



Hamilton County Communicable Disease Report 2004 - 2008



**HAMILTON COUNTY
PUBLIC HEALTH**

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Message from the Health Commissioners

One of the primary concerns of public health is preventing communicable diseases from occurring. We make every effort to do this by ensuring sanitary conditions in food establishments, providing immunizations for vaccine-preventable diseases and educating the public about the causes and symptoms of communicable diseases. When a communicable disease does occur, it is the responsibility of public health officials to identify the cause and take appropriate steps to prevent it from spreading.

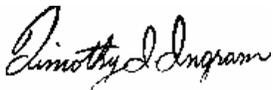
The Hamilton County Communicable Disease Report 2004-2008 provides data regarding the incidence and types of communicable diseases present in the county and, to some extent, when these diseases are most likely to occur and the age groups most affected.

Local health department staff work everyday to prevent the spread of communicable diseases by:

- Receiving reports and analyzing statistics on the incidence of communicable/infectious diseases.
- Confirming cases of communicable disease as reported and as meeting case definitions.
- Identifying the source, route of transmission and common links among affected persons.
- Identifying those who may have come in contact with the person reported to have the communicable disease.
- Providing or assuring treatment of affected persons and contacts as appropriate.
- Providing affected persons and the public with information about the disease including: symptoms, how diagnosis is confirmed, how the disease is spread and how it can be prevented.

I want to thank area hospitals, physicians and other local health departments for their cooperation in providing information for this report. I hope the Hamilton County Communicable Disease Report 2004-2008 is a valuable tool in the effort to reduce the incidence and spread of communicable disease and continue to make Hamilton County a safe and healthy place to live, work and play.

Sincerely,



Tim Ingram, R.S., M.S.
Health Commissioner

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Introduction

Communicable diseases are illnesses that are caused by infectious agents such as bacteria, viruses, fungi and parasites. Transmission of communicable diseases occurs through person-to-person contact or through intermediary sources such as insect/animal vectors and contaminated food and water. Reportable diseases in the context of this report are those communicable diseases that are of high public health concern and, therefore, reportable to public health officials (Appendix A). Many reportable diseases have a high propensity to spread and cause outbreaks, resulting in widespread and potentially severe illness in the community. In Ohio, these diseases are reported to local health departments according to the Ohio Administrative Code (OAC) Chapter 3701-3. Tracking these diseases allows state and local health departments to detect unusual incidences of disease, investigate sources of infection, implement effective control measures, and develop programs and policies to prevent the spread of disease.

There are six local health departments within Hamilton County responsible for investigating cases of over 100 different types of reportable diseases (Appendix A). Reportable diseases cause many different types of illnesses and possess unique characteristics that allow transmission to occur in many different ways. A fraction of these diseases can be prevented through standard immunizations — these are vaccine-preventable diseases. The general epidemiological classifications including types of illnesses and modes of transmission for selected reportable diseases are shown in Figure 1.¹

This is the first five-year report that characterizes the burden of communicable disease in Hamilton County. The report summarizes cases of reportable diseases among residents of Hamilton County during 2004 through 2008. Cases were counted if they met the inclusion criteria outlined in the technical notes section of the report (Appendix A). Some cases may have acquired their diseases (e.g., malaria) outside the county or even the United States. The report has been divided into sections that highlight selected diseases and specific disease trends in Hamilton County. At the time of publication, provisional data were available for 2009 and 2010; annual summaries for these years have been included in Appendix B.

The superscript numbers that are embedded in the narrative text (e.g., ^{1,2,3}) correspond to the numbers in the report references list on page 37.

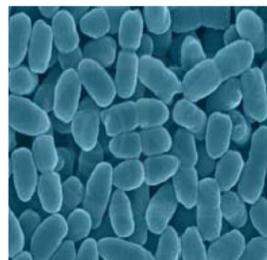
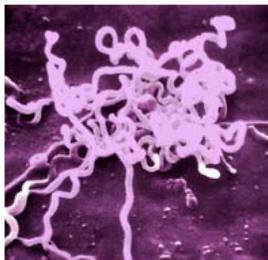
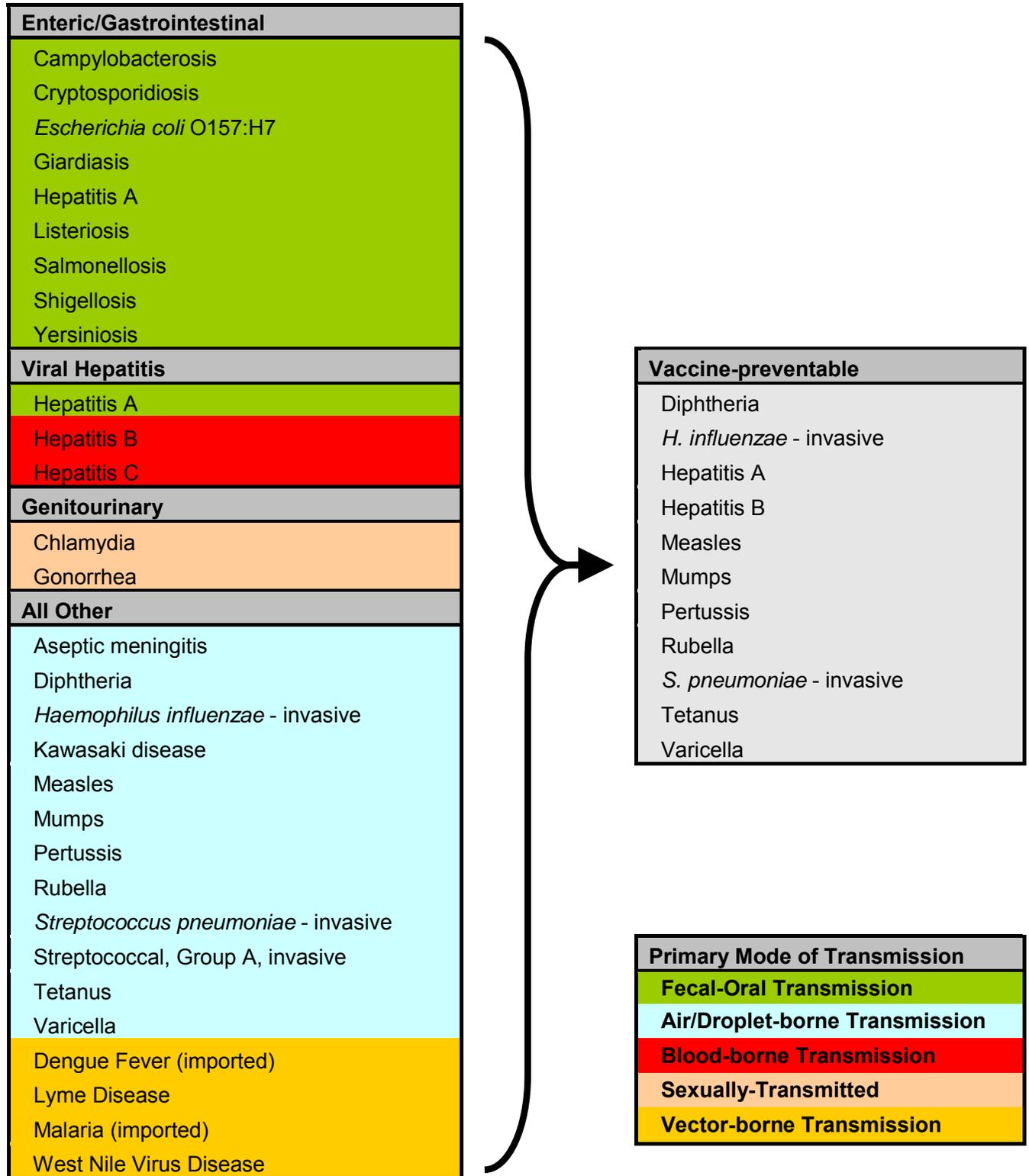


Photo courtesy of Washington County Department of Public Health and Environment, Minnesota

Figure 1. Classification of *Selected Reportable Diseases



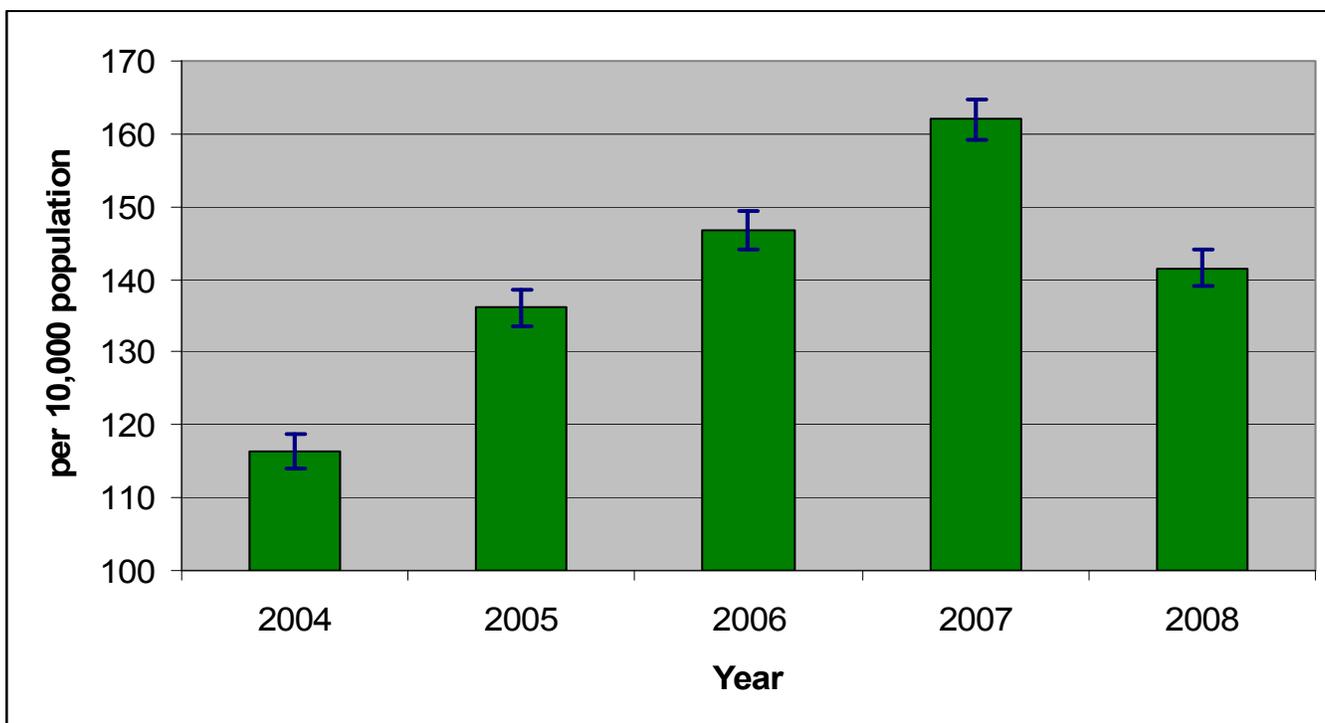
* This list does not represent all reportable diseases within the specified categories.

Executive Summary

During the five-year span of 2004 through 2008, nearly 60,000 cases of reportable diseases were reported in Hamilton County (Table 1). The incidence rate of total reportable diseases increased from 116 cases per 10,000 residents in 2004 to 162 cases per 10,000 residents in 2007; this increase was statistically significant (Figure 2, Appendix A). Following the peak incidence of 13,833 cases recorded in 2007, the incidence declined by approximately 13 percent in 2008 (Figure 2). Table 1 shows the number of each reportable disease recorded in Hamilton County during 2004 through 2008. These trends can be attributed to the changing levels of disease incidences in Hamilton County; however, advancements in the efficiency of laboratory testing and disease reporting may have also been contributing factors.

An increased incidence of reportable diseases such as sexually-transmitted infections (STIs), enteric infections (i.e., gastrointestinal illnesses), and pertussis (i.e., whooping cough) contributed largely to trends observed during the report period. The increasing incidence of STIs, namely chlamydia and gonorrhea genitourinary infections, provided evidence of a growing problem in Hamilton County; syphilis, also an STI, has increased sharply in more recent years. Enteric infections such as cryptosporidiosis and shigellosis also adversely impacted the health of Hamilton County residents. The strong association of certain enteric infections with daycare centers and recreational water facilities underscored the importance of maintaining safe environments. Pertussis, a vaccine-preventable disease, caused significant illness that disproportionately affected children. In 2009 and 2010, pertussis remained a recurring problem for Hamilton County and several other communities throughout the nation.

Figure 2. Incidence *Rates of Reportable Diseases – Hamilton County, Ohio, 2004 - 2008



*Blue bars represent 95% confidence intervals

The five-year incidence of reportable diseases was highest for STIs followed by viral hepatitis and enteric infections (Table 1). A similar distribution of disease burden was observed at the state level in Ohio.²⁻⁴ However, the Hamilton County rate was 81 percent higher than the Ohio rate for all reportable diseases combined including STIs. The Hamilton County rate was also 25 percent higher than the Ohio rate for all reportable diseases combined when STIs were not considered. Figure 3 illustrates the magnitude of the differences between the Hamilton County and Ohio (unadjusted) disease incidence rates.

Hamilton County maintained the highest rates of both chlamydia and gonorrhea infections among all counties, urban and rural, in the state of Ohio.³⁻⁴ The distribution of reportable diseases among the other general classifications of disease types (i.e., enteric, viral hepatitis, and all other) is shown in Figure 4; note that STIs and tuberculosis were omitted from Figure 4 (see Appendix A for an explanation of disease type classifications and case management by local health departments). The volume of new cases of acute and chronic hepatitis B and C (n=6,041) comprised the majority of viral hepatitis (93%) cases and also accounted for the second highest proportion (10%) of reportable diseases (Table 2, Figure 4). Enteric diseases had the third highest incidence with 3,004 (5%) total cases (Table 2, Figure 4). Approximately 2,855 (21%) of the reportable diseases investigated (exclusive of STIs) were vaccine-preventable (Table 2, Figure 4). Each of the aforementioned reportable diseases is explored further in subsequent sections of the report.

Figure 3. Incidence Rates of Reportable Diseases Including and Excluding Sexually Transmitted Infections (STIs) – Hamilton County and Ohio, 2004 - 2008

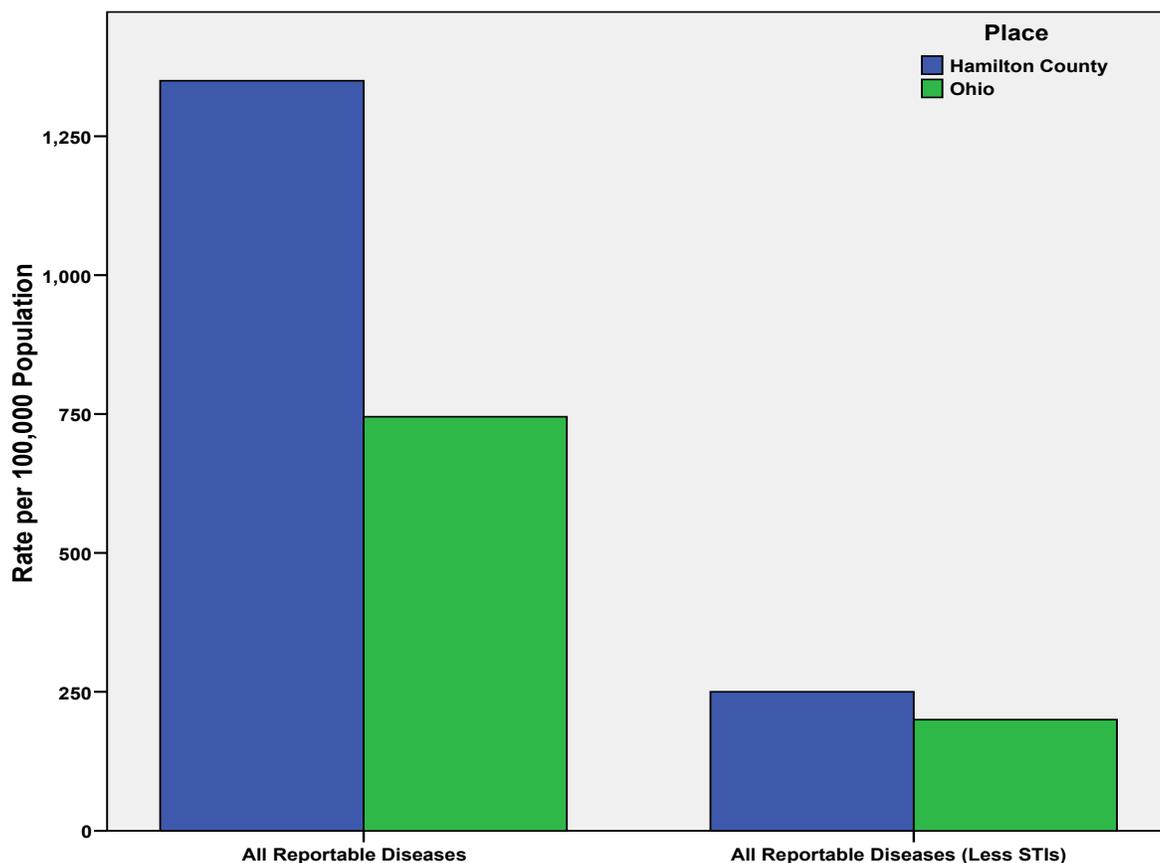


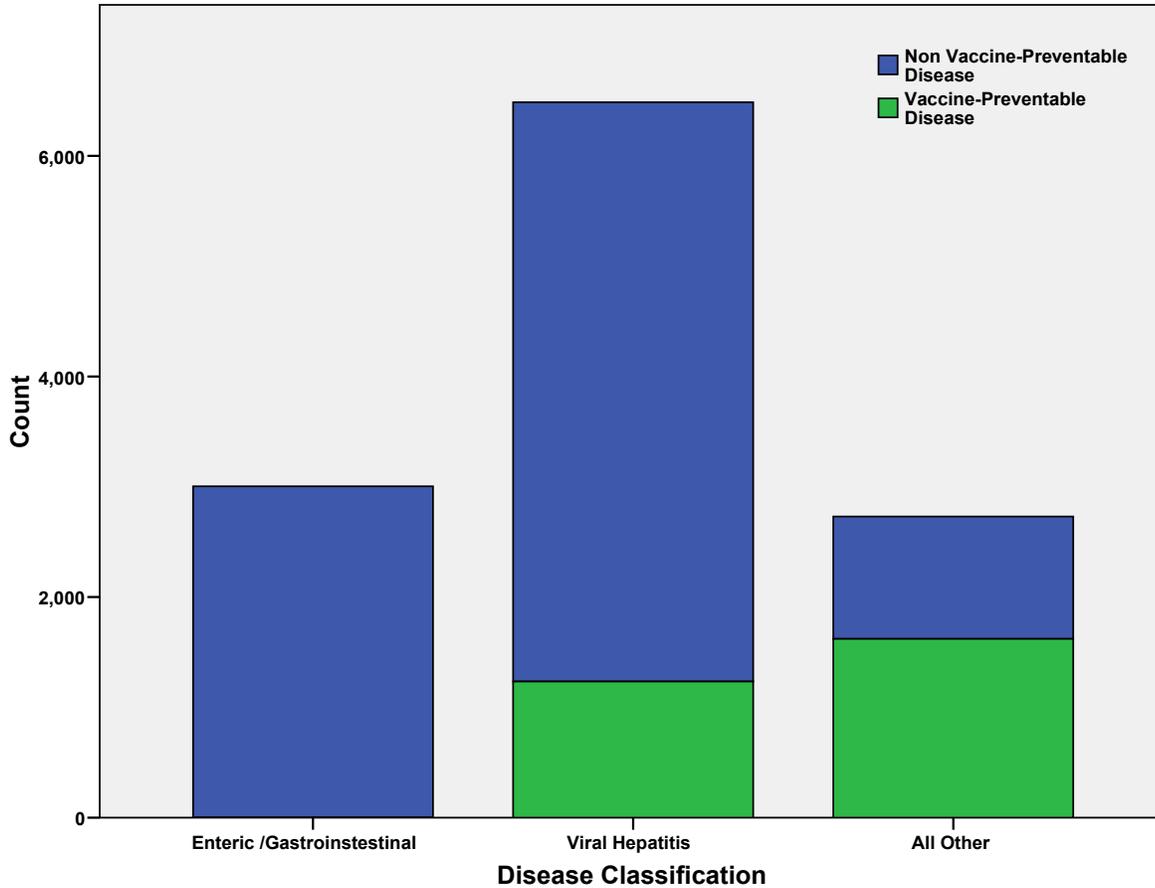
Table 1. Cases of Reportable Communicable Diseases, by Year of Report – Hamilton County, Ohio, 2004 - 2008

Disease	Year					Total
	2004	2005	2006	2007	2008	
Amebiasis	0	0	2	7	1	10
Botulism - infant	0	0	1	0	0	1
Brucellosis	1	0	0	0	0	1
Campylobacteriosis	87	78	87	89	65	406
Chlamydia infection	4675	5670	6651	6920	6821	30737
Cholera	0	0	0	1	0	1
Coccidioidomycosis	NR	NR	3	3	0	6
Creutzfeldt-Jakob Disease	0	0	2	2	2	6
*Cryptosporidiosis	7	462	26	116	11	622
Cytomegalovirus -congenital (CMV)	1	2	1	1	1	6
Dengue	1	2	1	3	2	9
<i>Escherichia coli</i> - enterohemorrhagic (shiga toxin producing) - Not O157:H7	1	2	3	3	3	12
<i>Escherichia coli</i> - enterohemorrhagic (shiga toxin producing) O157:H7	12	13	13	10	7	55
<i>Escherichia coli</i> - enterohemorrhagic (shiga toxin producing) Unknown serotype	1	2	2	1	3	9
Ehrlichiosis	0	0	0	0	1	1
*Encephalitis - post other infection	0	1	0	0	0	1
*Encephalitis - primary viral	3	0	0	0	0	3
Giardiasis	52	84	71	75	61	343
Gonococcal infection	2775	2950	3319	3519	3063	15626
<i>Haemophilus influenzae</i> (invasive disease)	3	6	6	11	13	39
Hemolytic uremic syndrome (HUS)	1	3	0	1	0	5
Hepatitis A	12	13	8	14	16	63
Hepatitis B (including delta) - acute	26	34	25	33	29	147
Hepatitis B (including delta) - acute/chronic status not determined	99	10	0	0	0	109
*Hepatitis B (including delta) - chronic	140	175	200	214	186	915
Hepatitis C - acute	0	0	2	0	0	2
Hepatitis C - acute/chronic status not determined	271	1	0	0	0	272
*Hepatitis C - chronic	912	1232	929	1052	852	4977
Hepatitis E	0	0	0	1	0	1
Herpes - congenital	0	1	2	2	3	8
HIV/AIDS	117	135	158	138	184	732
Influenza-associated pediatric mortality	0	0	1	1	1	3
Kawasaki disease (mucocutaneous lymph node syndrome)	8	13	3	9	9	42
Legionnaires' Disease	3	6	8	1	4	22
Listeriosis	3	2	5	0	1	11
Lyme Disease	0	7	8	2	7	24
Malaria	3	8	3	4	3	21
Meningitis - aseptic/viral	112	111	60	63	66	412
Meningitis - bacterial (Not <i>Neisseria meningitidis</i>)	1	2	2	3	2	10
*Meningococcal disease - <i>Neisseria meningitidis</i>	3	3	4	3	3	16
Mumps	0	1	9	1	2	13
Mycobacterial disease - other than tuberculosis	69	76	60	73	53	331
*Pertussis	150	110	62	32	79	433
Rocky Mountain spotted fever (RMSF)	1	0	3	0	1	5
Salmonellosis	85	85	67	123	90	450
*Shigellosis	21	3	63	910	78	1075
Streptococcal - Group A -invasive	21	24	26	15	24	110
Streptococcal - Group B - in newborn	8	8	10	2	6	34
Streptococcal toxic shock syndrome (STSS)	2	2	5	0	1	10
* <i>Streptococcus pneumoniae</i> - invasive antibiotic resistance unknown or non-resistant	57	75	74	62	76	344
* <i>Streptococcus pneumoniae</i> - invasive antibiotic resistant/intermediate	20	39	42	29	29	159
Syphilis	43	37	42	55	72	249
Toxic shock syndrome (TSS)	1	1	1	1	2	6
Tuberculosis	29	26	27	24	13	119
Tularemia	1	0	0	0	0	1
Typhoid fever	2	0	0	1	3	6
Varicella	NR	NR	332	197	104	633
Vibriosis - other (not cholera)	0	0	0	0	1	1
West Nile virus disease	1	5	1	4	3	14
Yersiniosis	3	2	2	2	0	9
Total	9844	11552	12432	13833	12057	59688

* See Appendix A: Notes on Specific Diseases NR: Not Reportable

Notes on Table 1: Data are provisional and were current as of July 2009. Reportable diseases with a zero incidence during 2004-2008 were omitted from the table. See Appendix A for a full listing of diseases that were omitted from table 1 due to zero incidence.

Figure 4. *Cases of Reportable Diseases by Disease Type and Year – Hamilton County, Ohio, 2004 - 2008



*The data in Figure 4 do not include sexually-transmitted infections or tuberculosis.

Table 2. *Cases of Reportable Communicable Diseases, Stratified by Disease Classification and Vaccine Preventable Status – Hamilton County, Ohio, 2004 - 2008

			Year					Total
			2004	2005	2006	2007	2008	
Non-Vaccine-Preventable	Disease Classification	Enteric	272	734	336	1339	323	3004
		Viral Hepatitis	1183	1233	931	1053	852	5252
		All Other	245	273	208	190	192	1108
	Total	1700	2240	1475	2582	1367	9364	
Vaccine-Preventable	Disease Classification	Enteric	-	-	-	-	-	-
		Viral Hepatitis	277	232	233	261	231	1234
		All Other	230	231	525	332	303	1621
	Total	507	463	758	593	534	2855	

*The data in Table 2 do not include sexually-transmitted infections or tuberculosis.

Highlighted Diseases

The incidence of reportable diseases may differ by the demographic and geographic characteristics of a population; moreover, these diseases may follow predictable, temporal patterns of disease incidence (i.e., seasonal risk). Certain populations may be more susceptible to specific disease types because of behavioral, environmental and/or medical risk factors. Therefore, the population risk associated with communicable disease can be characterized by studying trends in terms of people, places and times most affected by these conditions. The following sections highlight selected diseases and provide information regarding associated population risk characteristics and trends observed in Hamilton County, 2004 through 2008.

Enteric Infections

A variety of pathogens (e.g., *E. coli* 0157:H7) can cause enteric infections that are reportable in the state of Ohio.¹ Enteric infections result in disease characterized by symptoms of nausea, vomiting, diarrhea and/or fever. Individual cases of specific enteric infections and any unusual incidence (i.e. outbreak) of enteric-type illness meet state reporting requirements shown in Appendix C. Enteric infections are most commonly transmitted via food, water and/or person-to-person. Outbreaks may range in size from small clusters to large, community-wide outbreaks and may be linked with specific facilities such as restaurants, daycares, nursing homes and/or recreational water facilities. Although enteric infections occur at a lower rate than other reportable diseases discussed, these diseases can require more intensive, time-sensitive investigations and create a larger demand on local public health resources. Refer to Figure 1 for a list of reportable diseases in Ohio that are caused by enteric infections.



Community-wide outbreaks of the enteric diseases shigellosis and cryptosporidiosis occurred during the 2004-2008 period. A community-wide outbreak of shigellosis began at the end of 2006 and continued throughout 2007 into early 2008, affecting the daycare population throughout Hamilton County. Cryptosporidiosis associated with recreational water facilities in Hamilton County increased to outbreak levels in 2005 and also exceeded expected levels (though to a lesser degree) in 2007. Because these two outbreaks significantly impacted specific segments of the population within Hamilton County in 2005 and 2007, the general overview of enteric diseases that follows will be presented in the context of “outbreak years” (2005 and 2007) compared to “non-outbreak years” (2004, 2006 & 2008).

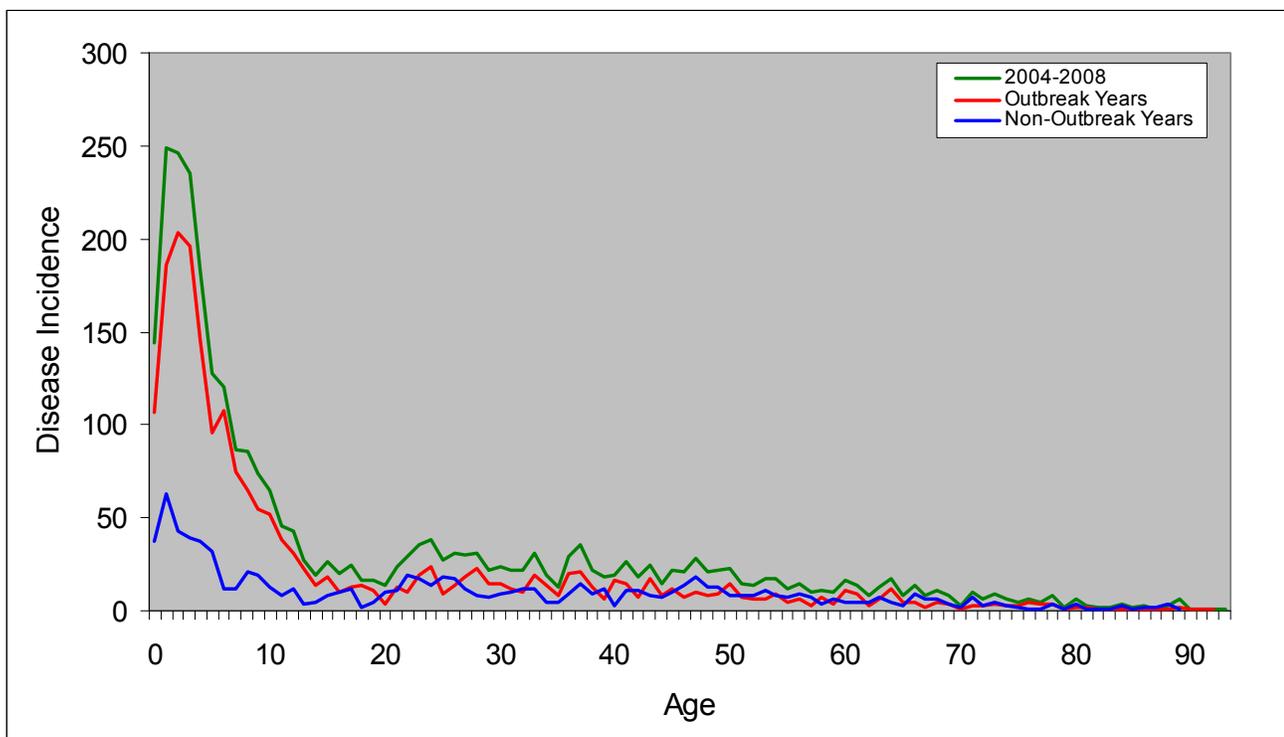
*Age

Children under the age of 15 years accounted for approximately 60 percent of all reportable enteric infections in Hamilton County between 2004 and 2008. During the cryptosporidiosis and shigellosis outbreaks, this age group was heavily impacted by both diseases. The yearly mean incidence of enteric infections for this age group was 350 cases per year. By comparison, the yearly mean incidence of enteric infections during non-outbreak years was 119 cases per year. Figure 5 shows the overall distribution of enteric infections by age between 2004 and 2008. Distributions by age are also shown for outbreak and non-outbreak years.

The 2004-2008 distribution of enteric infections among ages greater than 14 years was similar for each 10-year age group between 15 and 54 years of age (range: 200-244 total cases per age group) (Figure 5). Beginning at 55 years of age, the disease incidence began to decline with advancing age (range: 19-126 total cases per age group) (Figure 5). The yearly mean incidence of enteric infections for the age groups greater than 14 years between 2004 and 2008 was 239 cases per year, whereas the yearly mean incidence of enteric infections during non-outbreak years was 185 cases per year.

* age data unavailable for 2% of cases (n=57)

Figure 5. *Age Distribution of Cases of Reportable Diseases Caused by Enteric Infections – Hamilton County, Ohio, 2004 - 2008



* age data unavailable for 2% of cases (n=57)

**** Sex**

The distribution of enteric illness was nearly equal among males and females. Incidence among females (51%, n=1409) was slightly higher than among males (49%, n=1495). In non-outbreak years, the yearly mean incidence for males was 145 cases per year (range: 127-156) and 155 cases per year (range: 141-168) for females.

** sex data unavailable for 3% of cases (n=100)

***** Race**

The 2004-2008 burden of enteric illness by race was influenced by outbreak-associated cases. The white population was disproportionately impacted during the cryptosporidiosis outbreak of 2005, and the black population was more greatly impacted during the shigellosis outbreak in 2007. For all years, the white population accounted for 56 percent of all enteric infections with a rate of 164 per 100,000 residents, whereas the proportion among the black population was 38 percent with a rate of 348 per 100,000 residents. During non-outbreak years, the rates of enteric infections for these two populations were comparable (Table 3). During outbreak years, both races experienced elevated rates, but the magnitude of the increase was higher among the black population (Table 4). Rate calculations were suppressed for other races because of small counts (See Appendix A for full explanation of rate calculation methodology).

Table 3. Proportions and Rates of Enteric Infections by Race – Hamilton County, Ohio, 2004, 2006, 2008

	Count	Proportion***	Rate†	95% C.I.†
White	406	71%	66	65.3 – 66.7
Black	132	23%	67	65.8 – 68.2

Table 4. Proportions and Rates of Enteric Infections by Race – Hamilton County, Ohio, 2005 and 2007

	Count	Proportion***	Rate [†]	95% C.I. [‡]
White	603	49%	98	97.2 – 98.8
Black	557	45%	281	278.6 – 283.4

[†]See Appendix A for explanation of rate calculation methodology; 2000 US Census Estimate

[‡]rate 95% confidence interval

*** race data unavailable for 40% of cases (n=1200)

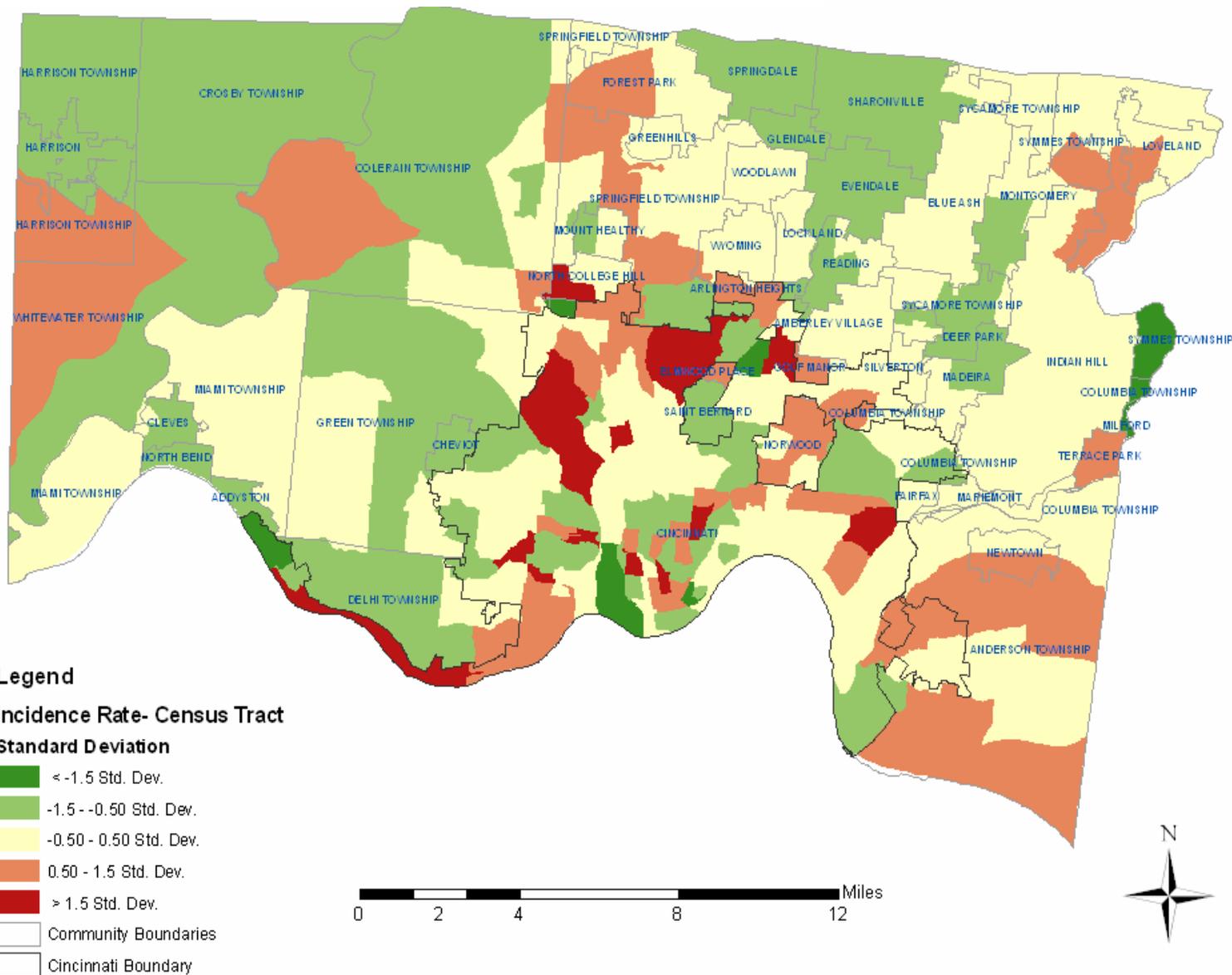
Spatial Distribution

Reportable enteric infections occurred in all communities within Hamilton County. However, there were significant disparities in disease incidence observed among these communities. Figure 6 depicts distribution of enteric infections within Hamilton County census tracts and specifically, the distribution of disease incidence rates is shown. Census tracts shaded in green indicate lower than expected rates, whereas census tracts shaded in red indicate higher than expected rates. The degree of shading corresponds to the magnitude of the difference between a census tract rate and the rate in Hamilton County (See Appendix A for full explanation of methodology and interpretation).

The city of Cincinnati contained 16 of the 17 census tracts with exceptionally high incidence rates of enteric infections – defined as greater than 1.5 standard deviations above the Hamilton County average rate per census tract, 2004-2008. North College Hill was the one additional Hamilton County community outside the city of Cincinnati with a census tract in this range. Shigellosis was the most frequently reported enteric infection among these census tracts. Shigellosis and cryptosporidiosis accounted for 42 percent and 20 percent of enteric infections, respectively, in census tracts with a greater than expected number of cases.

Hamilton County communities outside the city of Cincinnati with relatively high incidence rates also experienced disproportionate levels of shigellosis (30%) and cryptosporidiosis (35%). These high incidence rates were also attributed to the large, community-wide outbreaks that occurred in the five-year report period.

Figure 6. Distribution of Incidence Rates of Reportable Enteric Infections by Census Tract – Hamilton County, Ohio, 2004 - 2008



Seasonal Distribution

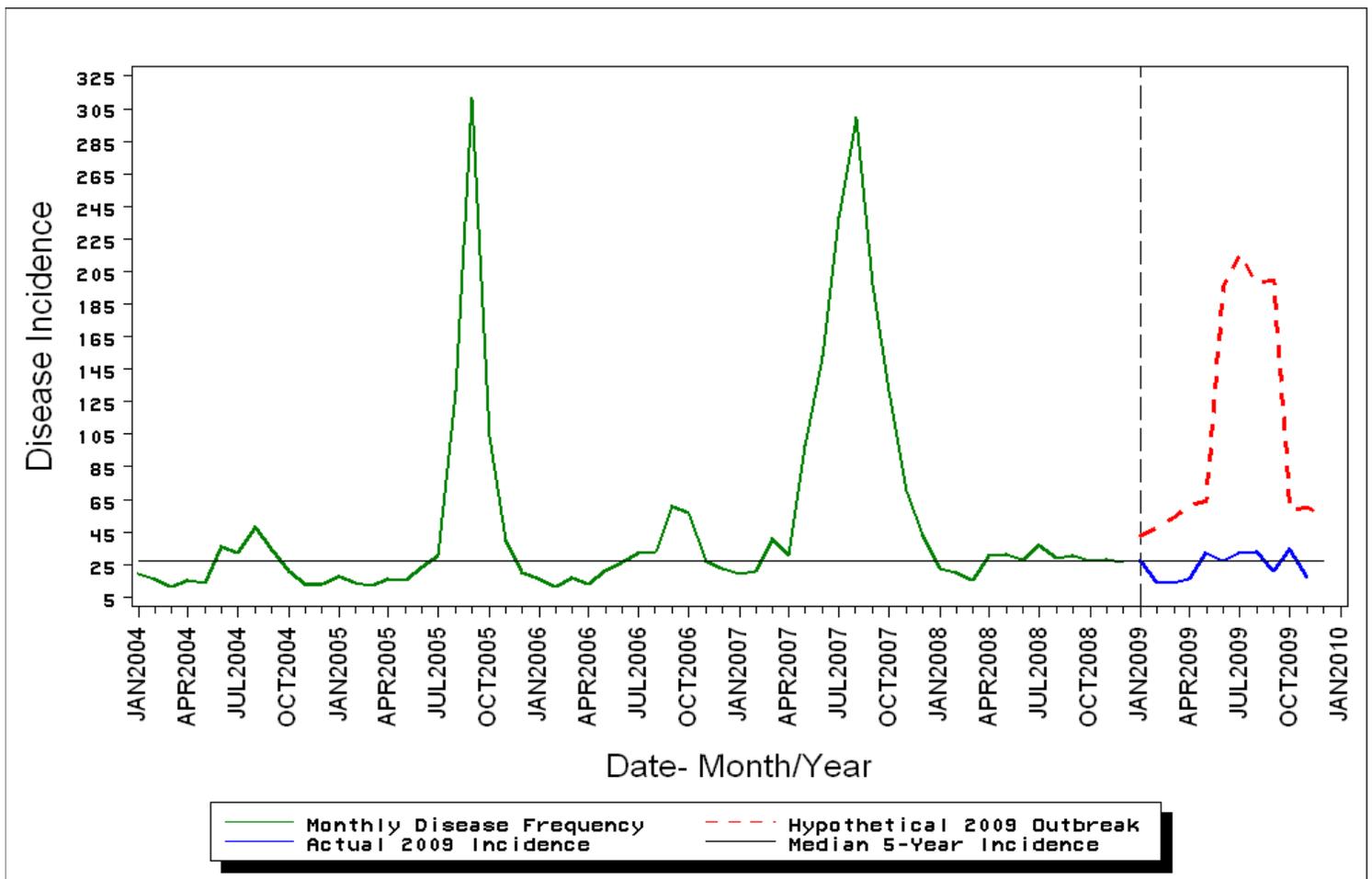
Increases in enteric infections have a tendency to occur during the warmer seasons of the year; however, this does not preclude outbreaks from occurring in any season. The incidence of enteric infections was higher each year, 2004-2008, between May and September (Figure 7). Many factors may contribute to the higher risk observed during these months such as increased use of recreational water facilities, increased use of daycare centers for school-age children, and an increased frequency of large social gathering (e.g., church festivals).

As evident by the significant spikes observed in 2005 and 2007, enteric infections caused a serious public health burden (Figure 7). As previously discussed, an outbreak of cryptosporidiosis occurred during the summer and fall of 2005 and an outbreak of shigellosis occurred during similar months in 2007. In 2008, the disease incidence associated with enteric infections dropped to the lowest level observed in five years (Figure 7). This trend was sustained in 2009.

Disease Prevention

A forecasting model was generated using the 2004-2008 data to forecast a hypothetical community-wide outbreak of enteric infections in 2009 (see Appendix A for statistical methodology). The model forecasted an outbreak with a peak incidence represented by the red dashed line in Figure 7. The model estimated that an additional 700 cases of enteric infection may have occurred between May and September of 2009 given a hypothetical outbreak scenario such as those that occurred in 2005 and 2007. This exercise underscores the importance of effective disease prevention in the community and the critical role that public health must serve to protect the public and promote prevention. In addition to health implications within local communities, these reportable diseases can create a significant economic burden. Laboratory testing, patient treatment, temporary exclusion from daycare centers, and lost time at work all have financial implications for residents as well as public health agencies. See www.hamiltoncountyhealth.org for recommended prevention activities.

Figure 7. Incidence of Cases of Reportable Enteric Infections – Hamilton County, Ohio, 2004 - 2008



Enteric Infection: Cryptosporidiosis

Cryptosporidiosis is a disease characterized by watery diarrhea, which usually lasts for one to two weeks. Other symptoms may include headache, severe abdominal cramping, nausea, and less commonly, vomiting.¹ The disease is caused by a parasite of the genus *Cryptosporidium*, commonly referred to as crypto. Crypto can be found in water and other sources that have been contaminated with animal or human feces that contain the parasite. Infection occurs when the parasite is ingested. Crypto is typically resistant to low levels of chlorine, such as the level used to treat recreational water facilities (e.g., swimming pools, water parks). Consequently, cryptosporidiosis has been associated with several waterborne outbreaks in the United States.⁵

- Cryptosporidiosis is most commonly reported in the summer months, with the highest incidence normally occurring in July and August. In the summer of 2005, a community-wide outbreak of cryptosporidiosis occurred in Hamilton County.
- There were between 400-500 cases of crypto in Hamilton County documented in the outbreak. Additional cases likely occurred, but were not identified by public health.
- The incidence of crypto in July-November 2005 was 36 per 100,000 residents, whereas the incidence in July-November 2004 was only 0.5 per 100,000 residents.

Figure 8 reflects the political jurisdictions in Hamilton County where the 2005 crypto outbreak was concentrated. Incidence rates were calculated for each political jurisdiction to compare the distribution of cases throughout Hamilton County (Figure 8). Political jurisdictions with an incidence rate greater than 98 cases per 100,000 residents (e.g., Anderson Township and the City of Norwood) were areas where more cases of crypto occurred than expected during the outbreak (Figure 8). Cases of crypto were identified throughout Hamilton County, but the outbreak was concentrated in the eastern side of the county. See Appendix A for technical notes on the calculation of incidence rates.

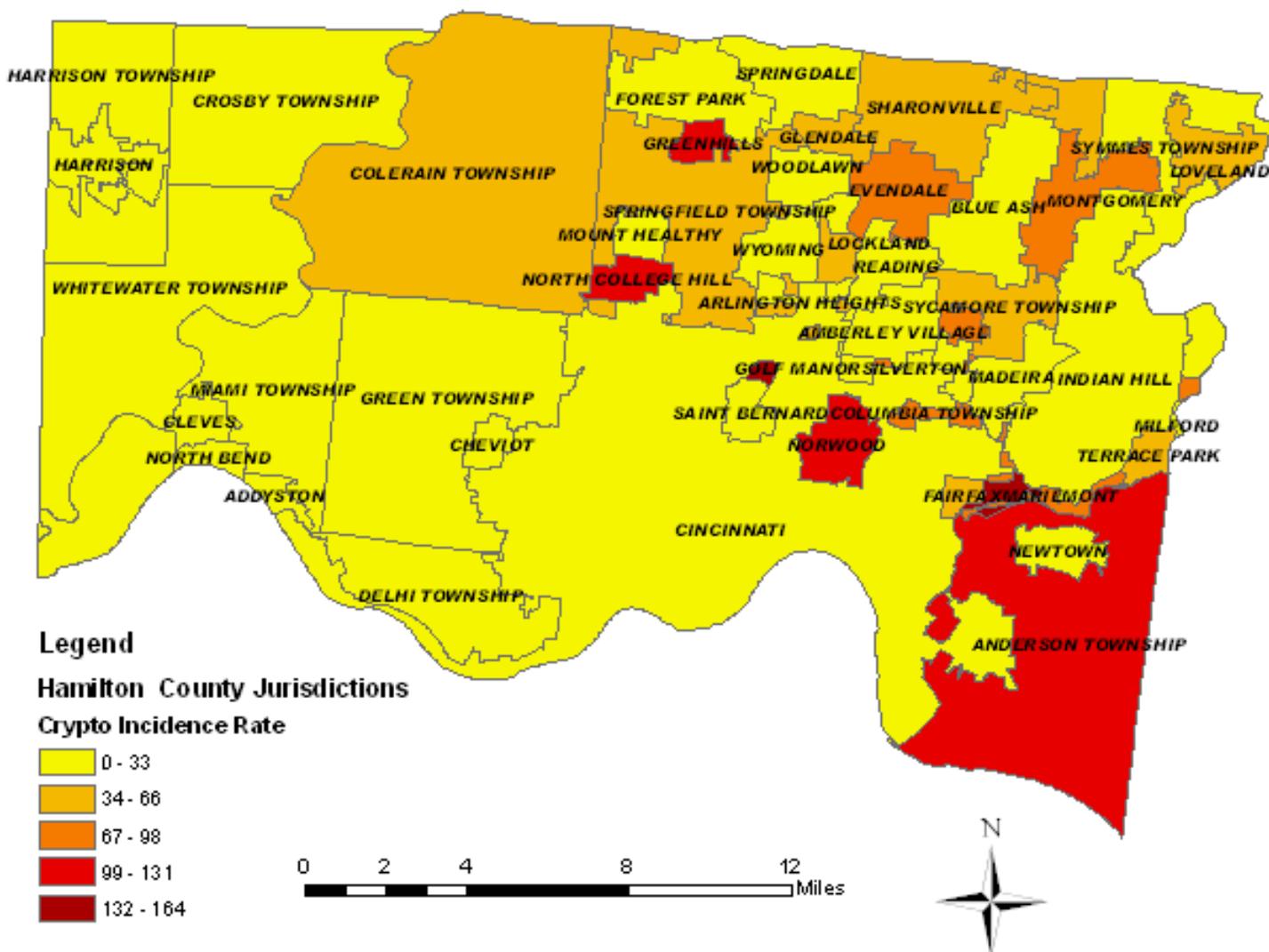
Heightened awareness and increased laboratory testing enabled public health officials to capture a large proportion of outbreak-related cases. Approximately *70 percent of Hamilton County cases in the outbreak reported having recreational water exposure, much of which occurred at water parks. Towards the end of the outbreak (October-November), the odds of developing the disease increased among daycare attendees. Local health jurisdictions in Hamilton County were able to control the outbreak through enhanced communication with local physicians and educational efforts directed at the general public, recreational water facilities and daycare centers.

For more information on Cryptosporidiosis, visit:

http://www.cdc.gov/ncidod/dpd/parasites/cryptosporidiosis/factsht_cryptosporidiosis.htm.

*Official outbreak statistics for Hamilton County were based on 412 probable or confirmed cases.

Figure 8. Outbreak of Cryptosporidiosis in Hamilton County, Ohio, July - November 2005: Incidence Rates by Political Jurisdictions



Enteric Infection: Shigellosis

Shigellosis, a bacterial infection caused by shigella, is a frequent cause of acute diarrheal illness among children two to four years of age in childcare settings.^{1,6} The relatively ubiquitous nature and low infectious dose of this enteric pathogen makes it a common cause of community outbreaks. Outbreaks of shigellosis have been associated with daycare centers, recreational water facilities, and contaminated food.⁶⁻¹⁸ In the United States, researchers have estimated that between 300,000-450,000 cases of shigellosis occur each year and approximately 25 percent of these cases are associated with daycare environments.^{19,20}

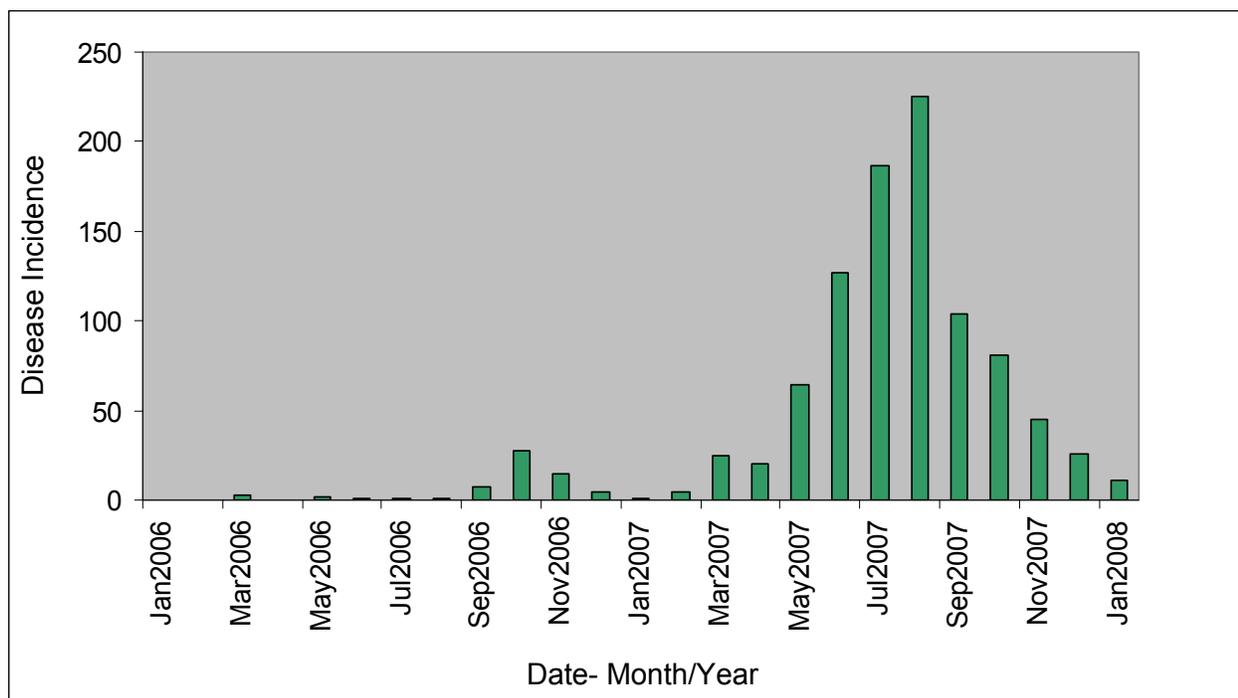
Childcare settings are particularly high-risk environments for diarrheal outbreaks such as shigellosis.^{21,22} To combat this problem, public health practitioners implement outbreak prevention and mitigation strategies to prevent and disrupt the transmission of shigella in daycare centers.^{1,21-22} Common control measures include exclusion of symptomatic daycare attendees and staff members, extensive screening for asymptomatic carriers and subsequent exclusion, education regarding proper hygiene practices, and appropriate staff assignments.^{1,21-22}

During the years of 2006 and 2007, outbreaks of shigellosis in daycare centers throughout Southwest Ohio contributed to nearly 1,000 cases in Hamilton County (Figure 9). Ten commercial childcare facilities were affected by the outbreak in the political jurisdictions served by Hamilton County Public Health. Local health departments used data gathered through surveillance and outbreak investigations to monitor and characterize high-risk populations. This information was then used to assist and inform the processes of mitigation and prevention of outbreaks.

The disease incidence peaked in August 2007. Cases of shigellosis identified through public health surveillance during the community outbreaks were a median of four years of age; 54 percent of the cases were female and 46 percent were male (Figure 10). Cases of black race represented the highest proportion (72%) of identified cases followed by cases of white race (20%); 8 percent of the case population were classified as another race. Research conducted on data collected from a sample of affected classrooms indicated that children two to three years of age had the highest likelihood for developing shigellosis in the daycare environment. Children in this age group had a likelihood of disease that was approximately four-five times higher than that of children over six years of age ([†]Odds Ratio: 4.66, 95% Confidence Interval 1.47-14.79). Children 4-6 years of age were also significantly more likely to acquire shigellosis than children older than six years of age ([†]3.72, 1.28-10.77).

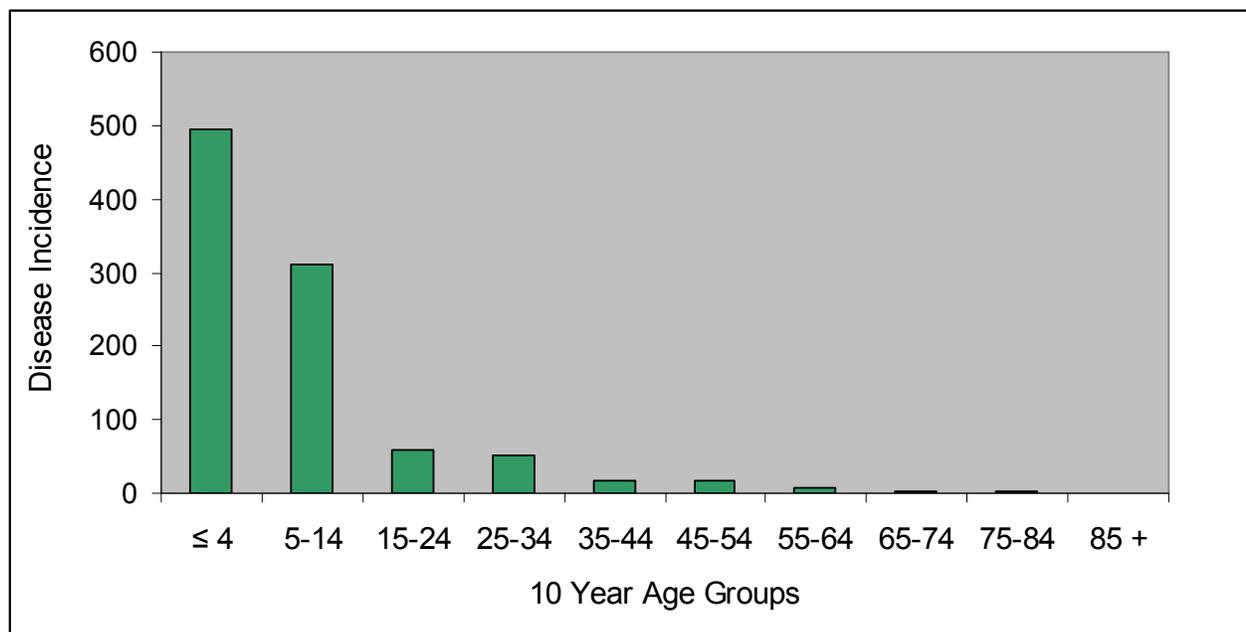
Intervention strategies including staff education and exclusion of ill children were effective in stemming the daycare-associated outbreaks during these years. Proper hand hygiene appeared effective in protecting the younger, diapered population who were largely dependent on direct care by daycare providers. The local health departments in Hamilton County continue to act quickly to detect and respond to outbreaks of shigellosis in the daycare environment.

Figure 9. Incidence of Shigellosis – Hamilton County, Ohio, 2006 - 2007



[†] The analysis was adjusted for classroom size, which may have an impact on disease transmission in certain settings.

Figure 10. *Age Distribution in Shigellosis Outbreak – Hamilton County, Ohio, 2006 - 2007

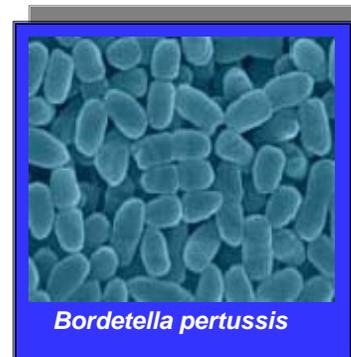


*age data unavailable for % of cases (n=9)

Pertussis

Pertussis, commonly referred to as Whooping Cough, is a vaccine-preventable disease that is characterized by three stages: catarrhal (First Stage), paroxysmal (Second Stage), and convalescent (Third Stage).¹ The catarrhal stage is the first stage of illness and has a gradual onset that initially resembles the common cold. This stage normally lasts for one to two weeks and is the stage in which the disease is most communicable. The second stage, the paroxysmal stage, can last for up to six weeks and is characterized by paroxysms, which are repeated violent coughs without intervening inhalation, followed by a gasp for air that produces a high-pitched whoop; vomiting often follows.¹ The convalescent stage is the final stage of the disease and normally lasts for two to three weeks. In this stage, the whooping cough and vomiting begin to subside and eventually stop.¹

Pertussis is caused by bacteria called *Bordetella pertussis*, which produces several toxins that contribute to the virulence and long duration of the disease.²³ Pertussis is transmitted through direct contact with the respiratory secretions of an infected person. The organism can be carried for several feet in aerosolized droplets. Those at high risk for developing the disease are persons who have had three or more hours of face-to-face contact with a person infected with pertussis. After being exposed, an infected person will normally develop symptoms in seven to 10 days; however, this can range from four to 21 days.²³ The secondary attack rate is very high among household contacts of a case. In fact, up to 80 percent of non-immune household contacts may develop the disease.²³ Pertussis is spread easily and can be very severe in infants and the immunocompromised; symptoms may be milder (i.e., cold like symptoms and a persistent cough) for older children and adults. Prompt public health intervention is crucial in a pertussis outbreak to protect the vulnerable populations.



In 2004 and 2005, an increased incidence of pertussis was observed in the United States (Figure 11).²³⁻²⁵ A growing proportion of adolescent and adult cases in 1990-2009 indicated that an apparent shift in disease risk had occurred (Figure 12).²³⁻²⁵ These findings also supported the hypothesis that

protection provided by the pertussis vaccine is likely to diminish in early adolescence and adulthood without a booster vaccine.^{23,25} In 2005, a vaccine called Tdap (tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis) was licensed in the United States and permitted expanded vaccine recommendations for adolescents (11-18 years) and adults.¹ Please see Appendix D for recommended immunization schedules.

In the winter of 2004, a high incidence of pertussis also occurred in Southwest Ohio. From December 2004 through January 2005, 86 cases were reported in Hamilton County (Figure 13). Several of the cases reported in December 2004 were not confirmed or officially counted until 2005. In 2004 and 2005 combined, 41 percent of pertussis cases were between the ages of 11 and 19 years. In 2008, a resurgence of pertussis occurred in Hamilton County with the largest proportion (39%) of cases between the ages of seven and 10 years (Figure 13). It should be noted that over 50 percent of infants that contract pertussis will be hospitalized; this group also has the highest case-fatality rate.

Figure 11. Reported Incidence Rate of Pertussis – U.S., 1990 - 2009

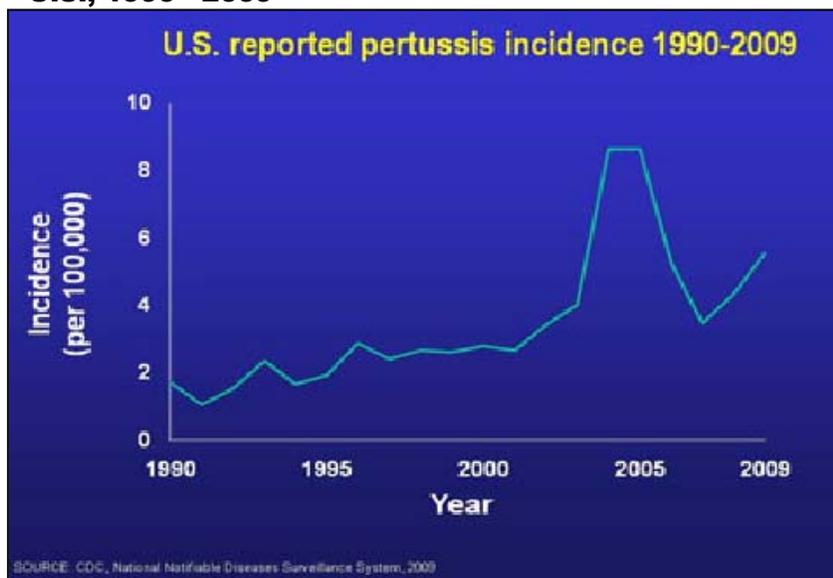


Figure 12. Reported Incidence Rate of Pertussis by Age Group – U.S., 1990 - 2009

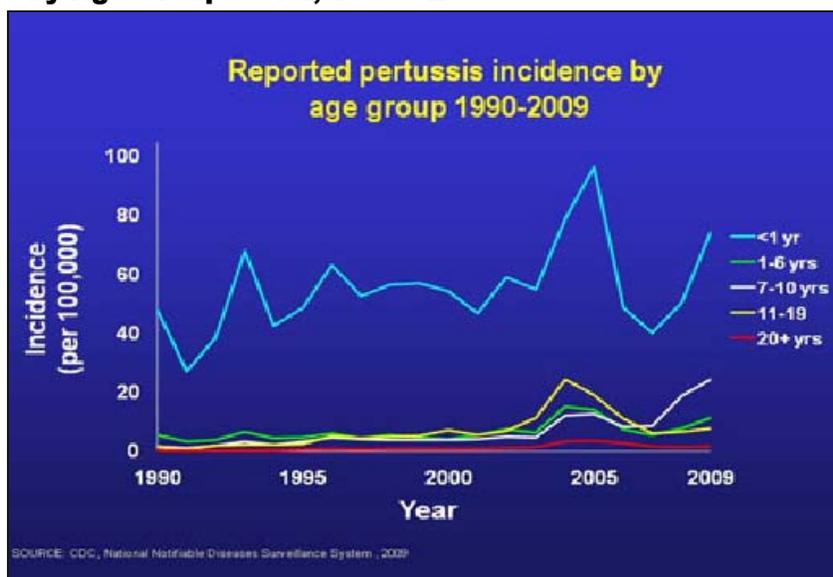
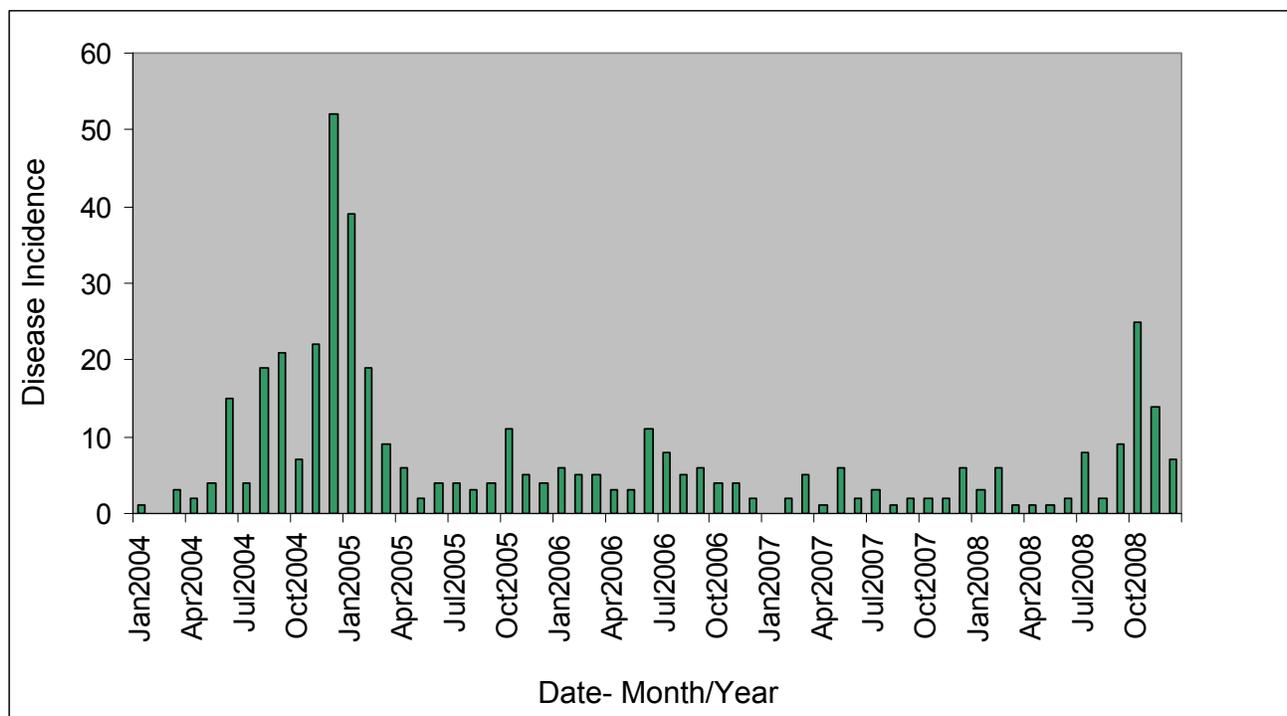


Figure 13. Cases of Pertussis by Month – Hamilton County, Ohio, 2004 - 2008



Sexually-Transmitted Infections

Sexually-Transmitted Infections (STIs), also referred to as sexually-transmitted diseases (STDs), are infections that are transmitted through sexual contact and can result in significant human illness. The Institute of Medicine (IOM) and the Centers for Disease Control and Prevention (CDC) have described STIs as “hidden epidemics of enormous health and economic consequence in the United States.”^{26,27} The most frequently reported STIs including chlamydia and gonorrhea commonly manifest as genitourinary tract infections. Although these infections are the most prevalent reportable STIs in the United States, other STIs such as syphilis and HIV/AIDS can result in more severe disease and even death; other STIs such as trichomoniasis are not reportable to public health, but also cause significant illness. Selected reportable STIs are highlighted in more detail below. For more information on additional STIs, see <http://www.cdc.gov/std/default.htm>.

Chlamydia Infection in Hamilton County, Ohio 2004-2008*

Chlamydia is the most frequently reported STI in the United States and remains largely under-reported.²⁶ This infection primarily causes urethritis in males and cervical infections in females; however, these insidious infections are often asymptomatic (i.e., no apparent symptoms) and can be responsible for more serious conditions such as pelvic inflammatory disease (PID) and potentially preterm birth.²⁸ An unpublished meta-analysis conducted by the Division of Epidemiology at Hamilton County Public Health revealed that pregnant women with chlamydia infection during pregnancy may have nearly twice the odds of delivering preterm (i.e., < 37 weeks) than women without chlamydia infection. It should be noted that standard practice guidelines do include the routine screening and treatment of chlamydia infections among pregnant women. A preterm baby is not only at a significantly higher risk of morbidity and mortality, but also results in marked healthcare costs. It has been estimated by the IOM that preterm birth costs \$16.9 billion per year in medical care, or \$33,200 per preterm infant.²⁹

Table 5 shows the number of chlamydia cases reported in Hamilton County in 2004 through 2008, classified by age group, sex, and race. More women than men are screened for chlamydia, partially explaining the higher incidence of this disease in females (80%) versus males (20%) in Hamilton County (Table 5). Cases between the ages of 15 and 24 years accounted for 77 percent of cases; age was unknown for 1 percent of the cases (Table 5). The age-specific rates are generally the highest for females in the 15-19 and 20-24 age groups and the highest among males in the 20-24 age group.²⁶ Cases in the black population represented 79 percent of the cases with a known race in Hamilton County; race was unknown for 37 percent of cases (Table 5).

The incidence rate of chlamydia infections increased nationally between 1990 and 2009 (Figure 14). In Hamilton County, the incidence rate increased by approximately 49 percent between 2004 and 2008 (Table 5). Hamilton County had the highest incidence rate of chlamydia infection in Ohio. Figure 15 shows the geographic distribution of chlamydia infections in Ohio during 2008. Improved screening efforts and more sensitive diagnostic tests may have contributed to the significant increase observed in Hamilton County, but a disproportionate rate of morbidity in Hamilton County remains evident. Further research is needed to elucidate this trend in the United States as well as in Hamilton County.

For more information on chlamydia see <http://www.cdc.gov/std/chlamydia/default.htm> or <http://www.odh.ohio.gov/healthStats/disease/std/std1.aspx>.

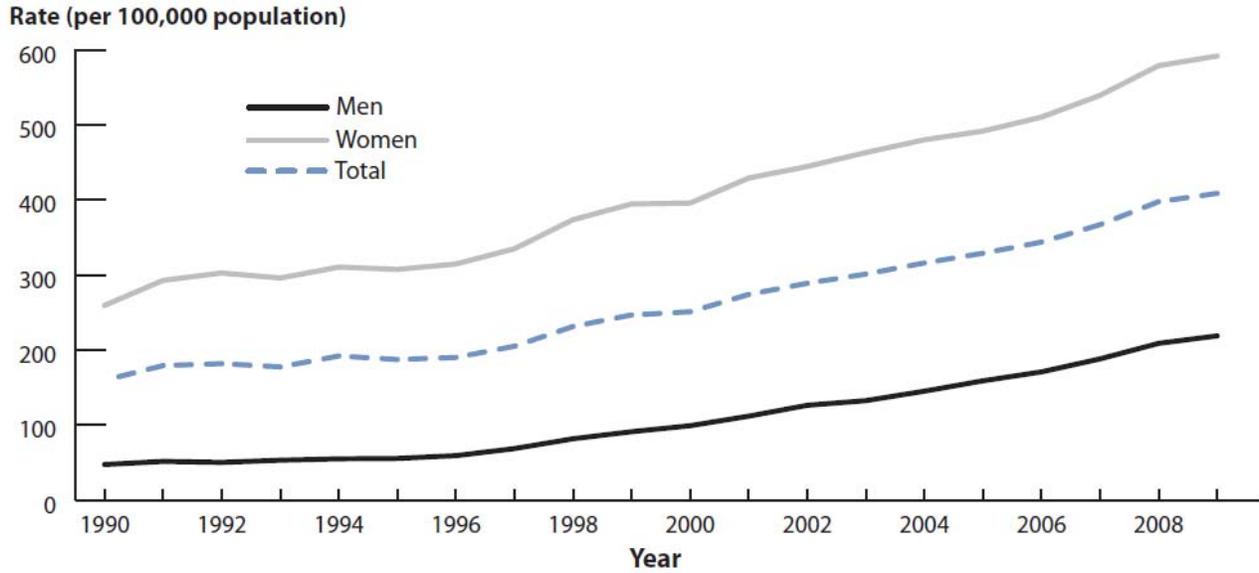
Table 5. Reported Cases of Chlamydia – Hamilton County, Ohio, 2004 - 2008

	2004 (n=4675)	2005 (n=5670)	2006 (n=6651)	2007 (n=6920)	2008 (n=6821)
Age in years					
0-14	181	197	180	200	149
15-24	3532	4247	5005	5243	5341
25-44	846	1098	1327	1355	1256
45-64	36	43	56	67	46
65+	4	2	2	3	1
Unknown/Missing	76	83	81	52	28
Sex					
Male	937	1194	1312	1390	1327
Female	3684	4354	5284	5485	5470
Unknown/Missing	54	122	55	45	24
Race					
White	701	721	763	750	734
Black	2474	2800	3325	3437	3289
Other	80	74	131	129	110
Unknown/Missing	1420	2075	2432	2604	2688
Hamilton County Rate (per 100,000 residents)	552.4	669.6	785.1	810.4	801.1
†Ohio Rate (per 100,000 residents)	342.6	366.6	362.7	400	407.1

*Data are from the Ohio Department of Health's STD Surveillance

†Rates were obtained from the Ohio Department of Health and were calculated using US census estimates, 2003-2008

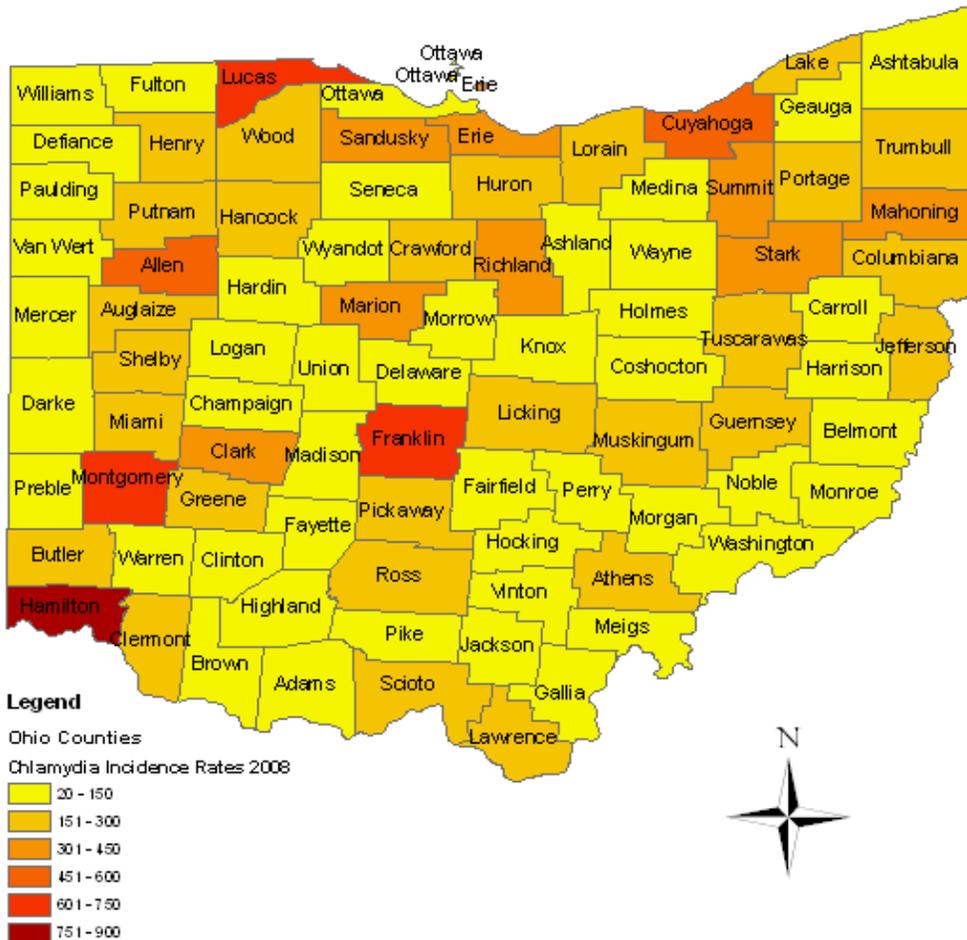
Figure 14. Chlamydia Rates by Sex – U.S., 1990 - 2009



NOTE: As of January 2000, all 50 states and the District of Columbia had regulations that required chlamydia cases to be reported.

Source: Centers for Disease Control and Prevention, STD Surveillance²⁶

Figure 15. Incidence Rates of Chlamydia by County, Ohio, 2008



Gonorrhea Infection in Hamilton County, Ohio 2004-2008*

Gonorrhea is the second most commonly reported infectious disease in the United States (behind chlamydia).²⁶ Gonorrhea and chlamydia infections can be difficult to distinguish clinically (particularly in women) and co-infection with both organisms can occur.²⁸ Gonorrhea infections may also be asymptomatic, particularly in women.²⁸ Similar to chlamydia infections, gonorrhea infections can lead to more severe conditions such as PID in women. These infections might also facilitate HIV transmission.²⁶

Table 6 shows the number of gonorrhea cases reported in Hamilton County in 2004 through 2008, classified by age group, sex and race. Females accounted for 63 percent of cases with known sex, which was a greater sex disparity than expected based on recent trends reported by CDC (Table 6).²⁶ Similar to chlamydia infections, more women than males are screened for gonorrhea infections, but women are also more likely to acquire an infection after just one exposure.³⁰ Blacks have the highest incidence rate of gonorrhea in the United States.²⁶ In Hamilton County, 2004-2008, 86 percent of cases with known race were black and 12 percent of cases were white; race data were missing for approximately 29 percent of cases (Table 6). Cases between the ages of 15 and 24 years accounted for 68 percent of total cases; age was unknown for less than 1 percent of the cases (Table 6).

The incidence of gonorrhea infections has decreased in the United States since 1990 (Figure 16). In Hamilton County, the incidence of gonorrhea infections increased by approximately 10 percent between 2004 and 2008. The most marked increase occurred between 2004 and 2007, during which the local rate increased by approximately 26 percent (Table 6). Although the incidence rate did decrease in 2008, Hamilton County maintained the highest rate in Ohio (Figure 17). Figure 17 shows the geographic distribution of gonorrhea infections in Ohio, 2008.

Antimicrobial Resistance: Gonorrhea infections can be treated with certain types of antibiotics (e.g., cephalosporins). However, the resistance of gonorrhea to various classes of antibiotics has become more prevalent.³¹ Therefore, the antibiotics used to treat gonorrhea infections have had decreased effectiveness in the population. CDC continues to monitor this trend in resistance through the Gonococcal Isolate Surveillance Project.^{26,31}

For more information on gonorrhea see www.cdc.gov/std/Gonorrhea/STDFact-gonorrhea.htm or <http://www.odh.ohio.gov/healthStats/disease/std/std1.aspx>.

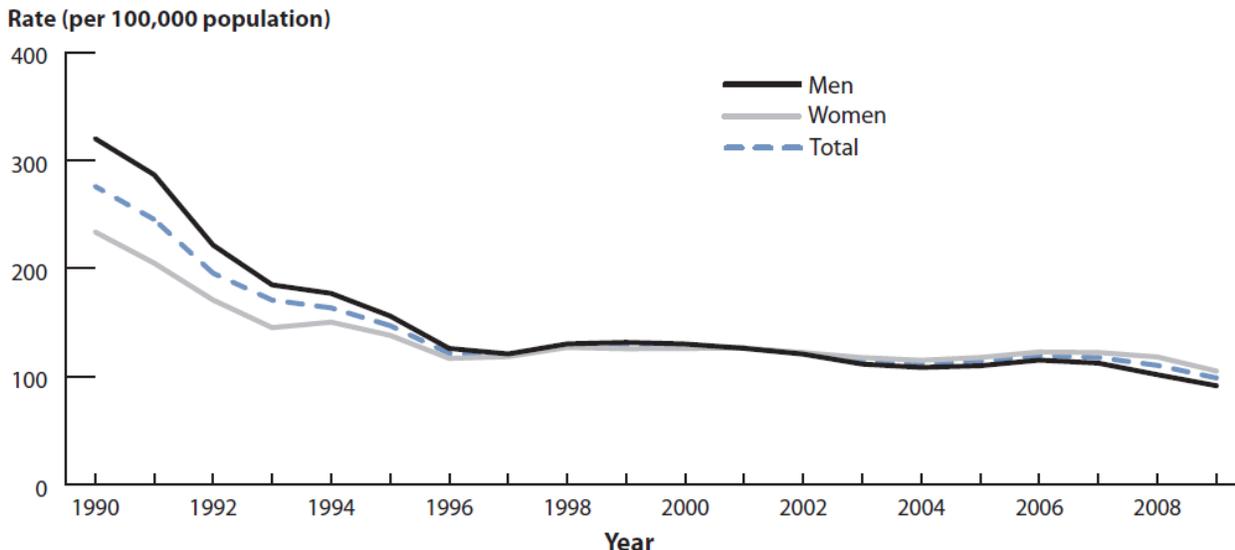
Table 6. Reported Cases of Gonorrhea – Hamilton County, Ohio, 2004 - 2008

	2004 (n=2775)	2005 (n=2950)	2006 (n=3319)	2007 (n=3519)	2008 (n=3063)
Age in years					
0-14	79	93	95	80	83
15-24	1739	1900	2197	2448	2206
25-44	840	807	863	849	717
45-64	82	105	125	106	44
65+	4	4	2	3	2
Unknown/Missing	31	41	37	33	11
Sex					
Male	1109	1244	1167	1260	943
Female	1637	1680	2129	2237	2115
Unknown/Missing	29	26	23	22	5
Race					
White	264	268	315	275	225
Black	1870	1873	1887	2137	1804
Other	22	27	55	48	46
Unknown/Missing	619	782	1062	1059	988
Hamilton County Rate (per 100,000 residents)	327.6	348.4	391.8	412.1	359.7
[†] Ohio Rate (per 100,000 residents)	177.7	176.3	175.1	174.7	143.7

*Data are from the Ohio Department of Health's STD Surveillance

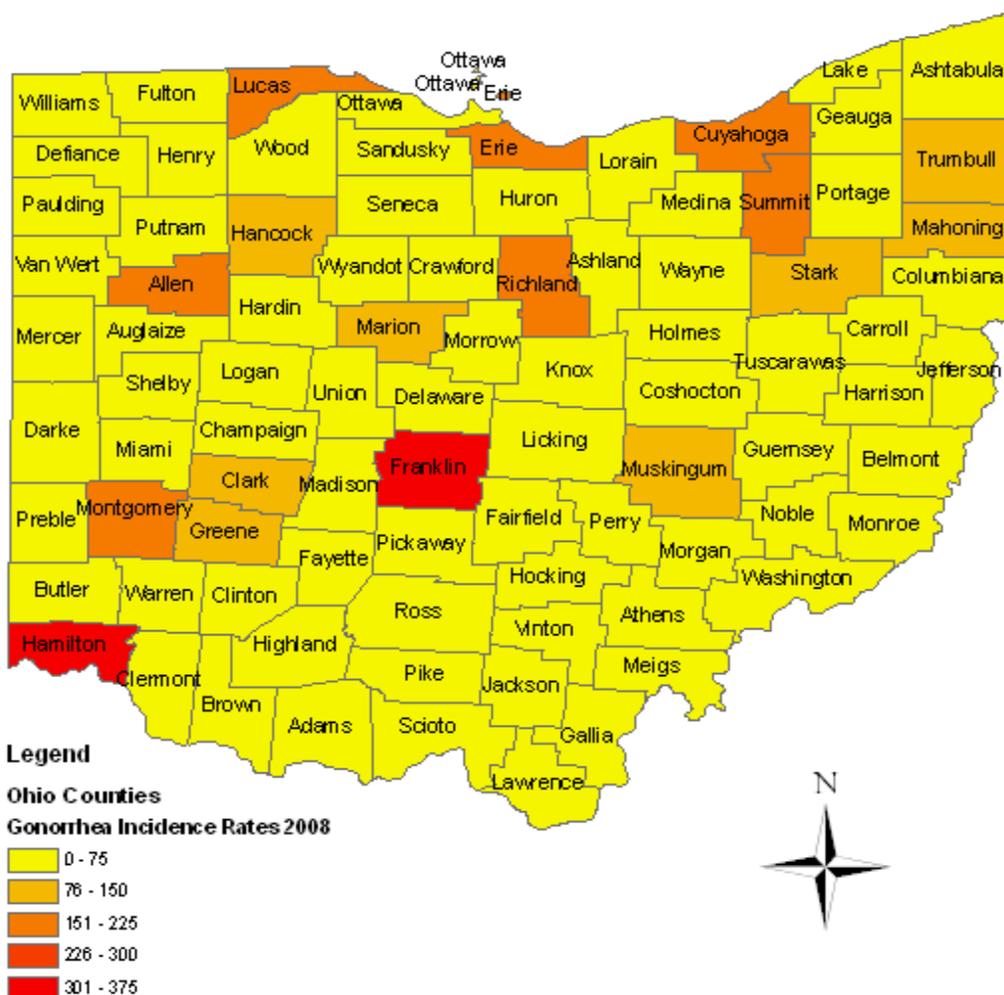
[†]Rates obtained from Ohio Department of Health and were calculated using US census estimates, 2003-2008

Figure 16. Gonorrhea Rates by Sex – U.S., 1990 - 2009



Source: Centers for Disease Control and Prevention, STD Surveillance²⁶

Figure 17. Incidence Rates of Gonorrhea by County, Ohio, 2008



Syphilis Infection in Hamilton County, Ohio 2004-2008*

Syphilis, caused by infection with the bacteria *Treponema pallidum*, is often clinically indistinguishable from other diseases and infections may remain asymptomatic for years.²⁶ Transmission may occur unknowingly as individuals in the primary or secondary stages of the disease may have chancres, sores and/or rashes that may not be recognized. If treatment is not received, the infection may progress to the late and latent stages putting the infected individual at risk of developing central nervous system disease and/or damage to internal organs, bones and joints all of which may lead to death.^{26, 28} Congenital transmission may also go undetected and is associated with a high risk of still or preterm birth and subsequent complications including low birth weights and developmental disabilities which can lead to death of the infant if left untreated.^{26, 28} Syphilis infection also facilitates transmission of HIV putting infected individuals at an estimated two to five times greater risk of acquiring HIV if exposed.

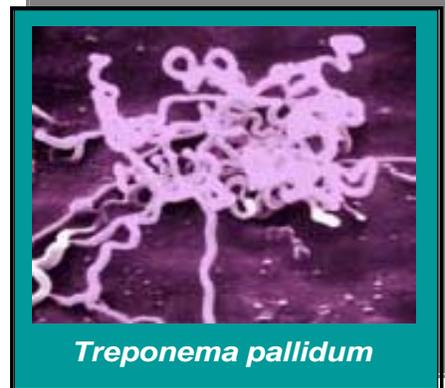


Table 7 shows the number of syphilis cases reported in Hamilton County in 2004 through 2008, classified by age group, sex and race. The higher incidence of males (75%) versus females (25%) may be partially explained by CDC analysis that showed 62% of all reported cases in 2009 were among men who have sex with men; a proportion that has been estimated to have increased from 7% in 2000.²⁶ Cases in the black population represented 50 percent of the cases with a known race; race was unknown for 5 percent of cases (Table 7). Cases between the ages of 25 and 44 years accounted for 58 percent of cases (Table 7). The rise in cases in the 15-24 year old age group seen in 2007 and 2008 reflects national trends.²⁶ The incidence rate of syphilis infections decreased nationally during the 1990's, but has since trended upward; largely driven by a higher rate of infections among males (Figure 18). In Hamilton County, the overall incidence rate increased by 63 percent between 2004 and 2008 (Table 7). The Ohio rate increased by 35 percent.

Hamilton County was among the counties with the highest incidence rates of syphilis infection in Ohio. Figure 19 shows the geographic distribution of syphilis infections in Ohio, 2008. More recent surveillance data from 2009-2010 show a substantial increase in the rate among urban (i.e. Cincinnati) residents within Hamilton (Figure 20). As with chlamydia, improved screening efforts and more sensitive diagnostic tests have likely contributed to the significant increase observed in Hamilton County, but a disproportionate rate of morbidity in Hamilton County remains evident.

For more information on syphilis see <http://www.cdc.gov/std/syphilis/default.htm> or <http://www.odh.ohio.gov/healthStats/disease/std/std1.aspx>.

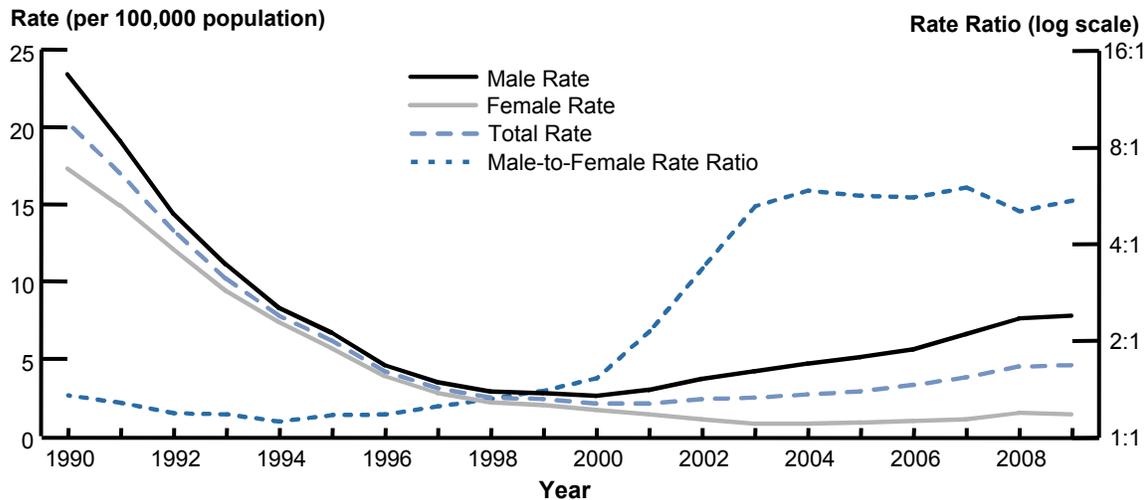
Table 7. Reported Cases of Syphilis – Hamilton County, Ohio, 2004 - 2008

	2004 (n=43)	2005 (n=37)	2006 (n=42)	2007 (n=55)	2008 (n=72)
Age in years					
0-14	0	0	1	0	0
15-24	3	2	8	22	28
25-44	30	31	28	23	32
45-64	9	2	5	9	11
65+	1	2	0	1	1
Unknown/Missing	0	0	0	0	0
Sex					
Male	40	31	29	39	48
Female	3	6	13	16	24
Unknown/Missing	0	0	0	0	0
Race					
White	23	15	13	18	21
Black	18	17	19	33	36
Other	2	3	8	2	7
Unknown/Missing	0	1	2	2	8
Hamilton County Rate (per 100,000 residents)	5.2	4.5	5.2	6.7	8.5
†Ohio Rate (per 100,000 residents)	4.9	4.2	4.4	4.8	6.6

*Data are from the Ohio Department of Health's STD Surveillance

†Rates were obtained from the Ohio Department of Health and were calculated using US census estimates, 2003-2008

Figure 18. Syphilis Rates by Sex – U.S., 1990 - 2009



Source: Centers for Disease Control and Prevention, STD Surveillance²⁶

Figure 19. Incidence Rates of Syphilis by County, Ohio, 2008

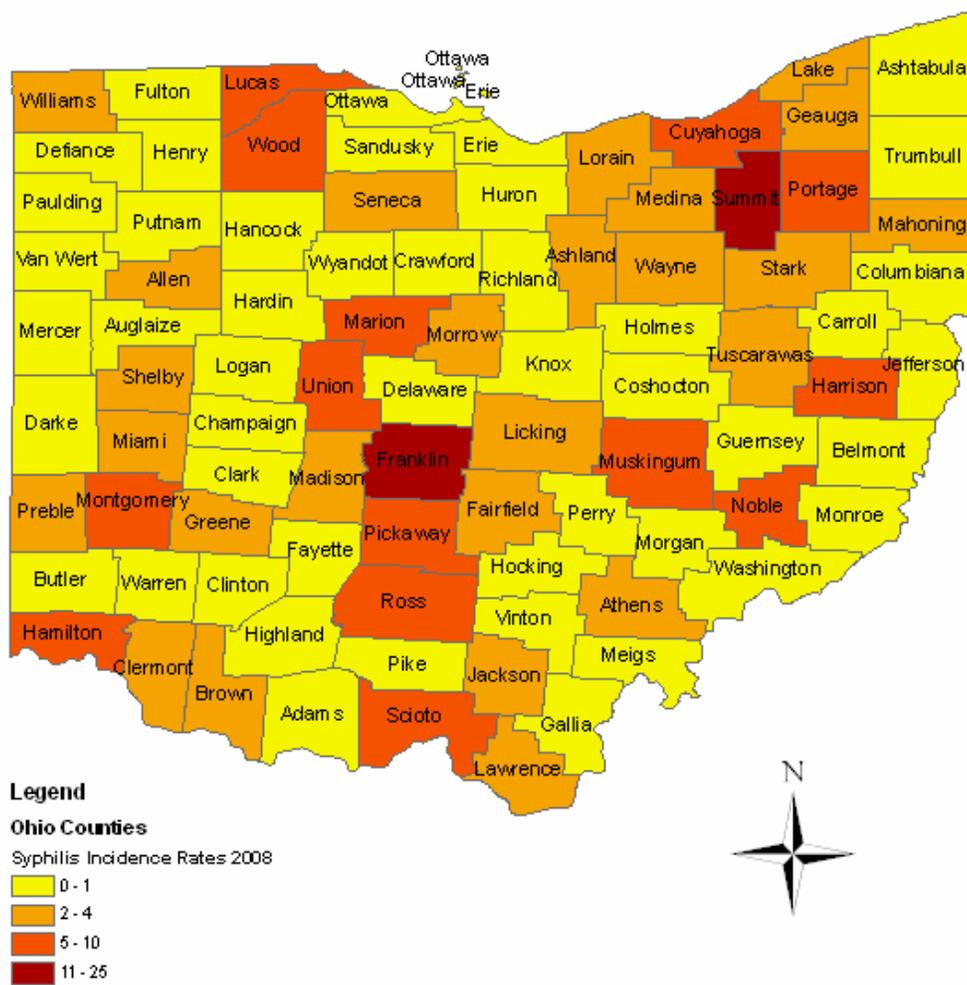
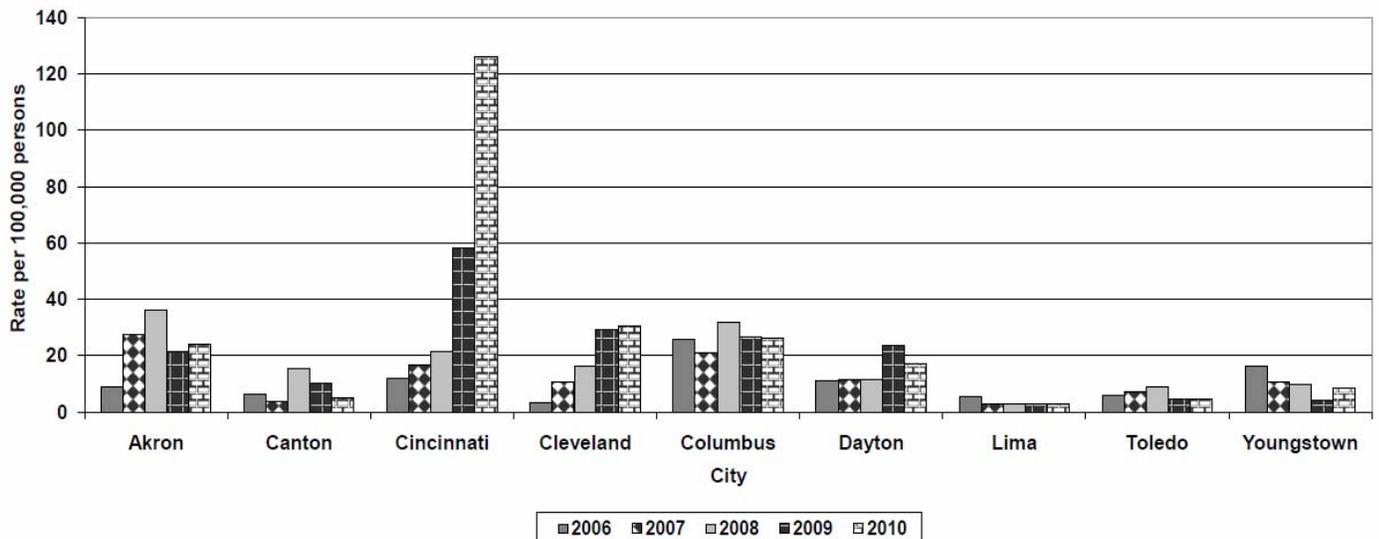


Figure 20. Incidence Rates of Syphilis in Select Ohio Cities, 2006 - 2010



Source: Ohio Department of Health, STD Surveillance³²

HIV/AIDS in Hamilton County, Ohio 2004-2008

Human Immunodeficiency Virus (HIV) is the virus that causes Acquired Immunodeficiency Syndrome (AIDS). Most people who are HIV positive will eventually develop AIDS. Without effective anti-HIV treatment, the case fatality rate is high.²⁶

Table 8 shows the number of Hamilton County residents living with HIV infection, 2004-2008, by age group, sex and race. Males accounted for 81 percent of the prevalence in Hamilton County during the 2004-2008 time period (Table 8). Of cases with known race, 54 percent were black and approximately 43 percent were white (Table 8). Cases between the ages of 40 and 49 years accounted for the large proportion (42%) of total cases (Table 8).

Tables 9 and 10 show the number of newly diagnosed cases of HIV and AIDS, respectively, 2004-2008, by age, sex and race. The demographic characteristics of new (i.e., incidence) cases of HIV were different than those associated with all existing cases of HIV/AIDS. Black residents accounted for 63 percent of new HIV cases, 2004-2008. In addition, residents between the ages of 20 and 29 years accounted for the highest proportion (32%) of new HIV cases (Table 9).

For more information on HIV/AIDS see <http://www.cdc.gov/hiv/general.htm>.

Table 8. Persons Living with HIV/AIDS – Hamilton County, Ohio, 2004 – 2008*

	2004 (n=1,577)	2005 (n=1,686)	2006 (n=1,814)	2007 (n=1,930)	2008 (n=2,052)
Age in years					
< 19	8	8	11	13	18
20-29	61	84	112	151	196
30-39	293	325	361	385	410
40-49	683	718	756	789	819
50+	532	551	574	592	609
Sex					
Male	1282	1366	1463	1557	1650
Female	295	320	351	373	402
Unknown/Missing	0	0	0	0	0
Race					
White	709	750	786	823	861
Black	832	897	986	1061	1140
Other	26	29	32	36	40
Unknown/Missing	10	10	10	10	11

Notes:

Living with HIV/AIDS represents all persons ever diagnosed and reported with HIV or AIDS who have not been reported as having died as of Dec. 31, 2007.

Data are reported through June 2009. Data are provisional as cases diagnosed in previous years continue to be reported to the Ohio Department of Health.

Table 9. Reported New Cases of HIV – Hamilton County, Ohio, 2004 -2008*

	2004 (n=63)	2005 (n=73)	2006 (n=86)	2007 (n=88)	2008 (n=103)
Age in years					
< 19	1	6	16	9	6
20-29	26	20	18	27	43
30-39	15	28	22	22	18
40-49	13	11	22	21	27
50+	8	8	8	9	9
Sex					
Male	49	56	67	71	79
Female	14	17	19	17	24
Unknown/Missing	0	0	0	0	0
Race					
White	21	30	26	30	30
Black	39	41	56	56	69
Other	3	2	3	2	4
Unknown/Missing	0	0	1	0	0

Table 10. Reported New Cases of AIDS Diagnosis – Hamilton County, Ohio, 2004 – 2008*

	2004 (n=54)	2005 (n=62)	2006 (n=72)	2007 (n=50)	2008 (n=81)
Age in years					
< 19	1	0	3	0	3
20-29	6	7	12	10	13
30-39	20	23	22	12	20
40-49	19	22	21	20	32
50+	8	10	14	8	13
Gender					
Male	45	49	53	42	61
Female	9	13	19	8	20
Unknown/Missing	0	0	0	0	0
Race					
White	14	18	16	14	25
Black	39	42	55	34	54
Other	1	2	1	2	1
Unknown/Missing	0	0	0	0	0

Notes:

Reported HIV (not AIDS) diagnoses include persons diagnosed with HIV (not AIDS) in the given calendar year. Cases could have progressed to AIDS in a subsequent calendar year.

AIDS diagnoses represent all reported AIDS cases diagnosed in the given calendar year.

Data are reported through June 2009. Data are provisional as cases diagnosed in previous years continue to be reported to the Ohio Department of Health.

*Data are from the Ohio Department of Health HIV/AIDS Surveillance Division

Viral Hepatitis

The word hepatitis literally means inflammation of the liver. The disease has multiple causes including pathogenic infection, excessive alcohol consumption, toxin exposure, and the use of certain medications, but most often develops as result of a viral infection.³³ Individual cases of viral hepatitis A, hepatitis B, hepatitis C, hepatitis D and hepatitis E are reportable in Ohio. Each type of hepatitis is caused by a different virus and can be further distinguished by the primary modes of transmission. Hepatitis B, hepatitis C and hepatitis D infections may also lead to chronic states of infection.

Hepatitis B and hepatitis C infections accounted for 99 percent (n=6,422) of all cases of viral hepatitis reported in Hamilton County during 2004 through 2008. The remaining cases were either hepatitis A (n=63) or hepatitis E (n=1). No cases of hepatitis D were reported. Cases of hepatitis D and hepatitis E are uncommon in the United States.³³ International estimates indicate that hepatitis B and hepatitis C infections may cause 25-30 percent and 50-55 percent of all cases of hepatocellular carcinoma (i.e. cancer of the liver), respectively.²⁸ This is the fifth most common cancer among men and eighth most common cancer among women throughout the world.²⁸

Hepatitis A and E

Hepatitis A virus (HAV) and hepatitis E virus (HEV) are both primarily transmitted via the fecal-oral route. This means that infection with either virus can occur from ingestion of microscopic quantities of fecal material transmitted via contaminated food, water, or close person-to-person contact.³³ The HAV infection often causes no symptoms in young children, but transmission to family members and/or caregivers may still occur.²⁸ A vaccination for HAV is available and is recommended for children at one year of age.³³ Although not mandated in Ohio, HAV vaccination requirements vary by state.³³ There is no HEV vaccine currently approved for use in the United States.

There were 29 confirmed, 4 probable, and 30 suspected cases of HAV infection reported during the five-year report period, 2004-2008. The mean incidence, 2004-2008, was 13 cases per year. Nearly all of the HAV cases (95%) were either in the jurisdiction of Hamilton County Public Health (n=26) or the City of Cincinnati (n=34). Cases of HAV outside of the City of Cincinnati did not occur in geographic clusters, but were less prevalent in the western part of the county. Moderate increases in risk were observed for residents 29-30 years of age and those in their early to mid-fifties. Case distribution by sex was nearly equal with 32 males and 31 females affected. Thirty-six percent of HAV cases were white residents and 17 percent of cases were black residents. The rate in the black population (*6 per 100,000 residents) was slightly higher than in the white population (*4 per 100,000 residents). (See Appendix A for full explanation of rate calculation methodology). The one reported case of Hepatitis E was not confirmed due to inconclusive laboratory results.

* race data unavailable for 46% of cases (n=29)

Hepatitis B

The primary mode of transmission of the hepatitis B virus (HBV) is through the blood-borne route, but it can also be transmitted through other infected bodily fluids. Both acute and chronic cases are considered infectious. Infection is known to occur perinatally (i.e., mother to baby), through needle sharing among intravenous drug users, and through sexual intercourse. Others at increased risk of HBV infection include household contacts of infected individuals, healthcare and emergency service personnel exposed to bodily fluids, men who have sex with men, and children adopted from a country in which the virus is widespread.³³⁻³⁴ A vaccine is available and recommended for all newborns, children not previously vaccinated, and others at risk of infection.³³ In Ohio, it is required for entry into daycares and schools (Appendix D).

According to the CDC, infected newborns have a 90 percent chance of remaining chronically infected, placing them at risk of developing severe health issues such as liver damage, liver cancer, and/or death (Appendix D).³³ Even though newborns may not be symptomatic at the time of birth, it is important that all newborns, particularly those of infected mothers, receive the recommended series

of vaccinations to prevent HBV infection. Infection can be prevented for nearly all newborns of infected mothers by properly adhering to the recommended vaccination schedule. During 2004 through 2008, HBV (n=1,171) accounted for 18 percent of all viral hepatitis cases and 2 percent of all reported communicable diseases. Chronic cases (n=915) accounted for the largest proportion (78%) of HBV cases. Acute cases (i.e., new infections) accounted for 13 percent (n=147) of the cases and 9 percent (n=109) of the cases were classified as unknown.

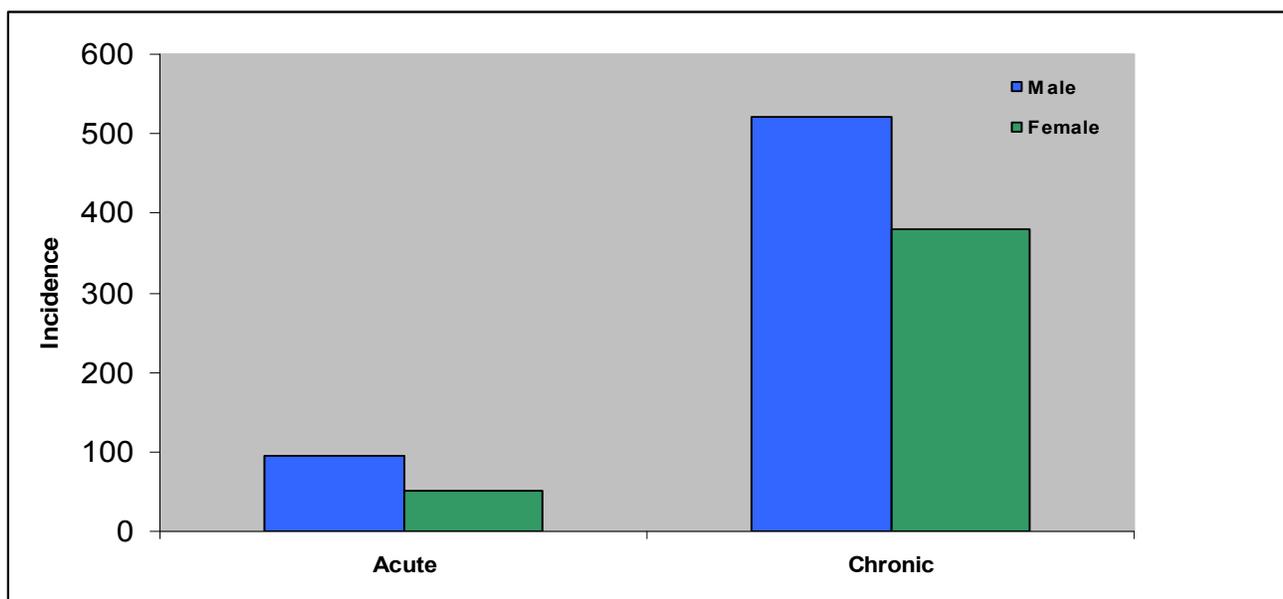
***Age**

The median age of HBV cases was 41 years (range: 0-91 years). The median age for chronic cases of HBV was also 41 years (range: 0-91 years), whereas the median age for acute cases of HBV was two years younger – 39 years (range: 18-74 years). This difference was expected as the chronic state can develop after the initial infection.

****Sex**

The incidence of chronic and acute cases of HBV was moderately higher for males (59%, n=680) than for females (41%, n=472). A similar distribution was observed for acute and chronic cases (Figure 21).

Figure 21. Incidence of Acute and Chronic Hepatitis B by Sex – Hamilton County, Ohio, 2004 - 2008



*****Race**

The incidence or total occurrence of HBV infections was highest in the black population (n=176, 89 per 100,000 residents), which accounted for 43 percent of all cases for which race data were available (Table 11). However, the rate of HBV infection in the Asian population (669 per 100,000 residents) was approximately 7.5 times greater than that in the black population; Asians accounted for 22 percent of all HBV cases (n=91). The white population accounted for the second highest number of cases (n=140), but also had the lowest rate (23 per 100,000 residents). (See Appendix A for full explanation of rate calculation methodology)

Among the cases of Asian race, 89 percent were classified as having a chronic status of infection (n=81). By comparison, the proportions of chronic cases among blacks and whites were 73 percent (n=128) and 68 percent (n=95), respectively.

Table 11. Proportions and Rates of Hepatitis B by Race – Hamilton County, Ohio, 2004 - 2008

	Count	Proportion***	Rate†	95% C.I.†
Black	176	43%	89	87.7 - 90.3
White	140	34%	23	22.6 - 23.4
Asian	91	22%	669	655 - 683
Other	5	1%	83	75.6 - 90.4

† See Appendix A for explanation of rate calculation methodology

† rate 95% confidence interval

* age data unavailable for 1% of cases (n=16)

** sex data unavailable for 2% of cases (n=19)

*** race data unavailable for 65% of cases (n=760)

Hepatitis C

Hepatitis C virus (HCV) infection most often occurs via the blood-borne route of transmission (Appendix A). According to CDC, it is the most common chronic, blood-borne infection in the United States, with approximately 3.2 million people infected.³³ Transmission in the United States most commonly occurs from exposure to infectious blood among injection drug users. Recipients of donated blood, blood products and organs prior to 1992 (before blood screening was available) are also at an increased risk of infection.³³ Needle-sticks in health care settings and perinatal transmission may also result in infection. Although these are risk factors, infection occurs less frequently after sexual intercourse with an infected person, through shared personal items contaminated with infected blood, or through invasive healthcare procedures.³³

No vaccine is currently available for HCV. CDC sites that only 15-20 percent of cases will clear the initial infection and not become chronically infected.³³ Chronic liver disease occurs in 60-70 percent of cases, 5-20 percent of cases will develop cirrhosis of the liver within a 20 to 30 year period post-infection, and up to five percent of cases die as a result of liver cancer or cirrhosis caused by chronic infection. This equates to 8,000-10,000 deaths annually in the United States and makes HCV the leading indication for liver transplants.³³

Hepatitis C virus (n=5,251) infection accounted for 81 percent of all viral hepatitis cases and 9 percent of all communicable diseases reported in Hamilton County. Excluding chlamydia and gonorrhea infections, HCV infection was the most frequently reported communicable disease. Chronic HCV infections (n=4,977) accounted for the largest proportion (95%) of HCV cases. Just under five percent (n=272) of the remaining cases were classified as unknown. A very small number of cases (n=2) were assigned a case status of acute.

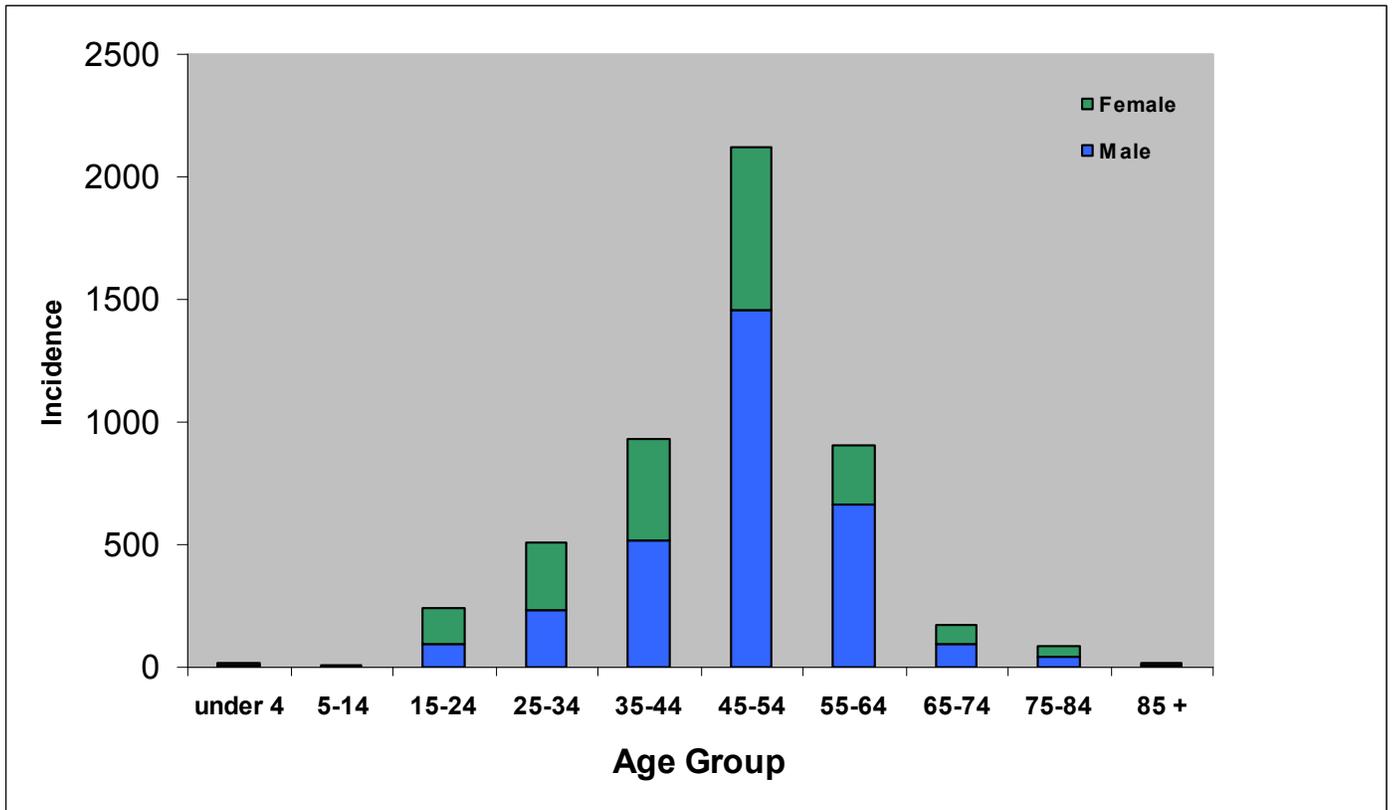
*Age

Hamilton County residents between 35 and 65 years of age were the most affected by HCV; the highest incidence of reported cases occurred among the 45-54 age group (Figure 19). The incidence of HCV was represented largely by newly reported cases of chronic HCV in Hamilton County (Appendix A). The incidence among those between 45 and 65 years of age accounted for 60 percent (n=3,081) of all cases. Cases 35 to 44 years of age comprised an additional 19 percent (n=943) of all cases. These statistics are reflective of national data cited by CDC, which show infection to be most prevalent among those born during the 1945 to 1965 time period.³³ Infection in this age cohort likely occurred when national rates of new infections were the highest during the 1970s and 1980s.³³

**Sex

The proportion of total HCV disease incidence was higher among males (62%, n=3,180) than among females (38%, n=1,917). Therefore, males accounted for 66 percent more cases than females in Hamilton County (Figure 22).

Figure 22. Hepatitis C Infections by Age Group and Sex – Hamilton County, Ohio, 2004 - 2008



*****Race**

The black and white populations accounted for 99 percent (n=1,177) of HCV cases for which race data were available – 23 percent (n=1191) of the total reported HCV cases (Table 12). Although a larger proportion of cases were white (61%, n=730) than black (38%, n=447), the rate among blacks (226 per 100,000 residents) was nearly twice the rate among whites (118 per 100,000 residents).

Table 12. Proportions and Rates of Hepatitis C by Race – Hamilton County, Ohio, 2004 - 2008

	Count	Proportion***	Rate†	95% C.I.†
White	730	61%	118	117.1 - 118.9
Black	447	38%	226	223.9 – 228.1
Other	14	1%	71	67.2 - 74.8

† See Appendix A for explanation of rate calculation methodology

† rate 95% confidence interval

* age data unavailable for 3% of cases (n=161)

** sex data unavailable for 3% of cases (n=154)

*** race data unavailable for 77% of cases (n=4,059)

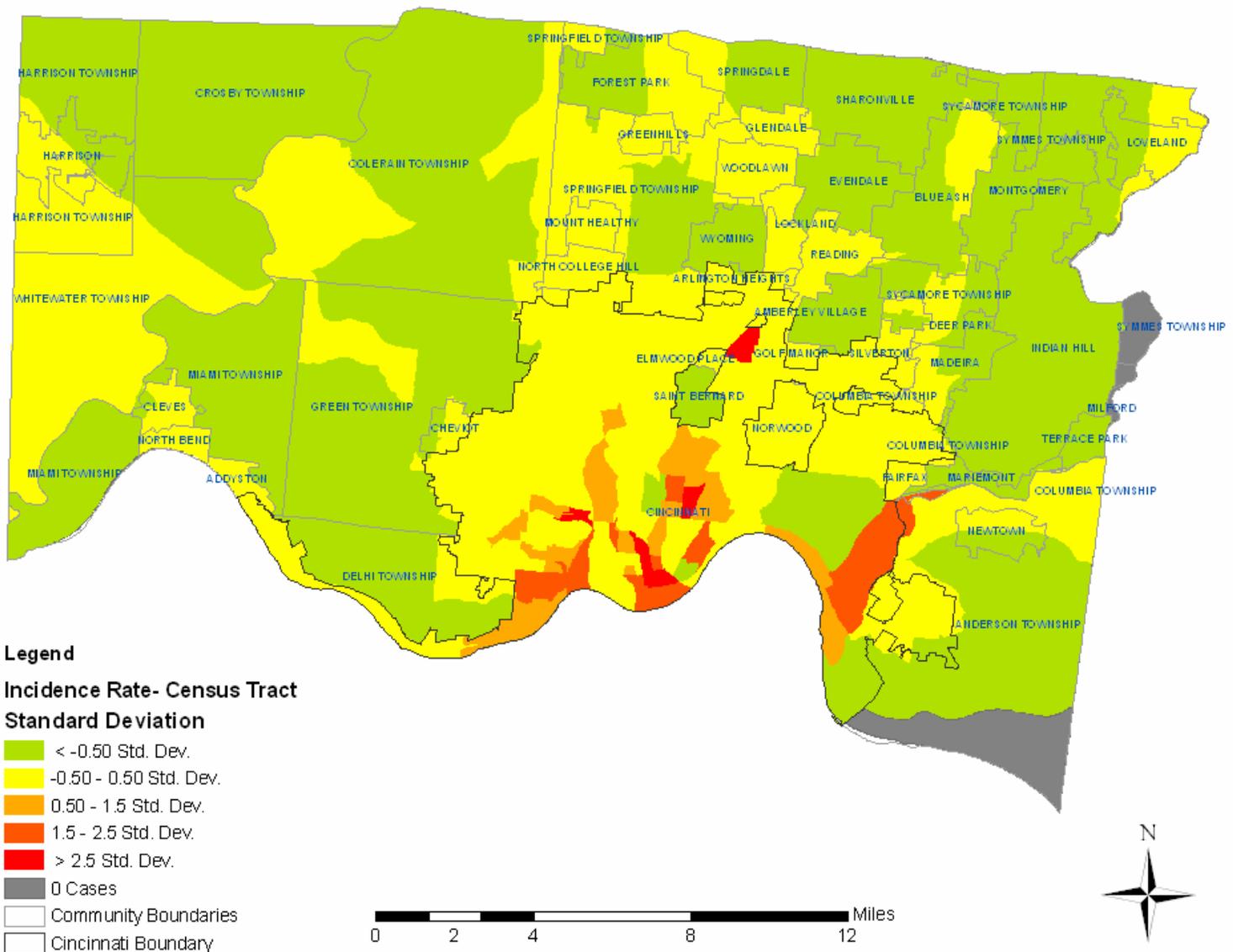
Spatial Distribution

Figure 23 shows the geographic distribution of all viral hepatitis cases within Hamilton County; distributions within each census tract are represented by incidence rates. Although two census tracts show zero cases reported, viral hepatitis was reported in all municipalities within Hamilton County.

Considerable differences in disease incidence rates were shown among these communities. Green shading denotes lower than expected rates, while red shading represents higher than expected rates. The degree of shading corresponds to the magnitude of the difference between a census tract rate and the rate in Hamilton County (See Appendix A for full explanation of methodology and interpretation).

The City of Cincinnati contained all 15 of the census tracts with high incidence rates of viral hepatitis infections – defined as greater than 1.5 standard deviations above the Hamilton County average rate per census tract, 2004-2008. An additional 19 census tracts within the City of Cincinnati were between 0.5 and 1.5 standard deviations above the Hamilton County incident rate.

Figure 23. Distribution of Incidence Rates of Report Viral Hepatitis Infection by Census Tract – Hamilton County, Ohio, 2004 - 2008



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Appendix A

Technical Notes

Definition of Reportable Diseases

OAC Chapter 3701-3-02 requires cases or suspected cases of certain, communicable diseases considered “dangerous to the public health” to be reported to local boards of health within specified timeframes. OAC Chapter 3701-3-12 requires the reporting of cases of HIV/AIDS, confirmed positive tests for HIV and HIV infections. Between January 1, 2004 and December 31, 2008, two revisions were effective, both of which were different from the current statute, effective January 1, 2009. The reportable diseases identified in this report are discussed in the context of the current reporting requirements (Appendix C). Effective January 1, 2009, reportable diseases are grouped according to the following classes in Ohio (only Class A, Class B (1), or Class B (2) diseases were included in this report):

Class A:

Diseases of major public health concern because of the severity of disease or potential for epidemic spread. Report by telephone immediately upon recognition that the case, suspected case or a positive laboratory result exists.

Class B (1):

Diseases of public health concern needing timely response because of potential for epidemic spread. Report by the end of next business day upon existence of a case, suspected case or positive laboratory is known.

Class B (2):

Diseases of significant public health concern. Report by the end of the work week after the existence of a case, suspected case or positive laboratory result is known.

Class C:

Report an outbreak, unusual incidence or epidemic by the end of the next business day.

For a complete list of reportable diseases in Ohio, see Appendix C.

Case Criteria

The case criteria used are those published in the Ohio Department of Health Infectious Disease Control Manual (<http://www.odh.ohio.gov/healthResources/infectiousDiseaseManual.aspx>). Cases of reportable diseases are grouped into the following categories:

- *Suspected case*: a case for which a reportable condition is being considered in the differential diagnosis, but for which confirmatory laboratory testing has not yet been completed.
- *Probable case*: a case that is classified as “probable” for reporting purposes; disease specific.
- *Confirmed case*: a case that is classified as “confirmed” for reporting purposes; disease specific.

Table 1— Diseases omitted due to zero incidence

anthrax, botulism (wound), cyclosporiasis, diphtheria, eastern equine encephalitis virus disease, hantavirus, leptospirosis, measles, plague, Q fever, poliomyelitis, Powassan virus disease, psittacosis, rabies (human), Reye syndrome, rheumatic fever, rubella (congenital and not congenital), severe acute respiratory syndrome (SARS), smallpox, *Staphylococcus aureus*, intermediate resistance to vancomycin (VISA), *Staphylococcus aureus* resistant to vancomycin (VRSA), St. Louis encephalitis virus disease, tetanus, trichinosis, typhus fever, viral hemorrhagic fever, western equine encephalitis virus disease, influenza A-novel virus, LaCrosse virus disease, other arthropod-borne disease, hepatitis B perinatal, hepatitis D (delta hepatitis), leprosy and yellow fever. Data on sexually-transmitted infections (STI) and tuberculosis are managed independently. STI data were obtained from the Ohio Department of Health and indicated a zero incidence for chancroid and granuloma inguinale.

Notes on Disease Types and Classifications

Diseases were classified into the following broad categories: enteric/gastrointestinal, viral hepatitis, genitourinary and other infections. Certain diseases in the viral hepatitis and other classification are vaccine-preventable. The classifications are defined as follows:

- **Enteric/Gastrointestinal:** Diseases normally caused by an infection of the gastrointestinal tract; these infections can, however, affect other organs of the body. These infections are normally transmitted via the fecal-oral route. Enteric infections can cause food-borne and water-borne outbreaks as well as outbreaks caused by direct person-to-person contact.
- **Viral Hepatitis:** Diseases caused infection with Hepatitis A, Hepatitis B, Hepatitis C, Hepatitis D, or Hepatitis E virus. Hepatitis A is often classified as an enteric infection, because it is more commonly implicated in food-borne outbreaks. Viral hepatitis, namely hepatitis B, C, and D infections, is diagnosed as acute or chronic and may be transmitted via several routes. One primary route of transmission is blood-borne transmission of Hepatitis B and C.
- **Genitourinary:** Diseases that are caused by an infection of the genitals and/or urinary tract. These infections are transmitted primarily through sexual contact and may be termed STIs.
- **Other:** Diseases that are caused by a variety of pathogens that are of public health concern, but do not normally fall into one of the other four categories. The primary route of transmission for many of these diseases is air/droplet- (e.g., pertussis and varicella) can be transmitted through air/droplets

Modes of transmission are defined as follows:

- **Fecal-Oral:** Diseases that are normally transmitted when infected stool is ingested. Amounts sufficient to cause disease vary according to the pathogen, but are usually minimal. Transfer of infected stool among people is associated with poor hand-hygiene practices (e.g. after using the bathroom, when changing diapers, in healthcare settings, etc.). Infected stool may be transferred through direct person-to-person contact or through contaminated environmental surfaces.
- **Air/Droplet-borne:** Diseases that are normally transmitted when an infectious agent (e.g., pertussis) is spread as an aerosol and usually enters a person through the respiratory tract. These infectious agents may become suspended in liquid droplets after a person coughs and/or sneezes or on particulates in the air (e.g. dust).
- **Blood-borne:** Diseases that are normally transmitted by contact with infected blood or blood-derived body fluids. Specifically, these diseases can be transmitted by contaminated needles, blood transfusions or sexual contact.
- **Sexually-Transmitted:** Diseases that are normally transmitted during sexual intercourse.
- **Vector-borne:** Diseases that are normally transmitted by animals or insects that carry the disease-causing pathogen (e.g., West Nile virus).

Certain diseases may also be classified according to the availability of a vaccine for the disease. Diseases for which there is a vaccine available are considered "vaccine preventable." These are diseases for which both required and voluntary immunizations are available.

Notes on Data

The primary sources of data were individual case and laboratory reports submitted to local health departments by infection preventionists, health care providers, and laboratories. Additional information was collected through disease interviews. Data files were obtained from the Ohio Department of Health Disease Reporting System (ODRS); this is the same data management system in which local health departments and some hospitals enter and store reports of disease. The data in this report are the most current as of July 2009 and therefore, do not necessarily parallel the statistics reported by the Ohio Department of Health. All data are presented by date of report or date of confirmation of disease. The data are used to generate estimates disease incidence; however, the reported rates are likely underestimates and might be considered the minimum level of disease.³⁵

The estimated incidence of chronic diseases (e.g., chronic hepatitis B and C) in 2004 - 2008 may not accurately reflect the actual number of new cases of these diseases. Factors including case migration and delays in laboratory confirmation can create biases in the estimated incidence rates derived annually. Although outside the scope of this report, further analysis is required to elucidate the epidemiology of chronic reportable diseases such as hepatitis C in Hamilton County.

Local Health Departments

There were six local health departments responsible for investigating cases or reportable diseases within Hamilton County during 2004-2008: Cincinnati Health Department, Hamilton County Public Health, Norwood Health Department, Sharonville Health Department, Springdale Health Department, and St. Bernard Health Department. Please note that as of the issue date of this report St. Bernard has joined Hamilton County Public Health. Each health department is responsible for investigating and managing cases of reportable diseases that occur within their respective jurisdictions (http://www.hamiltoncountyhealth.org/en/about/who_we_serve.html). Two exceptions are sexually transmitted infections (STIs) and tuberculosis. These diseases were tracked and investigated by dedicated, countywide programs in Hamilton County during 2004-2008. These data were obtained from the Ohio Department of Health STD Surveillance and HIV/AIDS Surveillance Divisions and the Tuberculosis Control Center (Cincinnati, Ohio). Note that In June 2008, Hamilton County Public Health assumed responsibility for tuberculosis control including case management and disease tracking in Hamilton County. The Cincinnati Health Department STD Surveillance Unit manages and investigates cases of STI in Hamilton County. The Hamilton County Planning and Zoning Commission provides a detailed breakdown of local population characteristics at: http://www.hamiltoncountyohio.gov/hcrpc/data_products/default.asp.

Notes of Statistical Calculations

Incidence Rates:

Rates allow for comparison of disease burden between population groups as well as over time. The rates presented in this report were unadjusted for age and other confounding factors. The population at risk was approximated using the United States Census population estimates for 2004 and 2008. The estimated population of Hamilton County ranged from 846,254 residents in 2004 to 851,494 residents in 2008.³⁶ Please note that new intercensal estimates will eventually replace these population estimates. The 2000 census estimate was used where indicated in the report. The one-year crude incidence rate (IR) was calculated as the proportion of disease events per 1,000, 10,000, or 100,000 people at risk (specified in narrative).

$$IR = \left(\frac{n}{p} \right) \times 100,000$$

In this formula, n = Number of cases identified in a one-year period and p = Population at risk. Rates with a low n (≤ 20) were considered unstable and not appropriate for statistical comparisons. Confidence intervals (when included) were calculated using a 95 percent significance level, which indicates that 95% of the time a population estimate would fall within the reported confidence interval; 5% of estimates will fall outside of confidence interval due to chance alone. Statistical significance (when reported) was also judged at the 95% confidence level; reported statistical significance indicates a likely true change. All proportions were rounded to the nearest whole number.

Autoregressive Integrated Moving Average (ARIMA) Methodology:

The autoregressive integrated moving average (ARIMA) model can be used by public health agencies to support infectious disease surveillance.³⁷ The ARIMA approach is a time series analysis method that does not require the assumption of independence among observations; this is a key difference between the ARIMA and other more common times series approaches in public health such as CUSUM.³⁸ The autocorrelation of the time series observations are incorporated in the ARIMA model. Pankratz gives a thorough review of the ARIMA modeling approach.³⁹ An ARIMA model formula may be represented by

$$z_t = \mu(1 - \phi_1) + \phi_1 z_{t-1} + a_t \quad \text{Or} \quad (1 - \phi_1 B) \hat{z}_t = a_t$$

An ARIMA(1,0,3)(0,0,1)₁₂ model was selected for the forecasting analysis depicted in Figure 7. The model contained both autoregressive and moving average parameters as well as an annual seasonal adjustment. An intervention analysis was used to forecast values under the conditions of outbreak and normal enteric disease levels. All statistical analysis was conducted using SAS 9.1 ETS.

The ARIMA model depicted in Figure 7 represented only a hypothetical estimate of disease incidence during an outbreak. The low incidence of enteric infections reported in 2008 impacted the magnitude of the forecasted values in 2009; the decrease in 2008 could have been partially due to improved community awareness and prevention efforts following the severe outbreaks managed in 2005 and 2007.

Standard Deviation Mapping:

There are several methods that can be used to establish cutoff values in a rate map. A standard deviation methodology for determining shading cutoff values was applied to the incidence rate maps shown in the Enteric Infections and Viral Hepatitis sections of the report. Map shading categories were comprised of intervals (e.g., <0.5-0.5; >0.5-<1.5; ≥1.5) calculated from the standard deviation of the distribution of census tract incidence rates in Hamilton County. This logic corresponded to percentage of census tract assignments as shown in the table below:

	Standard Deviation Cutoff Values	Percentage of Census Tracts in Interval		Standard Deviation Cutoff Values	Percentage of Census Tracts in Interval
Enteric Infections	< (-1.5)	3%	Viral Hepatitis Infections	< (-0.5)	32%
	(-1.5) – (-0.5)	31%		(-0.5) – 0.5	54%
	>(-0.5) – 0.5	40%		> 0.5 – 1.5	8%
	>0.5 – 1.5	19%		> 1.5 – 2.5	3%
	>1.5	7%		>2.5	3%

A census tract was then assigned to a shading category based on the placement of the incidence rate within the specified intervals. Lower category intervals captured incidence rates that were lower than expected in Hamilton County, whereas the higher category intervals captured incidence rates that were higher than expected in Hamilton County; all rates were unadjusted for factors such as age and sex; for age-adjustment, see future reports and a web-based statistical application coming soon to the HCPH website (2011). ArcMap Version 9.3 was used to perform all mapping calculations and to construct the intervals displayed above.

Notes on Specific Diseases

Cryptosporidiosis: The increased incidence observed in 2005 was due a community-wide outbreak that occurred August-November, 2005.

Encephalitis, post other viral: Counts include encephalitis that occurred following a (non-central) nervous system viral illness or after a vaccine was administered.

Encephalitis, primary viral: Counts include illnesses in which encephalitis was the major manifestation. Symptoms are due to direct invasion and replication of the infectious agent in the central nervous system, resulting in objective clinical evidence of cerebral or cerebellar dysfunction (this not a CDC definition; for use in Ohio).

Hepatitis B, chronic: This disease became reportable in Ohio in 2003. Cases might have been present in the community for many years prior to being confirmed by public health officials. The higher number of cases reported in 2005 compared to that in 2003 and 2004 reflects an increase in case confirmation and therefore, does not necessarily indicate an increase in disease incidence. Information on hepatitis B can be found online at <http://www.cdc.gov/ncidod/diseases/hepatitis/b/fact.htm>.

Hepatitis C, chronic: This disease became reportable in Ohio in 2003. Cases might have been present in the community for many years before being confirmed. The higher number of cases reported in 2005 compared to that in 2003 and 2004 reflects an increase in case confirmation and therefore, does not necessarily indicate an increase in disease incidence. Information on hepatitis C can be found online at <http://www.cdc.gov/ncidod/diseases/hepatitis/c/fact.htm>.

Meningitis, bacterial: Counts include cases of bacterial meningitis for which the agent was specified, excluding Group A streptococcus, Group B streptococcus (newborn), *Haemophilus influenzae*, invasive *Streptococcus pneumoniae* and meningococcal disease.

Norovirus: Individual cases are not reportable unless associated with an outbreak, an unusual incidence or epidemic. According to the Ohio Infectious Disease Reporting System (ODRS), seven food-borne, daycare and/or healthcare-associated outbreaks were investigated and documented over the period included in this report. Illness caused by noroviruses are usually characterized by sudden onset of nausea, vomiting, diarrhea, and some stomach cramping. Occasionally, ill individuals may also experience a low-grade fever, chills, headache and muscle aches. Additional information on Norovirus can be found online at <http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus.htm>

Pertussis: The increased incidence observed in 2004 and 2005 was due to an outbreak that began late in 2004 and ended early in 2005. The incidence increased again in the end of 2008.

Shigellosis: The increased incidence observed in 2006 through 2008 was due to a multiple daycare-associated outbreaks throughout the community that began in late 2006 and ended in early 2008.

Streptococcus pneumoniae, invasive: Counts Include only drug-resistant cases or cases in children less than 5 years of age. This disease became nationally reportable in 2003 for two groups: 1) cases <5 years of age regardless of drug resistance or 2) cases >5 years of age with infections of drug-resistant *Streptococcus pneumoniae*. Drug resistance in this context implies resistance or reduced sensitivity to certain antimicrobial agents.

Tuberculosis: Please see the Hamilton County Tuberculosis report: http://www.hamiltoncountyhealth.org/en/resource_library/reports.html

Varicella: This disease became reportable in Ohio in 2006. The increase in cases in 2006 corresponded with this new requirement and was reflective of an increase in case identification, but not necessarily an increase in disease incidence.

Questions

Questions or comments regarding this summary should be directed to the Hamilton County Public Health, Division of Epidemiology: (513) 946-7924.

Appendix B

*New Cases of Reportable **Diseases in Hamilton County as Reported in ODRS, 2009-2010

		Year		Total
		2009	2010	
Disease name	Amebiasis	2	7	9
	Campylobacteriosis	50	62	112
	Chlamydia	5,627	7,522	13,149
	Coccidioidomycosis	3	0	3
	Creutzfeldt-Jakob disease	2	1	3
	Cryptosporidiosis	7	15	22
	Cytomegalovirus - congenital	1	1	2
	Dengue	1	1	2
	E coli O157:H7	3	5	8
	E. coli, not O157:H7	2	8	10
	Ehrlichiosis	0	1	1
	Encephalitis, arboviral	0	2	2
	Giardiasis	67	79	146
	Gonorrhea	2,526	3,019	5,545
	Haemophilus influenza	16	13	29
	Hemolytic uremic syndrome	0	1	1
	Hepatitis A	7	10	17
	Hepatitis B, acute	23	40	63
	Hepatitis B, chronic	202	195	397
	Hepatitis C, acute	9	9	18
	Hepatitis C, chronic	702	920	1622
	Herpes, congenital	3	0	3
	HIV/AIDS	UNK	UNK	UNK
	Influenza-associated hospitalization	262	1	263
	Influenza-associated pediatric mortality	2	0	2
	Legionellosis	16	3	19
	Leprosy	1	0	1
	Listeriosis	1	3	4
	Lyme disease	8	1	9
	Malaria	6	3	9
	Measles Unknown	2	0	2
	Meningitis, aseptic	85	57	142
	Meningitis, bacterial	2	6	8
	Meningococcal disease	5	3	8
	Mumps	4	2	6
	Mycobacterium not TB	34	94	128
	Novel Influenza A	25	0	25
	Pertussis	118	103	221
	Rocky mountain spotted fever	2	0	2
	Rubella	1	0	1
	<i>S. aureus</i> - intermediate resistance to vancomycin-	0	1	1
	Salmonellosis	72	78	150
	Shigellosis	93	149	242
	Streptococcal toxic shock syndrome	4	0	4
	Streptococcal, Group A, invasive	31	33	64
	Streptococcal, Group B, newborn	6	2	8
	Streptococcus pneumoniae, invasive	124	111	235
	Syphilis (combined)	218	466	684
	Tetanus	1	0	1
	Toxic shock syndrome	2	0	2
	Tuberculosis	24	28	52
	Varicella	90	66	156
	Yersiniosis	6	2	8
Total		10,498	13,123	23,621

* Suspected, Probable, & Confirmed cases were included in counts (data are provisional and subject to change); cases were counted by the month reported to public health (Data: January 1, 2009- December 27, 2010).

*** Diseases with zero counts were omitted from the table (See Appendix C for full list of reportable diseases in Ohio)

UNK= Unknown

Know Your ABCs: A Quick Guide to Reportable Infectious Diseases in Ohio

from the Ohio Administrative Code Chapter 3701-3; Effective January 1, 2009 ([click here](#))

Class A Diseases of major public health concern because of the severity of disease or potential for epidemic spread - report by telephone immediately upon recognition that a case, a suspected case, or a positive laboratory result exists

Anthrax	Influenza A - novel virus	Rabies, human	Smallpox
Botulism, foodborne	Measles	Rubella (not congenital)	Tularemia
Cholera	Meningococcal disease	Severe acute respiratory syndrome (SARS)	Viral hemorrhagic fever (VHF)
Diphtheria	Plague		Yellow fever

Any unexpected pattern of cases, suspected cases, deaths or increased incidence of any other disease of major public health concern, because of the severity of disease or potential for epidemic spread, which may indicate a newly recognized infectious agent, outbreak, epidemic, related public health hazard or act of bioterrorism.

Class B (1) Diseases of public health concern needing timely response because of potential for epidemic spread - report by the end of the next business day after the existence of a case, a suspected case, or a positive laboratory result is known

Arboviral neuroinvasive and non-neuroinvasive disease:	Chancroid	Hepatitis B, perinatal	Rubella (congenital)
Eastern equine encephalitis virus disease	Coccidioidomycosis	Influenza-associated pediatric mortality	Salmonellosis
LaCrosse virus disease (other California serogroup virus disease)	Cyclosporiasis	Legionnaires' disease	Shigellosis
Powassan virus disease	Dengue	Listeriosis	<i>Staphylococcus aureus</i> , with resistance or intermediate resistance to vancomycin (VRSA, VISA)
St. Louis encephalitis virus disease	<i>E. coli</i> O157:H7 and other enterohemorrhagic (Shiga toxin-producing) <i>E. coli</i>	Malaria	Syphilis
West Nile virus infection	Granuloma inguinale	Meningitis, aseptic (viral)	Tetanus
Western equine encephalitis virus disease	<i>Haemophilus influenzae</i> (invasive disease)	Meningitis, bacterial	Tuberculosis, including multi-drug resistant tuberculosis (MDR-TB)
Other arthropod-borne disease	Hantavirus	Mumps	Typhoid fever
	Hemolytic uremic syndrome (HUS)	Pertussis	
	Hepatitis A	Poliomyelitis (including vaccine-associated cases)	
		Psittacosis	
		Q fever	

Class B (2) Diseases of significant public health concern - report by the end of the work week after the existence of a case, a suspected case, or a positive laboratory result is known

Amebiasis	Cytomegalovirus (CMV) (congenital)	Hepatitis E	Streptococcal disease, group B, in newborn
Botulism, infant	Ehrlichiosis/Anaplasmosis	Herpes (congenital)	Streptococcal toxic shock syndrome (STSS)
Botulism, wound	Giardiasis	Influenza-associated hospitalization	<i>Streptococcus pneumoniae</i> , invasive disease (ISP)
Brucellosis	Gonococcal infections (urethritis, cervicitis, pelvic inflammatory disease, pharyngitis, arthritis, endocarditis, meningitis, and neonatal conjunctivitis)	Leprosy (Hansen disease)	Toxic shock syndrome (TSS)
Campylobacteriosis	Hepatitis B, non-perinatal	Leptospirosis	Trichinosis
Chlamydia infections (urethritis, epididymitis, cervicitis, pelvic inflammatory disease, neonatal conjunctivitis, pneumonia, and lymphogranuloma venereum (LGV))	Hepatitis C	Lyme disease	Typhus fever
Creutzfeldt-Jakob disease (CJD)	Hepatitis D (delta hepatitis)	Mycobacterial disease, other than tuberculosis (MOTT)	Varicella
Cryptosporidiosis		Rocky Mountain spotted fever (RMSF)	Vibriosis
		Streptococcal disease, group A, invasive (IGAS)	Yersiniosis

Class C Report an outbreak, unusual incidence, or epidemic (e.g., histoplasmosis, pediculosis, scabies, staphylococcal infections) by the end of the next business day

Outbreaks:

- Community
- Foodborne
- Healthcare-associated
- Institutional
- Waterborne
- Zoonotic



NOTE: Cases of AIDS (acquired immune deficiency syndrome), AIDS-related conditions, HIV (human immunodeficiency virus) infection, perinatal exposure to HIV, and CD4 T-lymphocytes counts <200 or 14% must be reported on forms and in a manner prescribed by the Director.

Know Your ABCs (Alphabetical Order) Effective January 1, 2009

Name	Class	Name	Class
Amebiasis	B2	Malaria	B1
Anthrax	A	Measles	A
Arboviral neuroinvasive and non-neuroinvasive disease	B1	Meningitis, aseptic (viral)	B1
Botulism, foodborne	A	Meningitis, bacterial	B1
Botulism, infant	B2	Meningococcal disease	A
Botulism, wound	B2	Mumps	B1
Brucellosis	B2	Mycobacterial disease, other than tuberculosis (MOTT)	B2
Campylobacteriosis	B2	Other arthropod-borne disease	B1
Chancroid	B1	Outbreaks: Community, Foodborne, Healthcare-associated, Institutional, Waterborne, and Zoonotic	C
Chlamydia infections (urethritis, epididymitis, cervicitis, pelvic inflammatory disease, neonatal conjunctivitis, pneumonia, and lymphogranuloma venereum (LGV))	B2	Pertussis	B1
Cholera	A	Plague	A
Coccidioidomycosis	B1	Poliomyelitis (including vaccine-associated cases)	B1
Creutzfeldt-Jakob disease (CJD)	B2	Powassan virus disease	B1
Cryptosporidiosis	B2	Psittacosis	B1
Cyclosporiasis	B1	Q fever	B1
Cytomegalovirus (CMV) (congenital)	B2	Rabies, human	A
Dengue	B1	Rocky Mountain spotted fever (RMSF)	B2
Diphtheria	A	Rubella (congenital)	B1
<i>E. coli</i> O157:H7 and other enterohemorrhagic (Shiga toxin-producing) <i>E. coli</i>	B1	Rubella (not congenital)	A
Eastern equine encephalitis virus disease	B1	Salmonellosis	B1
Ehrlichiosis/Anaplasmosis	B2	Severe acute respiratory syndrome (SARS)	A
Giardiasis	B2	Shigellosis	B1
Gonococcal infections (urethritis, cervicitis, pelvic inflammatory disease, pharyngitis, arthritis, endocarditis, meningitis, and neonatal conjunctivitis)	B2	Smallpox	A
Granuloma inguinale	B1	St. Louis encephalitis virus disease	B1
<i>Haemophilus influenzae</i> (invasive disease)	B1	<i>Staphylococcus aureus</i> , with resistance or intermediate resistance to vancomycin (VRSA, VISA)	B1
Hantavirus	B1	Streptococcal disease, group A, invasive (IGAS)	B2
Hemolytic uremic syndrome (HUS)	B1	Streptococcal disease, group B, in newborn	B2
Hepatitis A	B1	Streptococcal toxic shock syndrome (STSS)	B2
Hepatitis B, non-perinatal	B2	<i>Streptococcus pneumoniae</i> , invasive disease (ISP)	B2
Hepatitis B, perinatal	B1	Syphilis	B1
Hepatitis C	B2	Tetanus	B1
Hepatitis D (delta hepatitis)	B2	Toxic shock syndrome (TSS)	B2
Hepatitis E	B2	Trichinosis	B2
Herpes (congenital)	B2	Tuberculosis, including multi-drug resistant tuberculosis (MDR-TB)	B1
Influenza A – novel virus	A	Tularemia	A
Influenza-associated hospitalization	B2	Typhoid fever	B1
Influenza-associated pediatric mortality	B1	Typhus fever	B2
LaCrosse virus disease (other California serogroup virus disease)	B1	Varicella	B2
Legionnaires' disease	B1	Vibriosis	B2
Leprosy (Hansen disease)	B2	Viral hemorrhagic fever (VHF)	A
Leptospirosis	B2	West Nile virus infection	B1
Listeriosis	B1	Western equine encephalitis virus disease	B1
Lyme disease	B2	Yellow fever	A
		Yersiniosis	B2

Appendix D

Recommended Immunization Schedules 2011

- Infant, Children, and Teens**
- Adults**

Recommended Immunization Schedule for Persons Aged 0 Through 6 Years—United States • 2011

For those who fall behind or start late, see the catch-up schedule

Vaccine ▼	Age ►	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
Hepatitis B ¹		HepB	HepB				HepB					
Rotavirus ²				RV	RV	RV ²						
Diphtheria, Tetanus, Pertussis ³				DTaP	DTaP	DTaP	see footnote ³	DTaP				DTaP
<i>Haemophilus influenzae</i> type b ⁴				Hib	Hib	Hib ⁴		Hib				
Pneumococcal ⁵				PCV	PCV	PCV		PCV			PPSV	
Inactivated Poliovirus ⁶				IPV	IPV			IPV				IPV
Influenza ⁷								Influenza (Yearly)				
Measles, Mumps, Rubella ⁸								MMR		see footnote ⁸		MMR
Varicella ⁹								Varicella		see footnote ⁹		Varicella
Hepatitis A ¹⁰								HepA (2 doses)				HepA Series
Meningococcal ¹¹												MCV4

Range of recommended ages for all children

Range of recommended ages for certain high-risk groups

This schedule includes recommendations in effect as of December 21, 2010. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Considerations should include provider assessment, patient preference, and the potential for adverse events. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations: <http://www.cdc.gov/vaccines/pubs/acip-list.htm>. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS) at <http://www.vaers.hhs.gov> or by telephone, 800-822-7967. Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

1. Hepatitis B vaccine (HepB). (Minimum age: birth)

At birth:

- Administer monovalent HepB to all newborns before hospital discharge.
- If mother is hepatitis B surface antigen (HBsAg)-positive, administer HepB and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth.
- If mother's HBsAg status is unknown, administer HepB within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if HBsAg-positive, administer HBIG (no later than age 1 week).

Doses following the birth dose:

- The second dose should be administered at age 1 or 2 months. Monovalent HepB should be used for doses administered before age 6 weeks.
- Infants born to HBsAg-positive mothers should be tested for HBsAg and antibody to HBsAg 1 to 2 months after completion of at least 3 doses of the HepB series, at age 9 through 18 months (generally at the next well-child visit).
- Administration of 4 doses of HepB to infants is permissible when a combination vaccine containing HepB is administered after the birth dose.
- Infants who did not receive a birth dose should receive 3 doses of HepB on a schedule of 0, 1, and 6 months.
- The final (3rd or 4th) dose in the HepB series should be administered no earlier than age 24 weeks.

2. Rotavirus vaccine (RV). (Minimum age: 6 weeks)

- Administer the first dose at age 6 through 14 weeks (maximum age: 14 weeks 6 days). Vaccination should not be initiated for infants aged 15 weeks 0 days or older.
- The maximum age for the final dose in the series is 8 months 0 days
- If Rotarix is administered at ages 2 and 4 months, a dose at 6 months is not indicated.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP). (Minimum age: 6 weeks)

- The fourth dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.

4. *Haemophilus influenzae* type b conjugate vaccine (Hib). (Minimum age: 6 weeks)

- If PRP-OMP (PedvaxHIB or Comvax [HepB-Hib]) is administered at ages 2 and 4 months, a dose at age 6 months is not indicated.
- Hiberix should not be used for doses at ages 2, 4, or 6 months for the primary series but can be used as the final dose in children aged 12 months through 4 years.

5. Pneumococcal vaccine. (Minimum age: 6 weeks for pneumococcal conjugate vaccine [PCV]; 2 years for pneumococcal polysaccharide vaccine [PPSV])

- PCV is recommended for all children aged younger than 5 years. Administer 1 dose of PCV to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.
- A PCV series begun with 7-valent PCV (PCV7) should be completed with 13-valent PCV (PCV13).
- A single supplemental dose of PCV13 is recommended for all children aged 14 through 59 months who have received an age-appropriate series of PCV7.
- A single supplemental dose of PCV13 is recommended for all children aged 60 through 71 months with underlying medical conditions who have received an age-appropriate series of PCV7.

- The supplemental dose of PCV13 should be administered at least 8 weeks after the previous dose of PCV7. See *MMWR* 2010;59(No. RR-11).

- Administer PPSV at least 8 weeks after last dose of PCV to children aged 2 years or older with certain underlying medical conditions, including a cochlear implant.

6. Inactivated poliovirus vaccine (IPV). (Minimum age: 6 weeks)

- If 4 or more doses are administered prior to age 4 years an additional dose should be administered at age 4 through 6 years.
- The final dose in the series should be administered on or after the fourth birthday and at least 6 months following the previous dose.

7. Influenza vaccine (seasonal). (Minimum age: 6 months for trivalent inactivated influenza vaccine [TIV]; 2 years for live, attenuated influenza vaccine [LAIV])

- For healthy children aged 2 years and older (i.e., those who do not have underlying medical conditions that predispose them to influenza complications), either LAIV or TIV may be used, except LAIV should not be given to children aged 2 through 4 years who have had wheezing in the past 12 months.
- Administer 2 doses (separated by at least 4 weeks) to children aged 6 months through 8 years who are receiving seasonal influenza vaccine for the first time or who were vaccinated for the first time during the previous influenza season but only received 1 dose.
- Children aged 6 months through 8 years who received no doses of monovalent 2009 H1N1 vaccine should receive 2 doses of 2010–2011 seasonal influenza vaccine. See *MMWR* 2010;59(No. RR-8):33–34.

8. Measles, mumps, and rubella vaccine (MMR). (Minimum age: 12 months)

- The second dose may be administered before age 4 years, provided at least 4 weeks have elapsed since the first dose.

9. Varicella vaccine. (Minimum age: 12 months)

- The second dose may be administered before age 4 years, provided at least 3 months have elapsed since the first dose.
- For children aged 12 months through 12 years the recommended minimum interval between doses is 3 months. However, if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.

10. Hepatitis A vaccine (HepA). (Minimum age: 12 months)

- Administer 2 doses at least 6 months apart.
- HepA is recommended for children aged older than 23 months who live in areas where vaccination programs target older children, who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

11. Meningococcal conjugate vaccine, quadrivalent (MCV4). (Minimum age: 2 years)

- Administer 2 doses of MCV4 at least 8 weeks apart to children aged 2 through 10 years with persistent complement component deficiency and anatomic or functional asplenia, and 1 dose every 5 years thereafter.
- Persons with human immunodeficiency virus (HIV) infection who are vaccinated with MCV4 should receive 2 doses at least 8 weeks apart.
- Administer 1 dose of MCV4 to children aged 2 through 10 years who travel to countries with highly endemic or epidemic disease and during outbreaks caused by a vaccine serogroup.
- Administer MCV4 to children at continued risk for meningococcal disease who were previously vaccinated with MCV4 or meningococcal polysaccharide vaccine after 3 years if the first dose was administered at age 2 through 6 years.

The Recommended Immunization Schedules for Persons Aged 0 Through 18 Years are approved by the Advisory Committee on Immunization Practices (<http://www.cdc.gov/vaccines/recs/acip>), the American Academy of Pediatrics (<http://www.aap.org>), and the American Academy of Family Physicians (<http://www.aafp.org>).

Recommended Immunization Schedule for Persons Aged 7 Through 18 Years—United States • 2011

For those who fall behind or start late, see the schedule below and the catch-up schedule

Vaccine ▼	Age ►	7–10 years	11–12 years	13–18 years	
Tetanus, Diphtheria, Pertussis ¹			Tdap	Tdap	Range of recommended ages for all children
Human Papillomavirus ²	see footnote ²		HPV (3 doses)(females)	HPV Series	
Meningococcal ³		MCV4	MCV4	MCV4	
Influenza ⁴			Influenza (Yearly)		Range of recommended ages for catch-up immunization
Pneumococcal ⁵			Pneumococcal		
Hepatitis A ⁶			HepA Series		Range of recommended ages for certain high-risk groups
Hepatitis B ⁷			Hep B Series		
Inactivated Poliovirus ⁸			IPV Series		
Measles, Mumps, Rubella ⁹			MMR Series		
Varicella ¹⁰			Varicella Series		

This schedule includes recommendations in effect as of December 21, 2010. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Considerations should include provider assessment, patient preference, and the potential for adverse events. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations: <http://www.cdc.gov/vaccines/pubs/acip-list.htm>. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS) at <http://www.vaers.hhs.gov> or by telephone, **800-822-7967**.

1. Tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap).

(Minimum age: 10 years for Boostrix and 11 years for Adacel)

- Persons aged 11 through 18 years who have not received Tdap should receive a dose followed by Td booster doses every 10 years thereafter.
- Persons aged 7 through 10 years who are not fully immunized against pertussis (including those never vaccinated or with unknown pertussis vaccination status) should receive a single dose of Tdap. Refer to the catch-up schedule if additional doses of tetanus and diphtheria toxoid-containing vaccine are needed.
- Tdap can be administered regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine.

2. Human papillomavirus vaccine (HPV). (Minimum age: 9 years)

- Quadrivalent HPV vaccine (HPV4) or bivalent HPV vaccine (HPV2) is recommended for the prevention of cervical precancers and cancers in females.
- HPV4 is recommended for prevention of cervical precancers, cancers, and genital warts in females.
- HPV4 may be administered in a 3-dose series to males aged 9 through 18 years to reduce their likelihood of genital warts.
- Administer the second dose 1 to 2 months after the first dose and the third dose 6 months after the first dose (at least 24 weeks after the first dose).

3. Meningococcal conjugate vaccine, quadrivalent (MCV4). (Minimum age: 2 years)

- Administer MCV4 at age 11 through 12 years with a booster dose at age 16 years.
- Administer 1 dose at age 13 through 18 years if not previously vaccinated.
- Persons who received their first dose at age 13 through 15 years should receive a booster dose at age 16 through 18 years.
- Administer 1 dose to previously unvaccinated college freshmen living in a dormitory.
- Administer 2 doses at least 8 weeks apart to children aged 2 through 10 years with persistent complement component deficiency and anatomic or functional asplenia, and 1 dose every 5 years thereafter.
- Persons with HIV infection who are vaccinated with MCV4 should receive 2 doses at least 8 weeks apart.
- Administer 1 dose of MCV4 to children aged 2 through 10 years who travel to countries with highly endemic or epidemic disease and during outbreaks caused by a vaccine serogroup.
- Administer MCV4 to children at continued risk for meningococcal disease who were previously vaccinated with MCV4 or meningococcal polysaccharide vaccine after 3 years (if first dose administered at age 2 through 6 years) or after 5 years (if first dose administered at age 7 years or older).

4. Influenza vaccine (seasonal).

- For healthy nonpregnant persons aged 7 through 18 years (i.e., those who do not have underlying medical conditions that predispose them to influenza complications), either LAIV or TIV may be used.
- Administer 2 doses (separated by at least 4 weeks) to children aged 6 months through 8 years who are receiving seasonal influenza vaccine for the first

time or who were vaccinated for the first time during the previous influenza season but only received 1 dose.

- Children 6 months through 8 years of age who received no doses of monovalent 2009 H1N1 vaccine should receive 2 doses of 2010-2011 seasonal influenza vaccine. See *MMWR* 2010;59(No. RR-8):33–34.

5. Pneumococcal vaccines.

- A single dose of 13-valent pneumococcal conjugate vaccine (PCV13) may be administered to children aged 6 through 18 years who have functional or anatomic asplenia, HIV infection or other immunocompromising condition, cochlear implant or CSF leak. See *MMWR* 2010;59(No. RR-11).
- The dose of PCV13 should be administered at least 8 weeks after the previous dose of PCV7.
- Administer pneumococcal polysaccharide vaccine at least 8 weeks after the last dose of PCV to children aged 2 years or older with certain underlying medical conditions, including a cochlear implant. A single revaccination should be administered after 5 years to children with functional or anatomic asplenia or an immunocompromising condition.

6. Hepatitis A vaccine (HepA).

- Administer 2 doses at least 6 months apart.
- HepA is recommended for children aged older than 23 months who live in areas where vaccination programs target older children, or who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

7. Hepatitis B vaccine (HepB).

- Administer the 3-dose series to those not previously vaccinated. For those with incomplete vaccination, follow the catch-up schedule.
- A 2-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children aged 11 through 15 years.

8. Inactivated poliovirus vaccine (IPV).

- The final dose in the series should be administered on or after the fourth birthday and at least 6 months following the previous dose.
- If both OPV and IPV were administered as part of a series, a total of 4 doses should be administered, regardless of the child's current age.

9. Measles, mumps, and rubella vaccine (MMR).

- The minimum interval between the 2 doses of MMR is 4 weeks.

10. Varicella vaccine.

- For persons aged 7 through 18 years without evidence of immunity (see *MMWR* 2007;56[No. RR-4]), administer 2 doses if not previously vaccinated or the second dose if only 1 dose has been administered.
- For persons aged 7 through 12 years, the recommended minimum interval between doses is 3 months. However, if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.
- For persons aged 13 years and older, the minimum interval between doses is 4 weeks.

The table below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age

PERSONS AGED 4 MONTHS THROUGH 6 YEARS					
Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses			
		Dose 1 to Dose 2	Dose 2 to Dose 3	Dose 3 to Dose 4	Dose 4 to Dose 5
Hepatitis B ¹	Birth	4 weeks	8 weeks (and at least 16 weeks after first dose)		
Rotavirus ²	6 wks	4 weeks	4 weeks ⁵		
Diphtheria, Tetanus, Pertussis ³	6 wks	4 weeks	4 weeks	6 months	6 months ³
<i>Haemophilus influenzae</i> type b ⁴	6 wks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose) if first dose administered at age 12–14 months No further doses needed if first dose administered at age 15 months or older	4 weeks ⁴ if current age is younger than 12 months 8 weeks (as final dose) ⁴ if current age is 12 months or older and first dose administered at younger than age 12 months and second dose administered at younger than 15 months No further doses needed if previous dose administered at age 15 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 months through 15 months who received 3 doses before age 12 months	
Pneumococcal ⁵	6 wks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose for healthy children) if first dose administered at age 12 months or older or current age 24 through 59 months No further doses needed for healthy children if first dose administered at age 24 months or older	4 weeks if current age is younger than 12 months 8 weeks (as final dose for healthy children) if current age is 12 months or older No further doses needed for healthy children if previous dose administered at age 24 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 months through 59 months who received 3 doses before age 12 months or for children at high risk who received 3 doses at any age	
Inactivated Poliovirus ⁶	6 wks	4 weeks	4 weeks	6 months ⁵	
Measles, Mumps, Rubella ⁷	12 mos	4 weeks			
Varicella ⁸	12 mos	3 months			
Hepatitis A ⁹	12 mos	6 months			
PERSONS AGED 7 THROUGH 18 YEARS					
Tetanus, Diphtheria/ Tetanus, Diphtheria, Pertussis ¹⁰	7 yrs ¹⁰	4 weeks	4 weeks if first dose administered at younger than age 12 months 6 months if first dose administered at 12 months or older	6 months if first dose administered at younger than age 12 months	
Human Papillomavirus ¹¹	9 yrs	Routine dosing intervals are recommended (females) ¹¹			
Hepatitis A ⁹	12 mos	6 months			
Hepatitis B ¹	Birth	4 weeks	8 weeks (and at least 16 weeks after first dose)		
Inactivated Poliovirus ⁶	6 wks	4 weeks	4 weeks ⁵	6 months ⁵	
Measles, Mumps, Rubella ⁷	12 mos	4 weeks			
Varicella ⁸	12 mos	3 months if person is younger than age 13 years 4 weeks if person is aged 13 years or older			

1. Hepatitis B vaccine (HepB).

- Administer the 3-dose series to those not previously vaccinated.
- The minimum age for the third dose of HepB is 24 weeks.
- A 2-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children aged 11 through 15 years.

2. Rotavirus vaccine (RV).

- The maximum age for the first dose is 14 weeks 6 days. Vaccination should not be initiated for infants aged 15 weeks 0 days or older.
- The maximum age for the final dose in the series is 8 months 0 days.
- If Rotarix was administered for the first and second doses, a third dose is not indicated.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP).

- The fifth dose is not necessary if the fourth dose was administered at age 4 years or older.

4. *Haemophilus influenzae* type b conjugate vaccine (Hib).

- 1 dose of Hib vaccine should be considered for unvaccinated persons aged 5 years or older who have sickle cell disease, leukemia, or HIV infection, or who have had a splenectomy.
- If the first 2 doses were PRP-OMP (PedvaxHIB or Comvax), and administered at age 11 months or younger, the third (and final) dose should be administered at age 12 through 15 months and at least 8 weeks after the second dose.
- If the first dose was administered at age 7 through 11 months, administer the second dose at least 4 weeks later and a final dose at age 12 through 15 months.

5. Pneumococcal vaccine.

- Administer 1 dose of 13-valent pneumococcal conjugate vaccine (PCV13) to all healthy children aged 24 through 59 months with any incomplete PCV schedule (PCV7 or PCV13).
- For children aged 24 through 71 months with underlying medical conditions, administer 1 dose of PCV13 if 3 doses of PCV were received previously or administer 2 doses of PCV13 at least 8 weeks apart if fewer than 3 doses of PCV were received previously.
- A single dose of PCV13 is recommended for certain children with underlying medical conditions through 18 years of age. See age-specific schedules for details.
- Administer pneumococcal polysaccharide vaccine (PPSV) to children aged 2 years or older with certain underlying medical conditions, including a cochlear implant, at least 8 weeks after the last dose of PCV. A single revaccination should be administered after 5 years to children with functional or anatomic asplenia or an immunocompromising condition. See *MMWR* 2010;59(No. RR-11).

6. Inactivated poliovirus vaccine (IPV).

- The final dose in the series should be administered on or after the fourth birthday and at least 6 months following the previous dose.
- A fourth dose is not necessary if the third dose was administered at age 4 years or older and at least 6 months following the previous dose.
- In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at risk for imminent exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).

7. Measles, mumps, and rubella vaccine (MMR).

- Administer the second dose routinely at age 4 through 6 years. The minimum interval between the 2 doses of MMR is 4 weeks.

8. Varicella vaccine.

- Administer the second dose routinely at age 4 through 6 years.
- If the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.

9. Hepatitis A vaccine (HepA).

- HepA is recommended for children aged older than age 23 months who live in areas where vaccination programs target older children, or who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

10. Tetanus and diphtheria toxoids (Td) and tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap).

- Doses of DTaP are counted as part of the Td/Tdap series.
- Tdap should be substituted for a single dose of Td in the catch-up series for children aged 7 through 10 years or as a booster for children aged 11 through 18 years; use Td for other doses.

11. Human papillomavirus vaccine (HPV).

- Administer the series to females at age 13 through 18 years if not previously vaccinated or have not completed the vaccine series.
- Quadrivalent HPV vaccine (HPV4) may be administered in a 3-dose series to males aged 9 through 18 years to reduce their likelihood of genital warts.
- Use recommended routine dosing intervals for series catch-up (i.e., the second and third doses should be administered at 1 to 2 and 6 months after the first dose). The minimum interval between the first and second doses is 4 weeks. The minimum interval between the second and third doses is 12 weeks, and the third dose should be administered at least 24 weeks after the first dose.

Information about reporting reactions after immunization is available online at <http://www.vaers.hhs.gov> or by telephone, 800-822-7967. Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for immunization, is available from the National Center for Immunization and Respiratory Diseases at <http://www.cdc.gov/vaccines> or telephone, 800-CDC-INFO (800-232-4636).

Recommended Adult Immunization Schedule

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Note: These recommendations *must* be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

Recommended adult immunization schedule, by vaccine and age group

VACCINE ▼	AGE GROUP ▶	19–26 years	27–49 years	50–59 years	60–64 years	≥65 years	
Influenza ^{1,*}		1 dose annually					
Tetanus, diphtheria, pertussis (Td/Tdap) ^{2,*}		Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs					Td booster every 10 yrs
Varicella ^{3,*}		2 doses					
Human papillomavirus (HPV) ^{4,*}		3 doses (females)					
Zoster ⁵		1 dose					
Measles, mumps, rubella (MMR) ^{6,*}		1 or 2 doses		1 dose			
Pneumococcal (polysaccharide) ^{7,8}		1 or 2 doses				1 dose	
Meningococcal ^{9,*}		1 or more doses					
Hepatitis A ^{10,*}		2 doses					
Hepatitis B ^{11,*}		3 doses					

*Covered by the Vaccine Injury Compensation Program.

 For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of previous infection)

 Recommended if some other risk factor is present (e.g., based on medical, occupational, lifestyle, or other indications)

 No recommendation

Report all clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System (VAERS). Reporting forms and instructions on filing a VAERS report are available at <http://www.vaers.hhs.gov> or by telephone, 800-822-7967.

Information on how to file a Vaccine Injury Compensation Program claim is available at <http://www.hrsa.gov/vaccinecompensation> or by telephone, 800-338-2382. Information about filing a claim for vaccine injury is available through the U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, D.C. 20005; telephone, 202-357-6400.

Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination also is available at <http://www.cdc.gov/vaccines> or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4636) in English and Spanish, 24 hours a day, 7 days a week.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

Vaccines that might be indicated for adults based on medical and other indications

VACCINE ▼	INDICATION ▶	Pregnancy	Immuno-compromising conditions (excluding human immunodeficiency virus [HIV]) ^{3,5,6,13}	HIV infection ^{3,6,12,13}		Diabetes, heart disease, chronic lung disease, chronic alcoholism	Asplenia ¹² (including elective splenectomy) and persistent complement component deficiencies	Chronic liver disease	Kidney failure, end-stage renal disease, receipt of hemodialysis	Healthcare personnel
				CD4+ T lymphocyte count						
				<200 cells/μL	≥200 cells/μL					
Influenza ^{1,*}		1 dose TIV annually								1 dose TIV or LAIV annually
Tetanus, diphtheria, pertussis (Td/Tdap) ^{2,*}		Td	Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs							
Varicella ^{3,*}		Contraindicated	2 doses							
Human papillomavirus (HPV) ^{4,*}		3 doses through age 26 yrs								
Zoster ⁵		Contraindicated	1 dose							
Measles, mumps, rubella (MMR) ^{6,*}		Contraindicated	1 or 2 doses							
Pneumococcal (polysaccharide) ^{7,8}		1 or 2 doses								
Meningococcal ^{9,*}		1 or more doses								
Hepatitis A ^{10,*}		2 doses								
Hepatitis B ^{11,*}		3 doses								

*Covered by the Vaccine Injury Compensation Program.

 For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of previous infection)

 Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)

 No recommendation

These schedules indicate the recommended age groups and medical indications for which administration of currently licensed vaccines is commonly indicated for adults ages 19 years and older, as of January 1, 2011. For all vaccines being recommended on the adult immunization schedule, a vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Licensed combination vaccines may be used whenever any components of the combination are indicated and when the vaccine's other components are not contraindicated. For detailed recommendations on all vaccines, including those used primarily for travelers or that are issued during the year, consult the manufacturers' package inserts and the complete statements from the Advisory Committee on Immunization Practices (<http://www.cdc.gov/vaccines/pubs/acip-list.htm>).

The recommendations in this schedule were approved by the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians (AAFP), the American College of Obstetricians and Gynecologists (ACOG), and the American College of Physicians (ACP).



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION



Footnotes

Recommended Adult Immunization Schedule—UNITED STATES - 2011

For complete statements by the Advisory Committee on Immunization Practices (ACIP), visit www.cdc.gov/vaccines/pubs/ACIP-list.htm.

1. Influenza vaccination

Annual vaccination against influenza is recommended for all persons aged 6 months and older, including all adults. Healthy, nonpregnant adults aged less than 50 years without high-risk medical conditions can receive either intranasally administered live, attenuated influenza vaccine (FluMist), or inactivated vaccine. Other persons should receive the inactivated vaccine. Adults aged 65 years and older can receive the standard influenza vaccine or the high-dose (Fluzone) influenza vaccine. Additional information about influenza vaccination is available at <http://www.cdc.gov/vaccines/vpd-vac/flu/default.htm>.

2. Tetanus, diphtheria, and acellular pertussis (Td/Tdap) vaccination

Administer a one-time dose of Tdap to adults aged less than 65 years who have not received Tdap previously or for whom vaccine status is unknown to replace one of the 10-year Td boosters, and as soon as feasible to all 1) postpartum women, 2) close contacts of infants younger than age 12 months (e.g., grandparents and child-care providers), and 3) healthcare personnel with direct patient contact. Adults aged 65 years and older who have not previously received Tdap and who have close contact with an infant aged less than 12 months also should be vaccinated. Other adults aged 65 years and older may receive Tdap. Tdap can be administered regardless of interval since the most recent tetanus or diphtheria-containing vaccine.

Adults with uncertain or incomplete history of completing a 3-dose primary vaccination series with Td-containing vaccines should begin or complete a primary vaccination series. For unvaccinated adults, administer the first 2 doses at least 4 weeks apart and the third dose 6–12 months after the second. If incompletely vaccinated (i.e., less than 3 doses), administer remaining doses. Substitute a one-time dose of Tdap for one of the doses of Td, either in the primary series or for the routine booster, whichever comes first.

If a woman is pregnant and received the most recent Td vaccination 10 or more years previously, administer Td during the second or third trimester. If the woman received the most recent Td vaccination less than 10 years previously, administer Tdap during the immediate postpartum period. At the clinician's discretion, Td may be deferred during pregnancy and Tdap substituted in the immediate postpartum period, or Tdap may be administered instead of Td to a pregnant woman after an informed discussion with the woman.

The ACIP statement for recommendations for administering Td as prophylaxis in wound management is available at <http://www.cdc.gov/vaccines/pubs/acip-list.htm>.

3. Varicella vaccination

All adults without evidence of immunity to varicella should receive 2 doses of single-antigen varicella vaccine if not previously vaccinated or a second dose if they have received only 1 dose, unless they have a medical contraindication. Special consideration should be given to those who 1) have close contact with persons at high risk for severe disease (e.g., healthcare personnel and family contacts of persons with immunocompromising conditions) or 2) are at high risk for exposure or transmission (e.g., teachers; child-care employees; residents and staff members of institutional settings, including correctional institutions; college students; military personnel; adolescents and adults living in households with children; nonpregnant women of childbearing age; and international travelers).

Evidence of immunity to varicella in adults includes any of the following: 1) documentation of 2 doses of varicella vaccine at least 4 weeks apart; 2) U.S.-born before 1980 (although for healthcare personnel and pregnant women, birth before 1980 should not be considered evidence of immunity); 3) history of varicella based on diagnosis or verification of varicella by a healthcare provider (for a patient reporting a history of or having an atypical case, a mild case, or both, healthcare providers should seek either an epidemiologic link with a typical varicella case or to a laboratory-confirmed case or evidence of laboratory confirmation, if it was performed at the time of acute disease); 4) history of herpes zoster based on diagnosis or verification of herpes zoster by a healthcare provider; or 5) laboratory evidence of immunity or laboratory confirmation of disease.

Pregnant women should be assessed for evidence of varicella immunity. Women who do not have evidence of immunity should receive the first dose of varicella vaccine upon completion or termination of pregnancy and before discharge from the healthcare facility. The second dose should be administered 4–8 weeks after the first dose.

4. Human papillomavirus (HPV) vaccination

HPV vaccination with either quadrivalent (HPV4) vaccine or bivalent vaccine (HPV2) is recommended for females at age 11 or 12 years and catch-up vaccination for females aged 13 through 26 years.

Ideally, vaccine should be administered before potential exposure to HPV through sexual activity; however, females who are sexually active should still be vaccinated consistent with age-based recommendations.

Sexually active females who have not been infected with any of the four HPV vaccine types (types 6, 11, 16, and 18, all of which HPV4 prevents) or any of the two HPV vaccine types (types 16 and 18, both of which HPV2 prevents) receive the full benefit of the vaccination. Vaccination is less beneficial for females who have already been infected with one or more of the HPV vaccine types. HPV4 or HPV2 can be administered to persons with a history of genital warts, abnormal Papanicolaou test, or positive HPV DNA test, because these conditions are not evidence of previous infection with all vaccine HPV types.

HPV4 may be administered to males aged 9 through 26 years to reduce their likelihood of genital warts. HPV4 would be most effective when administered before exposure to HPV through sexual contact.

A complete series for either HPV4 or HPV2 consists of 3 doses. The second dose should be administered 1–2 months after the first dose; the third dose should be administered 6 months after the first dose.

Although HPV vaccination is not specifically recommended for persons with the medical indications described in Figure 2, "Vaccines that might be indicated for adults based on medical and other indications," it may be administered to these persons because the HPV vaccine is not a live-virus vaccine. However, the immune response and vaccine efficacy might be less for persons with the medical indications described in Figure 2 than in persons who do not have the medical indications described or who are immunocompetent.

5. Herpes zoster vaccination

A single dose of zoster vaccine is recommended for adults aged 60 years and older regardless of whether they report a previous episode of herpes zoster. Persons with chronic medical conditions may be vaccinated unless their condition constitutes a contraindication.

6. Measles, mumps, rubella (MMR) vaccination

Adults born before 1957 generally are considered immune to measles and mumps. All adults born in 1957 or later should have documentation of 1 or more doses of MMR vaccine unless they have a medical contraindication to the vaccine, laboratory evidence of immunity to each of the three diseases, or documentation of provider-diagnosed measles or mumps disease. For rubella, documentation of provider-diagnosed disease is not considered acceptable evidence of immunity.

Measles component: A second dose of MMR vaccine, administered a minimum of 28 days after the first dose, is recommended for adults who 1) have been recently exposed to measles or are in an outbreak setting; 2) are students in postsecondary educational institutions; 3) work in a healthcare facility; or 4) plan to travel internationally. Persons who received inactivated (killed) measles vaccine or measles vaccine of unknown type during 1963–1967 should be revaccinated with 2 doses of MMR vaccine.

Mumps component: A second dose of MMR vaccine, administered a minimum of 28 days after the first dose, is recommended for adults who 1) live in a community experiencing a mumps outbreak and are in an affected age group; 2) are students in postsecondary educational institutions; 3) work in a healthcare facility; or 4) plan to travel internationally. Persons vaccinated before 1979 with either killed mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection (e.g. persons who are working in a healthcare facility) should be revaccinated with 2 doses of MMR vaccine.

Rubella component: For women of childbearing age, regardless of birth year, rubella immunity should be determined. If there is no evidence of immunity, women who are not pregnant should be vaccinated. Pregnant women who do not have evidence of immunity should receive MMR vaccine upon completion or termination of pregnancy and before discharge from the healthcare facility.

Healthcare personnel born before 1957: For unvaccinated healthcare personnel born before 1957 who lack laboratory evidence of measles, mumps, and/or rubella immunity or laboratory confirmation of disease, healthcare facilities should 1) consider routinely vaccinating personnel with 2 doses of MMR vaccine at the appropriate interval (for measles and mumps) and 1 dose of MMR vaccine (for rubella), and 2) recommend 2 doses of MMR vaccine at the appropriate interval during an outbreak of measles or mumps, and 1 dose during an outbreak of rubella. Complete information about evidence of immunity is available at <http://www.cdc.gov/vaccines/recs/provisional/default.htm>.

7. Pneumococcal polysaccharide (PPSV) vaccination

Vaccinate all persons with the following indications:

Medical: Chronic lung disease (including asthma); chronic cardiovascular diseases; diabetes mellitus; chronic liver diseases; cirrhosis; chronic alcoholism; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy [if elective splenectomy is planned, vaccinate at least 2 weeks before surgery]); immunocompromising conditions (including chronic renal failure or nephrotic syndrome); and cochlear implants and cerebrospinal fluid leaks. Vaccinate as close to HIV diagnosis as possible.

Other: Residents of nursing homes or long-term care facilities and persons who smoke cigarettes.

Routine use of PPSV is not recommended for American Indians/Alaska Natives or persons aged less than 65 years unless they have underlying medical conditions that are PPSV indications. However, public health authorities may consider recommending PPSV for American Indians/Alaska Natives and persons aged 50 through 64 years who are living in areas where the risk for invasive pneumococcal disease is increased

8. Revaccination with PPSV

One-time revaccination after 5 years is recommended for persons aged 19 through 64 years with chronic renal failure or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy); and for persons with immunocompromising conditions. For persons aged 65 years and older, one-time revaccination is recommended if they were vaccinated 5 or more years previously and were aged less than 65 years at the time of primary vaccination.

9. Meningococcal vaccination

Meningococcal vaccine should be administered to persons with the following indications:

Medical: A 2-dose series of meningococcal conjugate vaccine is recommended for adults with anatomic or functional asplenia, or persistent complement component deficiencies. Adults with HIV infection who are vaccinated should also receive a routine 2-dose series. The 2 doses should be administered at 0 and 2 months.

Other: A single dose of meningococcal vaccine is recommended for unvaccinated first-year college students living in dormitories; microbiologists routinely exposed to isolates of *Neisseria meningitidis*; military recruits; and persons who travel to or live in countries in which meningococcal disease is hyperendemic or epidemic (e.g., the "meningitis belt" of sub-Saharan Africa during the dry season [December through June]), particularly if their contact with local populations will be prolonged. Vaccination is required by the government of Saudi Arabia for all travelers to Mecca during the annual Hajj.

Meningococcal conjugate vaccine, quadrivalent (MCV4) is preferred for adults with any of the preceding indications who are aged 55 years and younger; meningococcal polysaccharide vaccine (MPSV4) is preferred for adults aged 56 years and older. Revaccination with MCV4 every 5 years is recommended for adults previously vaccinated with MCV4 or MPSV4 who remain at increased risk for infection (e.g., adults with anatomic or functional asplenia, or persistent complement component deficiencies).

10. Hepatitis A vaccination

Vaccinate persons with any of the following indications and any person seeking protection from hepatitis A virus (HAV) infection:

Behavioral: Men who have sex with men and persons who use injection drugs.

Occupational: Persons working with HAV-infected primates or with HAV in a research laboratory setting.

Medical: Persons with chronic liver disease and persons who receive clotting factor concentrates.

Other: Persons traveling to or working in countries that have high or intermediate endemicity of hepatitis A (a list of countries is available at <http://wwwn.cdc.gov/travel/content/diseases.aspx>).

Unvaccinated persons who anticipate close personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity should be vaccinated. The first dose of the 2-dose hepatitis A vaccine series should be administered as soon as adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.

Single-antigen vaccine formulations should be administered in a 2-dose schedule at either 0 and 6–12 months (Havrix), or 0 and 6–18 months (Vaqta). If the combined hepatitis A and hepatitis B vaccine (Twinrix) is used, administer 3 doses at 0, 1, and 6 months; alternatively, a 4-dose schedule may be used, administered on days 0, 7, and 21–30, followed by a booster dose at month 12.

11. Hepatitis B vaccination

Vaccinate persons with any of the following indications and any person seeking protection from hepatitis B virus (HBV) infection:

Behavioral: Sexually active persons who are not in a long-term, mutually monogamous relationship (e.g., persons with more than one sex partner during the previous 6 months); persons seeking evaluation or treatment for a sexually transmitted disease (STD); current or recent injection-drug users; and men who have sex with men.

Occupational: Healthcare personnel and public-safety workers who are exposed to blood or other potentially infectious body fluids.

Medical: Persons with end-stage renal disease, including patients receiving hemodialysis; persons with HIV infection; and persons with chronic liver disease.

Other: Household contacts and sex partners of persons with chronic HBV infection; clients and staff members of institutions for persons with developmental disabilities; and international travelers to countries with high or intermediate prevalence of chronic HBV infection (a list of countries is available at <http://wwwn.cdc.gov/travel/content/diseases.aspx>).

Hepatitis B vaccination is recommended for all adults in the following settings: STD treatment facilities; HIV testing and treatment facilities; facilities providing drug-abuse treatment and prevention services; healthcare settings targeting services to injection-drug users or men who have sex with men; correctional facilities; end-stage renal disease programs and facilities for chronic hemodialysis patients; and institutions and nonresidential day-care facilities for persons with developmental disabilities.

Administer missing doses to complete a 3-dose series of hepatitis B vaccine to those persons not vaccinated or not completely vaccinated. The second dose should be administered 1 month after the first dose; the third dose should be given at least 2 months after the second dose (and at least 4 months after the first dose). If the combined hepatitis A and hepatitis B vaccine (Twinrix) is used, administer 3 doses at 0, 1, and 6 months; alternatively, a 4-dose Twinrix schedule, administered on days 0, 7, and 21 to 30, followed by a booster dose at month 12 may be used.

Adult patients receiving hemodialysis or with other immunocompromising conditions should receive 1 dose of 40 µg/mL (Recombinax HB) administered on a 3-dose schedule or 2 doses of 20 µg/mL (Engerix-B) administered simultaneously on a 4-dose schedule at 0, 1, 2, and 6 months.

12. Selected conditions for which *Haemophilus influenzae* type b (Hib) vaccine may be used

1 dose of Hib vaccine should be considered for persons who have sickle cell disease, leukemia, or HIV infection, or who have had a splenectomy, if they have not previously received Hib vaccine.

13. Immunocompromising conditions

Inactivated vaccines generally are acceptable (e.g., pneumococcal, meningococcal, influenza [inactivated influenza vaccine]) and live vaccines generally are avoided in persons with immune deficiencies or immunocompromising conditions. Information on specific conditions is available at <http://www.cdc.gov/vaccines/pubs/acip-list.htm>.