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The purpose of this study was to determine incidence rates per 100,000 population of hepatitis A (HAV) in Dallas County for 1998 and 1999. Individuals who tested seropositive for hepatitis A between January 1, 1998 and December 31, 1999 were included. The variables of interest were sex, race, age, Zone Improvement Plan (ZIP code), and date of occurrence. Rates for 1998 were 1.9 times higher in Dallas County than the United States. In 1999, the Dallas County rate increased over 1.6 times. Rates were significantly higher in males for both years, and rates were highest among Hispanics and lowest among Blacks. Differences in age distribution varied between years by increasing in ages 50 and older in 1999. Several ZIP codes exceeded rates of 20 per 100,000 for both 1998 and 1999. Dallas County met the Advisory Committee on Immunization Practices guidelines for routine vaccination of all children in 1999.

A STUDY OF HEPATITIS A SEROPOSITIVITY

IN DALLAS COUNTY, 1998 – 1999

Kimberly G. Fulda, B.S.

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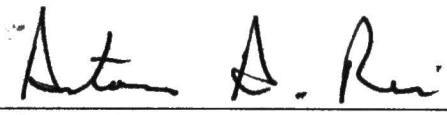

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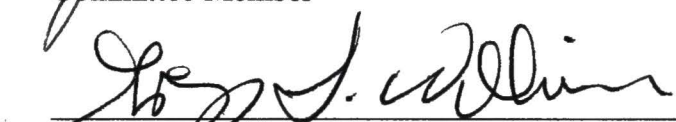

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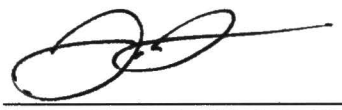

Dean, School of Public Health

A STUDY OF HEPATITIS A SEROPOSITIVITY IN DALLAS COUNTY, 1998 - 1999

THESIS

Presented to the School of Public Health

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CHAPTER I

INTRODUCTION

Hepatitis is a viral infection characterized by inflammation of the liver and jaundice. Five distinct viral hepatitides can cause hepatitis and uphold similar clinical features but different epidemiologic and etiologic characteristics. These five types include the hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis delta virus (HDV) - only existing as a co-infection with HBV, and hepatitis E virus (HEV) (Chin, 2000; Nelson, Williams, & Graham, 2001). Of the 37,005 viral hepatitis cases reported to the Centers for Disease Control and Prevention's (CDC) National Notifiable Disease Surveillance System in 1998, 23,229 (62.8%) cases were caused by HAV, and 10,258 (27.7%) cases were caused by HBV (Centers for Disease Control and Prevention, 1999b).

Hepatitis A is a non-enveloped RNA (positive-stranded) virus 27 nm in diameter and is classified in the *Hepatovirus* genus of the *Picornaviridae* family. HAV contains about 2,500 nucleotides and is constructed of at least four major structural polypeptides that encapsulate the RNA genome. HAV is resistant to nonionic detergents, chloroform, and ether and can be infectious for 2 - 4 weeks in feces at room temperature. Since HAV is relatively stable at a low pH and moderate temperature, the virus may remain infectious at a pH of 1.0 at 38°C for 90 minutes. High temperatures of at least 85°C/185°F, formalin,

or chlorine can inactivate HAV. In effect, a temperature of 85° to 95°C for 1 minute is necessary to effectively inactivate HAV in shellfish (Chin, 2000; Nelson, Williams, & Graham, 2001; World Health Organization, 2000).

Transmission

The most common route of hepatitis A infection is fecal-oral by person to person contact. About half of all outbreaks have no identified source of infection; however, outbreaks are commonly related to ingestion of contaminated food or water including raw or undercooked shellfish, food handled after cooking, and fresh produce. Persons considered to be at high risk for exposure to HAV include patients with chronic liver disease, persons who travel to or work in endemic countries, homosexual and bisexual men, IV drug users, children and employees of day care centers, and people working with infected non-human primates (Chin, 2000; Nelson, Williams, & Graham, 2001). In a national study, hepatitis A cases reported to 4 county health departments between 1983 and 1995 showed 52% of all cases to be from an unidentified source of infection, 14% from a history of injecting street drugs, 12% from household or sexual contact with someone infected with HAV, 11% from attending or working in a day care center, 7% from a history of homosexual male contact, and 4% from international travel (Bell et al, 1998).

Clinical Phases

Illness may be anywhere from mild to severe with symptoms lasting from 2 weeks to 6 months. Only 15% of all cases will last up to 1 year. There is complete recovery without any sequelae, and chronic infection is not associated with HAV. Mortality is only 0.3% in the US; however, mortality rates do increase with age (Chin, 2000). Five (2%) of 256 patients hospitalized from an epidemic of HAV in Shelby County, Tennessee died from complications. Results demonstrated an increased risk of complications and death after 40 years of age (Wilner, Uhl, & Howard, 1998). The cost of HAV related morbidity was estimated to be $200 million in 1991. This includes direct and indirect costs associated with doctor visits, work days lost, and school days lost (Centers for Disease Control and Prevention, 1999a).

The average incubation period before clinical symptoms appear is 28 days with a range of 15 – 50 days. Traces of the virus can be identified in the blood and feces from 10 – 12 days after infection, and the most infectious period ranges from 14 – 21 days before to 1 week after symptoms appear (World Health Organization, 2000). Symptoms of HAV typically include an abrupt onset of fever, malaise, anorexia, nausea, loss of appetite, diarrhea, abdominal discomfort, dark urine, and jaundice (Chin, 2000; Nelson, Williams, & Graham, 2001). There are 4 main clinical phases of HAV infection; classical hepatitis A, relapsing hepatitis A, cholestatic hepatitis A, and fulminant hepatitis A. Classical hepatitis A occurs in 80% of symptomatic cases and is usually self-limited in less than 8 weeks with few or no complications. Relapsing hepatitis A is characterized by 2 or more episodes up to 10 weeks after the onset of symptoms and occurs in 4% - 20% of

symptomatic cases. Cholestatic hepatitis A occurs in 10% of symptomatic cases and is characterized by several months of fever and jaundice without any symptom free intervals. Fulminant hepatitis A is the most serious and life-threatening form of HAV. It occurs in about 0.35% of symptomatic cases and may result in liver transplantation or death. Individuals at a higher risk of fulminant hepatitis A include the elderly and those with chronic liver disease (Chin, 2000; Kenner & Miskovsky, 2000; Nelson, Williams, & Graham, 2001).

Diagnostics

Various laboratory tests are available to help diagnose hepatitis A infection. It is possible to detect HAV RNA in body fluids; however, this test is expensive and mostly used for research purposes. Diagnostic procedures commonly practiced in patient care include testing for immunoglobulin M antibodies against HAV (IgM anti-HAV), immunoglobulin G antibodies (IgG), alanine aminotransferase levels (ALT), and aspartate aminotransferase levels (AST). The presence of IgM anti-HAV is indicative of recent illness and occurs from 5 – 10 days after infection until 3 – 6 months after infection. The detection of IgG without IgM anti-HAV suggests a prior hepatitis A infection with lasting immunity. Both ALT and AST are liver enzyme function tests that are elevated in the presence of liver damage, not necessarily from HAV. These tests must be interpreted carefully since they are typically elevated during acute infection, but may decline with end-stage liver failure (Chin, 2000; Nelson, Williams, & Graham, 2001; Rosenthal & Lighdale, 2000).

CHAPTER II

BACKGROUND

Epidemiology

Incidence rates of hepatitis A vary greatly with different race and age groups. Nationally, rates are highest among American Indians/Alaskan Natives and lowest among Asians, while rates among Hispanics are typically higher than rates among non-Hispanics (Centers for Disease Control and Prevention, 1999a). A national study of hepatitis A cases reported to 4 county health departments between 1983 and 1995 demonstrated incidence rates of 40.0 per 100,000 for American Indians, 38.2 per 100,000 for Hispanics, 15.7 per 100,000 for Whites, 11.4 per 100,000 for Blacks, and 11.2 per 100,000 for Asian/Pacific Islanders. Additionally, incidence rates were highest among 15 - 29 year olds and higher for men than women 15 years of age and older (Bell et al, 1998).

The symptomology of HAV partially explains the variation in age distribution. Approximately 70% of children less than 6 years of age infected with HAV are asymptomatic (World Health Organization, 2000). In a study of day-care centers, attack rates of hepatitis A increased with age and reached 41 cases per 1,000 population in children 6 years of age and older. Few cases were identified in children less than 2 years of age (Hadler, Webster, Erben, Swanson, & Maynard, 1980). Information released by

the World Health Organization stated that only 10% of children less than 6 years old develop jaundice with HAV infection; however, among older children and adults, jaundice occurs in more than 70% of cases (World Health Organization, 2000). Lednar et al found adult hepatitis A infection to be highly symptomatic with 28 of 29 (96.6%) and 35 of 46 (76.1%) cases from 2 different outbreaks presenting clinical symptoms (Lednar, Lemon, Kirkpatrick, Redfield, Fields, & Kelley, 1985).

Texas

Incidence rates of hepatitis A in Texas are higher than that of the national average. In 1998, there were 23,229 cases (incidence rate of 8.6 per 100,000 population) of HAV reported in the United States and 3,538 cases (incidence rate of 17.8 per 100,000 population) of HAV reported in Texas (Centers for Disease Control and Prevention, 1999b). An average of 33% of the population in the United States demonstrates evidence of prior HAV infection (Chin, 2000). A study of hepatitis A seroprevalence rates in El Paso, Texas, however, illustrated rates of total anti-HAV to be 65% among women 14-19 years of age and 89% in women 29-46 years of age. Such high rates were partly due to having a predominantly Hispanic sample (96%) and being in close proximity to Juarez, Mexico, where anti-HAV seroprevalence rates were 100% in women over 28 years of age (Redlinger, Nickey, O'Rourke, & Martinez, 1998).

Geographic Distribution by Community

Communities can be divided into low, intermediate, or high areas of endemicity based on age-specific rates of HAV infection. Each area differs by age of infection, incidence rate, and seropositivity. Areas of high endemicity may reach incidence levels of >700 cases per 100,000 population. Most cases occur before 15 years of age with seropositivity data indicating that 30%-40% of children are infected before 5 years of age (Centers for Disease Control and Prevention, 1999a; Williams, 1986). The lifetime risk of infection is >90%. Because a high percentage of cases occur in children, symptomatic cases of clinical hepatitis A in areas of high endemicity are rarely seen (World Health Organization, 2000). In areas of intermediate endemicity, hepatitis A is mostly associated with metropolitan communities. Incidence rates typically range from 50 – 100 cases per 100,000 population with higher rates among high risk groups. The age-specific rates are distributed more evenly among children, adolescents, and young adults resulting in more cases of clinical HAV (Centers for Disease Control and Prevention, 1999a; World Health Organization, 2000). For areas of low endemicity, most cases occur among older children and adults resulting in clinical cases. Most cases from identifiable sources are caused by personal contact with an infected individual or international travel. There are few outbreaks, and rates tend to remain relatively stable (Centers for Disease Control and Prevention, 1999a; World Health Organization, 2000; Bell et al, 1998).

Prevention

Without virus-specific therapy for HAV infection, prevention is emphasized to reduce morbidity. Preventive measures include providing public education about sanitation and personal hygiene, providing proper water treatment and sewage disposal, ensuring appropriate management of day care centers to reduce the risk of fecal-oral transmission, ensuring thorough cooking of oysters, clams, and other shellfish at suitable temperatures, and complying with recommendations for vaccination. Immunization may include either passive immunization with immune globulin (IG) or active immunization with inactivated vaccines (Chin, 2000).

Immunization

Passive immunization with IG can be effectively administered pre- or post-exposure to hepatitis A. IG is given intramuscularly and protects by providing active transfer of antibodies. A preexposure dose of IG may be given to persons anticipating exposure to HAV infected individuals such as when traveling to endemic areas. The Advisory Committee on Immunization Practices (ACIP) recommends a preexposure dose of 0.02 mL per kg for protection lasting 1 – 2 months and a dose of 0.06 mL per kg for protection lasting 3 – 5 months. Postexposure prophylaxis with IG can be given up to 2 weeks after exposure. The ACIP recommended dose for exposed individuals not previously vaccinated is 0.02 mL per kg (Malay, Tizer, & Lutwick, 2000; Preboth, 2000; Centers for Disease Control and Prevention, 1999a).

Two inactivated vaccines for hepatitis A, Havrix and Vaqta, were introduced and made available in the United States in 1995 and 1996, respectively. Neither vaccine is approved for children less than 2 years of age, and both are given as 2 doses intramuscularly at 6 months apart. Protective levels of immunity have been found to last 5 - 10 years after receiving both doses of either vaccine. Current dosage recommendations for Havrix include 2 formulations with ages 2 – 18 receiving 720 ELISA units per dose and 18 years of age and older receiving 1,440 ELISA units per dose given over a 2 dose schedule (American Academy of Pediatrics, 1996; Kemmer & Miskovsky, 2000; Preboth, 2000). No significant difference was found in immunogenicity between receiving the second dose of Havrix at the recommended 6 month interval or at 24 months or greater (Landry, Tremblay, Darioli, & Genton, 2001). Dosage recommendations for Vaqta also include 2 formulations consisting of 25 units per dose for ages 2 – 17 and 50 units per dose for greater than 17 years of age given over a 2 dose schedule (American Academy of Pediatrics, 1996; Kemmer & Miskovsky, 2000; Preboth, 2000). A study comparing the 2 vaccines found protective levels of anti-HAV to be significantly higher at 4 and 26 weeks after a single dose of Vaqta. Higher anti-HAV levels were also found after administering Vaqta as the booster dose; however, no conclusions about higher concentrations providing a longer duration of immunity were made (Bryan et al, 2001).

In 1999, recommendations set by the Advisory Committee on Immunization Practices (ACIP) for administering hepatitis A vaccinations were updated to include routine vaccination for children living in areas with incidence rates of 20 or more cases per

100,000 population and consideration of routine vaccination for children living in areas with rates of 10 or more cases but fewer than 20 cases per 100,000 population (Centers for Disease Control and Prevention, 1999a; Preboth, 2000). A large vaccination intervention program was established in Memphis, Tennessee after an outbreak of hepatitis A in 1995 and 1996. Initially, children 2 - 9 years of age were vaccinated, after which children 10 - 18 were vaccinated. The results of the study were promising since vaccinating a large number of children was accomplished. Furthermore, when compared to the 3 month period before the program began, the number of cases declined inside the intervention area (Craig et al, 1998).

Dallas County

Dallas County spans 880 square miles in central Texas. It ranks 10th among counties in the United States with a 1999 population estimate of 2,062,100 residents and a 1990 - 1999 growth rate of 11.3% (Gaquin & DeBrandt, 2000; U.S. Census Bureau). The population is 49.2% male with 8.3% of the population less than 5 years of age. The race/ethnicity composition includes 74.0% White, 21.0% Black, 4.3% Asian/Pacific Islander, and 21.4% Hispanic (U.S. Census Bureau).

CHAPTER III

METHODS

It is mandatory to report certain communicable diseases to the Texas Department of Health under the Health and Safety Code, Chapters 81, 84, and 87. Health care providers, hospitals, schools, laboratories, and justices of the peace are required to report each case of a notifiable disease to the local health department. These case reports are then transmitted weekly to the Texas Department of Health. Specific details of reportable conditions and the responsibility of the local health departments are listed in Title 25, Texas Administrative Code, Chapter 97 (Texas Department of Health, 1996; Texas Department of Health, 1999). Hepatitis A is classified as a reportable condition in Texas with a confirmed laboratory test positive for serum IgM anti-HAV (Texas Department of Health, 1996). Each case must be reported by name, age, sex, race/ethnicity, DOB, address, telephone number, disease, date of onset/occurrence, method of diagnosis, and name, address, and phone number of physician (Texas Department of Health, 1996; Texas Department of Health, 1999).

For this study, databases of individuals in Dallas County who tested positive for hepatitis A in 1998 and 1999 were utilized. The databases were obtained from the Dallas County Health Department and were analyzed to determine incidence rates per 100,000 population. Individuals in Dallas County who were seropositive for hepatitis A

between January 1, 1998 and December 31, 1999 were included. For race, 23.8% of cases in 1998 and 16.3% of cases for 1999 had unknown or missing data. Additionally, 42.3% of cases in 1998 and 21.1% of cases in 1999 had unknown or missing data for ethnicity. Unknown cases were excluded from analysis. There were no restrictions on sex, race, or age. The variables of interest included sex, race, age, Zone Improvement Plan (ZIP code) location, and date of occurrence. Rates atypical of HAV were noted from an outbreak at a local Luby's Cafeteria in March 1999. All personal identifying information was removed from the databases prior to beginning the study. Study methodologies were approved by the University of North Texas Health Science Center's Institutional Review Board.

All data were viewed and analyzed using EpiInfo and SPSS Version 10 software packages. Incidence rates of hepatitis A for 1998 and 1999 were calculated for Dallas County by sex, race, age, ZIP code location, and month of occurrence. Race was categorized as Asian/Pacific Islander, Black, Hispanic, White, and Other. Unknown variables were not included as Other. Age groups include 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, and 60 and older. Population data were obtained from the Dallas County Health Department, the Census Bureau, and 2000 County and City Extra Annual Metro, City, and County Data Book Ninth Edition (U.S. Census Bureau; Gaquin & DeBrandt, 2000). Relative risks, 95% confidence intervals, and p-values are reported for differences between overall incidence rates for Dallas County and the United Sates in 1998, incidence rates between males and females for 1998 and 1999, and incidence rates between individuals 50 years of age and older for 1998 versus 1999.

CHAPTER IV

RESULTS

All analyses were performed using reported cases of hepatitis A during 1998 and 1999 in Dallas County. Incidence rates in Dallas County were 16.4 per 100,000 population (n=336, total population=2,045,309) for 1998 and 26.5 per 100,000 population (n=546, total population=2,062,100) for 1999. Figure 1 (see Appendix) is a bar graph illustrating the relationship between incidence rates per 100,000 population in Dallas County (16.4), Texas (17.8), and the United States (8.6) for 1998. Residents of Dallas County in 1998 were 1.9 times more likely than the US general population to test positive for hepatitis A (RR=1.9, 95% CI=1.62, 2.26, $p<0.001$).

Gender

Incidence rates were higher among males than females for both 1998 and 1999. Incidence rates in 1998 were 23.3 per 100,000 for males (n=234) and 9.8 per 100,000 for females (n=102). Ultimately, males were 2.3 times more likely to test positive for HAV than females in 1998 (RR=2.3, 95% CI=1.88, 2.99, $p<0.001$). Incidence rates in 1999 were 33.9 per 100,000 for males (n=344) and 19.9 per 100,000 for females (n=202). Males were 1.7 times more likely to test positive for HAV than females (RR=1.7,

95% CI=1.48, 2.09, p<0.001). Figure 2 (see Appendix) demonstrates the incidence of HAV in Dallas County by gender for 1998 and 1999. Table 1 presents the incidence of hepatitis A and the male/female ratios.

Table 1: Cases and Incidence Rates (per 100,000) of Hepatitis A by Sex in Dallas County - 1998 and 1999

YEAR	*MALE*		*FEMALE*		*TOTAL*		*RATIO*
	n	Rate	n	Rate	n	Rate	
1998	234	23.3	102	9.8	336	16.4	2.3
1999	344	33.9	202	19.9	546	26.5	1.7

Race

Figures 3 and 4 (see Appendix) illustrate incidence rates of HAV for various racial groups including Asian/Pacific Islanders, Blacks, Hispanics, Whites, and Other. Rates among these groups partially followed patterns characteristic of HAV infection. The highest rates of HAV were found among Hispanics with incidence rates of 19.2 per 100,000 population in 1998 and 34.9 per 100,000 population in 1999. Rates are generally lowest for Asian/Pacific Islanders; however, rates in Dallas County were lowest among Blacks for both 1998 and 1999. Incidence rates were 5.7 per 100,000 population for Asian/Pacific Islanders and 4.7 per 100,000 population for Blacks in 1998, while rates were 7.9 per 100,000 population for Asian/Pacific Islanders and 5.8 per 100,000 population for Blacks in 1999.

Age

Incidence rates of hepatitis A were determined for 10 year age groups and ≥60. These results are presented in Figure 5 (see Appendix). Rates for 1998 were highest for 30-39 years of age (27.0 per 100,000 population) and lowest for 60 years of age and older (5.4 per 100,000 population). The incidence rate among 0-9 years of age was 20.0 per 100,000 population. Rates for 1999 were highest in ages 0-9 years (32.9 per 100,000 population) and lowest in ages 20-29 years (17.9 per 100,000 population). Age groups 50-59 and ≥60 were combined to compare rates between years. Individuals 50 years of age and older were 4.5 times more likely to have hepatitis A in 1999 than in 1998 (RR=4.5, 95% CI=2.96, 6.91, $p<0.001$). Rates for each age group varied between years. Table 2 shows the number of HAV reported cases and incidence rates per 100,000 for ages 2-5.

Table 2: Cases and Incidence Rates (per 100,000) of Hepatitis A for Ages 2-5 Years in Dallas County – 1998 and 1999

YEAR	AGE							
	2		3		4		5	
	n	Rate	n	Rate	n	Rate	n	Rate
1998	1	2.9	8	23.9	7	21.3	6	18.6
1999	6	17.4	9	26.9	10	30.5	12	37.8

Location

Incidence rates of hepatitis A in Dallas County vary by Zone Improvement Plan (ZIP code) location. As of 1999, there were 96 physical ZIP codes in Dallas County. Rates were determined to illustrate which ZIP codes met the ACIP recommendations for routine vaccination of children living in areas with incidence rates of 20 or more cases per 100,000 population. Several ZIP code locations exceeded these guidelines. In 1998, there were 22 (22.9%) ZIP codes with incidence rates greater than 20 cases per 100,000 population with the highest being ZIP code 75219 with a rate of 176.1 per 100,000 population (Table 3). As shown in Table 4, in 1999, 32 (33.3%) ZIP codes reached rates above 20 cases per 100,000 population with the highest rate being ZIP code 75251 with a rate of 1,123.6 per 100,000 population. Fifteen ZIP codes exceeded 20 cases per 100,000 population in both 1998 and 1999, Figure 6 (see Appendix). These numbers should be interpreted carefully, because incidence rates are affected by the size of a population. Areas with small populations will have higher rates from fewer cases.

Table 3 – Dallas County Zone Improvement Plan (ZIP Codes) with Hepatitis A Incidence Rates Above 20 Cases per 100,000 Population – 1998

ZIP Code	Cases	Population	Incidence Rate / 100,000
75219	35	19,870	176.1
75226	2	1,726	115.9
75201	2	1,807	110.7

(Table 3 –Continued)

75207	1	1,598	62.6
75204	9	17,438	51.6
75206	17	36,137	47.0
75063	5	11,598	43.1
75209	6	15,093	39.8
75182	1	2,577	38.8
75214	13	33,809	38.5
75220	12	35,030	34.3
75234	9	27,549	32.7
75235	5	15,478	32.3
75208	11	35,643	30.9
75240	12	40,712	29.5
75231	11	39,667	27.7
75223	4	15,004	26.7
75060	12	46,080	26.0
75233	3	12,027	24.9
75230	6	25,821	23.2
75212	5	22,611	22.1
75203	4	18,550	21.6

Table 4 – Dallas County Zone Improvement Plan (ZIP Codes) with Hepatitis A Incidence Rates Above 20 Cases per 100,000 Population – 1999

ZIP Code	Cases	Population	Incidence Rate / 100,000
75251	1	89	1123.6
75137	37	17,997	205.6
75116	31	19,417	159.7
75236	9	5,964	150.9
75219	27	20,033	134.8
75104	31	25,759	120.3
75201	2	1,822	109.8
75172	2	2,225	89.9
75235	14	15,605	89.7
75006	31	45,918	67.5
75203	11	18,702	58.8
75208	21	35,936	58.4
75226	1	1,740	57.5
75224	18	31,563	57.0
75249	5	8,790	56.9
75019	14	24,681	56.7
75204	8	17,581	45.5
75209	6	15,217	39.4

(Table 4 – Continued)

75115	15	38,236	39.2
75206	14	36,434	38.4
75211	20	58,598	34.1
75180	7	21,079	33.2
75223	5	15,127	33.1
75233	4	12,126	33.0
75234	9	27,775	32.4
75212	7	22,797	30.7
75237	4	13,013	30.7
75246	1	3,489	28.7
75220	10	35,317	28.3
75232	8	31,832	25.1
75215	6	23,997	25.0
75230	6	26,033	23.0

Month

Figures 7 and 8 (see Appendix) present the number of HAV cases by month in Dallas County for 1998 and 1999, respectively; whereas, Figure 9 (see Appendix) illustrates the monthly incidence rates for both 1998 and 1999. In 1998, the highest number of cases of

hepatitis A occurred in January (n=52, incidence rate=2.5 per 100,000), February (n=63, incidence rate=3.1 per 100,000), and March (n=50, incidence rate=2.4 per 100,000) accounting for 49.2% of all cases. The lowest rate for 1998 occurred in December (n=7, incidence rate=0.3 per 100,000). During 1999, however, 41.0% of all cases occurred in March (n=224, incidence rate=10.9 per 100,000). This was approximately 5 times the number of cases in February (n=45, incidence rate=2.2 per 100,000) and almost 19 times the number of cases in December (n=12, incidence rate=0.6 per 100,000). Of the 224 cases in March, 89 (39.8%) occurred in ages 50 and above. Table 5 presents the cases in March by age group.

Table 5 – Cases of Hepatitis A in Dallas County by Age Group for March 1999

AGE GROUP	n	%
0-9	17	7.6
10-19	16	7.1
20-29	23	10.3
30-39	35	15.6
40-49	44	19.6
50-59	40	17.9
≥60	49	21.9

CHAPTER V

DISCUSSION

Incidence rates of hepatitis A for 1998 and 1999 vary by sex, race, age, location, and time within Dallas County, Texas. The incidence of HAV in Dallas County for 1998 was less than the Texas state rate, but 1.9 times the national rate (Centers for Disease Control and Prevention, 1999b). Additionally, rates within the county increased in 1999 by over 1.5 times. When comparing differences between genders, there are contrasting results in the literature. Data from different research studies suggest higher rates among males, higher rates among females, and no difference between the 2 (Bell et al, 1998; Hadler, Webster, Erben, Swanson, & Maynard, 1980; Willner et al, 1998). Results from this study show statistically significant higher incidence rates among males than females for both 1998 and 1999 in Dallas County. In effect, males were 2.3 times more likely to be HAV positive in 1998 and 1.7 times more likely to be HAV positive in 1999 than females.

Incidence rates of hepatitis A differ among racial/ethnic groups. The variation is likely a result of differences in socioeconomic levels, living conditions, and contact with persons from endemic countries. Typically, rates are highest among American Indians/Alaskan Natives and lowest among Asian/Pacific Islanders, while rates are higher for Hispanics than non-Hispanics (Centers for Disease Control and Prevention, 1999a;

Bell et al, 1998). Results from this study show incidence rates in Dallas County were highest for Hispanics and lowest for Blacks in both 1998 and 1999. Data from the current study, however, should be interpreted carefully since there were high numbers of unknown cases for race and ethnicity.

Hepatitis A is generally asymptomatic in children less than 6 years of age causing reported incidence rates to be highest among older children and adults (Hadler, Webster, Erben, Swanson, & Maynard, 1980; Shaw et al, 1986; World Health Organization, 2000). In effect, morbidity is more pronounced with infection in the elderly population (Marcus & Tur-Kaspa, 1997). Incidence rates within various age groups in Dallas County differed between years. Rates were lowest among ages 60 and above and highest among ages 30-39 for 1998. These extremities changed in 1999 to be lowest among ages 20-29 and highest among ages 0-9. Additionally, there was a 4.5 fold increase in the incidence of HAV among individuals ages 50 and above from 1998 to 1999.

With an incidence rate of 16.4 per 100,000 population in 1998, Dallas County fell under the Advisory Committee on Immunization Practices (ACIP) recommendation for consideration of routine vaccination of children. This recommendation includes areas with rates greater than 10 but less than 20 per 100,000 population. In 1999, however, the incidence of hepatitis A was 26.5 per 100,000 population. This pushed Dallas County into the ACIP's recommendation of routine vaccination for children living in areas with rates of 20 or more cases per 100,000 population (Centers for Disease Control and Prevention, 1999; Preboth, 2000). When explored by geographic location, at least 22 ZIP

codes had rates in excess of 20 per 100,000 population each year with fifteen ZIP codes reaching 20 per 100,000 population in both 1998 and 1999.

Not only did geographic location of the incidence rates vary between years, but the number of cases per month did also. In 1998, January, February, and March together accounted for 49.2% of the total cases. For 1999, 41.0% of all cases occurred in March. This equated to at least 5 times the cases in any other month. Of the cases in March 1999, 39.8% occurred in ages 50 and above. For both years, the least number of cases occurred in December.

Outbreak in Local Cafeteria

The deviation of incidence rates between years in each variable can partially be explained by an outbreak at a local Luby's Cafeteria in Duncanville, Texas. A restaurant employee was diagnosed with hepatitis A on February 13, 1999, and the health department was notified on February 22, 1999. Approximately 150 cases of HAV were traced back to the employee (Beil, 1999). An incubation period ranging from 15-50 days explains the increase in cases of hepatitis A reported for March 1999 (224 cases). Of the cases reported in March, 89 were in ages 50 and older. This accounts for part of the 4.5 times increase in cases of HAV for ages 50 and above from 1998 to 1999. Furthermore, the ZIP code location of the cafeteria was 75137. In 1999, the incidence rate for this ZIP code reached 205.6 per 100,000 population with 37 cases. Similar effects may have been present in other ZIP codes surrounding the cafeteria.

Limitations

This is a descriptive study of hepatitis A using data from a reportable disease database. As with any data collection system, there may be flaws in the reporting procedure resulting in inaccurate data. For this study, there were high numbers of unknowns for the race and ethnicity variables. In 1998, 23.8% of cases were unknown for race, and 42.3% of cases were unknown for ethnicity. In 1999, 16.3% of cases were unknown for race, and 21.1% of cases were unknown for ethnicity. Additionally, an under-representation of the disease incidence rate is generally associated with passive data collection systems. Differences may exist in the reliability and accuracy of the system between geographic locations. There may be cases that were not reported for various reasons including a lack of knowledge about mandatory reporting by physicians and laboratory technicians, a feeling of inconvenience by physicians and technicians, and miscommunication about the person responsible for reporting the disease.

An under-representation of cases also results from asymptomatic infection among children. Since children without symptoms are not seen by physicians to conduct laboratory tests for serum IgM anti-HAV, the actual number of seropositive children is higher than the reported number of cases. For an accurate picture of the disease incidence, seroprevalence studies that test a sample of the population in question can be conducted.

Conclusion

Even with the introduction of 2 approved vaccines by 1996, hepatitis A remains the most reported vaccine preventable disease in the United States. Incidence rates vary across the nation among different race, age, socioeconomic, and religious communities (Centers for Disease Control and Prevention, 1999a). Current methods of controlling hepatitis A outbreaks consist of several preventive measures and immunization. Preventive measures include education about sanitation and hygiene, proper treatment of water and sewage, proper management of day care centers, and thorough cooking of foods (Chin, 2000). These aspects are regulated by local governing bodies for communities through different programs such as training classes for restaurant employees.

The ACIP has set standards for regulating immunization practices within different communities. The state of Texas and Dallas County fell within the recommendation for consideration of routine vaccination of children in 1998; however, Dallas County met the ACIP criteria for routine vaccination of children in 1999. When examined by ZIP code location several parts of Dallas County met the ACIP criteria for routine vaccination of children in both 1998 and 1999. Implementing such regulations is a challenge with current conflicting views. Concerns about routine vaccination include adding another immunization to an already seemingly overwhelming schedule of required shots, justifying vaccinating children when most are asymptomatic, and paying for large scale vaccination programs (Takayama, 1999; Le, 1999). These issues should be addressed in Dallas County by conducting more research and providing more education to health care

providers and county residents. The collection of additional information from seropositive individuals such as socioeconomic status, education, and occupation could provide information helpful in understanding the true prevalence of HAV among various groups of people. Future research should include conducting seroprevalence studies of HAV in Dallas County, as well as, studying the vaccines with respect to administration, dosage, effectiveness, and complications, different methods of mass distribution, and cost-effectiveness.

APPENDIX

Figure 1 - Incidence Rates of Hepatitis A for
Dallas County, Texas, and
the United States - 1998

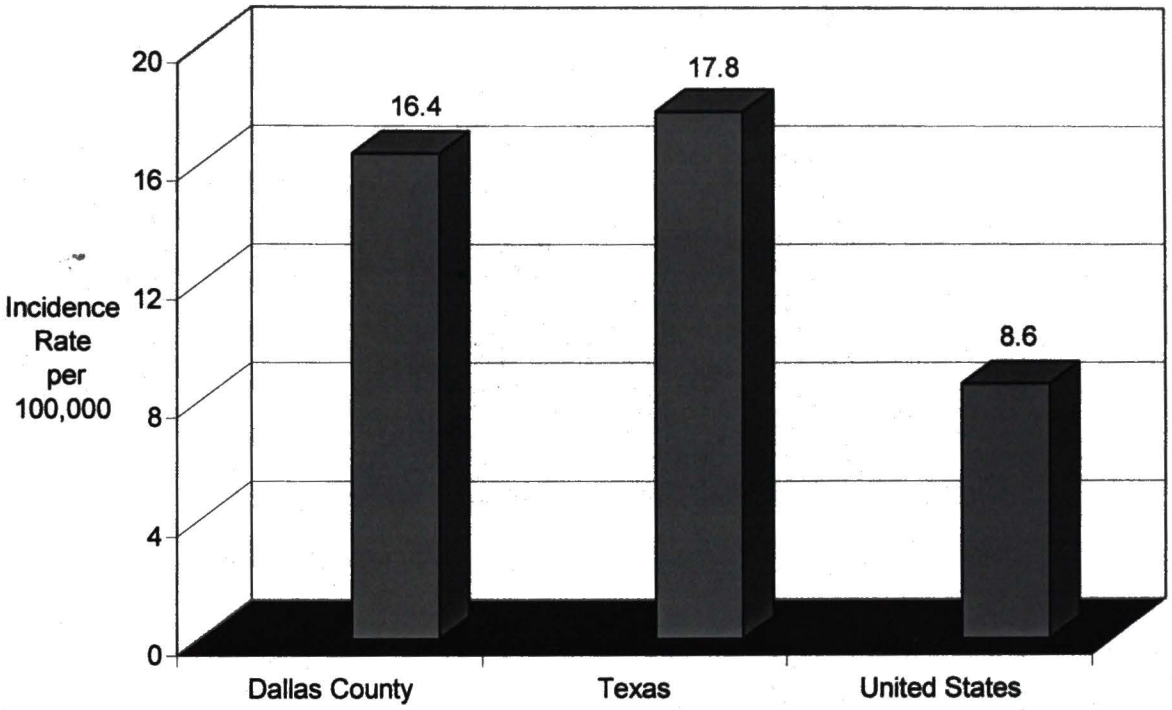
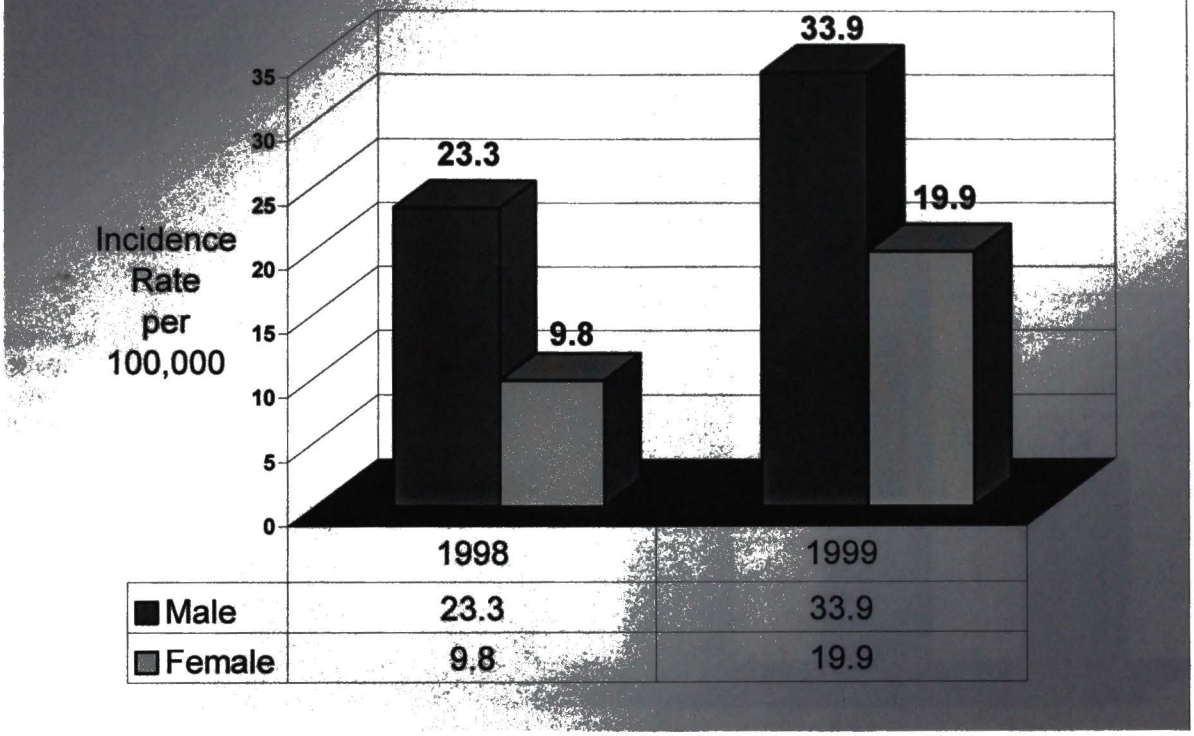


Figure 2. Distribution of Hepatitis A in Dallas County by Sex - 1998 and 1999



	1998	1999
Male	23.3	33.9
Female	9.8	19.9

Figure 3. Incidence Rates of Hepatitis A
in Dallas County
by Race - 1998

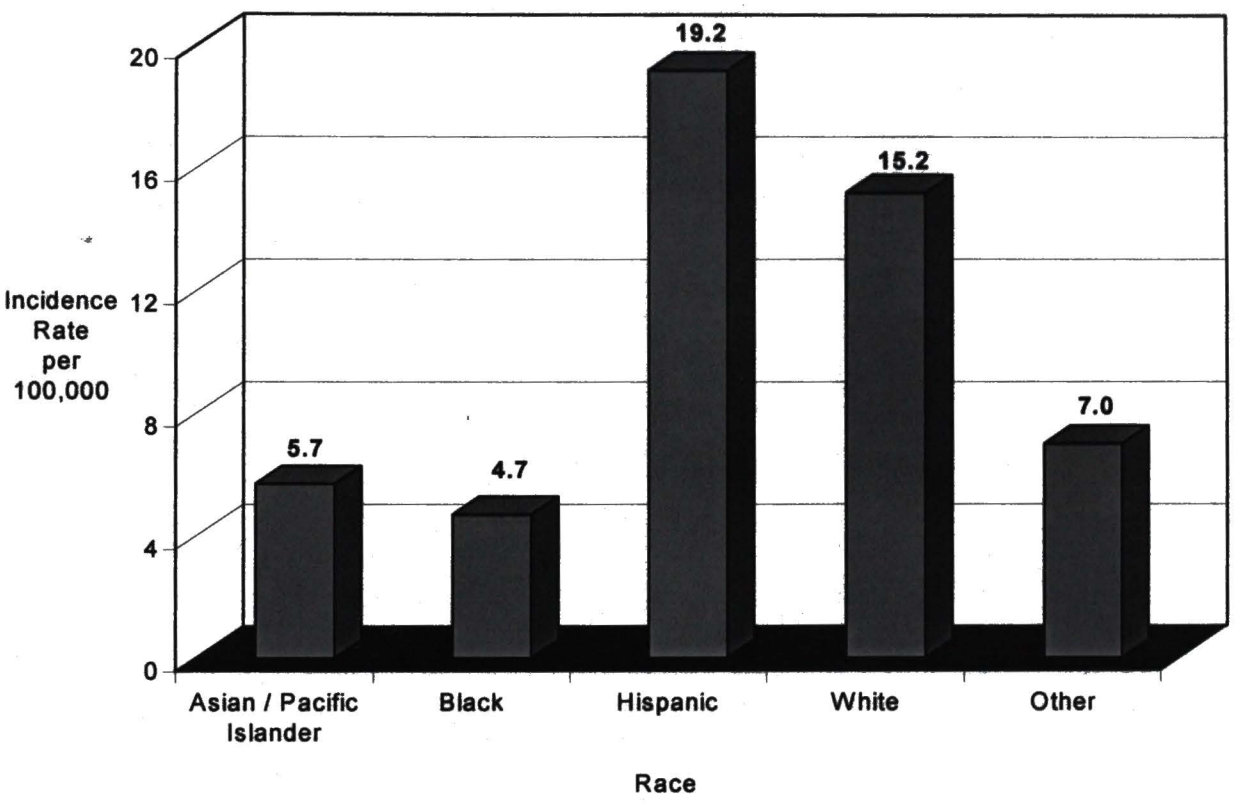


Figure 4. Incidence Rates of Hepatitis A
in Dallas County
by Race - 1999

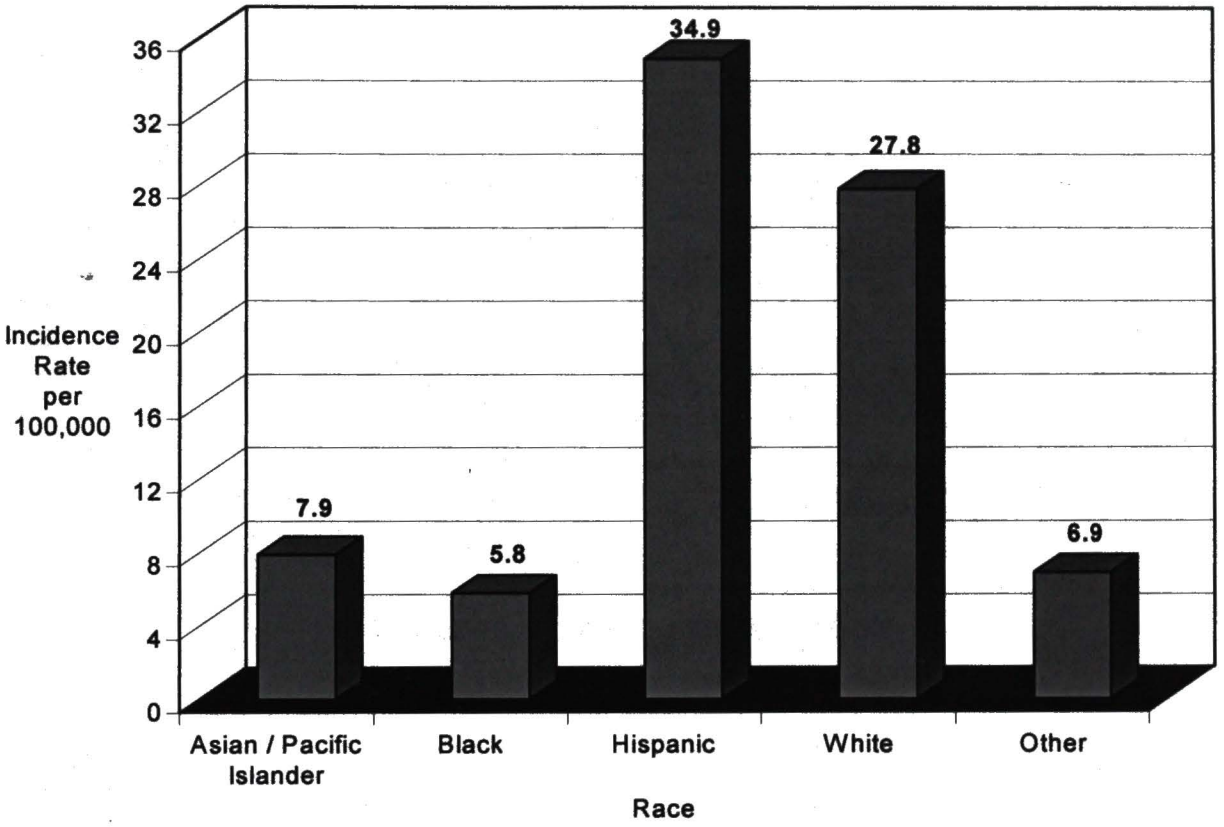


Figure 5. Incidence Rates of Hepatitis A
in Dallas County
by Age - 1998, 1999

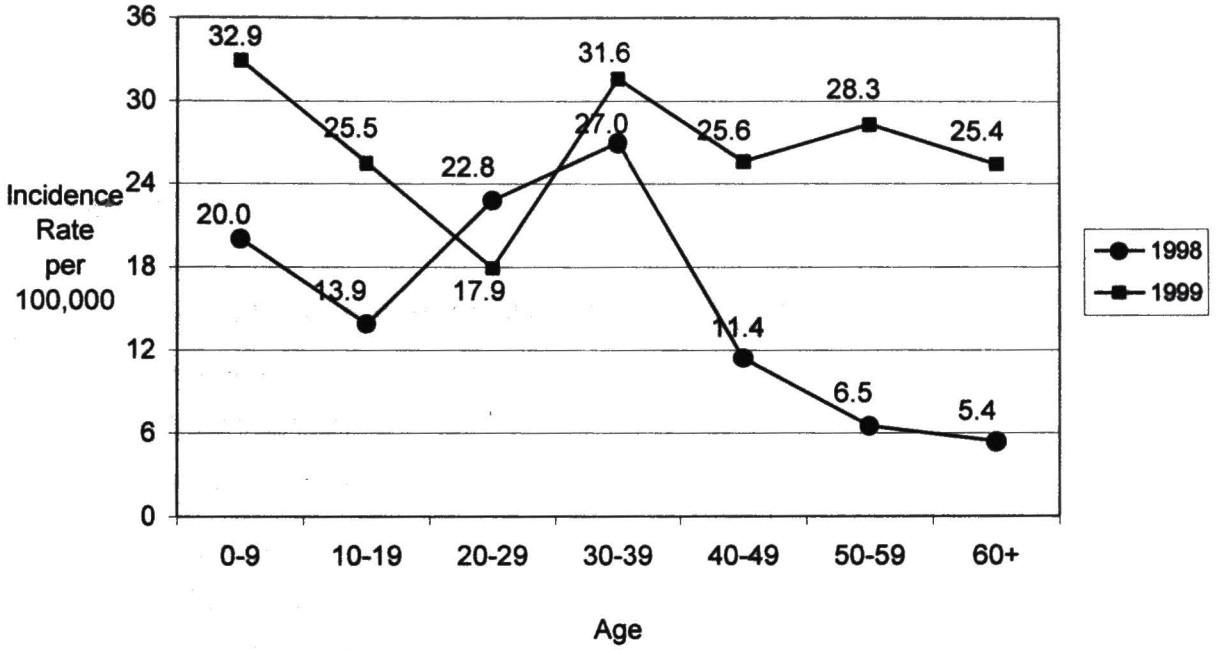


Figure 6. Incidence Rates of Hepatitis A
in Dallas County by
Zone Improvement Plan (ZIP Code) - 1998, 1999

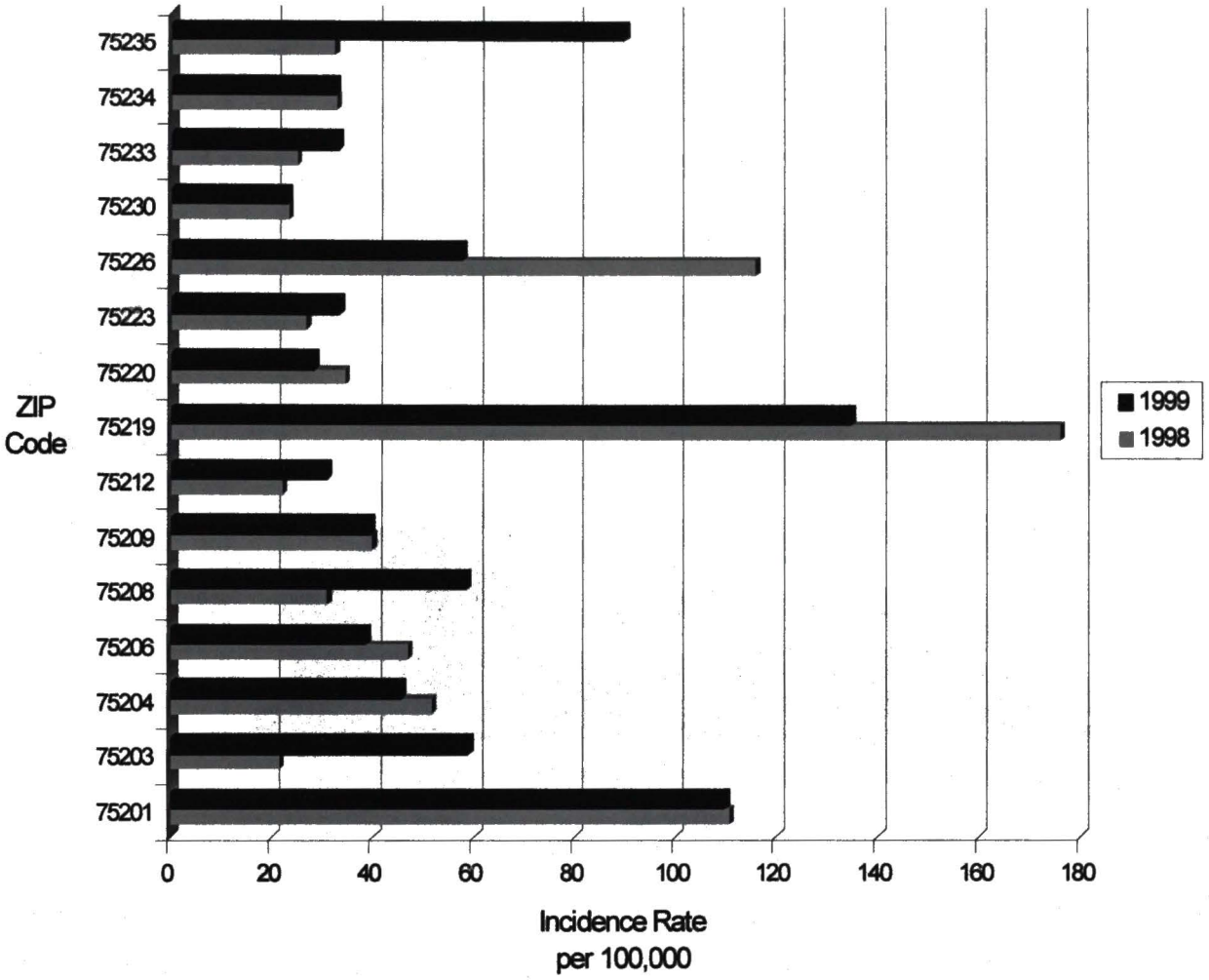


Figure 7. Distribution of Hepatitis A in Dallas County by Month - 1998

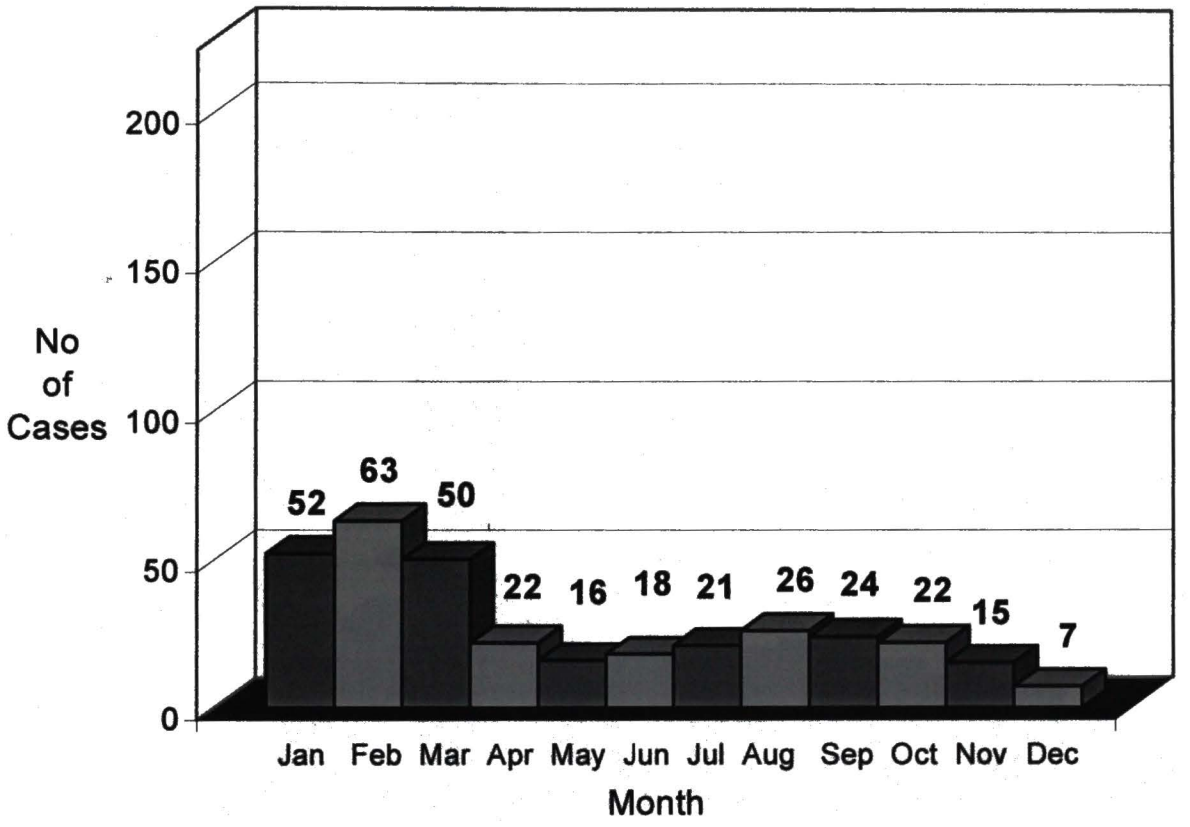


Figure 8. Distribution of Hepatitis A in Dallas County by Month- 1999

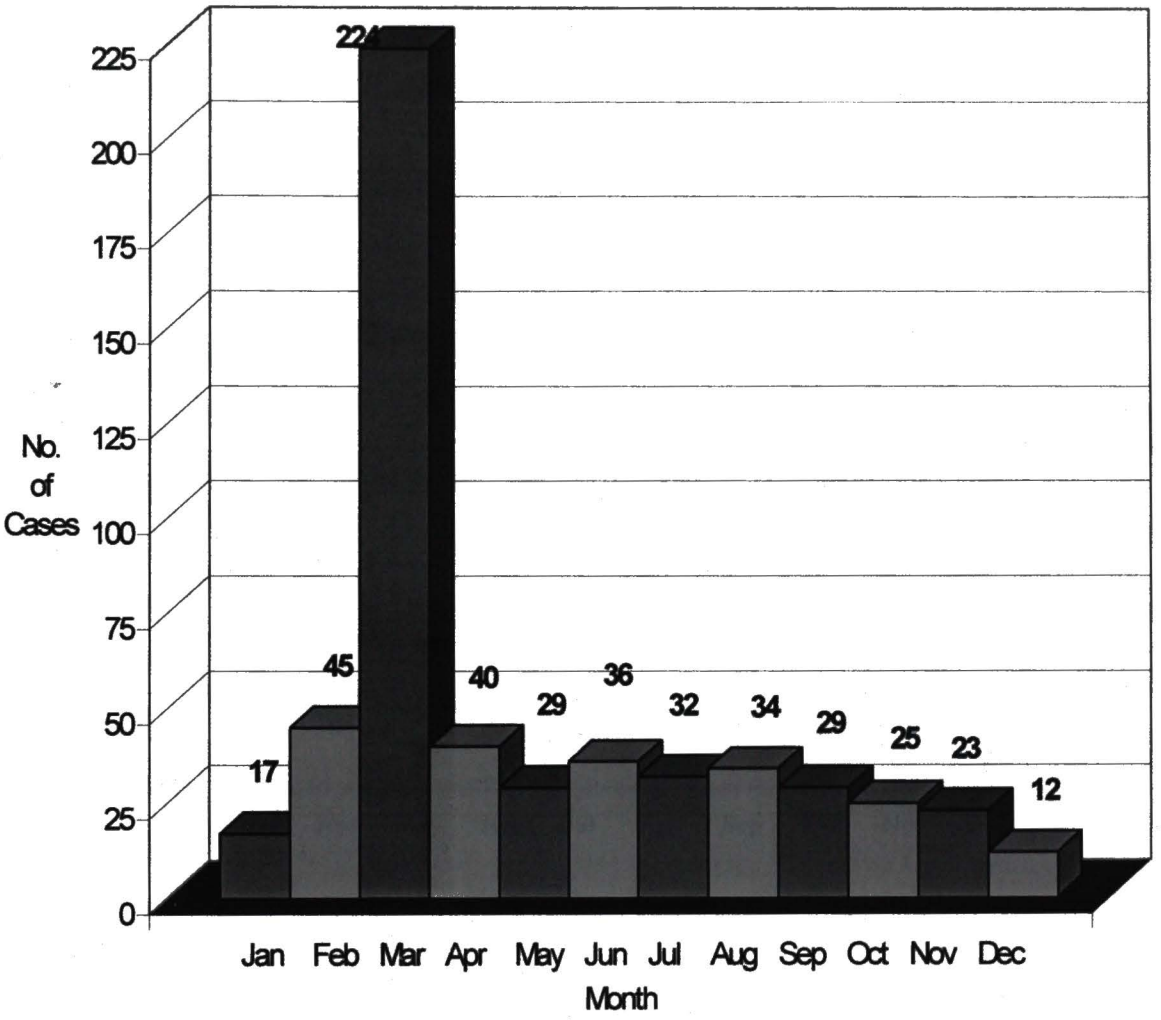
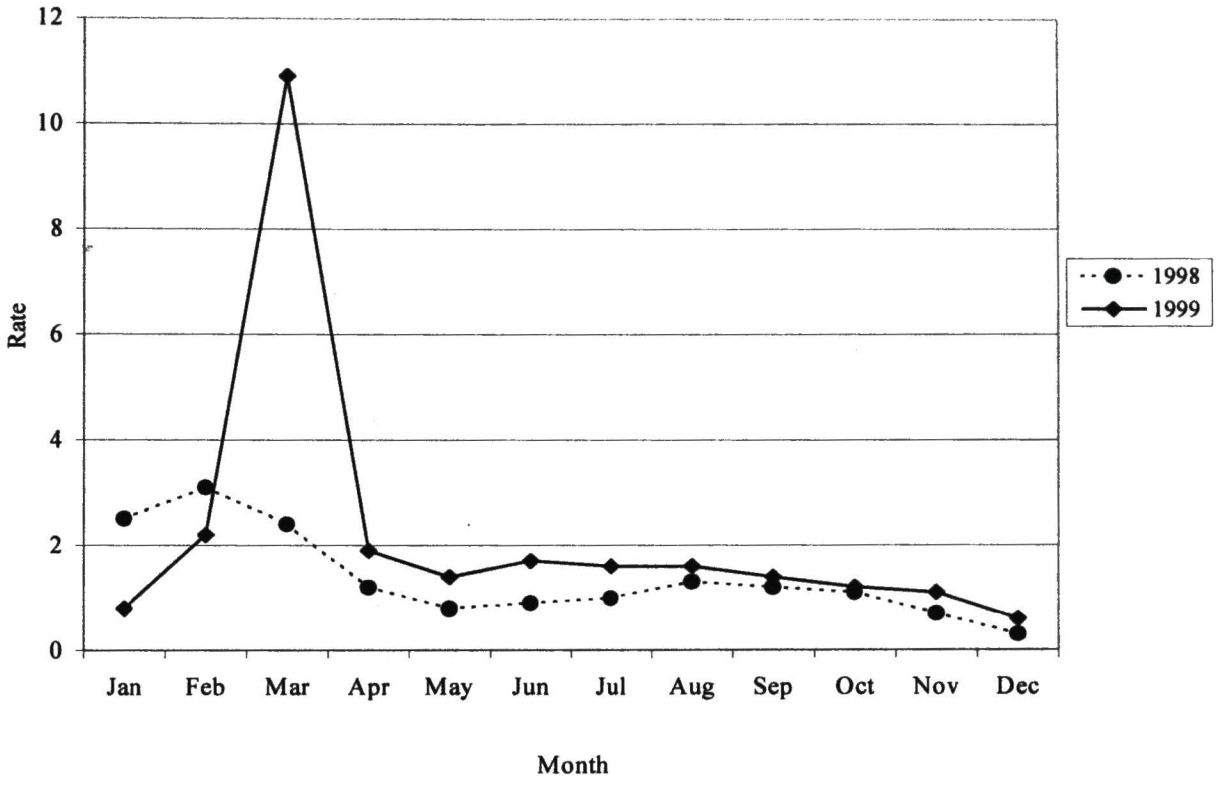


Figure 9. Incidence Rates of Hepatitis A
in Dallas County
by Month - 1998, 1999



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