10 to 19 years of age.

Race and Ethnicity
In 2015, 60.7% of cases in Iowa were non-Hispanic, 10.4% were Hispanic. Over 68.8% of cases were white and 1.2% black (Figure 5.19).
**Figure 5.19** Pertussis cases by race, Iowa, 2015

Source: Iowa Disease Surveillance System, Center for Acute Disease Epidemiology, Iowa Department of Public Health

**Risk and Protective Factors**

Risk factors for pertussis include being a close contact of a person with pertussis and not receiving a pertussis-containing immunization. Populations at risk of severe complications of pertussis infection are infants and persons with pre-existing health conditions.26

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Enteric and Waterborne Diseases

Linn County 2020 Goals
Reduce infections caused by *Campylobacter* species to 15.1 cases per 100,000 population, a 33% reduction from 22.5 cases per 100,000 in 2010.

Reduce infections caused by Shiga toxin-producing *Escherichia coli* (STEC) to 1.7 cases per 100,000 population, a 50% reduction from 3.3 cases per 100,000 in 2010.

Reduce infections caused by *Salmonella* species to 18.2 cases per 100,000 population, a 24% reduction from 23.9 cases per 100,000 in 2010.

Trends
In 2015, the enteric disease with the highest rate was Shigellosis, with 128.8 cases of infection per 100,000 population, an increase of 127 cases per 100,000 population from 2014 (Table 5.2). This significant increase was the result of a foodborne outbreak that began in early May of 2015, which was tracked back to daycare facilities in Linn County. The top five leading enteric diseases typically including Camplyobacteriosis, Cryptosporidiosis, E. Coli, Giardiasis, and Salmonellosis (Figure 5.20). Over time, the incidence of Cryptosporidiosis demonstrated the most fluctuation of the enteric diseases with a low of 0.5 cases per 100,000 population in 2006 and a high of 42.9 cases per 100,000 population in the following year.

Figure 5.180 Rates of top 5 reportable enteric diseases in Linn County, 2007-2015

Source: Iowa Disease Surveillance System, IDPH
Table 5.2 Rate of enteric diseases for Linn County, Iowa and United States, 2015

<table>
<thead>
<tr>
<th>Disease</th>
<th>Linn County</th>
<th>Iowa</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacteriosis</td>
<td>21.8</td>
<td>25.2</td>
<td>17.2</td>
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<tr>
<td>Salmonellosis</td>
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<td>20.3</td>
<td>17.2</td>
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<td>Giardiasis</td>
<td>6.4</td>
<td>7.0</td>
<td>4.5</td>
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<tr>
<td>Cryptosporidiosis</td>
<td>9.6</td>
<td>12.2</td>
<td>3.0</td>
</tr>
<tr>
<td>E. Coli infection</td>
<td>3.2</td>
<td>5.4</td>
<td>2.2</td>
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<tr>
<td>Shigellosis</td>
<td>128.8</td>
<td>22.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>0.9</td>
<td>0.5</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Source: Iowa Disease Surveillance System, IDPH, Notifiable Diseases and Mortality Tables, CDC

**Risk and Protective Factors**

Enteric diseases are caused by ingesting contaminated food or water. Many strategies may be used to prevent infection from enteric diseases. Some common methods of prevention include not consuming raw or undercooked meat, poultry, or eggs or raw milk, thoroughly washing produce before eating, practicing good hand hygiene, and not preparing food for others while ill.
Zoonotic Diseases

Lyme Disease

Trends
In 2015, the rate of Lyme disease in Linn County was 17.7 cases per 100,000 population, twice the rate from the previous year. Overtime, the rate of Lyme disease in Linn County has steadily increased. However, the increase in 2015 was abrupt, but not statistically significant increase from 2014. Since 2009, the Lyme disease rate of Linn County was higher than the rate of Iowa but traditionally less than the United States until 2014 (Figure 5.19).

Figure 5.19 Lyme disease rates in Linn County, Iowa, and United States, 2007-2016

Risk and Protective Factors
Lyme disease is transmitted to humans and animals through the bite of the blacklegged or deer tick. Therefore, prevention strategies for Lyme disease involve preventing tick bites and include avoiding woody or bushy areas with high grass, use insect repellent that contains DEET or permethrin, wear light colored long sleeve clothing, and identify and remove any ticks from your body soon after coming indoors.27

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West Nile Virus

*Trends*
In 2015, there were zero cases of West Nile Virus in Linn County compared to 14 in Iowa. However, there was a slight increase in number of cases of West Nile Virus in Iowa in 2016 with a rate of 1.2 cases per 100,000 population in 2016 compared to 0.4 cases per 100,000 population in 2015 (Figure 5.20). West Nile Virus first appeared in the United States in 1999 and rates of infection increased shortly thereafter in 2002 and 2003. In the years following, rates decreased and West Nile is now endemic in the United States.²⁸

Figure 5.20 West Nile Virus in Iowa and the United States, 2007-2016

Source: Iowa Disease Surveillance System, IDPH, CDC

*Risk and Protective Factors*
West Nile Virus is most commonly transmitted to humans by mosquitoes. Therefore, prevention strategies for West Nile Virus involve preventing mosquito bites, and include using insect repellent, wearing long sleeves and pants when outdoors, and reducing the number of mosquitoes around homes by eliminating standing water outdoors.²⁹

Rabies

Trends
Human rabies is very rare in the United States, and even less common in Iowa. In 2015, there were 3 cases of human rabies in the United States and no cases in Iowa or Linn County. The last human rabies case in Iowa was in 2002, and the last reported case prior to that occurred in 1951. The human rabies case in 2002 was a Linn County resident. In Linn County from 2012 to 2016, there is an average of less than one case of animal rabies per year. In Iowa, there are about 18 cases of animal rabies per year, and in the United States, there was an average of 5,900 cases annually (Table 5.1). In Iowa, 77% of the animals with rabies are bats or skunks (Figure 5.21).

Table 5.3 Animal Rabies Cases in Linn County, Iowa and United States, 2012-2016

<table>
<thead>
<tr>
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<td>5,865</td>
<td>6,063</td>
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<td>N/A</td>
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</table>

Source: Iowa Department of Public Health Rabies Summaries, 2008-2011

Figure 5.21 Animal rabies cases in Iowa by animal type, 2012-2016

Source: Iowa Department of Public Health Rabies Summaries

**Risk and Protective Factors**

Rabies is a viral disease that affects mammals, and is spread through contact with an infected animal’s saliva, usually through the bite of a rabid animal. While all mammals can get rabies, wild animals are most likely to be infected. To prevent human exposure to rabies, pets should be vaccinated against rabies and human and pet contact with wild animals should be avoided. Additionally, wild animals should not be kept as pets. If a person has potentially been exposed to rabies, post-exposure prophylaxis is available to prevent disease from occurring.\(^{32}\)

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http://www.idph.state.ia.us/Rabies/Public.aspx.
Acute Hepatitis B

In 2015, there was one case of acute hepatitis in Linn County with an average of 0.4 cases per year between 2012 and 2015. Due to the small numbers of cases per year, a stable rate of acute hepatitis B cases could not be calculated for Linn County. While cases of acute Hepatitis B have generally decreased in Iowa and the United States over the past 10-years, a slight increase was noted in 2015 in both locations (Figure 5.22). However, this fluctuation is minor comparatively.

Figure 5.22 Rate of acute hepatitis B cases, Linn County, Iowa and United States, 2006-2015

Risk and Protective Factors

Hepatitis B is spread when through blood, semen or other body fluids are passed from one person to another, usually through sexual contact, sharing drug injection equipment or childbirth. Those who engage in unprotected sex or who are injection drug users are the greatest risk for infection. Prevention strategies for hepatitis B include abstinence (not having sex), mutual monogamy (each sexual partner only has one partner), reduce number of sex partners, use of a condom, not using injection drugs or not sharing drug injection equipment, and administration of hepatitis B vaccine. Hepatitis B vaccine is recommended for all children and for adults with risk factors for hepatitis B.33

Summary
In 2015, the most common infectious disease in Linn County was chlamydia, with 1,045 diagnoses and a rate of 479.9 cases per 100,000 population. Of the sexually transmitted diseases, gonorrhea was the second most common, followed by syphilis, and HIV. Pertussis rates in 2012 were the highest they had been in the 10-year observation period, with 136.3 cases per 100,000 population, but having since normalized to 2.7 cases per 100,000 population in 2015. Tuberculosis cases continue to be small from year to year with a 5-yr average of 2.8 cases per year. Among enteric diseases in Linn County, Shigellosis demonstrated the highest incidence of infection in 2015 following an outbreak in May of 2015. Following Shigellosis, the most common infections were Campylobacter, Salmonella, Cryptosporidium, Giardiasis, E. coli, and hepatitis A. Zoonotic diseases have lower rates than sexually transmitted diseases or enteric diseases, with the most common zoonotic disease from 2007 to 2015 being Lyme disease with a rate of 17.7 cases per 100,000 population for 2015. Lastly, acute hepatitis B is uncommon in Linn County, with only two cases from 2011 to 2015.