Communicable and Environmental Disease Services Section

2001 Annual Report

Act, before disease becomes persistent through long delays.

Ovid, 43 BC to AD 17

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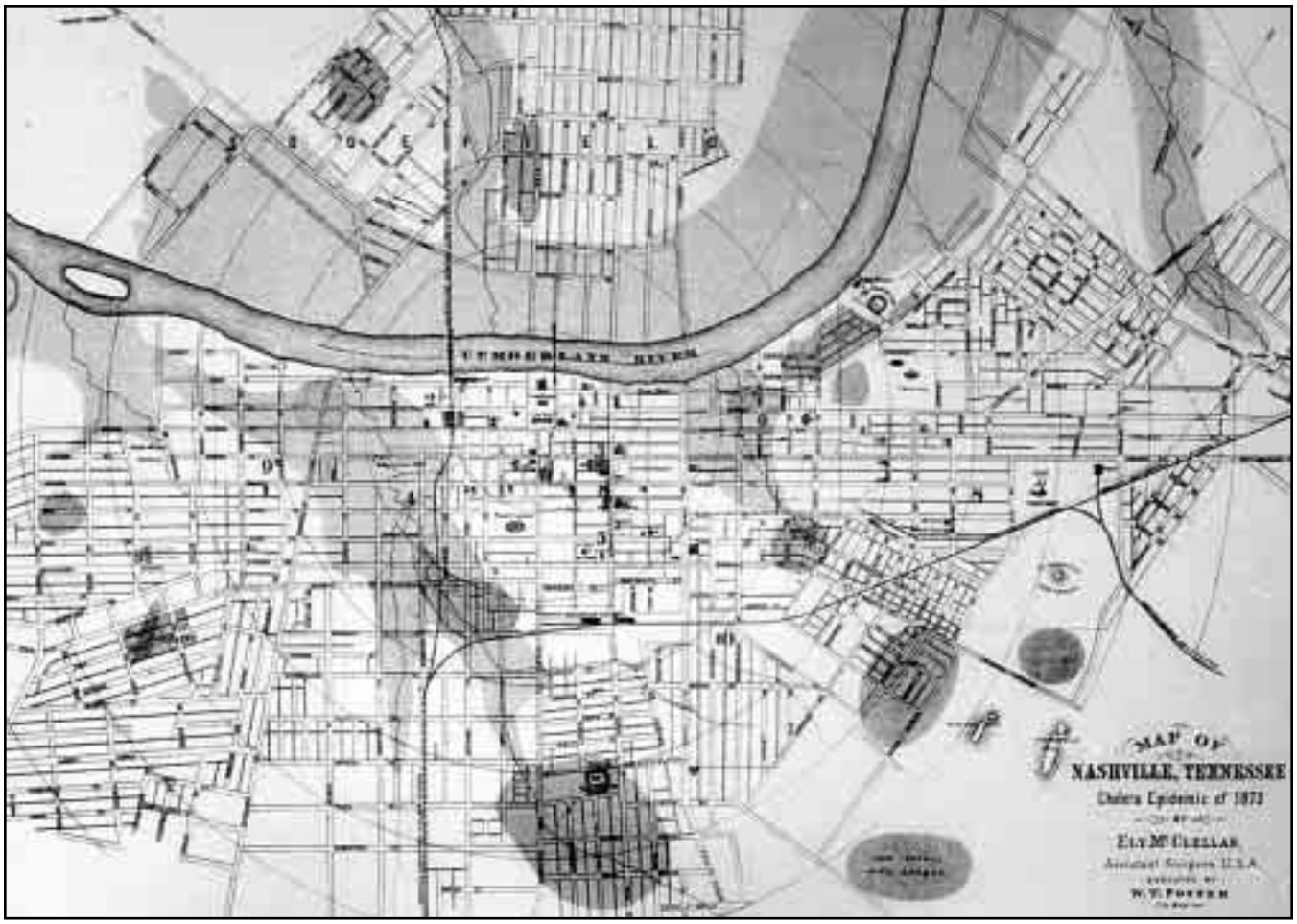
Electronically available at the Tennessee Department of Health website
www.state.tn.us/health
click on Communicable and Environmental Disease Services

This report reflects the contributions of the many committed professionals who comprise the Communicable and Environmental Disease Services Section, Tennessee Department of Health.



Map of the cholera epidemic in Nashville, Tennessee, 1873

McClellan, E. Courtesy of the National Library of Medicine, History of Medicine Division, National Institutes of Health, Bethesda, MD

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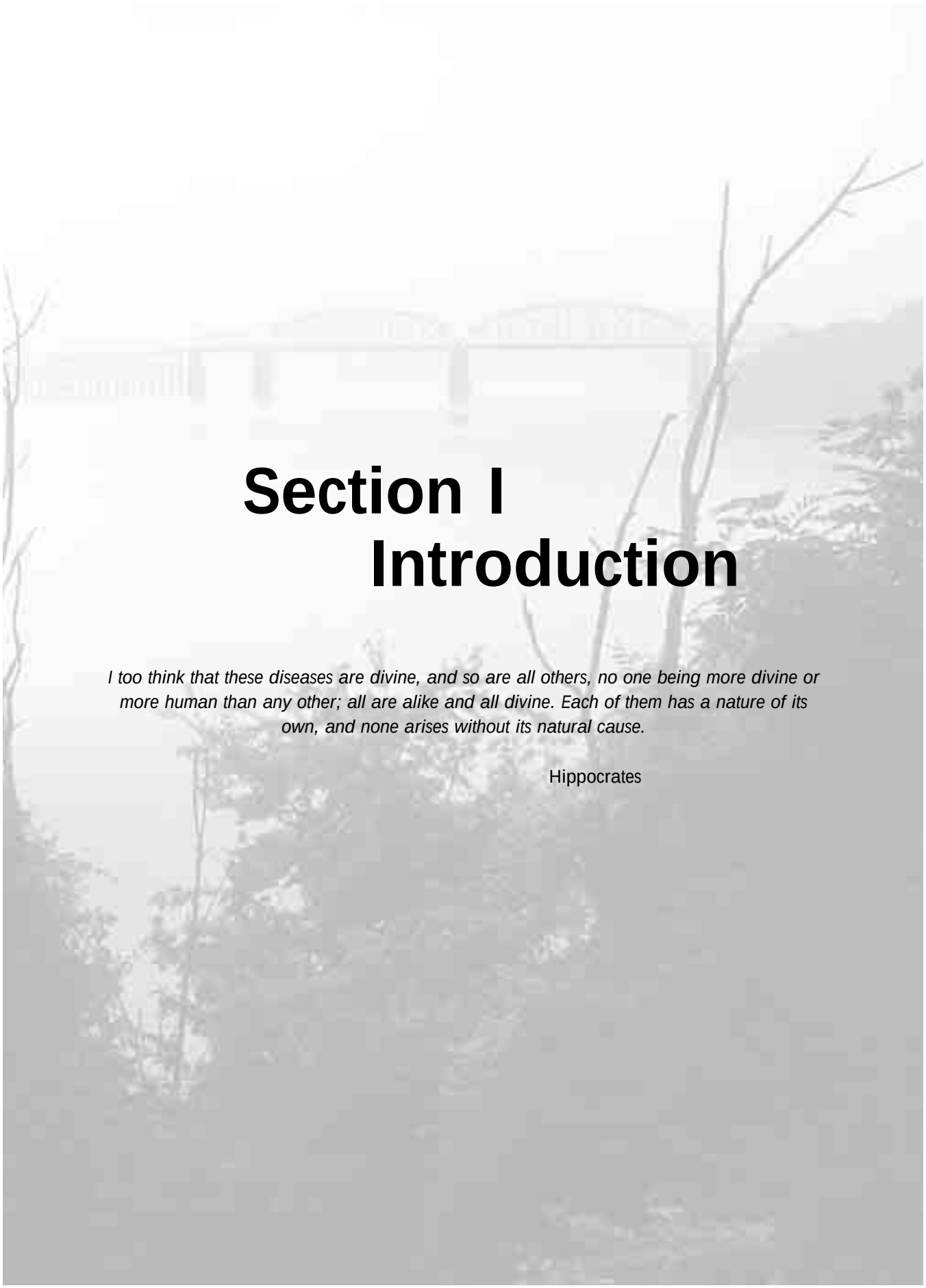

Section I
Introduction

I too think that these diseases are divine, and so are all others, no one being more divine or more human than any other; all are alike and all divine. Each of them has a nature of its own, and none arises without its natural cause.

Hippocrates

Exterior view: a sign posted on a door states, Diphtheria Keep Out.

Coleman, WM. The handbook of the people's health. New York: Macmillan, 1913.

A. Purpose of Report

The Communicable and Environmental Disease Services Section (CEDS) is a division of the Bureau of Health Services, Tennessee Department of Health. The Department is responsible for the health of the citizens of the state; CEDS is assigned the responsibility of detecting, preventing, and controlling infectious and environmentally-related illnesses. A unique attribute of infectious diseases is that they can often be prevented, and thus, efforts to that end result in lower expenditures for health care and less personal discomfort and pain. Environmentally-related illnesses are often the result of the interaction of external physical and chemical factors with other variables, including life style, nutrition, and genetics. Detecting, preventing, and controlling both infectious and environmental disease provides enormous benefits to the citizens of Tennessee.

The annual report is designed to provide health care organizations and providers, government and regulatory agencies, and other concerned individuals and groups, with important statistical information about potentially preventable diseases. The report can serve as one source of data for them and can help assure that involved individuals and organizations have access to the same information. It also provides an assessment of the efforts undertaken by CEDS over a period of years.

Surveillance, tracking infectious disease incidence and prevalence, is at the heart of the work of this section. The reporting and tracking of cases of illness is essential to knowing who is involved and where problems are occurring. One important goal of this report is to assist providers, laboratorians, and infection control personnel with reporting of notifiable diseases. Addresses, telephone numbers and policies relative to surveillance are presented to assist with this important task.

Examining descriptive epidemiologic data over time is the foundation for knowing where prevention and control efforts need to be focused. This report is a summary of surveillance data from 1995 through 2001 and builds upon the 1999 and 2000 annual reports.

We acknowledge, with gratitude, the efforts of the many committed health care professionals throughout Tennessee who contribute to the ongoing reporting of disease. Surveillance is dependent on reporting. This annual report could not be developed without the assistance of personnel in local and regional health departments, physicians, infection control practitioners, and laboratory staff who have reported cases as required by law.

B. Notifiable Diseases in Tennessee

A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of disease. In 1893, Congress authorized the weekly reporting and publication of notifiable diseases, collected from state and municipal authorities. The first annual summary of The Notifiable Diseases was published in 1912 and included reports of 10 diseases from 19 states, the District of Columbia, and Hawaii; by 1928, all states participated in the reporting. In 1961, the Centers for Disease Control assumed

responsibility for the collection and publication of data concerning nationally notifiable diseases. As world travel becomes increasingly more common, the comparison of data about infectious diseases across states, nations, and continents is crucial.

The list of notifiable diseases is revised periodically. As new pathogens emerge, a disease may be added to the list, or, one might be deleted as its incidence declines. Public health officials at state health departments and the Centers for Disease Control and Prevention collaborate in determining which diseases should be notifiable, however, law mandates reporting at the state level. In Tennessee, State Regulations 1200-14-1-.02 to .08 require the reporting of notifiable diseases by physicians, laboratorians, infection control personnel, nurses and administrators in settings where infectious diseases are diagnosed.

The Tennessee Department of Health List of Notifiable Diseases was last revised in November 1999, and was put into effect in January 2000. The list is presented in Section H. Section I lists those diseases for which isolates are to be sent to the Tennessee Department of Health State Laboratory.

C. Reporting Notifiable Diseases

There are four categories of reporting notifiable diseases: immediate telephone reporting, followed with a written report; written report only; special confidential reporting of HIV/AIDS; and laboratory reporting of all blood lead test results. Reports of infectious diseases are usually sent first to the local health department, which is responsible for providing basic public health intervention. Regional health departments can also be called; they submit reports of notifiable diseases to the Tennessee Department of Health central office in Nashville on a weekly basis.

Form PH1600 (revised 11/01) is used for written reports. It can be obtained by calling your local health department or CEDS at 615-741-7247/800-525-2437. It can also be downloaded from the CEDS website; (see Section F.) CEDS as well as regional and local health departments welcome questions about disease reporting.

Notifiable disease data are submitted electronically by the Tennessee Department of Health to the Centers for Disease Control and Prevention on a weekly basis. There they are combined with all state data for national analyses and are reported in the weekly publication, Morbidity and Mortality Weekly Report. Ongoing analyses of this extensive database have led to better diagnoses and treatment methods, national vaccine schedule recommendations, changes in vaccine formulation, and the recognition of new or resurgent diseases.

The numbers of cases of notifiable disease presented in the annual report should be considered as the minimum number of cases of actual disease. There are several reasons for this: a person must seek medical care to receive a diagnosis, not all cases are confirmed with laboratory testing, and not all confirmed cases are reported. The data in the annual report track the geographic distribution of disease as well as trends over time and serve as the foundation for the efforts of the Department of Health to control communicable disease.

D. Isolate Characterization at the State Laboratory

Laboratory regulations require clinical laboratories to forward isolates of selected pathogens to the Tennessee Department of Health State Laboratory in Nashville. The isolates provide an important resource for further characterization and tracking of disease in Tennessee. The list of required isolates is presented in Section I.

E. Emerging Infections and the Emerging Infections Program

One important emphasis of CEDS is on new and emerging infections. These include antibiotic resistant infections and emerging foodborne pathogens such as *Listeria, E.coli* O157:H7, *Cyclospora cayetanensis*, and multi-drug resistant *Salmonella* serotype Newport. Emerging vector-borne diseases include ehrlichiosis, La Crosse encephalitis and West Nile Virus. Other emerging infections include meningococcal serogroup Y, adult and adolescent pertussis, and multi-drug resistant tuberculosis.

The Emerging Infections Program (EIP) is a population-based network of CDC and state health departments, working with collaborators (academic centers, local health departments, infection control practitioners, and other federal agencies) to assess the public health impact of emerging infections and to evaluate methods for their prevention and control.

Currently, the EIP Network consists of ten sites: California Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee.

The Tennessee Emerging Infections Program (EIP) is a collaborative effort of CEDS, the Vanderbilt University School of Medicine Department of Preventive Medicine, and the Centers for Disease Control and Prevention. From December 1999 until December 2002, the following eleven counties in Tennessee were involved in the EIP: Cheatham, Davidson, Dickson, Hamilton, Knox, Robertson, Rutherford, Shelby, Sumner, Williamson, and Wilson. In January 2003, the entire state will be involved in one major program of the EIP, the Foodborne Diseases Active Surveillance Network (FoodNet).

The core activity of the EIP is active surveillance of laboratory-confirmed cases of reportable pathogens. Laboratory directors and staff, physicians, nurses, infection control practitioners, and medical records personnel are key participants in EIP. Components of the EIP in Tennessee investigate foodborne infections (FoodNet and the Environmental Health Specialist Network, EHS-Net) invasive bacterial infections (the Active Bacterial Core Surveillance program, ABCs), unexplained encephalitis (Tennessee Unexplained Encephalitis Surveillance, TUES), and *Campylobacter*-associated Guillain-Barre syndrome.

F. Communicable and Environmental Disease Services Website

Further tabulations of data regarding disease surveillance in Tennessee are available at the CEDS web site. To access the site go to www.state.tn.us/health. Click on Communicable and Environmental/Diseases.

G. Useful Contact Persons, Telephone Numbers, E-Mail and U.S. Mail Addresses

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H. List of Notifiable Diseases

The diseases and conditions listed below are declared to be communicable and/or dangerous to the public and are to be reported to the local health department by all hospitals, physicians, laboratories, and other persons knowing of or suspecting a case in accordance with the provision of the statutes and regulations governing the control of communicable diseases in Tennessee.

Category 1: Immediate telephonic reporting required followed with a written report using PH 1600

Anthrax
Botulism
1. Foodborne
2. Wound

Diphtheria
Disease Outbreaks
1. Foodborne
2. Waterborne
3. All Other

Encephalitis, Arboviral
1. California/LaCrosse serogroup
2. Eastern Equine
3. St. Louis
4. Western Equine
5. West Nile

Group A Streptococcal Invasive Disease
Group B Streptococcal Invasive Disease
Haemophilus influenzae Invasive Disease
Hantavirus Disease
Hepatitis – Type A acute
Listeriosis
Measles
Meningococcal Disease
Meningitis – Other Bacterial
Mumps
Pertussis
Plague
Poliomyelitis
Rabies – Human
Rubella & Congenital Rubella Syndrome
Typhoid Fever

Possible Bioterrorism Indicators
Anthrax
Plague
Venezuelan equine encephalitis
Smallpox
Botulism
Q Fever
Staph enterotoxin B pulmonary poisoning
Viral hemorrhagic fever
Brucellosis
Ricin poisoning
Tularemia

Category 2: Only written report using form PH 1600 required

Botulism – infant
Brucellosis
Campylobacteriosis
Chanchroid
Chlamydia trachomatis
Cholera
Cyclospora
Cryptosporidiosis
Ehrlichiosis
Escherichia coli O157:H7
Giardiasis (acute)
Gonorrhea
Hemolytic Uremic Syndrome
Hepatitis, Viral
1. Type B acute
2. HBsAg positive pregnant female
3. Type C acute

Influenza – weekly casecount
Legionellosis
Leprosy (Hansen Disease)
Lyme Disease
Malaria
Psittacosis
Rabies – Animal
Rocky Mountain Spotted Fever
Salmonellosis – other than *S.* typhi
Shiga-like Toxin positive stool
Shigellosis
Streptococcus pneumoniae Invasive Disease
1. Penicillin resistant
2. Penicillin sensitive

Syphilis
Tetanus
Toxic Shock Syndrome
1. Staphylococcal
2. Streptococcal

Trichinosis
Tuberculosis – all forms
Vancomycin Resistant Enterococci
Varicella deaths
Vibrio infections
Yellow Fever
Yersiniosis

Category 3: Requires special confidential reporting to designated health department personnel

Acquired Immunodeficiency Syndrome (AIDS) Human Immunodeficiency Virus (HIV)

Category 4: Laboratories required to report all blood lead test results, both normal and abnormal

Lead poisoning is a blood lead level ≥ 10 ug/dl for children 0-72 months of age

I. Referral of Cultures to the Department of Health State Laboratory

According to Statutory Authority T.C.A. 68-29-107, and General Rules Governing Medical Laboratories, 1200-6-3-.11 directors of laboratories are to submit cultures of the following organisms to the Department of Health, Laboratory Services, for confirmation, typing, and/or antibiotic susceptibility including but not limited to:

Salmonella species, including *S. typhi*
Shigella species
Corynebacterium diphtheria
Brucella species
Mycobacterium species
Legionella species
Clostridium tetani
Listeria species*
Plasmodium species
Vibrio species
Clostridium tetani
Francisella species
Yersinia pestis
Escherichia coli O157:H7
Clostridium botulinum
*Haemophilus influenzae**
*Neisseria meningitidis**
*Streptococcus pneumoniae**
Group A *Streptococcus**

For pathogens marked with an asterisk (*), only isolates from sterile sites are required to be submitted. Sterile sites include blood, CSF, pleural fluid, peritoneal fluid, joint fluid, sinus surgical aspirates, or bone. Group A Streptococcus will be considered in isolates from intraoperative cultures and tissues obtained during surgery.

Information for Sending Cultures

Please include the patient's full name, address, age, and sex, the physician's name and address, and the anatomic source of culture.

For UPS and Federal Express Items:
Tennessee Department of Health
Laboratory Services
630 Hart Lane
Nashville, TN 37247-0801
Phone 615-262-6300

For U.S. Mail:
Tennessee Department of Health
Laboratory Services
PO Box 305130
Nashville, TN 37230-5130

J. Tennessee Population Estimates, 2001

The following statewide population estimates were prepared by the Tennessee Department of Health, Bureau of Health Informatics, Division of Health Statistics and Research and were used in calculating rates in this report. These population estimates were also utilized in sections K and M.

SEX	FREQUENCY
Female	2,944,720
Male	2,795,301
Total	5,740,021

RACE SEX	FREQUENCY
White Male	2,252,502
White Female	2,358,522
Black Male	439,512
Black Female	495,182
Other Male	103,287
Other Female	91,016
Total	5,740,021

AGE GROUP (years)	FREQUENCY
0-4	378,252
5-9	399,460
10-14	398,921
15-19	398,800
20-24	389,464
25-29	407,049
30-34	415,669
35-39	457,567
40-44	453,435
45-49	416,496
50-54	377,680
55-59	296,687
60-64	241,494
65-69	206,371
70-74	179,734
75-79	145,972
80-84	94,878
85+	82,092
TOTAL	**5,740,021**

K. Tennessee Department of Health Regions

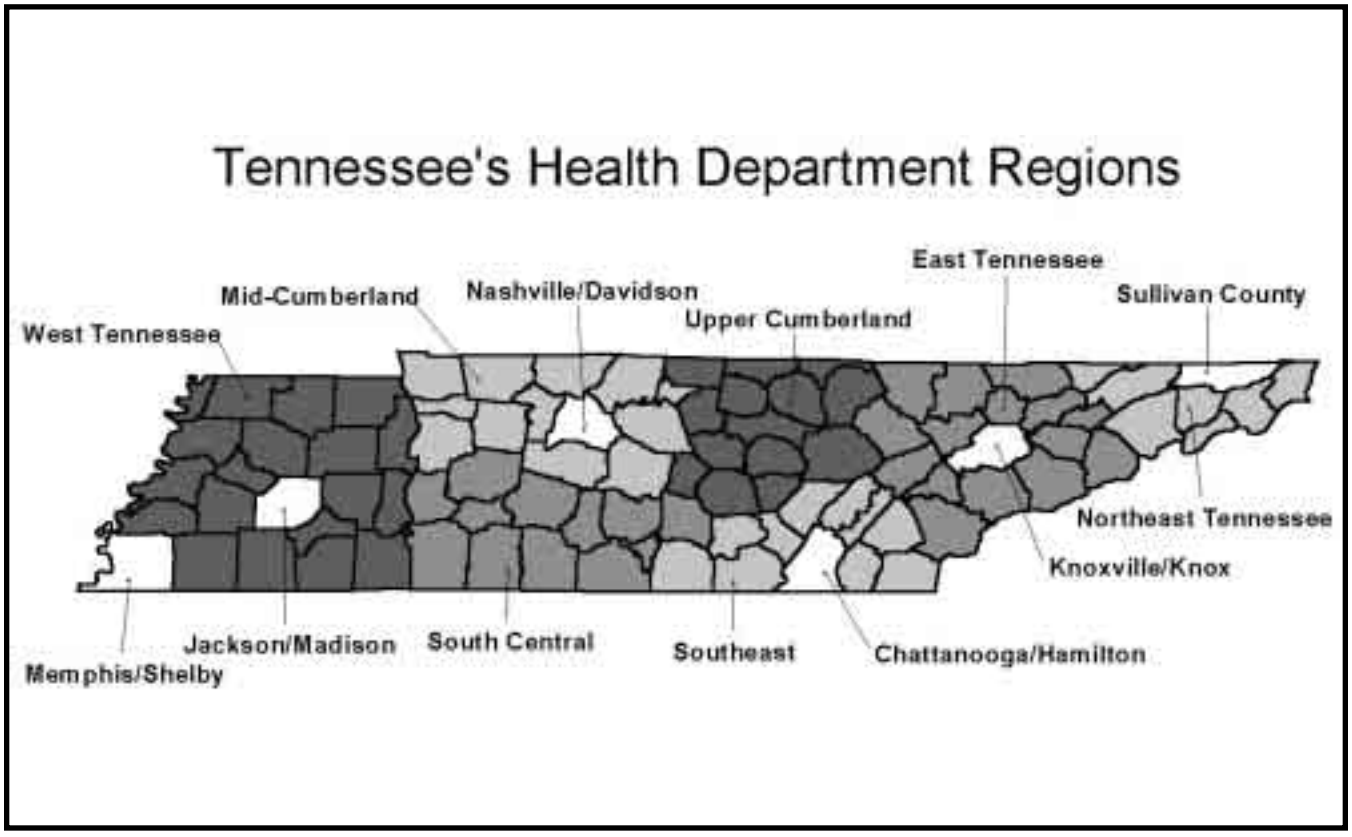
Metropolitan regions include six counties: Sullivan (population 152,787), Knox (population 385,572), Hamilton (population 307,497), Davidson (population 565,352), Madison (population 92,389), and Shelby (population 896,013).

Nonmetropolitan regions are comprised of the seven groups of counties listed on the following page.

L. Notes on Sources Utilized in Preparing the Report

Statistics utilized in the various disease sections throughout this Annual Report present the year the disease was diagnosed.

Disease rates for the United States come from the Centers for Disease Control and Prevention. Summary of Notifiable Diseases, United States, 2000, MMWR 2000;49:53.



M. Tennessee's Nonmetropolitan Regions: Counties and Population

Northeast
(Population 325,189))

Carter (56,927)
Greene (63,388)
Hancock (6,768)
Hawkins (54,370)
Johnson (17,638)
Unicoi (17,713)
Washington (108,380)

East
(Population 609,621)

Anderson (7,145)
Blount (108,270)
Campbell (40,048)
Claiborne (30,146)
Cocke ((33,884)
Grainger (20,934)
Hamblen ((58,337)
Jefferson (45,070)
Loudon (40,240)
Monroe (39,846)
Morgan (20,003)
Roane (52,033)
Scott (21,548)
Sevier (73,703)
Union (18,414)

Southeast
(Population 300,675))

Bledsoe (12,516)
Bradley (88,850)
Franklin (39,770)
Grundy (14,288)
Marion (27,750)
McMinn (49,857)
Meigs (11,194)
Polk (16,226)
Rhea (28,608)
Sequatchie (11,616)

Upper Cumberland
(Population 309,130)

Cannon (12,946)
Clay (7,918)
Cumberland (48,058)
Dekalb (17,552)
Fentress (16,805)
Jackson (11,162)
Macon (20,873)
Overton (20,186)
Pickett (5,048)
Putnam (63, 188)
Smith (17,988)
Van Buren (5,477)
Warren (38,565)
White (23,364)

Mid-Cumberland
(Population 867,526)

Cheatham (36,552)
Dickson (43,843)
Houston (7,916)
Humphreys (18,114)
Montgomery (135,023)
Robertson (56,083)
Rutherford (190,143)
Stewart (12,650)
Sumner (134,336)
Trousdale (7,345)
Williamson (133,825)
Wilson (91,696)

South Central
(Population 344,296)

Bedford (38,327)
Coffee (48,667)
Giles (29,675)
Hickman (22,740)
Lawrence (40,003)
Lewis (11,437)
Lincoln (31,616)
Marshall (27,106)
Maury (70,376)
Perry (7,504)
Wayne (16,845)

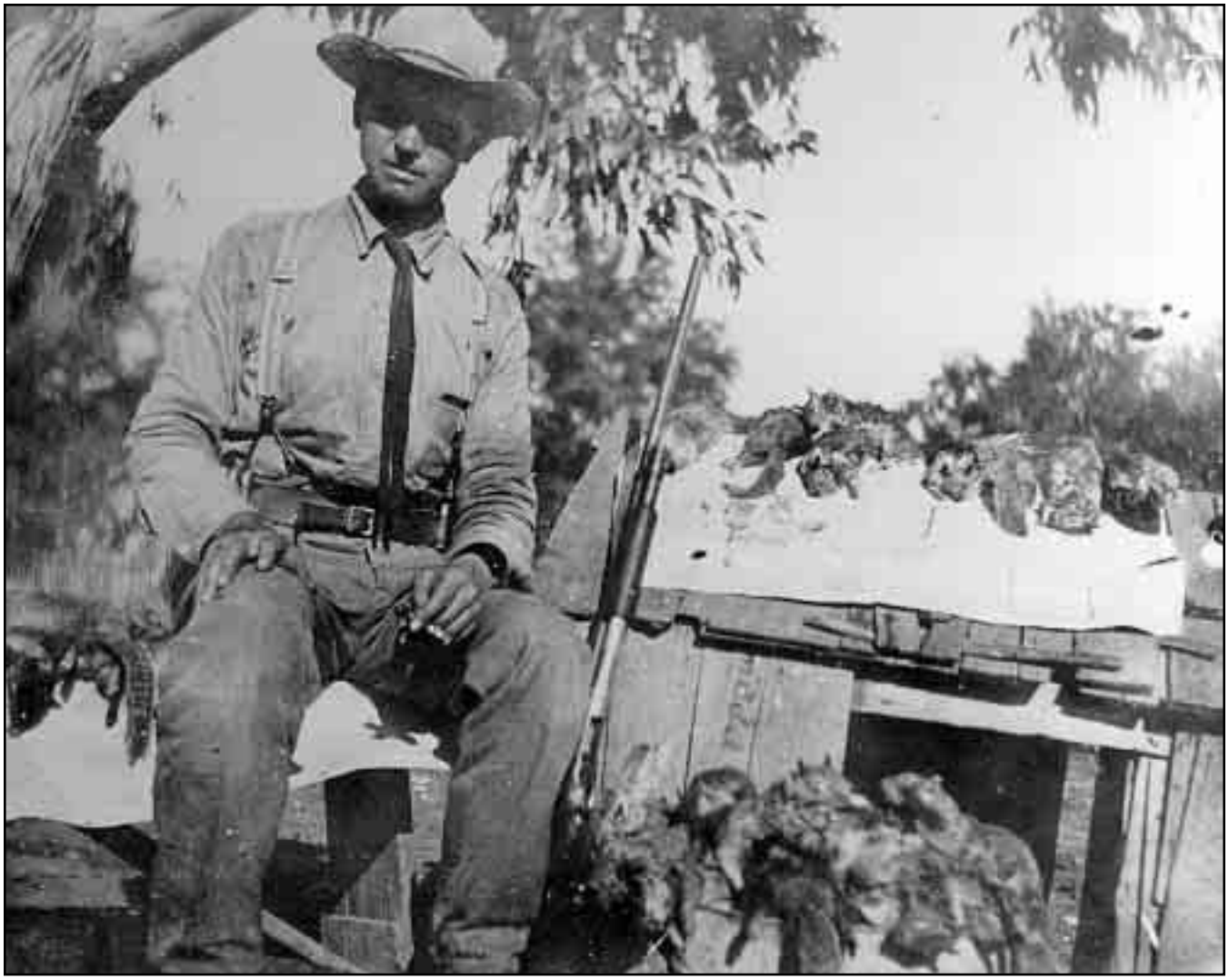
West
(Population 519,787)

Benton (16,616)
Carroll (29,538)
Chester (15,711)
Crockett (14,547)
Decatur (11,697)
Dyer (37,121)
Fayette (30,536)
Gibson (48,031)
Hardeman (28,361)
Hardin (25,791)
Haywood (19,761)
Henderson (25,732)
Henry (31,083)
Lake (7,764)
Lauderdale (27,021)
McNairy (24,644)
Moore (5,887)
Obion (32,346)
Tipton (52,956)
Weakley (34,644)

Section II
Reported Cases by Year of Diagnosis, 1995-2001

A more frightful teacher than the plague, which swept over humanity with special fury in the middle of the fourteenth century, it is difficult to imagine.

Diepgen



A portrait of a man seated on a bench alongside a pile of dead rodents; on the right, his rifle leans against a small wooden shack covered with dead rodents in front of which sits a container overflowing with dead rodents, San Francisco, 1908. Throughout history, from the plague to hantavirus, rodents have been the source of disease.

Courtesy of the National Library of Medicine, History of Medicine Division
National Institutes of Health, Bethesda, MD

Tennessee Reported Cases by Year of Diagnosis, 1995-2001

DISEASE	1995	1996	1997	1998	1999	2000	2001
AIDS Cases	930	881	749	790	650	674	606
Botulism Food	0	1	0	0	2	0	0
Botulism Infant	0	0	0	1	2	1	4
Brucellosis	0	2	1	1	0	0	1
Campylobacteriosis	346	335	299	285	251	272	364
Chlamydia	13152	13121	12501	13717	14216	15073	15556
Cryptosporidiosis	1	5	17	11	12	12	25
E. Coli 0157:H7		*45	46	55	53	59	50
Ehrlichiosis		*2	5	6	19	46	20
Giardiasis	146	155	175	207	159	184	190
Gonorrhea	13894	11710	11018	11840	11366	11877	10144
Group A *Streptococcus*		*13	87	42	50	83	87
Group B *Streptococcus*						*87	157
Haemophilus influenzae		*29	31	33	36	26	48
Hepatitis B Surface Antigen Positive, Pregnant				*2	3	36	104
Hepatitis A	1993	737	407	224	190	154	187
Hepatitis B	640	517	437	266	228	213	272
Hepatitis C	958	373	232	166	96	97	64
Hemolytic Uremic Syndome		*3	1	1	8	12	10
HIV Cases	1080	972	966	840	803	1127	606
La Crosse Encephalitis		*1	8	9	6	19	17
Legionellosis	25	27	32	23	23	14	30
Listeriosis		*6	14	13	7	13	9
Lyme Disease	29	25	47	45	39	28	30
Malaria	10	14	12	16	7	13	14
Measles (indigenous)	0	2	0	1	0	0	0
Meningococcal Disease	51	62	81	69	61	56	63
Meningitis, Other Bacterial			*41	36	44	52	54
Mumps	6	1	9	2	0	2	1
Penicillin-resistant *Streptoccus pneumoniae*		*6	82	192	291	266	226
Pertussis	210	27	42	41	40	41	72
Rocky Mountain Spotted Fever	33	47	38	31	55	57	87
Rubella	1	0	0	2	0	1	0
Salmonellosis, Non-Typhoidal	463	507	439	587	548	693	724
Shigellosis	390	216	285	884	622	344	124
Syphilis Congenital	33	33	38	13	11	18	24
Syphilis Early Latent	1129	957	984	659	649	627	553
Syphilis Late Latent	529	472	595	499	426	511	570
Syphilis Neurological	10	7	9	15	12	14	10
Syphilis Primary	283	279	235	143	223	162	89
Syphilis Secondary	623	571	512	424	418	370	242
Tetanus	1	1	2	1	0	0	1
Tuberculosis	465	504	467	439	382	383	313
Toxic Shock Staphylococcus	5	1	2	4	3	3	1
Toxic Shock Streptococcus				*6	5	1	0
Trichinosis	0	3	1	4	0	0	0
Tularemia	2	1	0	0	0	1	6
Typhoid	1	3	1	2	1	2	1
Vancomycin Resistant Enterococci			*46	322	447	524	711
Yersiniosis						*7	14

*Indicates year the disease became reportable in Tennessee

Section III
Disease Summaries

Everybody knows that pestilences have a way of recurring in the world, yet somehow we find it hard to believe in ones that crash down on our heads from a blue sky. There have always been as many plagues as wars in history, yet always plagues and wars take people equally by surprise.

Albert Camus

Interior view: advertisement showing turn of the century soda fountain; stresses need for caution when choosing refreshing drinks during the summer
Coleman, WM. The handbook of the people's health. New York: Macmillan, 1913.

Courtesy of the National Library of Medicine, History of Medicine Division
National Institutes of Health, Bethesda, MD

A. FOODBORNE DISEASE

The Tennessee FoodNet Program

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of CDC's Emerging Infections Program (EIP). FoodNet is a collaborative project of the CDC, ten EIP sites (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, New Mexico, Oregon and Tennessee), the U.S. Department of Agriculture (USDA), and the Food and Drug Administration (FDA). The project consists of active surveillance for foodborne diseases and related epidemiologic studies designed to help public health officials better understand the epidemiology of foodborne diseases in the United States. Foodborne diseases include infections caused by bacteria such as *Salmonella, Shigella, Campylobacter, Escherichia coli* O157, *Listeria monocytogenes, Yersinia enterocolitica*, and *Vibrio*, and parasites such as *Cryptosporidium* and *Cyclospora*. In 1995, FoodNet surveillance began in five locations: California, Connecticut, Georgia, Minnesota and Oregon. Each year the surveillance area, or catchment, has expanded, with the inclusion of additional counties or additional sites (New York and Maryland in 1998, eleven counties in Tennessee in 2000, Colorado in 2001, and New Mexico in 2002). The total population of the current catchment area is 36 million persons, or 10% of the United States population.

FoodNet provides a network for responding to new and emerging foodborne diseases of national importance, monitoring the burden of foodborne diseases, and identifying the sources of specific foodborne diseases.

FoodNet goals

- Describe the epidemiology of new and emerging bacterial, parasitic, and viral foodborne pathogens
- Estimate the frequency and severity of foodborne diseases in the United States
- Determine how much foodborne illness results from eating specific foods, such as meat, poultry, and eggs

Why is FoodNet important to public health?

Foodborne diseases are common; an estimated 76 million cases occur each year in the United States.[1] Although most of these infections cause mild illness, severe infections and serious complications do occur. The public health challenges of foodborne diseases are changing rapidly; in recent years, new and emerging foodborne pathogens have been described and changes in food production have led to new food safety concerns. Foodborne diseases have been associated with many different foods, including some previously thought to be safe, such as eggs and fruit juice, both of which have transmitted *Salmonella* during recent outbreaks. Public health officials in the ten EIP sites are monitoring foodborne diseases, conducting epidemiologic and laboratory studies of these diseases, and responding to new challenges from these diseases. Information gained through this network will lead to new interventions and prevention strategies for addressing the public health problem of foodborne diseases.

How is FoodNet different from other foodborne disease surveillance systems?

Current "passive" surveillance systems rely upon reporting of foodborne diseases by clinical laboratories to state health departments, which in turn report to CDC.

[1] Mead PS , Slutsker L, Dietz V et al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:607-25.

Although foodborne diseases are extremely common, only a fraction of these illnesses are routinely reported to CDC via these surveillance systems. This is because a complex chain of events must occur before such a case is reported, and a break at any link along the chain will result in a case not being reported. FoodNet is an "active" surveillance system, meaning public health officials frequently contact laboratory directors to find new cases of foodborne diseases and report these cases electronically to CDC. In addition, FoodNet is designed to monitor each of these events that occur in the foodborne diseases pyramid and thereby allow more accurate and precise estimates and interpretation of the burden of foodborne diseases over time. Because most foodborne infections cause diarrheal illness, FoodNet focuses these efforts on persons who have a diarrheal illness.

FoodNet Components

Component 1. Active laboratory-based surveillance.

The core of FoodNet is laboratory-based active surveillance at over 300 clinical laboratories that test stool samples in the ten participating states. In Tennessee, 50 hospitals have been served by 39 laboratories which are visited regularly by surveillance officers to collect information on laboratory-confirmed cases of diarrheal illnesses. Additionally, active surveillance for hemolytic uremic syndrome (HUS) (a serious complication of *E. coli* O157 infection), Guillain-Barré syndrome (a serious complication of *Campylobacter* infection) and toxoplasmosis takes place. The result is a comprehensive and timely database of foodborne illness in a well-defined population. Beginning in 2003, active surveillance will be conducted in the 155 hospital laboratories throughout the Tennessee.

Component 2. Survey of clinical laboratories.

In October 1995, collaborating FoodNet investigators conducted a baseline survey of all clinical laboratories in the five original catchment areas to determine which pathogens were included in routine bacterial stool cultures, which tests had to be specifically requested by the physician, and what specific techniques were used to isolate the pathogens. In 1997, a baseline survey was conducted in the two new sites, and a follow-up survey in the five original sites to assess any recent changes in laboratory practices. Another survey was conducted in 2000. In Tennessee, all 39 (100%) of the qualifying laboratories participated; these laboratories process approximately 33,000 stool specimens per year. "Routine stool cultures" include culturing for *Salmonella, Shigella,* and *Campylobacter* in all of these laboratories. Most laboratories only culture for *Yersinia* and *Vibrio* by special request. Though most laboratories can culture *E. coli* 0157:H7, very few have the ability to isolate non- 0157:H7 Shiga toxin producing *E. coli* strains.

Component 3. Survey of physicians.

To obtain information on physician stool culturing practices, collaborating FoodNet investigators mailed a survey questionnaire to 5,000 physicians during 1996 in five sites and 750 physicians in 1997 in the two new sites. Because laboratories test stool specimens from a patient only upon the request of a physician or other health care provider, it is important to measure how often and under what circumstances physicians order these tests. As changes occur in the way health care is provided in the United States,

stool-culturing practices may also change over time. The practices of physicians who send stool samples to laboratories within the catchment areas will be monitored by surveys and validation studies.

Component 4. Survey of the population. Collaborating FoodNet investigators contact randomly selected residents of a catchment area and ask individuals if they had a recent diarrheal illness, whether he or she sought treatment for the illness, and whether he or she had consumed certain foods known to have caused outbreaks of foodborne illness. Because many people who become ill with diarrhea do not see a physician, little is known about the number of cases of diarrhea in the general population and how often persons with diarrhea seek medical care. The population survey is an essential part of an evaluation for foodborne illness because it allows for an estimate of the population who seeks medical care when affected by diarrheal illness. It is conducted each year in all FoodNet states.

Component 5. Epidemiologic Studies. In 1996, FoodNet began epidemiologic studies of *E. coli* O157 and *Salmonella* serogroups B and D infections. More than 60% of *Salmonella* infections in the United States are caused by serogroups B and D *Salmonella*. In 1998, FoodNet began a case-control study of *Campylobacter*. *Campylobacter* is consistently the most frequently isolated pathogen in FoodNet sites. These large epidemiologic studies will provide more precise information about which food items or other exposures might be risk factors for infections with these organisms. To allow the most precise classification of the isolates from the patients in these studies, *Salmonella, E. coli* O157, and *Campylobacter* isolates from these patients are sent from FoodNet sites to CDC for further study, including antibiotic resistance testing, phage typing, and molecular subtyping. In 2002, three more case-control studies were initiated: infants under the age of one year with *Campylobacter* and *Salmonella*; *Salmonella* Enteritidis, and *Salmonella* Newport. They will continue for two years and are expected to identify risk factors that can be addressed to prevent their occurrence.

Preliminary FoodNet Data on the Incidence of Foodborne Illnesses, United States, 2001

Data gathered in 2001 via the FoodNet program shows a decrease in the major bacterial foodborne illnesses, however, it does not show a sustained decline in some infections which indicates that ongoing preventive efforts are needed.[1]

During 2001, a total of 13,705 laboratory-diagnosed cases of 10 foodborne diseases under surveillance were identified: 5,198 *Salmonellla* infection, 4,740 *Campylobacter*, 2,201 *Shigella*, 574 *Cryptosporidium*, 565 *E. coli* 0157, 145 *Yersinia*, 94 *Listeria*, 80 *Vibrio*, 32 *Cyclospora*, and 76 of hemolytic uremic syndrome. Substantial variations in the incidence of specific diseases, defined as laboratory-diagnosed infections per 100,000 persons, were reported among the sites. As Table 1 indicates, the incidence of *Campylobacter* cases ranged from 7.0 in Maryland to 31.7 in California; the incidence of *Salmonella* ranged from 8.2 in Oregon to 20.6 in Georgia.

[1] Centers for Disease Control and Prevention. Preliminary FoodNet data on the incidence of foodborne illnesses-selected sites, United States, 2001. *MMWR* 2002;51:325-9.

TABLE 1. Incidence* of cases of infection with nine pathogens and of one syndrome under surveillance in the Foodborne Diseases Active Surveillance Network (FoodNet), by site, compared with national health objectives for 2010 — United States 2001

Pathogen/syndrome	CA	CO	CT	GA	MD	MN	NY	OR	TN	Overall incidence	National health objective for 2010
Campylobacter	31.7	15.9	14.5	7.4	7.0	19.4	11.7	17.4	7.5	13.8	12.3
E. coli O157	1.1	1.9	1.1	0.6	0.4	4.8	1.5	2.3	1.4	1.6	1.0
Listeria	0.5	0.2	0.4	0.2	0.3	0.1	0.3	0.4	0.2	0.3	0.25
Salmonella	14.3	14.7	13.3	20.6	14.7	14.1	12.8	8.2	15.4	15.1	6.8
Shigella	13.2	7.1	1.8	8.6	3.3	10.0	1.3	3.2	3.5	6.4	NA†
Vibrio	0.6	0.2	0.3	0.3	0.4	0.1	0.1	0.1	0.1	0.2	NA
Yersinia	0.5	0.4	0.3	0.6	0.3	0.4	0.3	0.4	0.4	0.4	NA
Cryptosporidium	0.9	0.7	0.5	1.9	0.7	3.9	0.7	1.7	1.0	1.5	NA
Cyclospora	NR§	NR	0.1	0.3	NR	NR	NR	NR	NR	0.1	NA
HUS¶	1.0	1.3	0.3	0.3	1.0	1.8	0.5	1.7	0.8	0.9	NA

* Per 100,000 persons.
† Not applicable.
§ None reported.
¶ Hemolytic uremic syndrome. Incidence per 100,000 children aged <15 years.

The crude incidence of foodborne disease also varied by age. Infants and children had the highest incidence of most foodborne infections. The rates were highest in children aged ≤1 year for *Salmonella, Campylobacter, Yersinia*, and *Listeria*, and highest in children aged 1-4 years for *Shigella*, *E. coli* 0157 and *Cryptosporidium*.

The number of FoodNet sites and the population under surveillance nearly doubled from 1996 to 2001. To account for the increased population and variation in the incidence of the ten foodborne illnesses among sites, a log-linear Poisson regression model was used to estimate the effect of time on the incidence of the various pathogens, treating time (i.e. calendar year) as a categorical variable with 1996 as the reference year.[2]

Bacterial pathogens with the highest relative incidence during 1996-2001 were *Campylobacter, Salmonella*, and *Shigella*. Pathogens with the lowest incidence were *E. coli* 0157, *Listeria*, and *Yersinia*. The incidence of infection with most pathogens decreased during 1996-2001. For four pathogens, *Yersinia*, *Listeria, Campylobacter*, and *Salmonella*, this decrease was observed consistently over several years.

The declines in the incidence of these foodborne infections occurred in the context of several control measures, including implementation by the U.S. Department of Agriculture's Food Safety Inspection Service (FSIS) of the Pathogen Reduction/Hazard Analysis Critical Control Point (HACCP) systems regulations in meat and poultry slaughter and processing plants, along with changes in egg production guidelines. There have also been industry-wide efforts to reduce food contamination, to improve food safety education, and to increase regulation of imported food.

EHS-Net. A program under the FoodNet umbrella is the Environmental Health Specialist Network (EHS-Net). EHS-Net is a network of environmental health specialists and epidemiologists collaborating and exchanging ideas with laboratories, state food protection programs, the Environmental Health Branch of the National Center of Environmental Health at CDC, the Food and

2 Frome EL. The analysis of rates using Poisson regression models. *Biometrics* 1983; 39:665-74.

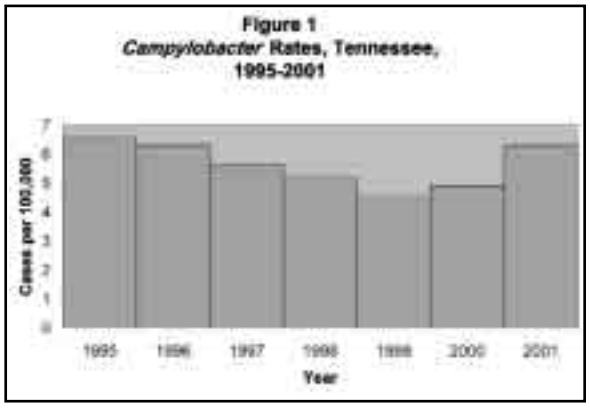
Drug Administration and FoodNet. EHS-Net's mission is to identify environmental antecedents to foodborne illness and foodborne disease outbreaks where active foodborne disease surveillance systems are in place (FoodNet).

A major effort of EHS-Net has been the Retail Food Survey. The NARMS Retail Food Survey is a cooperative project involving the USDA, FoodNet and six state-based FoodNet partners. Environmentalists at participating sites purchase uncooked meat products from retail grocery stores in their areas each month. In Tennessee the Tennessee Department of Health State Laboratory tests the samples for contamination. The laboratory also carries out testing for *Campylobacter, Salmonella, Enterococcus* and *E. coli*, using standardized methods and procedures. The goal is to determine the burden of microbial contamination of retail meat products and their potential contribution to foodborne illnesses.

Additional information on FoodNet activities is available through the CDC website (www.cdc.gov/foodnet/).

Campylobacteriosis

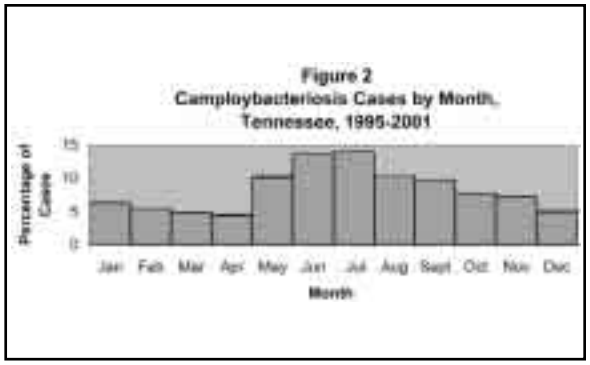
Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses in Tennessee; the causative agent is primarily *Campylobacter jejuni*. Despite the downward trend in the cases reported since 1995, the incidence rate in 2001 started to rise toward the rates of 1995 and 1996. A total of 364 cases were reported to CEDS in 2001, representing 6.3 per 100,000 persons. This is an increase when compared to the rates of 4.9 per 100,000 in 2000 and 4.6 per 100,000 in 1999 **(Figure 1)**.



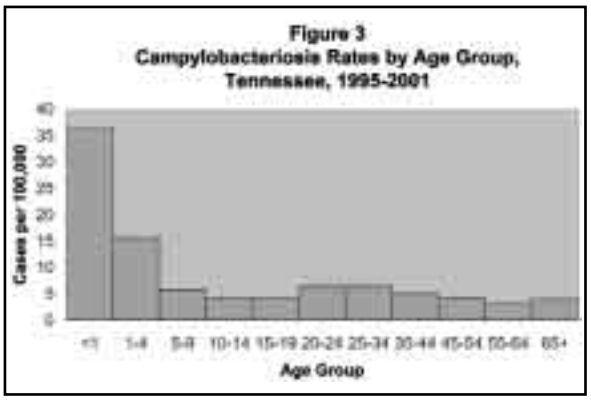
Regional rates in Tennessee in 2001 varied, with the highest rate of 14.8 per 100,000 in Knoxville to the lowest of 1.3 per 100,000 in the western regions.

Nationwide, there is substantial variation in the incidence of campylobacteriosis. In the FoodNet surveillance areas in 2001, *Campylobacter* rates ranged from 7.0 per 100,000 in Maryland to 31.7 per 100,000 in California.

For 1995 through 2001, reported cases of campylobacteriosis in Tennessee increased dramatically during the summer months with 66.7% of cases occurring from May through October **(Figure 2)**. In 2001, campylobacteriosis peaked in June with 62 (17.0%) cases.



Over the past seven years, males accounted for over 57% of *Campylobacter* infections; they had more cases in every age group except those aged 55-64 years. Nearly 38% of cases occurred in individuals 25-54 years and 23.5% of cases among children aged 4 years or younger. The highest incidence (36.5 cases per 100,000) occurred in infants <1 year of age **(Figure 3)**. In 2001, children aged <1 year and 1-4 years represented 8.8% and 19.2% of all cases respectively.

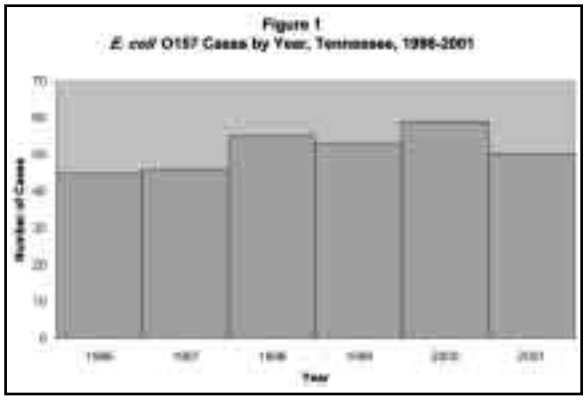


Active surveillance for *Campylobacter* is carried out in Tennessee under the auspices of the FoodNet program. A case-control study is currently underway in Tennessee to identify the risk factors for infants with salmonellosis and campylobacteriosis. Begun in March 2002, the study involves an interview with the parents of all infants aged ≤1 year in the FoodNet surveillance area who are diagnosed with these two diseases. This important project should help us better understand the reasons for the disproportionately high rates of these diseases among some of the most vulnerable age groups.

Under the auspices of the Emerging Infections Program, another study currently underway is investigating the association between Guillan-Barre Syndrome (GBS) and a preceding infection with *Campylobacter jejuini*. GBS is a relatively rare illness characterized by weakness and paralysis. Investigators at the Tennessee Department of Health and Vanderbilt University are interested in learning of newly diagnosed cases of GBS; please notify Dr. Ban Mishu Allos, the Principal Investigator, at 615-343-1743 of any such cases if you would like to enroll a patient.

E. coli O157:H7 and Hemolytic Uremic Syndome.

Fifty cases of *E. coli* O157:H7 were recorded by CEDS in 2001. The number of reported cases of this disease has varied from a high of 59 in 2000 to a low of 45 in 1996. The disease became reportable in Tennessee in 1996 **(Figure 1)**. Active surveillance for *E.coli* O157:H7 is carried out in Tennessee under the auspices of the FoodNet program.

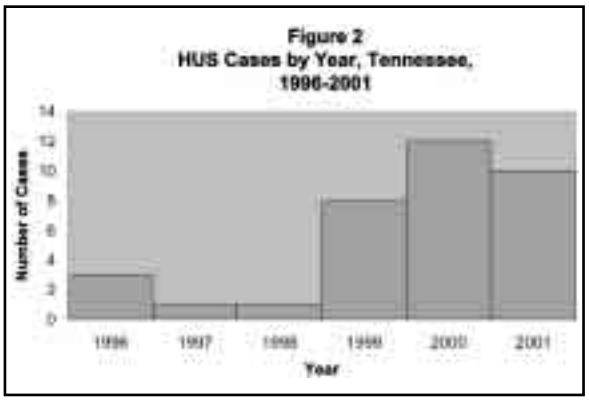


Proper cooking of foods and thorough handwashing techniques prevents *E. coli* O157:H7 infection. Ground beef should be cooked to an internal temperature of 160° F. Cross-contamination of uncooked meat and ready-to-eat foods must be avoided.

Fruits and vegetables require thorough washing prior to eating. Milk, juice and cider should be pasteurized. Persons with diarrhea should avoid sharing swimming and bath facilities or preparing food for others.

Outdoor summer activities such as swimming in contaminated water, contact with petting zoos or farm animals, and consumption of poorly prepared food and beverages increase the risk for *E. coli* O157:H7 infection.

Shiga toxin producing *E. coli* (STEC), of which serotype O157 is but one, are a significant cause of hemorrhagic colitis and hemolytic uremic syndrome (HUS). These are diseases which may result in severe complications such as renal failure and death. In 2001, 10 cases of HUS were reported to CEDS; the average age of those cases was 4.2 years. Each case had an average hospital stay of 20.1 days. **Figure 2** depicts the number of cases of HUS detected since 1995.



The Tennessee Department of Health State Laboratory routinely tests suspected fecal cultures for shiga toxin-producing *E. coli* (STEC). Immunomagnetic separation can be used to enhance identification of *E. coli* O157:H7 in otherwise questionable cultures. Serologic testing for antibodies against the major STEC serotypes is available if microbiologic tests are not done or are negative.

Shiga-like toxin positive stools were placed on the list of notifiable diseases in 2000.

Food and Waterborne Parasitic Diseases

Parasites can cause diseases that range from the mildly annoying to the severe and even fatal. Many parasitic diseases have traditionally been considered exotic, and therefore, frequently have not been included in the differential diagnoses of patients with diarrhea in Tennessee. Nevertheless, these organisms are among the common causes of morbidity and mortality in various and diverse geographic locations worldwide. Tourists returning to their own countries, immigrants from endemic areas, and immunocompromised persons are at risk for acquiring parasitic diseases in non-endemic areas.

Three parasitic diseases are reportable in Tennessee: cryptosporidiosis, cyclosporiasis, and giardiasis. Water, fecal-oral, and foodborne routes transmit all three and all three can be causes of significant diarrhea and weight loss. All three are uncommon in Tennessee.

Cryptosporidiosis

The characteristics of *Cryptosporidia* make it a major threat to both drinking and recreational water. They are ubiquitous in animals, resistant to chlorine, and small

and difficult to filter. Their oocysts (the protective shells that surround them) allow them to remain viable in the environment for a long period of time over wide extremes of temperatures. Though cryptosporidiosis is not new, there is evidence to suggest that contemporary living practices and demographics are creating an environment which enhances the spread of the disease. The expanding use of day care centers by infants and young children, the dramatic rise in the numbers of elderly people who live in institutions, the growing numbers of immunocompromised people living with Acquired Immunodeficiency Syndrome, organ transplants, chemotherapy and radiation therapy, along with water supplies that may be piped long distances from their source to their use, are all factors that contribute to the emergence of cryptosporidiosis as a threat. In 1993, the largest waterborne outbreak in U.S. history was caused by this pathogen. An estimated 403,000 persons served by the South Milwaukee, Wisconsin, water plant became ill, constituting a 52% attack rate. Several immunocompromised patients died.

The reported numbers of cases in Tennessee have been low, ranging from 1 in 1995, to 17 in 1997, to 12 in 2000. In 2001, 25 cases were reported; however, several laboratories have reported concern with false positive results with newly developed laboratory testing kits.

Nationally the incidence of cases per 100,000 for cryptosporidiosis in FoodNet sites has also varied, from 0.5 in California to 3.9 in Minnesota. The rate per 100,000 in Tennessee is 1.0. The overall incidence rate in FoodNet sites is 1.5.

Cyclosporiasis

Cyclosporiasis was first described in humans in New Guinea in 1977; however, the causative organism eluded taxonomic classification until 1993. Oocysts in the environment are quite stable, surviving freezing, formalin, and chlorination. Oocysts can contaminate food and water but direct person-to-person transmission is considered unlikely.

Intensive study of *Cyclospora* in the United States was undertaken as the result of several large outbreaks. In 1996 and 1997 a total of almost 3000 cases of cyclosporiasis were reported; they were primarily associated with social events and epidemiologically linked to the consumption of fresh raspberries. Traceback data linked the raspberries to five Guatemalan farms. The source of contamination was thought to be fungicide containing surface water sprayed on the berries. Other smaller clusters of the disease have been linked to fresh basil and fresh lettuce, none of which came from Guatemala. In the U.S. this disease tends to occur most commonly in metropolitan areas during the summer months.

The prevalence of *Cyclospora* infections in this country is not known but it is thought to be low. In 2001, no cases were reported in seven of the nine FoodNet sites including Tennessee. Only Connecticut and Georgia reported cases. Given the high percentage of foodborne illness nationally with an

[1] Mead PS, Slutsker L, Dietz V, et.al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:606-625.

unknown pathogen (81%), many cases of cyclosporiasis may go undiagnosed.[1]

Diagnosing Cryptosporidiosis and Cyclosporiasis

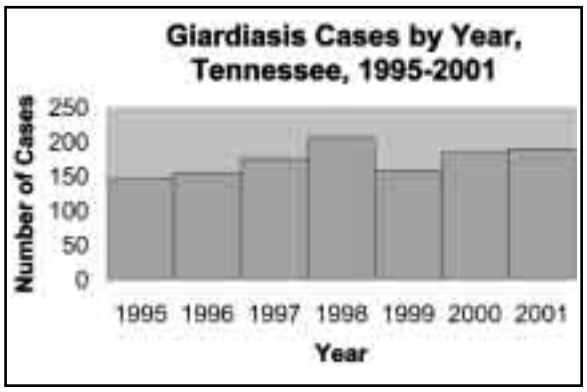
One of the most crucial steps in diagnosing these two parasitic infections is to ask for specific laboratory tests. Routine laboratory examination of stool for ova and parasites is inadequate to detect *Cryptosporidium* and *Cyclospora* and clinicians must ask laboratory personnel to test specifically for these organisms. Since shedding of oocysts can be intermittent, at least three stool specimens collected on three separate days should be examined before considering the test results to be negative. Specimens should be transported in fixatives such as 5 to 10% buffered formalin or sodium acetate-formalin (SAF). Polyvinyl alcohol (PVA)-preserved specimens are not appropriate for monoclonal antibody detection or for the modified acid-fast staining procedure that may be used. While an experienced microbiologist may be able to detect heavy concentrations of oocyts in a wet mount, additional testing will be needed to confirm the identification or detect low numbers of organisms. A modified acid-fast or fluorescent antibody stain is an acceptable test for both parasites. Fluorescent antibody and EIA kits for testing *Cryptosporidium* are commercially available. Testing for the presence of these parasites is available at the Tennessee Department of Health State Laboratory.

Giardiasis

This parasite is the most common cause of parasitic infection in the United States and Canada and is a common cause of endemic and epidemic diarrhea throughout the world. Nearly all children in the developing world become infected at some point in their lives.

Acquisition of the parasite requires oral ingestion of *Giardia* cysts. This can occur in one of three ways: through the ingestion of contaminated water (the most frequent), via person-to-person transmission, and with the intake of contaminated food. Many waterborne outbreaks have involved the use of untreated surface water or water that has been inadequately treated. Person-to-person transmission occurs in small children in daycare centers, persons in custodial living centers, and men who have sex with men.

The **figure** depicts the numbers of cases of giardiasis reported in Tennessee from 1995 through 2001; the numbers have remained fairly constant ranging from a low of 146 in 1995 to a high of 207 in 1998.



Listeriosis

The bacterium *Listeria monocytogenes* causes listeriosis, a rare but serious foodborne disease. Though it results in only about 2,500 cases of the estimated 76 mil-

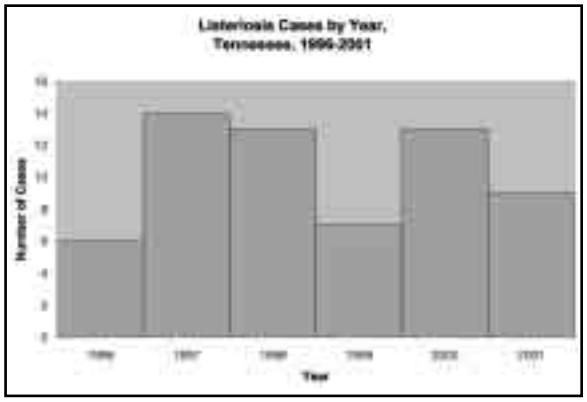
lion foodborne illnesses per year in the U.S., listeriosis produces 27% of the deaths from foodborne pathogens. The case-fatality rate for the disease is 15%. Listeriosis also produces the highest rate of hospitalization of any foodborne illness. Among FoodNet sites in 1999, it caused 89% of all of the hospitalizations that occurred as a result of foodborne illness. *Listeria* may cause meningitis and severe neurological sequelae.

Pregnant women are at increased risk for listeriosis. They are approximately 20 times more likely than other healthy adults to get the disease. About one-third of cases occur during pregnancy; this can lead to premature delivery, infection of the newborn, or stillbirth. Newborns, rather than their mothers, suffer the serious effects of the infection in pregnancy.

Other groups at increased risk include people with HIV/AIDS, cancer, diabetes, kidney disease, those who take glucocortcosteroids, and the elderly. These groups usually present with sepsis, meningitis, or meningo-encephalitis. Listeriosis has caused foodborne outbreaks of acute gastroenteritis in groups of people who were not immunocompromised.

L. monocytogenes is found in soil and water. Vegetables can become contaminated from soil or manure. Animals may carry the bacterium without appearing ill and thus contaminate foods of animal origin. *Listeria* are found in raw foods, uncooked meats and vegetables as well as processed foods that become contaminated after processing. Examples include soft cheeses, hot dogs, and cold cuts at the deli counter. Groups at risk should consider avoiding these foods, or heating them to steaming before eating.

In Tennessee, listeriosis became a reportable disease in 1996. Six cases were reported that year; the next year, the number jumped to 14. In 1998, a multistate outbreak of listeriosis resulted from post-processing contamination in a hot dog manufacturing plant in another state. Tennessee Department of Health staff assisted in the early identification of that outbreak.[1] In 1999, 2000, and 2001 case numbers were 7, 13, and 15 cases respectively. The **figure** depicts those numbers from 1996 through 2001.



In FoodNet sites, during 1996-2001, the incidence of listeriosis decreased 35%, a substantial and sustained decline. The decline occurred in the context of control measures instituted by the USDA's HACCP systems regulation in meat and poultry slaughter and processing plants. However,

[1] Centers for Disease Control and Prevention. Multistate outbreak of Listeriosis-United States, 1998. *MMWR* 1998;47:108.

listeriosis continues to cause significant outbreaks and deaths nationwide.

Active surveillance for *Listeria* is carried out in Tennessee under the auspices of the FoodNet program. Since February 2000, Tennessee has been part of a FoodNet-sponsored study of listeriosis. The goals are to identify risk factors for listeriosis in FoodNet sites and to describe the spectrum of illness in patients with the disease.

Norovirus

For many years, failure to isolate causative agents from apparently infectious outbreaks of diarrhea and vomiting led to the widely held assumption that undetected viruses were responsible for such disease. Despite extensive virologic investigations in laboratories around the world, relatively little progress were made in this area until 1972, when the Norwalk virus was described and partially characterized. It was initially detected in diarrheal stools obtained from people during an outbreak of gastroenteritis in Norwalk, Ohio, that involved elementary school students and family contacts. Subsequently, additional viruses with similar properties were discovered elsewhere, including the Hawaii, Montgomery County, and Snow Mountain viruses. All of them had similar morphology by electron microscopy, and all were observed in the stools of individuals with gastroenteritis. Subsequent molecular studies have clearly identified them as members of the *Caliciviridae* family.

Recently re-named, noroviruses were first recognized in association with point-source outbreaks of gastroenteritis. Features that are characteristic of such outbreaks include an incubation period of 24 to 48 hours, a short-lived illness of 2-3 days' duration with vomiting as a prominent symptom in most affected individuals, high secondary attack rates, and lack of identifiable pathogens on routine stool culture.

Almost any type of food may serve as a vehicle for outbreaks of Norovirus-associated gastroenteritis. Other sources of infection are drinking contaminated water and swimming in pools or lakes in which ill individuals have been swimming, an indication of the highly infectious nature of these viruses. Contamination of foodstuffs has been traced to both presymptomatic and post-symptomatic food handlers, thus complicating infection control recommendations. Outbreaks are particularly common in closed settings such as hospitals, nursing homes, ships, and the military. Secondary transmission is a prominent feature as well.

Noroviruses are estimated to cause 67% of the foodborne illnesses in the United States and 33% of all the foodborne hospitalizations annually. By comparison, the most common bacterial cause of foodborne infections is *Campylobacter*, which is estimated to result in 14% of the foodborne illness in this country. The **table** presents the five most common causes of foodborne illness in the United States.[1] Norovirus is not on the list of reportable diseases in Tennessee, and thus incidence and prevalence data are not available. However, all

[1] Mead PS, Slutsker L, Dietz V, McCaig LF, Bresee JS, Shapiro C et.al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:606-625.

foodborne outbreaks are required to be reported, thus these data about noroviruses are collected annually.

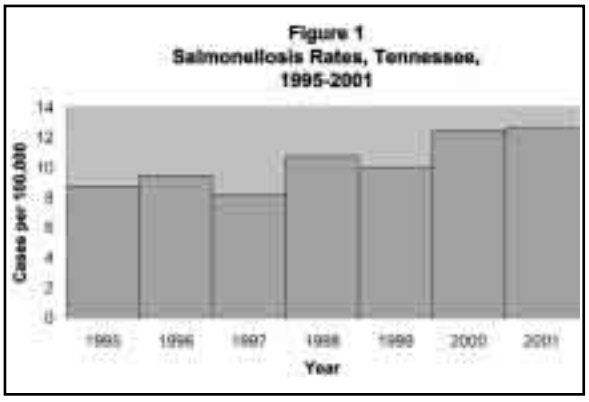
Percent of Foodborne Illness Caused by Known Pathogens, United States, 1999[1]

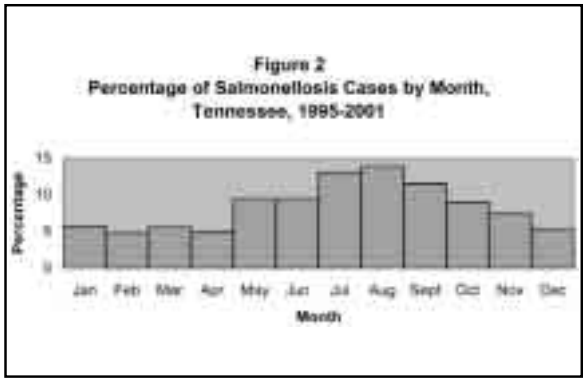
Pathogen	Percent of Illness
Norovirus	67%
Campylobacter	14%
Salmonella	8%
C. perfringens	2%
Giardia	1%

At the annual FoodNet Vision Meeting in Atlanta, March 2002, the decision was made to make Norwalk-like viruses a priority for study and research. Both outbreaks and sporadic cases are of concern; the goal is to bring this pathogen into the mainstream of food safety. The foci will be on increasing the routine testing for the virus in outbreaks via polymerase chain reaction (PCR) and on prevention measures.

Salmonellosis

The incidence rates of salmonellosis in Tennessee in 2001 and 2000 were at their highest level of the past seven years **(Figure 1)**. In 2001, a total of 724 cases were reported to CEDS. This represented an overall rate of 12.6 cases per 100,000 persons, compared to the 1999 Tennessee rate of 10.3 cases per 100,000 and the 2000 U.S. rate of 14.5 cases per 100,000. Rates of infection ranged from 7.3 per 100,000 in the southeast region to 18.9 per 100,000 in Hamilton County. From 1995 to 2001, salmonellosis reports followed a typical seasonal trend with two-thirds of cases occurring during the summer and fall. **Figure 2** depicts this trend. In 2001, salmonellosis peaked in August with 119 (16.4%) cases.





From 1995 to 2001, children under four years of age accounted for 35% of salmonellosis cases with the highest incidence rate,122.7 cases per 100,000. In 2001, children aged <1 year and 1-4 years represented 15.2% and 19.3% of cases respectively. The overall gender-specific rate of salmonellosis for the past seven years has been similar between males and females.

There are over 2000 serotypes of *Salmonella*, which causes salmonellosis. From 1995 to 2001, the most frequently isolated serotypes in U.S were S. Typhimurium, *S.* Newport and *S.* Enteriditis. In 2001, *S.* Typhimurium accounted for 26.1% of all *Salmonella* iso-

[1] Mead PS, Slutsker L, Dietz V, et.al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:606-25.

lates sent to Tennessee Department of Health State Laboratory, followed by *S*. Newport (16.1%) and *S*. Enteriditis (7.5%). One case of *S*. Typhi was identified in a 25-year- old white male from Bradley County.

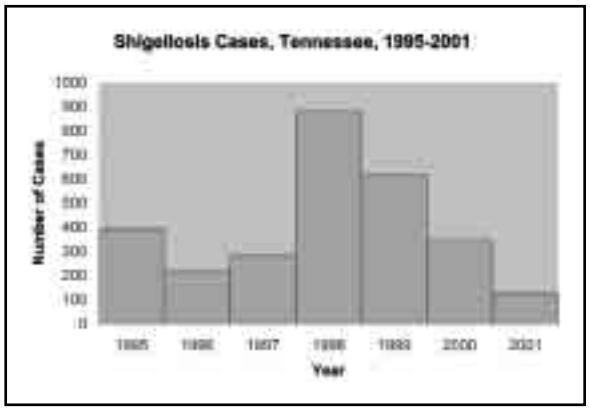
Multi-drug resistant *S*. Typhimurium definitive phage type 104 (DT 104) continues to be a public health concern in Tennessee. In 2001, the Tennessee Department of Health State Laboratory reported 63 individual patterns of pulsed-field gel electrophoresis for 200 *S*. Typhimurium positive isolates. Two patterns, identified as specific to DT 104, accounted for 59 (29.5%) of these *S*. Typhimurium isolates.

Active surveillance for *Salmonella* is carried out in Tennessee under the auspices of the FoodNet program. In April 2002, Foodnet case-control studies of *S*. Enteritidis and *S*. Newport were begun to identify behavioral, dietary and medical risk factors for, and medical consequences of, *Salmonella* infections. *Salmonella* Enteritidis isolates will undergo phage typing at CDC and PFGE will be carried out at the Tennessee Department of Health State Laboratory. *Salmonella* Newport will undergo antimicrobial resistance testing at CDC. Also in 2001, a case-control study began to better characterize *Salmonella* infections in infants.

Shigellosis

Shigellosis is an infectious disease caused by a group of bacteria called *Shigella*. Most people who are infected with *Shigella* develop diarrhea, fever, and stomach cramps starting a day or two after they are exposed to the bacterium. The diarrhea is often bloody, however, shigellosis usually resolves in 5 to 7 days. In some persons, especially young children and the elderly, the diarrhea can be so severe that the patient needs to be hospitalized. Some persons who are infected may have no symptoms at all, but may still pass the *Shigella* bacteria to others. Transmission occurs person-to-person by the fecal-oral route, with only a few organisms (10-100) needed to cause infection. Currently, active laboratory surveillance is being conducted for *Shigella* in Tennessee under the auspices of the FoodNet program.

The numbers of cases of this disease in Tennessee have varied from 1995-2001, with a high of 884 in 1998 to a low of 124 in 2001. The **figure** depicts these rather dramatic changes. The incidence of cases of shigellosis per 100,000 in the nine FoodNet sites in 2001 varied from California, which had a high of 13.2 to



New York, which had a low of 1.3.

The spread of *Shigella* from an infected person to other persons can be stopped by frequent and careful handwashing. When possible, young children with a *Shigella* infection who are still in diapers should not be in contact with uninfected children.

People who have shigellosis should not prepare food for others until they have been shown to no longer be carrying the *Shigella* bacterium. Basic food safety precautions prevent shigellosis.

If a child in diapers has shigellosis, everyone who changes the child's diapers should be sure the diapers are disposed of properly in a closed-lid garbage can, and should wash his or her hands carefully with soap and warm water immediately after changing the diapers. After use, the diaper changing area should be wiped down with a disinfectant such as dilute household bleach, Lysol, or bactericidal wipes.

Foodborne Outbreaks

Foodborne outbreaks are defined as the occurrence of two or more cases of a similar gastrointestinal illness resulting from the ingestion of a common food. Foodborne diseases pose the greatest risk to the very young, the elderly and those with compromised immune systems.

The detection and investigation of foodborne outbreaks in Tennessee have improved in recent years with aggressive local health department support and the increased resources available through the Tennessee Emerging Infections Program. From 1993-1995, no outbreaks were reported to CDC from Tennessee. In 1996 there was one and in 2001 there were 24. Two areas of concern about foodborne disease detection remain: there are a high number of foodborne outbreaks in which the etiology remains unknown, and second, the food vehicle is often difficult to identify. In 2001, 65% of foodborne outbreaks had a laboratory-confirmed etiology, and 35% had an identified vehicle.

Timely reporting of foodborne outbreaks has allowed for rapid acquisition of both stool and food cultures. Human stool collection typically provides the basis for determining disease etiology. Collecting these specimens has been facilitated by the development of stool kits, which contain all of the necessary materials and instructions; they can be mailed or delivered by courier to ill persons. Pulsed-field gel electrophoresis (PFGE) and polymerase chain reaction (PCR) of human and food samples are now employed by the Tennessee Department of Health State Laboratory. The methodology has increased the ability to determine the etiology and vehicle of foodborne outbreaks.

Following is a line listing of foodborne disease outbreak investigations that occurred

Foodborne Disease Outbreaks, Tennessee, 2001

County	# Ill	Etiology	Site
Maury	10	Norovirus	Nursing home
Davidson	811	Norovirus	Restaurant
White	3	*B. cereus*	Restaurant
Hamilton	200	Norovirus	Restaurant
Shelby	29	*S. aureus*	Restaurant
Hamilton	20	Unknown	Catered event
Smith	12	*S. aureus*	Restaurant
Davidson	23	Norovirus	Private home
Shelby	12	Unknown	Sports club
Shelby	62	Unknown	Summer camp
Johnson and VA	~80	*S.* enteritidis	Camp
Shelby	8	*B. cereus*	Restaurant
Fayette	3	Unknown	Private home
Carroll	30	Unknown	County fair
Henry and KY	4	Unknown	Restaurant
Wilson	9	Norovirus	Private home
Dyer	9	Norovirus	Private home
Knox and KY	11	Norovirus	Camp, restaurant
McNairy	2	Unknown	Restaurant
Carter	62	*S. aureus*	Cafeteria
Knox	10	Unknown	Restaurant
Sumner	19	*S. aureus*	Private home
Hickman	11	*S. aureus*	Workplace potluck

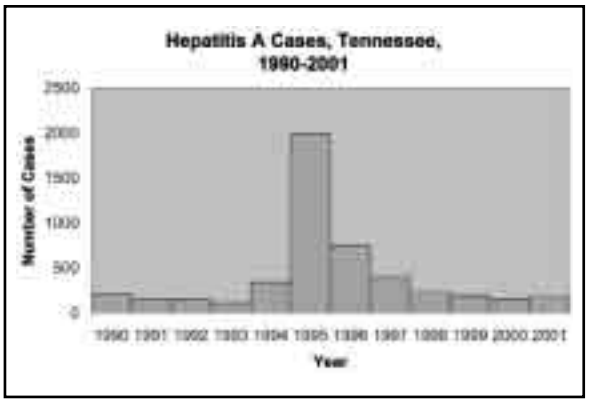
B. HEPATITIS

Hepatitis A

Hepatitis A (HAV) is an RNA virus from the family *Picornaviridae*. HAV is usually spread from person to person via the fecal-oral route, either via person-to-person contact or less commonly, through ingestion of contaminated food or water. Good personal hygiene and proper sanitation can help prevent hepatitis A. Over 70% of children ≤6 years of age who acquire the virus are asymptomatic.

In the past three years rates in the United States have fallen to historic lows. This may be due in part to widespread use of inactivated hepatitis A vaccine in Native American children and in high rate countries and states and in the western United States where most disease occurs.

Since a major outbreak of hepatitis A in Memphis and Shelby County, which began in 1994, hepatitis A cases reported in Tennessee, have continued to decline. At the peak of the outbreak in 1995, nearly 2000 cases were reported with about 1600 from Shelby County. In contrast, in 2001, only 187 cases were reported. The **figure** depicts the changes before and after 1994. The rate of hepatitis A in Tennessee per 100,000 populations in 2001 was 3.25, below the national rate of 4.91 in 2000. The rate is increased slightly in 2001 due to disease in men who have sex with men in Shelby County.



Persons at risk of HAV infection include the following: household contacts of infected persons, sexual contact with infected persons, persons (especially children) living in regions of the U.S. with consistently increased rates of hepatitis A, persons traveling to countries where hepatitis A is common, men who have sex with men, and injecting and non-injecting drug users.

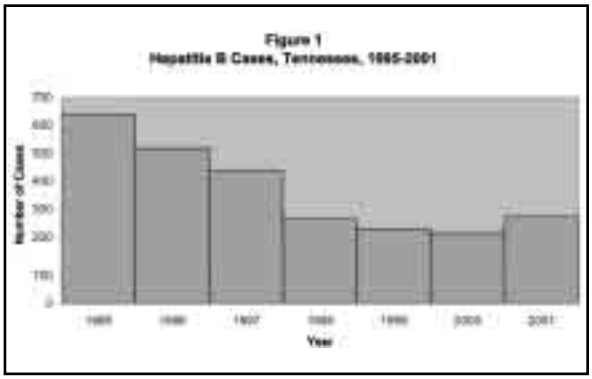
Short-term protection against hepatitis A is available from immune globulin. It can be given before and within two weeks after coming in contact with HAV. One simple and inexpensive measure that decreases disease spread is thorough hand washing with soap and water after defecating, after changing a diaper, and before preparing and eating food.

Hepatitis A vaccine is the best protection. Hepatitis A vaccine is licensed for use in children aged ≥2 years and is advised for the following: travelers to areas with increased rates of hepatitis A, men who have sex with men, injecting and non-injecting drug users, persons with clotting-factor disorders (e.g. hemophilia), persons with chronic liver disease, and children living in regions of the U.S. with consistently increased rates of hepatitis A.

The FDA recently licensed Twinrix® which is a hepatitis A/B combination vaccine for use in adults aged ≥18 years and older. Use of this vaccine in young adults who have not been vaccinated against hepatitis A or B will be helpful in protecting this group. The availability of a hepatitis A vaccine that is effective in infants and can be incorporated into the routine childhood immunization schedule is needed to completely control hepatitis A in Tennessee and move closer to hepatitis A elimination in the United States.

Hepatitis B

Acute hepatitis B (HBV) case reports in Tennessee increased by 28% from 2000 to 2001 **(Figure1)**. Tennessee hepatitis B rates of 4.9 per 100,000 continued to be higher than the 2000 United States rate of 2.7 per 100,000 people. The Healthy People 2010 objective for hepatitis B rates for people aged <25 years is 0. In 2001, Tennessee had 64 cases of hepatitis B in people aged < 25 years. Males were 57.7% of the caseload



and females were 42.3%. Race-specific rates were five times higher in blacks than in whites (14.1 vs. 2.7 per 100,000). Regions reporting the highest case rates of hepatitis B per 100,000 in 2001, in descending order were Shelby County (15.7), Davidson County (5.4), and East Tennessee (5.4).

While there is no cure for hepatitis B, it can be prevented. Vaccination with hepatitis B vaccine is the most effective means of preventing HBV infection and its consequences. The vaccine is administered in three doses: the initial dose, followed in one month by dose two, with the final dose given at six months. The first dose of vaccine can be administered as early as the day of birth. The vaccine is recommended for all infants, beginning at birth, adolescents, persons whose occupation exposes them to human blood, people who live in the same household or who have sexual contact with someone who has hepatitis B virus infection, people who have sex with more than one partner, intravenous drug users, hemophiliacs, patients or staff of institutions for the developmentally disabled, and those who travel internationally to area with a high prevalence of hepatitis B virus.

Perinatal Hepatitis B

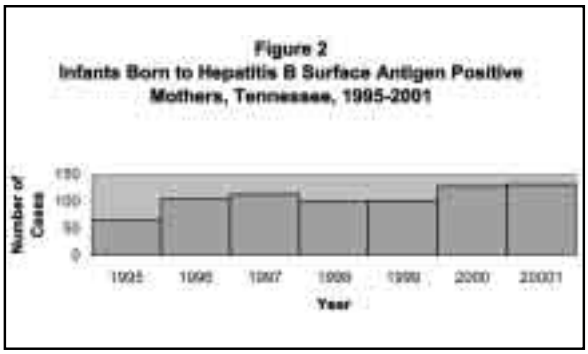
Children born to hepatitis B surface antigen (HBsAg) positive women are at high risk of becoming chronic carriers for hepatitis B. If these children are administered hepatitis B immune globulin (HBIG) and hepatitis B vaccine at birth, their chances for being protected from the illness are greatly increased.

Tennessee Code Annotated 68-5-602 (a) requires that all women in Tennessee be tested for hepatitis B during the prenatal period, and that the positive test results be reported to the delivering hospital and the health department. Further, a woman with no test results at delivery is to be tested at that time. The law requires that an infant born to an HBsAg positive mother receive, in a timely manner, the appropriate treatment as recognized by the Centers for Disease Control and Prevention. This treatment includes hepatitis B vaccine and hepatitis B immune globulin.

The Tennessee Department of Health receives the hepatitis B test results and counsels all women who are reported as HBsAg positive. The department also identifies and treats their contacts, confirms that the information is in

medical records, insures that the delivering hospital has a record of the mother's status, and has HBIG and vaccine available. Tennessee reports an average of 1-3 infants each year whom, despite appropriate treatment at birth and appropriate vaccination, become chronic carriers of hepatitis B.

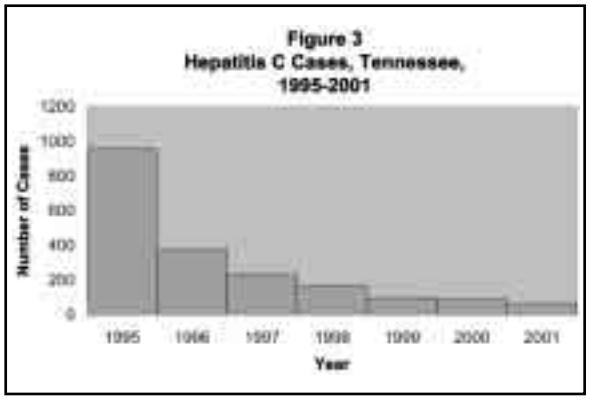
Figure 2 shows the number of infants reported as being born to an HBsAg positive mother.



Hepatitis C

There are estimated to be 2.7 million persons chronically infected with hepatitis C in the United States. Hepatitis C (HCV) was made reportable in Tennessee in 1997. Prior to that time, all hepatitis C reports were placed in the "non-A, non-B viral hepatitis" category. As noted in the figure 3, reported cases of hepatitis C fell sharply from 1995 to 1996, because guidelines for reporting only acute hepatitis C cases were widely distributed.

Since many communicable disease reports consist of only a positive anti-HCV test, it requires considerable resources to confirm an acute hepatitis C case. Although adequate resources are not always available, efforts have been made the past two years to



decrease the number of chronic cases being reported.

CEDS has received funding from CDC to establish a position for a hepatitis coordinator. The role of this person is to assist regional and local departments of health with counseling and education resources and improving disease reporting. One arm of this new initiative is to inform high-risk individuals of the importance of screening for hepatitis C and to integrate hepatitis C prevention into ongoing human immunodeficiency virus (HIV) and sexually transmitted disease (STD) prenatal and counseling activities.

Another activity under the auspices of CDC funding has been to educate medical providers, medical staff and field workers about HCV infection, epidemiology, transmission routes, risk factors, and co-infection with HIV, disease outcomes, and prevention.

C. MENINGITIS/ENCEPHALITIS AND SEPTICEMIA

Active Bacterial Core Surveillance: The ABCs Program

Another program under the umbrella of the Emerging Infections Program is Active Bacterial Core Surveillance (ABCs). Active laboratory surveillance is conducted for invasive bacterial diseases due to pathogens of public health importance. For each case of invasive disease in the study population, a case report with basic demographic information is filed and, in most cases, bacterial isolates from a normally sterile site are sent to CDC for laboratory study. ABCs has been in place in Tennessee in the four major metropolitan areas since 1988.

Objectives

- To determine the incidence and epidemiologic characteristics of invasive disease due to group A *Streptococcus*, group B *Streptococcus*, *Haemophilus influenzae*, *Neisseria meningitidis*, and *Streptococcus pneumoniae* in major metropolitan areas in Tennessee.
- To determine molecular epidemiologic patterns and microbiologic characteristics of public health relevance for isolates causing invasive infections from select pathogens.
- To provide an infrastructure for further research, such as special studies aimed at identifying risk factors for disease, post-licensure evaluation of vaccine efficacy, and monitoring effectiveness of prevention policies.

Pathogen Specific Objectives

Group A *Streptococcus* (GAS)

- To determine the distribution of serotypes, define the prevalence of new serotypes and determine the association between specific serotypes and disease severity.
- To determine the incidence of severe GAS disease and the potential risk of subsequent disease among household members.
- To identify potentially modifiable risk factors for community-acquired GAS infections and evaluate the relative importance of various underlying diseases as risk factors.

Group B *Streptococcus* (GBS)

- To provide health care workers with information about newly-published prevention guidelines.
- To determine the extent to which cases of early-onset GBS disease are preventable through current prevention strategies.
- To identify serotypes responsible for disease in order to guide vaccine development.

Haemophilus influenzae

- To evaluate progress in the elimination of serotype b disease.
- To detect possible emergence of disease due to other capsular types.
- To determine possible preventable reservoirs of the bacteria.

Neisseria meningitidis

- To monitor trends in serogroup specific disease.
- To acquire baseline data in preparation for the availability of infant meningococcal conjugate vaccine.
- To evaluate trends in molecular subtypes and the emergence of antimicrobial resistance.

Streptococcus pneumoniae

- To track emerging antimicrobial resistance in pneumococcal isolates.
- To evaluate the impact the effectivness of the pneumococcal conjugate vaccine for young children.

- To evaluate prevention among the elderly through pneumococcal polysaccharide vaccine use.

Under the auspices of the ABCs program, a number of studies have been undertaken to reach some of the objectives listed above. They are in various levels of completion. An assessment of the effectiveness of current prenatal Group B *Streptococcus* screening guidelines was completed in 2002.[1] A multistate study to assess the field effectiveness of the new conjugate pneumococcal vaccine has been underway since 2000. This vaccine covers the seven most common pneumococcal serotypes causing invasive disease in children. In 2002, a pneumococcal preventability project was initiated. The purpose of the project is to assess the burden of invasive pneumococcal disease that could have been prevented had current adult immunization recommendations been followed. The project will also examine the burden of fluoroquinolone resistance in the ABCs surveillance area.

Tennessee Unexplained Encephalitis Study (TUES)

Encephalitis, infection of the brain parenchyma, is a potentially devastating neurologic disease. Over 100 different viral, bacterial, fungal and parasitic agents have been associated with this syndrome, however in up to 85% of cases no pathogen is ever identified.[2] One reason for the high proportion of unexplained cases is the difficulty in culturing organisms causing encephalitis from cerebrospinal fluid (CSF). In the last decade, diagnostic tests targeting species-specific DNA sequences such as the polymerase chain reaction (PCR) have emerged as rapid, highly sensitive methods to detect pathogens in the central nervous system (CNS).[3]

In response to the development of these improved diagnostic methods, the Emerging Infections Program (EIP) initiated encephalitis surveillance at three sites nation-wide. The Tennessee Unexplained Encephalitis Surveillance (TUES) study, begun in January 2000, was started to better characterize the epidemiology and microbiology of encephalitis. Criteria for enrollment includes altered mental status > 24 hours associated with an abnormal neurologic exam, focal neuroimaging study or EEG, or CSF pleocytosis. Cases ≤ six months of age, or patients with severe immunocompromise are excluded. Cases of encephalitis are identified by passive surveillance through clinician referral. Study personnel obtain informed consent. Physicians are asked to submit CSF, acute and convalescent serum, nasopharyngeal and rectal swabs, and (if available) brain tissue. Specimens are tested for a number of core pathogens, with supplementary tests for less common pathogens performed as indicated by specific epidemiological factors or exposures.

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1 Schrag SJ, Zell ER, Lynfield R, et.al. A population-based comparison of strategies to prevent early-onset group B streptococcal disease in neonates. *N Eng J Med* 2002;347:233-9.

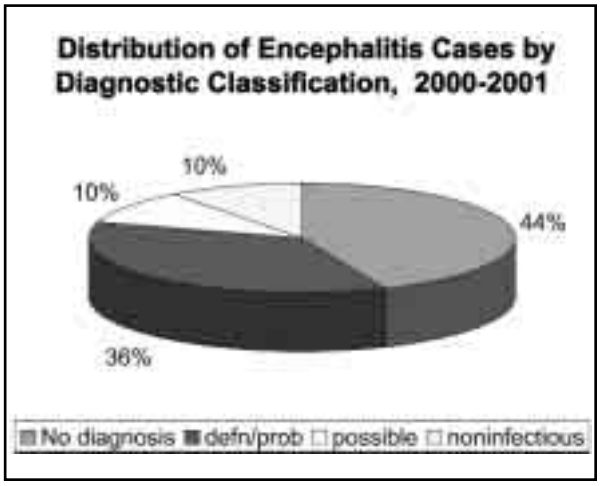
2 Nicolosi A, Hauser WA, Beghi E, Kurland LT. Epidemiology of central nervous system infections in Olmsted County, MN, 1950-1981. *J Infect Dis* 1986;154:399-408.

3 Tang YW, Hibbs JR, Tau KR, Qian Q, Skarhus HA, Smith TF, Pershing DH. Effective use of polymerase chain reaction for diagnosis of central nervous system infections. *Clin Infect Dis* 1999; 29:803-6.

A total of 216 patients meeting the case definition for encephalitis have been enrolled into the study, (81 enrolled in 2000, 57 in 2001, 78 in 2002 to date). The decrease in the number of cases during 2001 is likely an artifact, as the study was closed to enrollment from late August through December, while the study protocol was being revised. The study closure during this time period precludes analysis of seasonal variation in symptom onset.

The majority of cases (92.8 %) were referred from acute care facilities in Tennessee, although only 68.6% had an in-state residential address. Cases ranged in age from 6 months to 84 years (mean age 27 years, median age of 33 years). Cases were evenly divided among males and females (49.6% versus 50.4%). Cases were often critically ill: 55.9% required ICU care, 19.4% were comatose at the time of study entry, and 14.2% expired within three months of study entry.

Diagnoses were classified as infectious, non-infectious, or unexplained. Infectious diagnoses were sub-classified based on predetermined, organism-specific criteria as confirmed, probable, or possible **(Figure)**. The chart details the specifics of these diagnoses. Of cases initially believed to represent acute encephalitis, 8.3% were ultimately diagnosed with a non-infectious condition. Diagnoses for these cases included lymphoma, multiple sclerosis, vasculitis, mitochondrial disorders, cerebrovascular accidents, and psychiatric conditions. In 48.2% of cases, the cause of the encephalitis-like illness was not determined despite extensive testing.



In one-third (32.9%) of cases, a confirmed or probable infectious etiology was identified. Specific microorganisms are listed in the **Table**. Herpes simplex virus was the most common pathogen detected, accounting for 14 cases. Nine cases had varicella zoster virus identified by PCR from CSF. While none of these cases were associated with primary varicella infection, the majority had dermatomal zoster either prior to, or within one week after then onset of CNS symptoms. Detection of Epstein Barr virus (EBV) in CSF was frequent, however the clinical significance of this is unclear, as this virus persists latently in macrophages. None of the cases with a positive EBV PCR had serologies suggestive of acute infection. Conversely, in the three cases with strong serologic evidence of acute EBV infection, PCR of CSF was negative. California serogroup viruses (presumably La Crosse virus), and West Nile virus were the arborviruses detected in our population. The first case of West Nile virus in the state of Tennessee was identified through the study. Rabies was identified as the etiologic agent in one study case in 2002.

The most frequently identified bacterial pathogen was *Bartonella*, causing cat scratch encephalopathy. Zoonoses associated with encephalitis included human monocytic ehrlichiosis, Rocky Mountain spotted fever, and Q-fever. Two additional notifiable pathogens, *T. pallidum* (neurosyphilis) and *M. tuberculosis* (tuberculous meningoencephalitis) were identified. Other infectious etiologies included Creutzfeld-Jakob disease (CJD) and fungal meningoencephalitis.

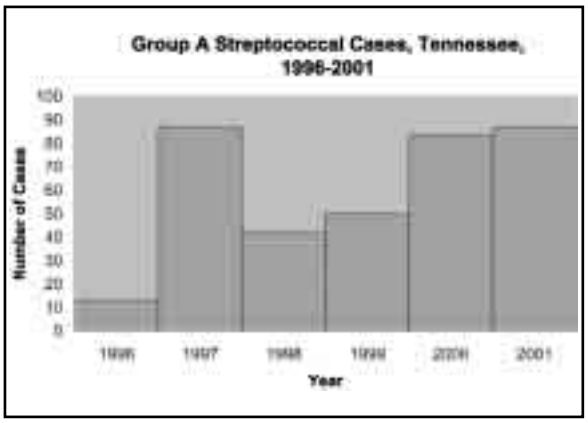
Results from the first three years of the study suggest that encephalitis is a relatively common and life-threatening syndrome. The range of pathogens causing this syndrome is broader than frequently appreciated in the literature, and includes many reportable and potentially treatable agents. PCR of spinal fluid appears to be a sensitive method for diagnosing herpes group viruses, but despite extensive molecular and serologic testing, no diagnosis is found in almost 50% of cases. To find out more about the TUES study, or to enroll a patient, please call the TUES Study Coordinators (Diane Levine or Delia Woods), at (615) 322-1519 or toll-free (877) 756-5800, or Dr. Karen Bloch at (615) 222-6611.

Microbiologic diagnoses among cases entered into the TUES study, 2000-2001

Class	Organism	Definite (n)	Probable (n)	Possible (n)	Total
Viral					63
	Adenovirus	0	0	3	3
	EBV	9	1	2	12
HSV	14	0	1	1	5
	Influenza	0	0	4	4
	La Crosse	7	1	0	8
	Parainfluenza	0	0	1	1
	Parvovirus	0	1	2	3
	Rabies	1	0	0	1
	Rotavirus	0	1	0	1
	VZV	9	0	2	11
	WNV	3	1	0	4
Bacterial					28
	Bartonella	5	3	1	9
	Coxiella	0	1	0	1
	Ehrlichia	1	3	1	5
	M. Tb	1	0	0	1
	Mycoplasma	0	0	3	3
	Rickettsia	3	2	2	7
	Streptococcus	0	0	1	1
	Treponema	1	0	0	1
Fungal					2
	Blastomyces	1	0	0	1
	Cryptococcus	1	0	0	1
Miscellaneous					1
	CJD	1	0	0	1
		57	14	23	94

Group A Streptococcal Disease

Group A streptococcal disease (GAS) reporting began in 1996 in Tennessee. Group A *Streptococcus* case reports in Tennessee increased by 74.0% from 1999 to 2001 **(Figure)**. The group A streptococcal rate (1.6 per 100,000) was lower than the 2001 United States rate of 3.2 per 100,000 population. Approximately 3% of the cases are classified as streptococcal toxic shock syndrome (STSS) and 6% are classified as necrotizing fasciitis (NF). Group A streptococcal cases are more frequent in young children and older adults



The diseases of STSS and NF occur more often among persons infected with GAS serotypes M-1 and M-3 which are toxin producing strains. Over 10 million noninvasive GAS infections (primarily throat and skin infections) occur annually in the United States.

GAS invasive disease occurs primarily among the elderly, the immunosuppressed, and those with chronic cardiac or respiratory disease, and diabetes. Persons with skin lesions (i.e. children with varicella) and intravenous drug users are other groups at risk for GAS. Blacks and American Indians are more often affected than whites.

There has been national passive surveillance for GAS invasive infection and STSS since 1999. Active laboratory-based surveillance for invasive GAS is conducted within the nine states that are participating in the Emerging Infection Program (total population: 29 million).

Worldwide, rates of GAS invasive disease, STSS, and NF, increased from the mid-1980s to early 1990s. Increases in the rate and severity of GAS invasive disease are associated with increases in the prevalence of M-1 and M-3 serotypes. CDC development of a new genotyping system for GAS isolates (*emm* typing) allows better strain identification. Investigating clusters of disease will help to identify interventions that can help to prevent the spread of infection. A CDC-sponsored work group recently published guidelines for the infection control/health department response to postpartum and post-surgical GAS cases and for the prevention of secondary cases in household contacts.[1]

Group B Streptococcal Disease

Group B *Streptococcus* (GBS) emerged as the leading infectious cause of neonatal morbidity and mortality in the United States in the 1970s. Reporting GBS cases in Tennessee began in 2000; in that year 87 were reported. In 2001 that number increased to 157.

[1] The Prevention of Invasive Group A Streptococcal Infections Workshop Participants. Prevention of invasive group A streptococcal disease among household contacts of case patients and among postpartum and postsurgical patients: recommendations from the Centers for Disease Control and Prevention. *Clin Infect* Dis 2002; 35:950-9.

In the early 1980s, clinical trials demonstrated that administering antibiotics during labor to women at risk of transmitting GBS to their newborns could prevent invasive disease in the first week of life. As a result of the efforts of clinicians, researchers, professional organizations and the public health community, recommendations for patient evaluation and intrapartum prophylaxis to prevent perinatal GBS were issued in 1996 by the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention, and in 1997 by the American Academy of Pediatrics.[1]

The guidelines recommended the use of one of two methods: a risk-based approach or a screening-based approach. The first approach identified candidates for intrapartum prophylaxis according to the presence of specific risk factors. The second approach recommended screening of all pregnant women for vaginal and rectal GBS colonization between 35 and 37 weeks gestation. Colonized women are then offered antibiotics at the time of labor.

Indications for intrapartum antibiotic prophylaxis to prevent perinatal GBS disease under a universal prenatal screening strategy based on combined vaginal and rectal cultures collected at 35-37 weeks' gestation from all pregnant women[2]

Vaginal and rectal GBS screening cultures at 35-37 weeks' gestation for ALL pregnant women (unless patient had GBS bacteriuria during the current pregnancy or a previous infant with invasive GBS disease)

Intrapartum prophylaxis indicated

*Previous infant with invasive GBS disease
*GBS bacteriuria during current pregnancy
*Positive GBS screening culture during current pregnancy (unless a planned cesarean delivery, in the absence of labor or amniotic membrane rupture is performed)
*Unknown GBS status (culture not done, incomplete, or results unknown) and any of the following:
  -Delivery at <37 weeks' gestation
  -Amniotic membrance rupture ≥18 hours
  -Intrapartum temperature ≥100.4°F (≥38.0°C)

Intrapartum prophylaxis not indicated

*Previous pregnancy with a positive GBS screening culture (unless a culture was also positive during the current pregnancy)

*Planned cesarean delivery performed in the absence of labor or membrane rupture (regardless of maternal GBS culture status)

*Negative vaginal and rectal GBS screening culture in late gestation during the current pregnancy, regardless of intrapartum risk factors

[1] Centers for Disease Control and Prevention. Prevention of perinatal group B streptococcal disease: a public health perspective. *MMWR* 1996:45(RR-7):1-24.

[2] Schrag S, Gorwitz R, Fultz-Butss K, Schuchat A. Prevention of perinatal group B streptococcal disease. Revised guidelines from CDC. *MMWR* 2002;51:1-23.

The Active Bacterial Core Surveillance (ABCs), a program of the Emerging Infections Program, provided the first large-scale direct comparison of these two strategies.[1] By incorporating population-based surveillance for early-onset GBS disease into a sample survey of a population of over 600,000 live births, this analysis found that the screening approach was >50% more effective that the risk-based approach at preventing perinatal disease. The protective effect of the screening approach was robust and persisted after controlling for risk factors associated with early-onset GBS disease (e.g.preterm delivery, prolonged membrane rupture, maternal age, and race).

The benefit from screening stemmed from two main factors. First, by identifying GBS-colonized women who did not present with obstetric risk factors, screening reached more of the population than did the risk-based approach. Among the cohort of screened women, 18% of all deliveries were to mothers who were colonized with GBS but did not have risk factors. Also GBS-positive women in the screening cohort were also more likely to receive intrapartum antibiotics than were the women with obstetric risk factors in the risk cohort.

Based on these new data, in November 2001, CDC consulted with multiple partners to revise the 1996 guidelines for the prevention of perinatal group B streptococcal disease. The major differences with the new guidelines include the recommendation of universal prenatal culture based screening for vaginal and rectal GBS colonization of all pregnant women at 35-37 weeks gestation. The figure on page 50 depicts the algorithm suggested by the recommendations.[1]

Numerous studies have indicated that the accuracy of screening for GBS can be enhanced by careful attention to the timing of cultures, by the anatomic sites swabbed, and by the precise laboratory methods used. Collection of cultures between 35 and 37 weeks gestation is recommended to improve the specificity and sensitivity of detection among women who remain colonized at time of delivery. Swabbing both the rectum through the anal sphincter and lower vagina increases the yield substantially. The use of selective enrichment broth (either SMB broth or Lim broth), with overnight incubation followed by a subculture onto solid blood agar medium, decreases false-negative cultures.

Meningococcal Disease

Meningococcal Disease is a bacterial infection caused by *Neisseria meningitidis* that may result in meningitis or sepsis. A case is confirmed by a positive antigen test of cerebrospinal fluid (CSF), clinical purpura fulminans or a positive blood or CSF culture. Clinical features include fever, headache, and stiff neck in meningitis cases, and sepsis and rash in meningococcemia. Approximately 10%-15% of meningococcal disease cases are fatal. Of

[1] Centers for Disease Control and Prevention. Prevention of perinatal group B streptococcal disease: a public health perspective. *MMWR* 2002;51:1-23.

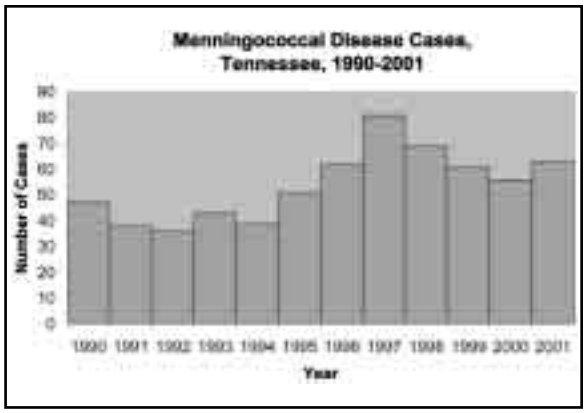
[2] Schrag SJ, Zell ER, LynfieldR, et.al. A population-based comparison of strategies to prevent early-onset group B Streptococcal disease in neonates. *N Engl J Med* 2002;347:233-9

patients who recover, 10%-15% have permanent hearing loss or other serious sequelae.

Transmission generally occurs through direct contact with respiratory secretions from a nasopharyngeal carrier. Risk groups include infants and young children (for endemic disease), refugees, household contacts of case patients, military personnel, college freshmen (who live in dormitories), and people exposed to active and passive tobacco smoke.

Surveillance is conducted worldwide through the National Electronic Telecommunication Surveillance System (NETSS), the National Bacterial Meningitis and Bacteremia Reporting System, and the Emerging Infection Program's Active Bacterial Core Surveillance (ABCs). Immediate reporting via telephone is required in Tennessee followed with a written report within one week. Serotyping of meningococcal isolates is performed routinely at the Tennessee Department of Health Laboratory.

The number of cases reported in Tennessee since 1990 has ranged from a low in 1992 of 36 cases to a high in 1997 of 81 cases. Sixty-three cases were reported in 2001 **(Figure)**. The trend in the U.S. is increased frequency of outbreaks and changes in distribution of serogroups responsible for endemic disease as well as increased disease among adolescents and young adults. The ABCs program obtained isolate data from Davidson, Hamilton, Knox, Shelby, and Williamson Counties for the years 1995-2001. A total of 148 isolates were



sent to the Tennessee Department of Health Laboratory for serotyping. Of these isolates serotyped, Group Y, 55 (37%) was most frequently identified followed by Group C, 42 (28%) and Group B, 30 (20%). Group Y serogroup accounted for 34% of the total isolates submitted in 1995. It increased to 41% in 1997, then slightly declined in 2001 to 37%, but continued to be the most common serogroup over the past six years. This same trend has been observed throughout the United States.

Rabies

The animal rabies picture has remained stable in Tennessee for the last 20 years. The number of cases in the northeastern counties is currently at a low point, while a five-year surge in Rutherford County (which accounted for 61% of the positive skunks in the state in 1997) is finally diminishing. Rabid bats can be found in any area of the state; the normal background rate of rabies in bats tested at the Tennessee Department of Health State Laboratory is estimated to be less than 0.5%. Skunk rabies remains the most common of the two variants of the virus found in Tennessee, which include skunk and bat. The **Table** depicts the total number of posi-

tive immunofluorescent antibody test by type of animal for 1995-2001. The **Map** depicts the location of positive rabies tests by species in Tennessee in 2000.

Immunofluorescent Antibody Positive Animal Specimens, Tennessee, 1995-2001

Species	1995	1996	1997	1998	1999	2000	2001
Skunk	82	80	135	127	79	88	98
Bat	7	12	8	5	10	15	11
Cat						1	
Cow	3			1			
Dog	3	6	3	6	5	3	2
Fox	4	1	1	1	1		
Goat				1			
Horse	1	1	2	1			
Total	**100**	**100**	**149**	**142**	**95**	**107**	**111**

Rabid bats are of increasing interest since 90% of human rabies deaths in the U.S. over the past 20 years have been due to bat exposures. The last Tennessee human case was a male from Franklin County who died in 2002. The last cases prior to 2002 were a Cumberland County female who died in 1994[1] and a woman from Kentucky with rabies who died in a Tennessee hospital in 1996.[2] All three tested positive for the Eastern Pipistrelle bat rabies strain.

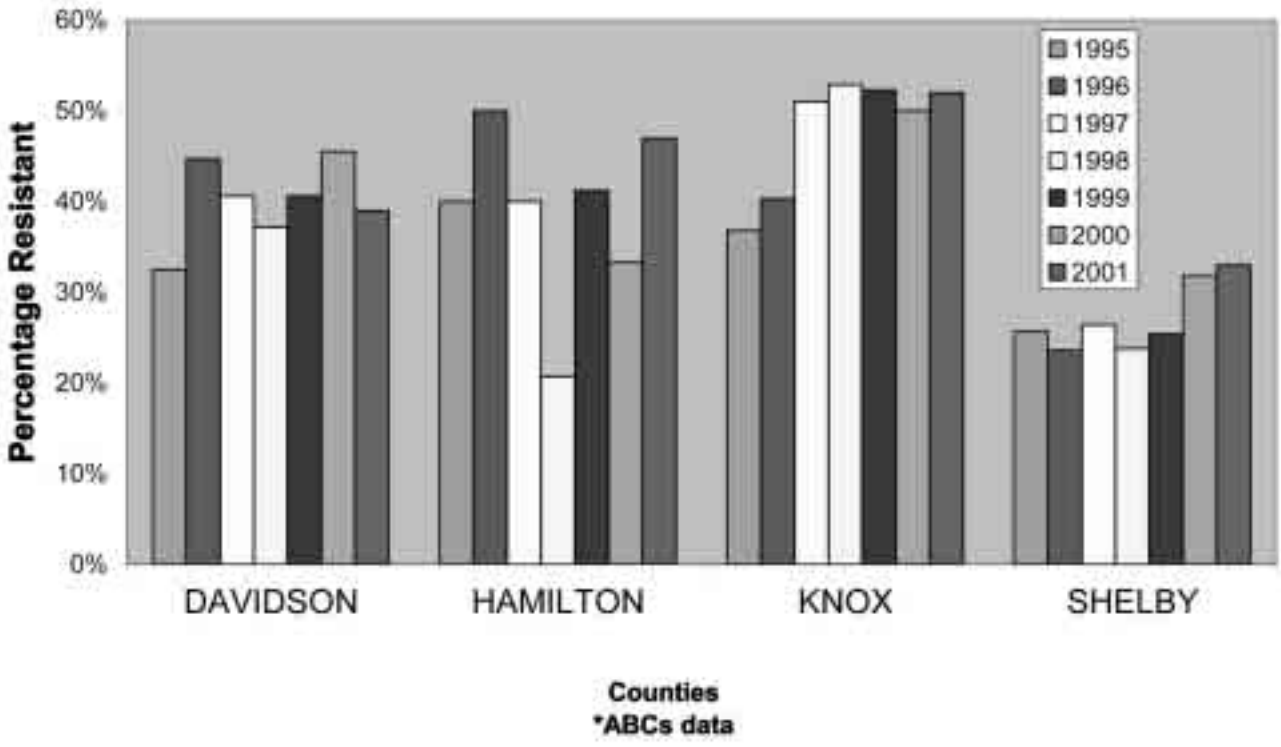
Streptoccus *pneumoniae* Invasive Disease

Streptococcus pneumoniae is the leading cause of meningitis, otitis media and pneumonia in hospitalized patients. It is the second leading cause of bacteremia and produces serious invasive disease in very young and very old individuals. The Active Bacterial Core Surveillance Program, a part of the Tennessee Emerging Infections Program, began collecting data on invasive *Streptococcus pneumonal* in 1995. Since then, this active laboratory-based system has documented an alarming increase in drug resistance in the four largest counties under surveillance from 1995-2001 **(Figure 1, p. 54)**. The rates in Knox County and Davidson County are of particular concern and have resulted in the

[1] Centers for Disease Control and Prevention. Rabies-Alabama, Tennessee, and Texas, 1994. MMWR 1995;44:269-272.

[2] Centers for Disease Control and Prevention. Human rabies-Kentucky and Montana, 1996. MMWR 1997;46:397-400.

Figure 1
Invasive Pneumococcal Disease, Percentage of Nonsusceptible Isolates*, Tennessee, 1995-2001



two counties working together to form Tennessee's Appropriate Antibiotic Use Campaign. The Knox County campaign was a major intervention in the late 1990s that resulted in decreased antibiotic prescriptions for treating patients with upper respiratory infections.[1]

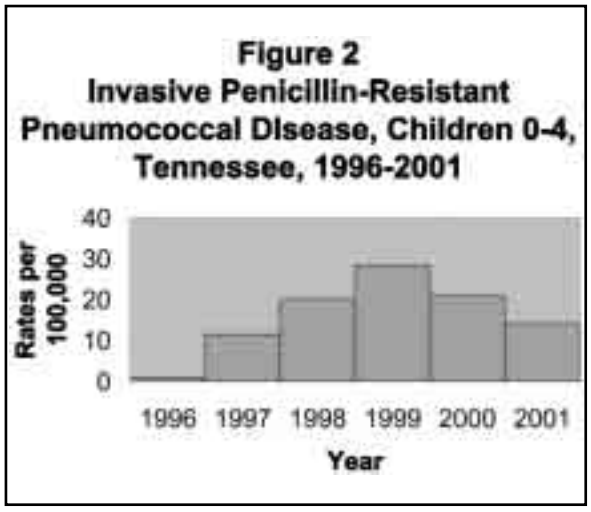
In 2002, the Tennessee Department of Health brought together members from physician groups, managed care organizations, hospitals, pharmaceutical companies, nurse practitioner groups, childcare centers and others interested in antibiotic resistance and formed appropriate antibiotic use coalitions in Davidson and Knox Counties. The coalition's missions are to reduce inappropriate antibiotic use and the spread of antibiotic-resistant bacteria that cause many upper respiratory illnesses through state and local partnerships. This mission will be accomplished by working with various organizations across Tennessee to further educate parents of young children and practitioners about the importance of appropriate antibiotic use.

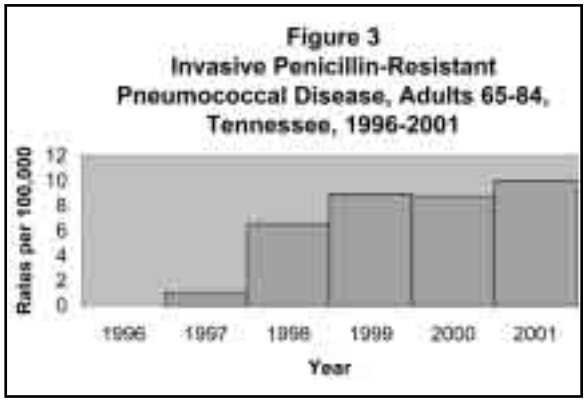
Another component of Tennessee's Appropriate Antibiotic Use Campaign is to encourage the use of the pneumococcal conjugate vaccine (Prevnar®) in young children. This vaccine is recommended for

[1] Perz JF, Craig AS, Coffey CS, Jorgensen DM, Mitchel E, Hall S, Schaffner W, Griffin MR. Changes in antibiotic prescribing for children after a community-wide campaign. *JAMA* 2002; 287:3103-9.

all children under two years of age and for children age 2-5 with high-risk medical conditions. Unfortunately supplies of PCV-7 have been limited. Until the supply of Prevnar® improves, priority should be given to children under age 1 year and to children age 1-5 years with chronic medical conditions. Since pneumococcal vaccines prevent invasive disease caused by both susceptible and nonsusceptible strains, it is critical that their utilization be increased.

Routine reporting of invasive penicillin-resistant pneumococcal disease statewide began in 1996 in Tennessee. In 2000, reporting expanded to include all invasive disease. **Figure 2** shows the rate of invasive penicillin resistant pneumococcal disease in children aged 0-4 years. The decline since 1999 is due to the introduction of Prevnar®. Similar rates for older adults age 65-84 are shown in **Figure 3**. A steady rate increase is apparent suggesting that more efforts need to be made to increase pneumococcal vaccinations in this population.

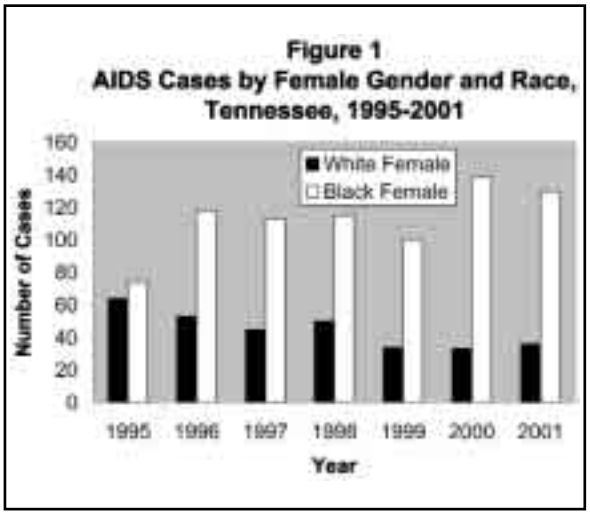


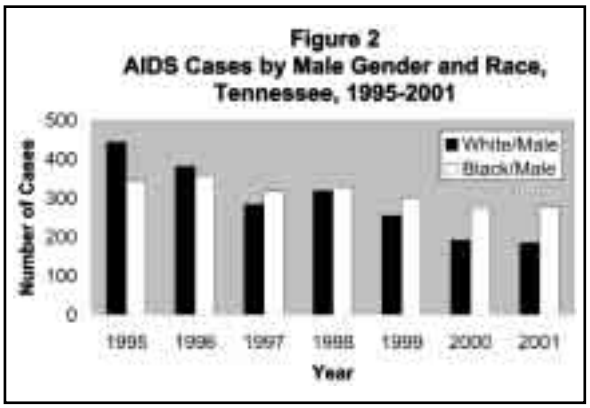


D. SEXUALLY TRANSMITTED DISEASES

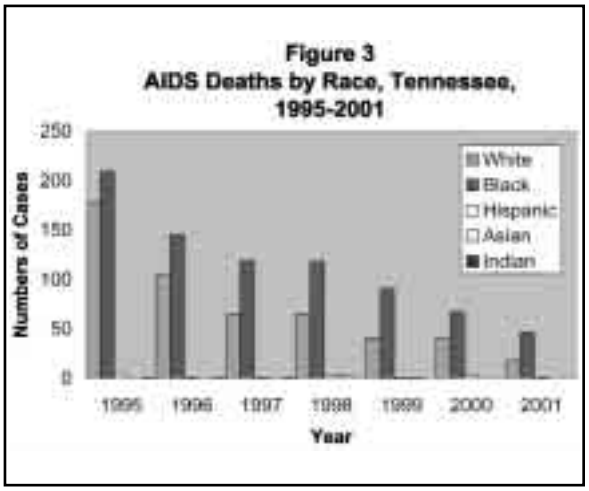
AIDS (Acquired Immunodeficiency Syndrome)

The total number of reported cases of acquired immunodeficiency syndrome (AIDS) in Tennessee from 1982 (the year AIDS data were first recorded) through 2001 is 5,741. The number of new cases of AIDS has decreased among whites, from 508 cases in 1995 to 221 cases in 2001. New AIDS cases among the black population have decreased from 418 in 1995 to 409 cases in 2001. **Figures 1 and 2 depict** the changes in the number of cases among females by race and among males by race. The total number of Hispanic cases diagnosed with AIDS in 2001 was 10. Males have higher rates of AIDS than females. The overall state AIDS incidence rate per 100,000 population in 2001 was 11.2. The rate in the United States in 2001 was 14.7.[1] The regional AIDS rates per 100,000 are as follows: Northeast, 2.5; East, 2.6; Southeast, 5.6; Upper Cumberland, 3.2; Mid-Cumberland, 5.8; South Central, 3.8; West, 7.3; and the Metropolitan regions, 20.4. The counties with the highest incidence rates in 2001 include, in descending order, Haywood (35.4), Shelby (29.7), Davidson (23.9), Van Buren (18.2), and Marion (18.0)





The number of AIDS deaths for the year 2001 was 65, which is a decrease from 2000 when there were 134 deaths. The total number of deaths from complications related to AIDS, from 1982 through 2001 was 4,541; **Figure 3** depicts the overall decline in these deaths. Highly reactive anti-retroviral therapy and other advances in medical treatments have been effective in prolonging the life of a person living with AIDS.



[1] Centers for Disease Control and Prevention. *HIV/AIDS surveillance report,* 2001;13 (No.2):8.

Pediatric HIV/AIDS due to Perinatal Risk

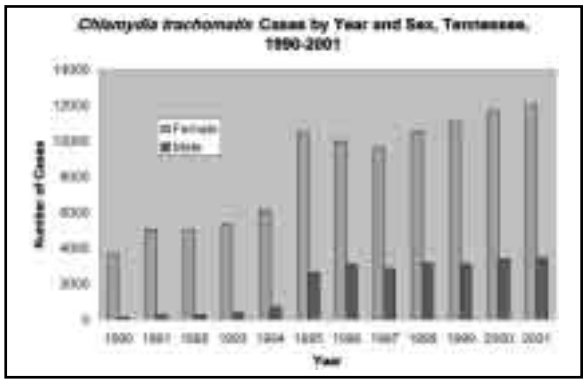
From 1995 through 2001, 37 perinatal exposed infants were reported with HIV infection and/or an AIDS diagnosis. The reporting of infants with HIV/AIDS due to perinatal exposure peaked in birth year 1993 with 15 infants. From 1995 to 2001 that number has remained fairly constant from 5 in 1995, to 4 in 2001. *Due to reporting delays, additional infants born during this time period may be reported as HIV/AIDS* at a late date. However, current trends are encouraging and point to improved interventions including anti-retroviral agents used during pregnancy and labor, and medical care for women and their newborns.

Chlamydia

Infections due to *Chlamydia trachomatis* are among the most prevalent of all sexually transmitted diseases (STD). In women, these infections often result in pelvic inflammatory disease, which can cause infertility, ectopic pregnancy, and chronic pain. In addition, pregnant women infected with *Chlamydia* can infect their babies during delivery.

Chlamydia became reportable in Tennessee in July 1987. In 1988, 1,880 cases were reported and the number of cases increased steadily through 1991, when 5,359 cases were reported. Cases increased modestly through 1994 when 6,787 cases were reported. In 1995, a significant increase in state funding was made available for testing in STD and family planning clinics. As a result, 13,152 cases were reported in 1995, a 94% increase from 1994. This same level of funding was available in 1996 and 1997. In 1998, the introduction of funding for the Region IV Infertility Project led to a modest increase in testing each year through the present. As a result, the number of cases increased to 15,557 in 2001.

Reported cases among patients aged 15-19 years (6,272) and 20-29 years (7,548) represented 89% of the *Chlamydia* morbidity in 2001. Females comprised 78% of all reported cases reflecting the selective use of limited testing resources **(Figure)**. Forty-two percent of female morbidity was reported in black females and 34 percent in white females, though incidence rates



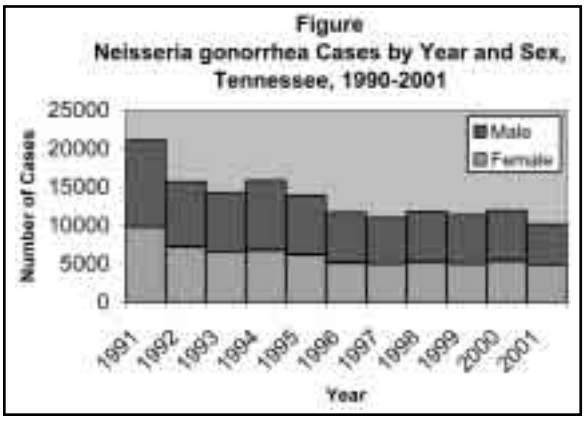
were much higher in blacks. Black females aged 15-19 years have the highest rate of infection with 5,774 cases per 100,000 population.

In 2001, screening of just over 106,000 patients for *Chlamydia* in health department STD, prenatal, and family planning clinics, resulted in 5 to 9% positive testing results in metropolitan areas and 3 to 6% positive test results in rural areas. The overall statewide screening positive rate was 7%.

Gonorrhea

Infections due to *Neisseria gonorrhoeae* remain a major cause of pelvic inflammatory disease, infertility, ectopic pregnancy, and chronic pelvic pain. Epidemiologic studies provide strong evidence that gonococcal infections facilitate HIV transmission.

Following a record high of 35,362 gonorrhea cases reported in 1976 (a rate of 817 per 100,000 population), the number decreased 71 percent to 10,144 cases in 2001 **(Figure)**.



In Tennessee, 69% of all reported cases of gonorrhea in 2001 were black patients. The metropolitan regions of the state have consistently accounted for 81-85% of the state's morbidity during this time period.

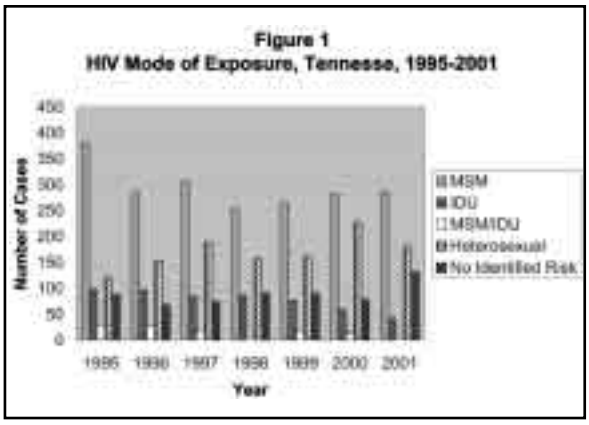
The 10,144 gonorrhea cases reported in 2001 represent an overall rate of 177 cases per 100,000 population. In contrast to the first half of the 1990s when cases decreased dramatically, the decrease in reported cases has been less striking in the past few years. In 2001, an overall decrease of 15% compared to 2000 was broadly based with decreases in half of the 95 counties. The overall rate of 177 per 100,000 population was well above the *Healthy People 2010* national goal of 19. Among women, those aged 15-19 years had the highest rate (906 per 100,000) while men aged 20-29 had the highest rate (649 per 100,000).

Screening of just over 106,000 patients for gonorrhea in health department STD, prenatal, and family planning clinics in 2001 detected 2 to 11% positive test results in metropolitan areas and 1 to 3% positive test results in the more rural areas of the state. These screening activities are directed primarily at women, particularly those aged 15-19 years. Funding for screening activities undoubtedly plays a role in year-to-year trends.

HIV (Human Immunodeficiency Virus)

In 1992, human immunodeficiency virus (HIV) infection became a reportable disease in Tennessee. From 1992 through 2001, the number of reported cases of HIV (includes only persons with HIV who have not developed AIDS) was 6,514. The number of persons reported to be living with HIV infection and with AIDS in Tennessee through 2001 is 11,116. Cases are assigned to the year of earliest reported diagnosis. The largest number of reported cases is among blacks as compared to other populations. Males have more reported cases than females.

Figure 1 (next page) indicates that the highest risk of HIV infection is for men having sex with men (MSM). The next highest risk behavior for adults is heterosexual contact with at risk individuals followed by intravenous drug use (IDU). A total of 41 cases of pediatric HIV infection have occurred in infants born to HIV-infected mothers since 1995. A total of 2 cases of pediatric HIV infection have resulted from blood transfusions.

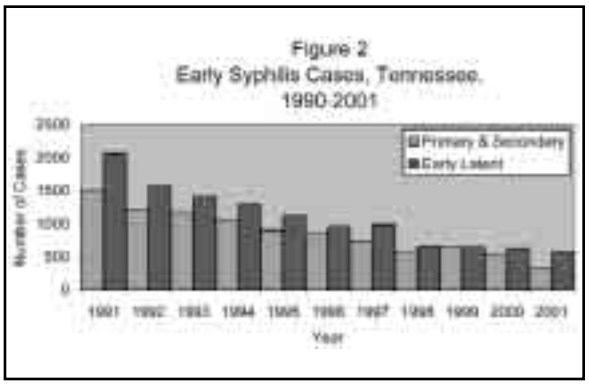


The overall state HIV incidence rate per 100,000 in 2001 is 14.44. Department of Health regional HIV rates per 100,000 population are as follows: Northeast, 3.1; East, 4.3; Southeast, 3.3; Upper Cumberland, 4.5; Mid-Cumberland, 4.8; South Central, 2.01; West, 7.9; and the Metropolitan regions, 34.5. The counties with the highest reported incidence rates include, in descending order, Haywood (81), Davidson (73.2) and Shelby (46.2).

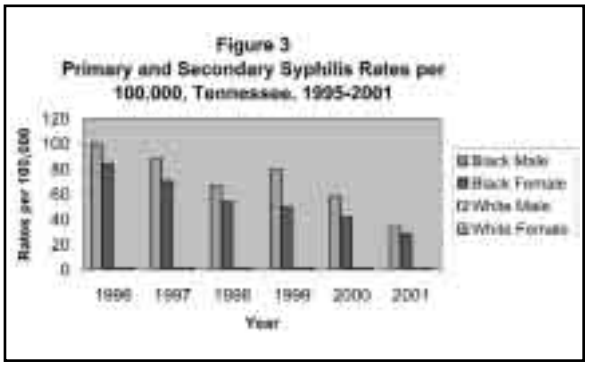
Syphilis

Most syphilis cases in Tennessee occur in large metropolitan areas. The six Tennessee metropolitan regions represent approximately 43% of the state's population; they account for 93% of the 884 cases of early syphilis (primary, secondary, and early latent) cases in 2001. These six metropolitan regions include the following: Chattanooga-Hamilton County, Jackson-Madison County, Knoxville-Knox County, Nashville-Davidson County, Memphis-Shelby County, and Sullivan County. In 2001 two cities, Memphis and Nashville, reported 564 and 213 cases, respectively, or 88% of the state's total cases. The seven remaining rural regions comprise 57% of the state's population but account for only 7% of the early syphilis cases in 2001.

Cases of early syphilis have decreased steadily in Tennessee since 1990 **(Figure 2)**. Early syphilis cases have been fairly



evenly distributed by sex, however, the syphilis rates for both male and female Black populations are disproportionately high. These two groups, which make up 16% of the state's population, consistently represent 85% of reported morbidity. The overall rate for primary and secondary syphilis was 16 cases per 100,000 in 1996, while the rate for blacks was 91. The overall rate in 2001 decreased 63% to 6 cases per 100,000, and the rate for blacks decreased 66% since 1996, to 31 cases per 100,000 **(Figure 3)**. Blacks aged



20-29 years and 30-39 years had rates per 100,000 of 211 and 198 respectively in 1996. By 2001, the rate for these groups had fallen 51 and 66 percent, to 103 and 67 per 100,000.

Despite the decrease in syphilis during the last several years in Tennessee, there is great concern that in 2001, two cities in the state ranked fourth and ninth among selected cities with populations >200,000 for reported rates of primary and secondary syphilis. Memphis, with a rate of 23.2 per 100,000 was ranked number 4.[1] Nashville's rate per 100,000 was 13.3 and gave it a ranking of 9 on the list. Detroit, with a rate of 28.6 was ranked number 1, Atlanta, with a rate of 27.5 was ranked number 2, and Baltimore, with a rate of 24.7 was number 3.

In 2001, 331 cases were primary and secondary syphilis, 553 were early latent (less than one year) syphilis, 580 were late and late latent cases, and 24 were congenital syphilis cases. The 331 primary and secondary cases represent a rate of 6 cases per 100,000 population, within reach of the *Healthy People 2010* national objective of 0.2 cases per 100,000.

On October 8, 1999, the National Syphilis Elimination Campaign was inaugurated in Nashville. Nashville/Davidson County, Memphis/Shelby County, and the Tennessee Department of Health State Laboratory received federal funds to begin highly focused efforts to reduce the rates of this disease through early detection and treatment. These ongoing efforts are credited with helping decrease disease rates.

[1] US Department of Health and Human Services. Sexually Transmitted Disease Surveillance 2002. September 2001, 115.

E. VACCINE-PREVENTABLE DISEASES

Vaccine-Preventable Disease

One of the great medical advances of the 20th century was the elimination or control of most vaccine-preventable diseases as the result of the widespread use of vaccines. The incidence of reportable vaccine-preventable diseases in Tennessee has declined to the point that most are medical rarities. There were 75 cases of pertussiss and one case of tetanus reported in 2001. There were no cases of measles, rubella, or *Haemophilus influenza* B (Hib) reported in 2001. Since 1995, there have been only three cases of measles, four cases of rubella and one case of Hib reported in Tennessee. All of the cases occurred in individuals who were not immunized.

Pertussis Despite high rates of pertussis vaccine usage among infants and children (88% at 24 months of age), there continues to be disease in the state, with 75 confirmed or probable cases reported. There are two significant factors causing this: waning immunity from the vaccine and children contracting disease before they receive three doses of DTaP vaccine.

Due to the waning of vaccine-produced immunity, which occurs within 5-10 years after the last dose of DTP/DTaP, many adults and adolescents have insufficient or no immunity to pertussis. This results in cases of adult and adolescent pertussis which are not usually clinically serious, but allows for a significant reservoir of infection to be present in the community and serve as the disease source to most cases in infants. In 2001, persons aged >12 years old accounted for 19 (25%) of the reported cases. An adult vaccine is under development.

The other significant source of pertussis morbidity is among infants and children who have received less than three doses of DTaP vaccine, the minimum needed to confer protection. The source of cases in this age group is often an infected household contact or health care worker. Of the 75 cases reported in 2001, 35 (46%) occurred in children too young to have received the necessary doses. Fifteen (20%) cases occurred in children older than age one who had not completed their complete series as appropriate for age.

The 75 cases reported in 2001 represent an increase of 76% from 2000. The increase in the number of cases in 2001 was due in part to the use of polymerase chain reaction (PCR) testing by the Tennessee Department of Health State Laboratory. This improved testing allowed for the detection of disease in patients with resolving disease, most of whom were epidemiologically linked to a case. The increasing use of PCR testing, both in the public and private sector, will likely result in the detection of cases that have been previously missed.

Tetanus There was one case of tetanus reported in 2001. The patient was a 69-year-old male who suffered a significant, dirty wound to his foot while gardening. He had no history of receiving tetanus containing vaccine in his adult life. He refused to seek medical attention at the time of the injury and within approximately 11 days of his injury developed symptoms consistent with tetanus and was hospitalized. Despite aggressive treatment, he died after a brief illness.

Although tetanus vaccine has been in short supply since 2000, the shortage was not a contributing factor to the death. Vaccine was still available through many physicians, all emergency rooms and health departments. The patient would have met the guidelines for the use of the vaccine. His refusal to accept post injury medical treatment was the major factor in his death.

Tetanus disease is uncommon in the United States and in Tennessee. The current recommendation for protection from tetanus is a primary series of DTaP/DT/Td and a booster dose every ten years. Adherence to this schedule induces protective against disease that approaches 100% immunity.

Childhood Immunization Levels

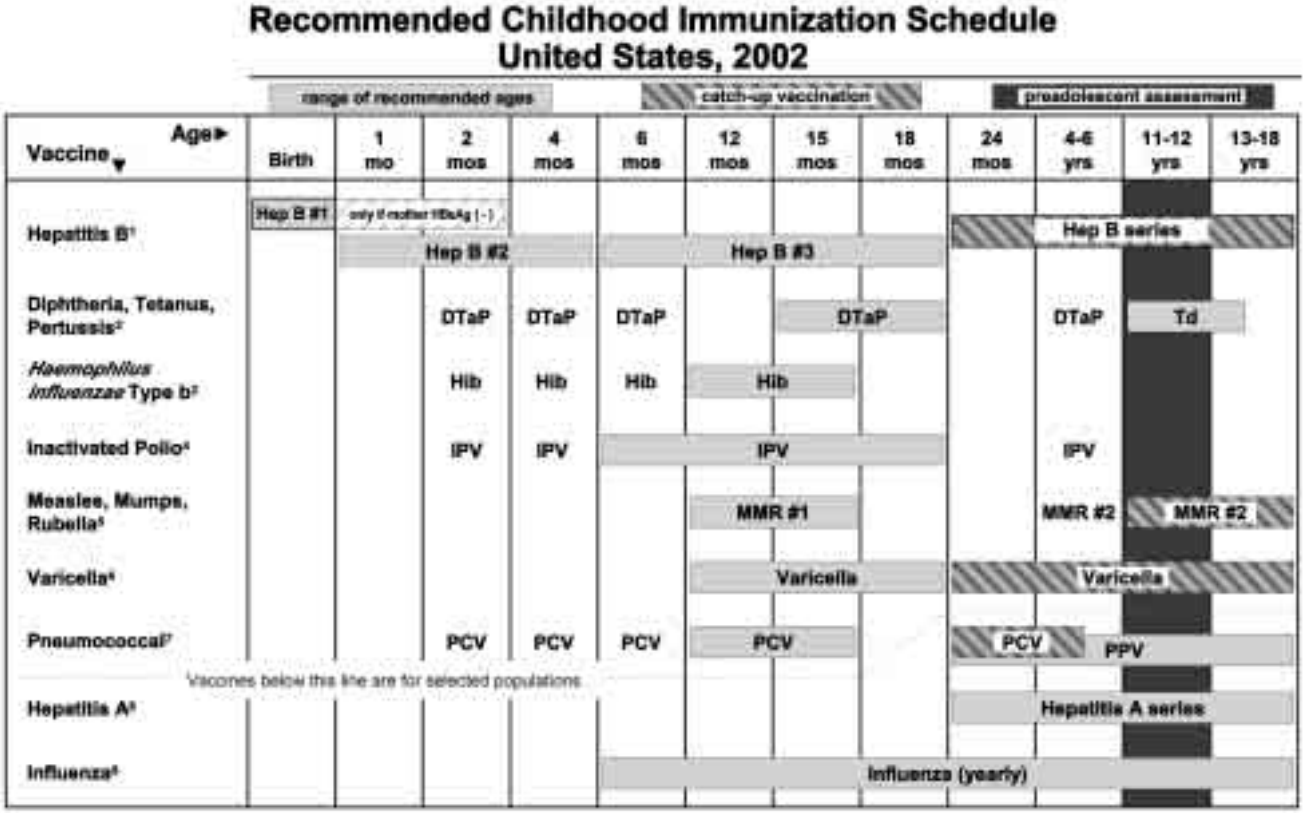
The Tennessee Department of Health has conducted an annual survey of the immunization status of Tennessee's children at their second birthday since 1983, the longest running survey of its type in the nation. The survey is a statistically valid sample of resident births and is further refined by creating a valid sample for each of the Department's 13 regions. This year's survey results are based on a sample of 1,499 children. Completion rates are based on four doses of DTaP/DT, three doses of polio, and one dose of MMR. This standard is used to allow comparisons with previous surveys. Completion rates for HIB, HBV and varicella vaccines were also examined.

The completion rate for the state on the 2001 survey was 88.2%. This is the highest rate yet observed. Completion rates by provider type were similar. Children receiving all of their vaccines in a private physician's office were better immunized (87.9%) than those seen in the public sector (86.9%). Children receiving vaccine in a combination of private and public facilities were better immunized (91.8%) than children receiving all their vaccine in one setting. Historically these children were less well immunized than those receiving all vaccine from one type provider were. However, this same result has been noted for the past three years and appears to be more than just an artifact of sampling.

TennCare enrollees' completion rates (86.3%) were lower than privately insured children (90.4%). The difference is not particularly surprising given the lower socioeconomic status (a risk factor for lower immunization rates) of TennCare enrollees compared to privately insured children. This difference is much smaller than the differences noted when the traditional Medicaid program was in existence. The 1995 survey examined completion rates for Medicaid enrollees compared to children not on Medicaid. Children on Medicaid had completion rates almost 20% lower than those children not on the program.

Race, as a determinant of completion rates, is much less of a factor than was the case ten years ago. The completion rates for black children (85.5%) is only slightly lower than the completion rates for whites (88.7%) and is more a factor of economic status than anything else. However, the completion rates for black children were significantly lower in Shelby and Davidson Counties than their white counterparts. The

differences (11% lower in Shelby and 9% in Davidson) are noteworthy since the majority of Tennessee's black children reside in these two counties. Completion rates among other races, primarily Asian Americans, were 95.8%, but this population represents less than 2% of the birth cohort and has little impact on overall coverage.



F. VECTOR-BORNE DISEASES

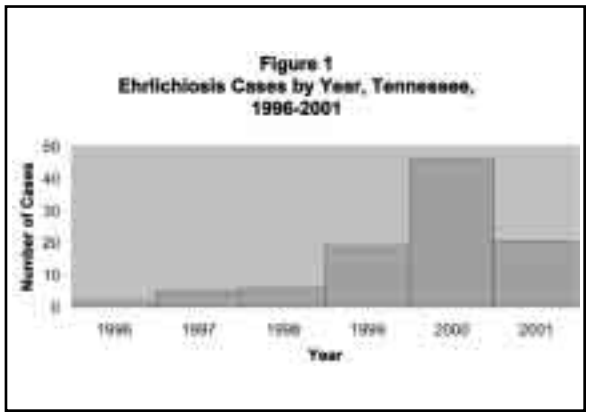
Tick-Borne Diseases

Three varieties of tick-borne diseases are prevalent in Tennessee: ehrlichiosis, Lyme Disease, and Rocky Mountain spotted fever.

Ehrlichiosis

There are two forms of the ehrlichiosis: human monocytic ehrlichiosis (HME) and human granulocytic ehrlichiosis (HGE) which are caused by different species of *Ehrlichia bacteria*. HME is more common in Tennessee and other southeastern states; it is caused by *Ehrlichia chafeensis* and is transmitted by the Lone Star tick. HGE, more common in midwestern and northeastern states, is caused by other *Ehrlichia* species and is primarily carried by *Ixodes* ticks. Both HME and HGE are commonly characterized by an acute onset of headache, fever, myalgia, rigors and/or malaise with leukopenia, thrombocytopenia and elevated liver enzymes.

Ehrlichiosis was first recognized in Tennessee with a cluster of 11 cases in Cumberland County in 1993.[1] It was made a notifiable disease in 1997 in Tennessee; indirect fluorescent antibody serological testing has been available at the Tennessee Department of Health State Laboratory since 1998. As seen in **Figure 1**, only 13 cases were reported in the three years 1996-98, but 19 were reported in 1999 including two fatal cases. In 2000 that number more than doubled to 46. However, in 2001, less than half that number was reported.



Of the 20 cases, 16 were males and 4 were female. There were geographical and seasonal variations in Tennessee as well. The youngest case was aged 10 years; 13 cases were over 50 years of age. Fourteen of the 20 reported cases in 2001 came from the Nashville and Mid-Cumberland regions. This finding may be partially due to the availability of a research program at Vanderbilt University Medical Center, which utilizes polymerase chain reaction (PCR) and culturing to aid in diagnosing the infection.

Lyme Disease

Lyme disease is acquired from the bite of ticks infected with *Borrelia burgdorferi*, a spirochete. Immature ticks become infected by feeding on small rodents, such as the white-footed mouse, and other mammals that are infected with *Borrelia burgdorferi*. In later stages, these ticks then transmit the Lyme disease spirochetes to humans and other mammals during the feeding process. Lyme disease bacteria are maintained in the blood systems and tissues of small rodents.

Within days to weeks following a tick bite, 80% of patients will have a red, slowly

[1] Standaert SM, Dawson JE, Schaffner W, Childs JE, Biggie KI, Singleton J, Gerhardt RR, Knight ML, Hutcheson RH. Ehrlichiosis in a golf-oriented retirement community. *N Engl J Med* 1995;333:420-425.

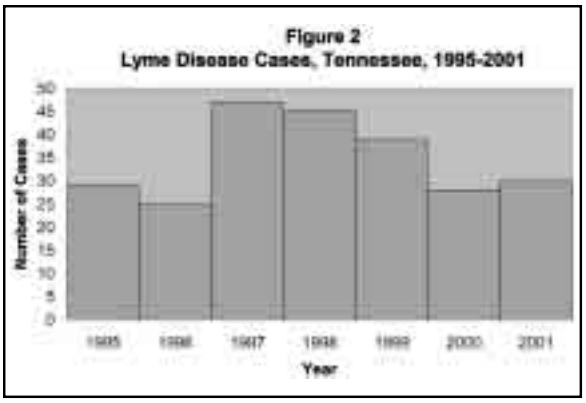
expanding "bull's-eye" rash (called erythema migrans), accompanied by general tiredness, fever, headache, stiff neck, muscle aches, and joint pain. If untreated, weeks to months later some patients may develop arthritis, including intermittent episodes of swelling and pain in the large joints; neurologic abnormalities, such as aseptic meningitis, facial palsy, motor and sensory nerve inflammation (radiculoneuritis) and inflammation of the brain (encephalitis); rarely cardiac problems, such as atrioventricular block, acute inflammation of the tissues surrounding the heart (myopericarditis) or enlarged heart (cardiomegaly).

The incubation period for the red "bull's-eye" rash (erythema migrans) is usually 7-14 days following tick exposure. Some patients present with later manifestations without having experienced early signs of disease. Lyme disease is rarely, if ever, fatal.

Lyme disease is the leading cause of vector-borne infectious illness in the U.S. with about 15,000 cases reported annually, though the disease is greatly under reported. Based on reported cases during the past ten years, 90% of cases of Lyme disease occurred in 10 states - northeastern, upper midwestern, and west coast states. Lyme disease is most common during the late spring and summer months in the U.S. (May through August) when nymphal ticks are most active and human populations are frequently outdoors and most exposed.

The diagnosis of Lyme disease is based primarily on clinical findings, and it is often appropriate to treat patients with early disease solely on the basis of objective signs and a known exposure. Serologic testing may, however, provide valuable supportive diagnostic information in patients with endemic exposure and objective clinical findings that suggest later stage disseminated Lyme disease. When serological testing is indicated, CDC recommends testing initially with a sensitive first test, either an enzyme-linked immunosorbent assay (ELISA) or an indirect fluorescent antibody (IFA) test, followed by testing with the more specific Western Immunoblot (WB) test to corroborate equivocal or positive results obtained with the first test. Although antibiotic treatment in early localized disease may blunt or abrograte the antibody response, patients with early disseminated or late-stage disease usually have strong serological reactivity and demonstrate expanded WB immunoglobulin G (IgG) banding patterns to diagnostic *B. burgdorferi* antigens. Antibodies often persist for months or years following successfully treated or untreated infection. Thus, seroreactivity alone cannot be used as a marker of active disease. Neither positive serologic test results nor a history of positive Lyme disease assures that an individual has protective immunity. Repeated infection with *B. burgdorferi* has been documented.

Tennessee reported cases of lyme disease for 2001 increased to 30 cases compared to 28 cases in 2000 **(Figure 2)**. The vast majority of patients who exhibit erythema migrans (EM) rash in the southern United States do not have positive Lyme serology or the chronic sequelae of Lyme Disease.



The illness these patients exhibit is Lyme-like disease or southern tick-associated rash illness (STARI). The initial illness is similar to Lyme disease with patients presenting with the characteristic expanding EM rash. Approximately 50% of the patients present with mild constitutional symptoms such as fever, malaise or headache. Late sequelae do not typically occur in these patients. In addition to negative serologic testing, the skin biopsies do not grow *Borrelia burgdorferi*. The tick most commonly associated with this illness is the Lone Star tick, *Amblyomma americanum*, rather than *Ixodes scapularis*, the common vector of Lyme disease. A new *Borrelia* species, *B. lonestari*, has been identified by PCR as the putative agent of Lyme-like disease. According to a recent study, the bite of an *A. americanum* can transmit *B. lonestari* to a human who then presents clinically with an illness that is considered indistinguishable from early stage Lyme disease.[1]

The Tennessee Department of Health is assisting the CDC in identifying patients with Lyme-like disease as part of an investigation to determine its etiology. Call Tracy McCauley, RN or Timothy Jones, MD, at the Tennessee Department of Health, 615-741-7247 or 1-800-525-2437, to enroll patients.

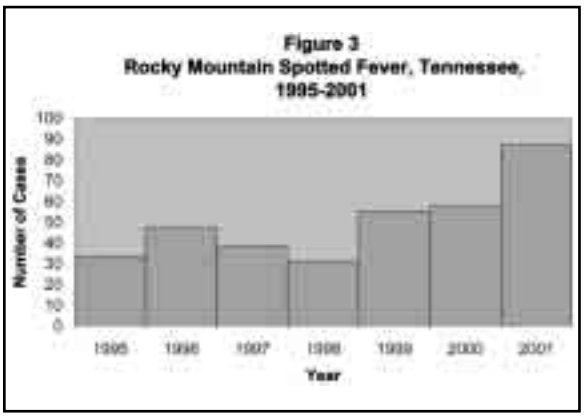
Rocky Mountain Spotted Fever

Rocky Mountain spotted fever (RMSF) is the most prevalent tickborne disease in Tennessee. In Tennessee, RMSF is transmitted most commonly by the American (or brown) dog tick, *Dermacenter variabilis*, and less frequently by the Lone Star tick (which is the most common tick in Tennessee). The illness is characterized by a variety of symptoms that almost always (99% of the time) includes a fever. Other symptoms include myalgias, headache, abdominal pains, nausea and vomiting, fatigue and a petechial rash. The rash starts out as faint maculae on the extremities, the wrists and ankles, and spreads centrally as the disease progresses. Thrombocytopenia, hyponatremia and elevated liver enzymes are common laboratory findings. The diagnosis is confirmed by a four-fold rise in antibody titers. The disease is caused by an intracellular bacterium, *Rickettsia rickettsii*, which can result in 20-25% mortality without treatment and 5% mortality in patients treated appropriately with antibiotics. Without treatment, the bacteria will continue to attack the cells lining small blood vessels which can lead to systemic disease. Manifestations of this can include cardiac and renal dysfunction, neurological problems, and gangrene in the extremities.

The majority of RMSF cases occur in the

[1] James AM, Liveris D, W ormser GP, et al. Borrelia lonestari infection after a bite by an *Amblyomma americanum* tick. *J Infect Dis* 2001; 183:1810-14.

south Atlantic and south central regions of the US with Tennessee usually in the top five reporting states. Between 28 and 87 cases of RMSF were reported during 1995 to 2001 **(Figure 3)**. In 2001, 38% of RMSF cases occurred in persons aged 0-19



years. Over 2/3 of RMSF cases are male and 94% are white; these statistics may reflect exposure factors, population composition and reporting factors. RMSF is seasonal in occurrence with over 88% of cases having onset between April and September and fewer in late season. However, in temperate climates such as Tennessee, RMSF and ehrlichiosis can occur year round.

Tick Bite Prevention and Care

The best way to prevent ehrlichiosis, Lyme disease and RMSF is to limit exposure to ticks. These insects are commonly found in the fringe regions of forests and areas of tall vegetation where they wait for hosts in the shade. When walking in wooded areas, the following precautions should be taken to avoid tick bites:

- Wear long pants and tuck pant legs into socks
- Wear light-colored clothing to better see crawling ticks
- Apply insect repellent with DEET (N,N-dimethyl-methyl-toluamide)
- Conduct a thorough body check on yourself and on children
- Do not remove ticks from pets with bare hands (you can become infected by crushing infected ticks with bare fingers)

Ticks require several hours to transmit Lyme disease, RMSF and ehrlichiosis. If an attached tick is found on the body, remove it with a pair of fine tipped tweezers by grasping the tick as close to the skin as possible and pulling steadily upwards.

Arboviral Diseases

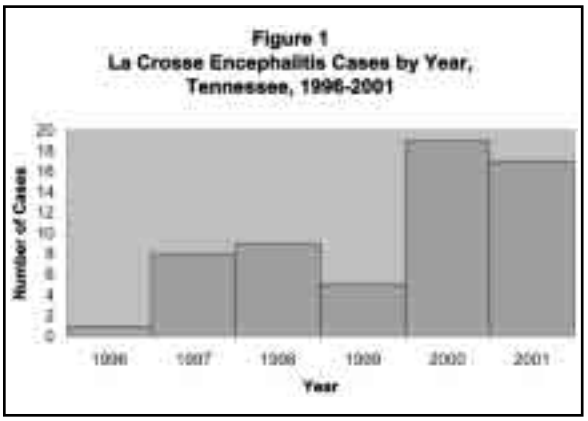
There are two classifications of arboviral diseases of concern to public health practioners in Tennessee: La Crosse encephalitis and West Nile Virus.

La Crosse Encephalitis

La Crosse virus, one of the California-serogroup viruses, is the primary cause of pediatric arboviral encephalitis in the U.S. The primary vector is the treehole mosquito (*Aedes triseriatus*). Most cases of La Crosse virus infection are asymptomatic or mildly symptomatic. Less than 1% of cases seek medical attention and are thus diagnosed and reported. Severe La Crosse virus infections can manifest as aseptic meningitis or encephalitis. Death is rare.

Since 1964, an average of approximately 73 cases of La Crosse encephalitis have been reported to the CDC each year. In recent years, West Virginia, Tennessee and North Carolina have become foci of disease. From 1964-1996, only 9 cases of La Crosse encephalitis were reported in

Tennessee.[1] In 1997, a cluster of eight cases was reported from a hospital in Knoxville.[2] Active surveillance for La Crosse encephalitis has been performed since 1997. In 2000, 19 cases of La Crosse encephalitis were reported. **Figure 1** depicts the cases reported in Tennessee from 1996-2001.



In 2000, a blinded cohort study of La Crosse encephalitis was performed in eastern Tennessee. Fifteen children with confirmed La Crosse encephalitis were compared with 25 children with similar illnesses subsequently confirmed not to be due to La Crosse virus. Demographic and clinical characteristics of both groups were similar. Persons with La Crosse had spent more hours outdoors during the period of likely exposure, and were more likely to have treeholes within 100 meters of their residence. In addition, the total burden of *Aedes albopictus* (Asian tiger mosquito) was more than three times greater around the homes of La Crosse cases compared with non-La Crosse cases. La Crosse virus has recently been identified in wild *Ae. albopictus* in Tennessee.[3,4] This mosquito, which was introduced into the United States around 1985, has spread rapidly and lives in habitats similar to *Ae. triseriatus*. *Ae. albopictus* is an aggressive biter, and may be an important new vector for La Crosse infection in this area.

La Crosse infection should be considered in patients (particularly children) with fever and signs or symptoms of central nervous system infection presenting during summer months in Tennessee. Treatment is supportive. The diagnosis can be confirmed by demonstrating a four-fold or greater change in serum antibody titer between acute and convalescent specimens, or enzyme immunoassay antibody capture in CSF or serum. Antibody testing is available free of charge at the Tennessee Department of Health State Laboratory, and can be arranged by contacting the local health department.

West Nile Virus

West Nile virus (WNV) is a mosquito-borne pathogen that can cause encephalitis (inflammation of the brain) and meningitis (inflammation of the tissue covering the brain and spinal cord) in rare instances. WNV has been found in

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1 Boyce TG, Craig AS, Schaffner W, Dermody TS. Fever and encephalopathy in two school age boys. *Pediatri Infect Dis J* 1998;17939-40.

2 Jones TF, Craig AS, Patterson L, Ussery X, Nasci R, Schaffner W. A newly recognized focus of La Crosse encephalitis in Tennessee. *Clin Infect Dis* 1998;28:93-7.

3,Gerhardt RR, Gottfried KL, Nasci RS, et al. The first isolation of La Crosse encephalitis virus from naturally infected Aedes albopictus. *Emerg Inf Dis*.2001; 7:807-11.

4 Gottfried KL, Gerhardt RR, Nasci RS et al. Temporal abundance, parity, survival rates and arbovirus isolation of field-collected container-inhibiting mosquitoes in eastern Tennessee, *Jr Amer Mosq Cont Assoc.* 2002: 18:164-172.

Europe, Africa, the Middle East and western and central Asia, being first isolated in the West Nile District of Uganda in 1937. The virus was first noted in the Western Hemisphere in 1999 when an outbreak occurred in New York City causing 62 cases and 7 deaths; since then, the virus has spread through much of the eastern United States. WNV is a member of the Flavivirus family, and is closely related to Saint Louis encephalitis and Japanese encephalitis viruses.

The virus is typically carried by mosquitoes of the genus *Culex (Cx. pipiens and Cx. restuans)* and is transferred to birds where the virus multiplies. It is then picked up by another mosquito, ready to infect other birds. This natural cycle is interrupted when a mosquito infects accidental hosts such as humans and horses. The virus does not reach adequately high blood concentrations in people or horses for it to be picked up and distributed, therefore anything but birds are dead-end hosts. Typically in an endemic area, 1 out of 500 mosquitoes carry this virus and most infected mosquito species cannot transmit the virus to people. However, with sufficiently high mosquito populations, the virus can find its way into the human population. If infected, most individuals are asymptomatic[1] but some may exhibit a number of symptoms after an incubation period of 3-15 days. These include fever (90% of symptomatic individuals), headache, nausea, muscle or joint pain and fatigue. Encephalitis or meningitis occurs in less than 1% of cases. The risk of serious disease and death is highest in patients over 50 years old. The case fatality rate ranges from 3 to 15% (defined as the percentage of hospitalized patients that die from the disease) though the overall death rate is believed to be significantly lower, less than 1%, because so many people are asymptomatic.

As seen in **Figures 1 and 2**, WNV has rapidly expanded in geographic range in the

Figure 1
WNV Activity in the US, 2001

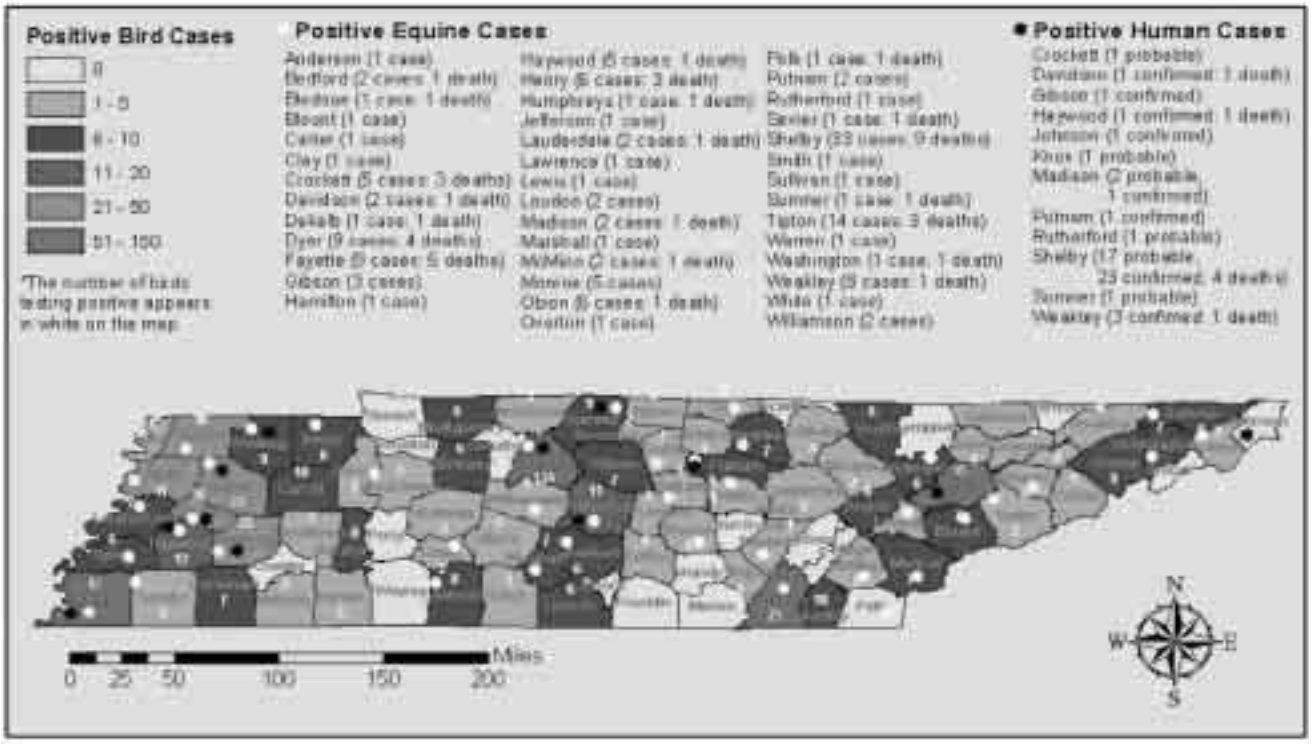
	Humans			Birds	
Year	Cases (deaths)	States	Counties	States	Counties
1999	62 (7)	1	6	4	28
2000	21 (2)	3	10	12	145
2001	66 (9)	10	39	28	358

Figure 2
States Reporting Any WNV Activity

[1] Ratio of symptomatic (hospitalized) to asymptomatic individuals ranges from 1/130 to 1/300. However, in a survey done in NYC, October 1999, 20% of seropositive individuals (in a population of 46,220) reported experiencing a mild febrile illness (not hospitalized) that could have been caused by WNV.

United States. WNV testing began in Tennessee in the summer of 2001; about 65 positive birds were found in Shelby County which was a forerunner of the WNV activity in 2002 **(map below)**. No human cases were reported in Tennessee in 2001, however one equine case was found in Jefferson County.

Distribution of Positive West Nile Virus Cases, Tennessee
Birds (N=824), Equine (N=141), and Human (N=55)
November 20, 2002



Produced by: Knox County Health Department, Epidemiology and Reporting
November 7, 2002

Section IV
Childhood Lead Poisoning Prevention Program in Tennessee

There is no reason to doubt, of course, the ability of the scientific method to solve each of the specific problems of disease by discovering causes and remedial procedures. Whether concerned with particular dangers to be overcome or with specific requirements to be satisfied, all the separate problems of human health can and will eventually find their solution. But solving problems of disease is not the same thing as creating health and happiness.

RENE' DUBOS, 1959

Lead poisoning: female carrying basins filled with washed white lead from vats to stoves, 1902

Oliver, Sir Thomas. New York: Dangerous Trades, 1902. Courtesy of the National Library of Medicine, History of Medicine Division National Institutes of Health, Bethesda,

Childhood Lead Poisoning Prevention Program

Tennessee's Childhood Lead Poisoning Prevention Program (CLPPP), funded in July 2001 by the Centers for Disease Control and Prevention, has made significant progress in the development of a statewide program.

A data management and surveillance system was initiated and refined in 2001. During the year a total of 17,630 children were screened. Those children with a blood lead level (BLL) of 10 µg/dL (micrograms per deciliter) or greater were referred for follow up for a confirmatory blood test and case management. Elevated BLLs as low as 10 µg/dl may have negative health effects, depending on the age and condition of the child. All screened BLLs were entered into a state database. The following table depicts the BLLs based on laboratory data.

Numbers of Children Screened with Resulting Blood Lead Levels, Tennessee (excluding Shelby County), 2001

Total Screened	<10µg/dL	10-14 µg/dL	15-19	≥ 20 µg/dL
17,630	17,390	117	41	80

Children ages 6-72 months are the primary target for lead screening in Tennessee. In 2001, 15,642 children in that age range were screened; 146 had a confirmed BLLs ≥10 µg/dl (0.93%).

Numbers of Children 6-72 Months of Age, with Resulting Blood Lead Levels Above Normal, Tennessee (excluding Shelby County), 2001

Total Children Screened Ages 6-72 Months	≥10 µg/dl	Percentage of screened with ≥10 µg/dl
15,642	146	0.93%

Shelby County

According to the most current census data, 29.5% or 23,455 children who live in Shelby County are below the poverty level. These children are 13 times more likely to be lead poisoned. Current screening activities in Shelby County are reaching about 38% of this high-risk population.

Numbers of Children Screened for Blood Lead Levels, with Results, Shelby County, Tennessee, 1998-2001

Year	Children Screened	≥10µg/dl	Percentage of screened with ≥10 µg/dl
1998	8,391	1,007	12.08%
1999	9,140	917	10%
2000	13,925	716	5%
2001	13,051	614	5%

As more screening data are collected, the true picture of lead poisoning will appear. Presently, the children at highest risk are not being tested. Analysis of national data has shown that although childhood lead poisoning occurred in all population groups, the risk was higher for persons having low income, living in older housing,

and belonging to certain racial and ethnic groups. For all income levels, non-Hispanic black children had a greater risk of elevated BLLs than white children; the disparity was even greater for black children living in families below the poverty line. National studies show children enrolled in Medicaid had three times the prevalence of elevated BLLs compared to non-Medicaid children.

Despite the success achieved, lead poisoning remains a preventable environmental health problem in the United States. Tennessee's CLPPP program is dedicated to eliminating childhood lead poisoning. It is the intent of the program to ensure that lead-poisoned infants and children receive medical and environmental follow-up. To this end, the program aims to increase the number of reported screenings by 25% by June 2003. The Tennessee Medicaid managed care progam (TennCare) screenings are essential to meeting this objective. Strong emphasis is being placed on the identification of underserved and at-risk populations and the development of awareness campaign efforts to prevent childhood lead poisoning. The Centers for Medicaid and Medicare Service have determined that young children who receive Medicaid benefits constitute 60 percent of the total population with "elevated blood levels at or above the recognized level of concern (10 µg/dL)." Of children nationwide, this same Medicaid population of children produces 83 percent of children who require individual follow up.To reach the objective of *Healthy People 2010* of eliminating elevated BLLs in children, screening efforts must be increased.

Section V
Tuberculosis

Public health is purchasable. Within natural limitations a community can determine its own death rate.... No duty of society, acting through its governmental agencies, is paramount to this obligation to attack the removable causes of disease.

Dr. Hermann Biggs, New York State Commissioner of Health, 1913

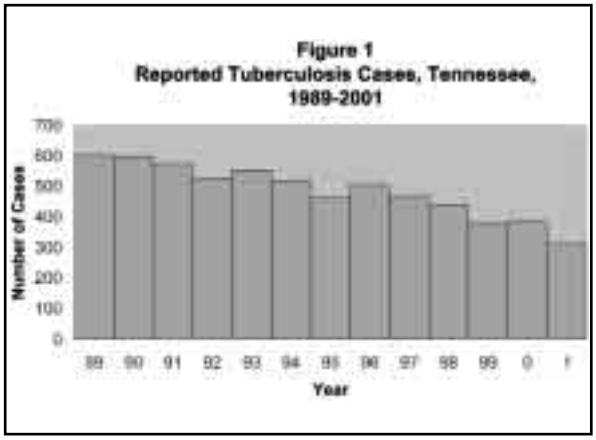
Group of tents used as housing units for consumptive patients; several men are sitting on chairs in front of the tents. United States Army, Fort Stanton Sanatorium, Arizona

Courtesy of the National Library of Medicine, History of Medicine Division National Institutes of Health, Bethesda, MD.

Tuberculosis

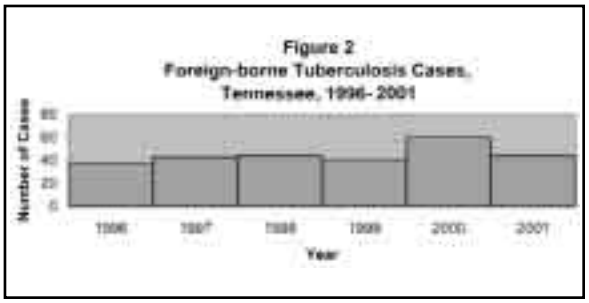
Tennessee reported 313 cases of tuberculosis (TB) in 2001, representing a decrease of 18.5% compared with the 383 TB cases reported in 2000. The corresponding TB case rate of 5.5 per 100,000 population is the lowest ever recorded for the state and is below the national 2001 case rate of 5.6 cases per 100,000 population.

Tennessee's two largest metropolitan areas have the highest burden of TB disease in the state, with Memphis/Shelby County reporting 79 cases (8.8 per 100,000 population) and Nashville/Davidson County reporting 67 cases (11.9 per 100,000 population) for 2001. The Centers for Disease Control and Prevention (CDC) ranked Tennessee the 16th in the nation according to TB case rates and 8th according to the number of TB cases. **Figure 1** illustrates the steady decline of TB morbidity in Tennessee from 1989 through 2001.



Of the 313 cases reported in 2001, 44% were found in non-Hispanic Whites, 44% were found in non-Hispanic Blacks, 7% were found in Hispanics (all races) and 5% were found in "other" races. TB case distribution by sex indicates that males accounted for 65% of the total morbidity.

During the past five years, the percentage of TB cases occurring among foreign-born persons and the demographics of those cases have changed remarkably. These changes reflect both the prevalence of TB globally and immigration trends in Tennessee. The total number of foreign-born cases is illustrated in **Figure 2**. The increasing number of foreign-born cases



has prompted the Tennessee TB Elimination Program to implement a Targeted Testing and Treatment Initiative to identify and treat members of this population for latent TB infection (LTBI).

Since March 1, 2002, regional and metropolitan TB programs throughout Tennessee have been providing education and screening for LTBI or TB disease for foreign-born persons both at local health departments and in the community. In the first four months of the initiative, over 3000 foreign-born persons were provided education and screening for LTBI. Approximately 38% of these were diagnosed with LTBI, and five cases of active TB were detected. New standards for evaluation and treatment of both TB disease and LTBI have also been implemented statewide and should result in improved quality of care for all persons who receive services from the Department of Health.

The availability of drug susceptibility results provides guidance in the establishment and maintenance of appropriate drug treatment regimens. During 2001, 93% of all culture positive cases in Tennessee had initial drug susceptibility tests performed, a proportion that is slightly lower than the level of susceptibility testing achieved in 2000 (98%). Therefore, in 2002 the TB Elimination Program will strive to obtain drug susceptibility testing on all culture-positive TB cases. The incidence of drug-resistant tuberculosis continues to decline in Tennessee. In 2001, there were no reported cases of multi-drug resistant tuberculosis (MDR-TB), defined by CDC as those cases with organisms resistant to at least isoniazid and rifampin. However, a total of 8% of TB cases reported in Tennessee in 2001 had resistance to at least one TB medication including 4% of TB cases with initial isoniazid resistance. Therefore, the CDC, the Tennessee Department of Health and the Tennessee TB Advisory Committee strongly recommends that all patients diagnosed with active TB begin treatment with at least four first-line TB medications (usually isoniazid, rifampin, pyrazinamide and ethambutol) pending the results of drug susceptibility testing.

The treatment of TB disease is complicated and is typically prescribed for a duration of six to nine months. Directly observed therapy (DOT) is an essential tool, which is utilized to enable monitoring for potential toxicity and ensure adherence. In Tennessee and the United States, DOT is recommended as the standard of care for all patients with TB disease. In 2001, approximately 43% of TB cases reported in Tennessee received strict DOT, 46% were treated with a combination of DOT and self-administered therapy, and only 6% of patients were allowed completely self-administered therapy. In 2002, the Tennessee TB Elimination Program plans to increase provider and patient awareness of the benefits of utilizing DOT throughout the duration of TB treatment.

Section VI
Investigations and Outbreaks in 2001 in Tennessee

It is in health that cities grow; in sunshine that their monuments are built. It is in disease that they are wrecked; in pestilence that effort ceases and hope dies.

Annual Report of the Commissioner of Health, Milwaukee, 1911

Examination, in New Orleans, of rats suspected of carrying bubonic plague, 1914 United States Public Health Service

Courtesy of the National Library of Medicine, History of Medicine Division
National Institutes of Health, Bethesda, MD

Investigations and Outbreaks in Tennessee in 2001

The following section presents significant investigations and disease outbreaks that highlight efforts of the Communicable and Environmental Services Section (CEDS) in conjunction with health department personnel from across the state over the past year. The investigations and outbreaks illustrate the importance of both the burden of illness for the patients/families involved as well as the work that takes place in public health in preventing disease. They also show the variety of problems seen, and the investigation strategies utilized, by public health professionals on a regular basis. Publication of findings can lead to the prevention of future outbreaks that have the potential to harm large numbers of people.

A Hepatitis Outbreak at a Hazardous Waste Recycling Plant

In January 2001, physicians from an emergency room at a hospital in Memphis reported treating several patients with elevated liver enzymes, nausea, and vomiting, possibly caused by chemically induced hepatitis. All of the patients were workers who had responded to a fire at their place of work, a plant that stores, treats, and disposes of solid and liquid waste under the Resource Conservation Recovery Act. The apparent outbreak was reported to the Memphis-Shelby County Health Department, Bureau of Environmental Services. The Tennessee Department of Health assisted with portions of the outbreak investigation.

Early on January 16, 2001, a fire occurred in a building at the plant. Vapors escaped from a shredding machine and were ignited by a nearby propane forklift which was not equipped with the proper safety device. The fire quickly spread to adjacent areas that contained an accumulation of volatile organic liquid. The local fire department was called but by the time firefighters arrived, employees had extinguished the fire.

A liver specialist at the university medical center interviewed and tested most of the employees one week after the fire. Of 110 employees, alanine aminotransaminase (ALT) levels were obtained on 91 (81.7%) within three weeks. Of these 91 employees, 85 (93.4%) were interviewed.

Cases of hepatitis were defined as an ALT level greater than 1.5 times the upper limit of normal, 50 International Units (IU). Forty-four (44%) of the 91 employees were identified as cases from January 17, 2001, through February 7, 2001. Eight employees had ALT levels higher than 1000 IU. At the last testing in April 2001, ALT levels had returned to normal in 24 of the 40 cases. ALT levels were decreasing, but not normal in 13 cases.

Preliminary results showed that of the 85 employees interviewed, 28 (33%) were ill. The most common symptoms were nausea (82%), vomiting (57%), eye irritation (46%), abdominal cramps (43%), headache (43%), dizziness (32%), and diarrhea (25%). Onset of symptoms occurred within one week of the fire and resolved within five days. The risk of having an abnormal ALT level was 29.73 ($p<0.05$) working in the building where the fire occurred. Of the

36 employees in the building where the fire occurred, 33 (92%) were among the cases with high ALT levels. Of the 20 administrative, transportation, laboratory, dock, and hazardous material dump workers, only two working at the receiving dock were cases.

It appears that hepatotoxic substances in the building injured these workers in mid-January 2001. The immediate cause of the injury was the fire in the building on January 16, 2001, which appeared to facilitate the exposure of the workers to solvents. No one solvent could be implicated. The combination of a fire involving solvents and the increased temperature in the building may have facilitated the inhalation of the solvent. It also appears that inconsistent use of personal protective equipment, especially respirators, may have contributed to the exposures. The Tennessee Occupational Safety and Health Agency assisted with the investigation and wrote recommendations to prevent future incidents.

Aseptic Meningitis Outbreak Associated with Echovirus 13

In May 2001, an infectious disease physician and an infection control nurse at a hospital in Memphis noticed an increase in the number of admissions for aseptic meningitis. They requested that the Memphis/Shelby County Regional Health Department and the Tennessee Department of Health, Communicable and Environmental Disease Services section assist them with an investigation.

Aseptic meningitis results in characteristic symptoms and cerebrospinal fluid changes but with negative bacterial cultures. It is usually viral in origin. Initial isolates of cerebrospinal fluid from the patients in this outbreak revealed an Enterovirus, primarily echovirus type 13. There are 28 types of echoviruses; types 30, 11, 6, and 9 are most commonly associated with recent outbreaks in the United States. The predominant type changes yearly.[1]

Enteroviruses are spread via the fecal-oral route and patients can shed the virus in their stools for up to six weeks. Risk factors include inadequate handwashing in situations with close personal contact such as day care settings.

The investigation revealed that between April 15 and July 15, 2001, there were over 200 cases of laboratory-confirmed or suspected viral meningitis. Of these cases about 75 patients had enterovirus detected in CSF or stool.

These specimens were subsequently sent to the Tennessee Department of Health State Laboratory. Of these, 33 were identified as echovirus 13 based on neutralization using pooled antisera. Twenty-four (72.7%) of the echovirus 13 specimens were from CSF and 9 (27.3%) were from stool. These 33 patients, mostly children, were admitted or examined in the emergency department between April 27 and July 15, 2001. Twelve (36.4%) of these patients were female and 21 (63.4%) were male. The age range was from 16 days to 14 years,

[1] Centers for Disease Control and Prevention. Echovirus 13-United States 2001. *MMWR* 2001;50:777-80.

with the exception of one 46-year-old male outpatient. Fifteen (45.5%) of the patients were ≤3 months, none were 4 to 11 months, 17 (51.5%) were 1 to 14 years, and one (3%) was ≥15 years. Further, the hospitalization rate for black children was over twice that for white children.[2]

Echovirus 13 is an emerging pathogen. It has rarely been detected in the United States, accounting for only 65 of approximately 45,000 enterovirus isolates submitted to CDC during 1970-2000. It was associated with outbreaks in the United Kingdom and Germany in 2000; in 2001, several outbreaks of echovirus 13 were reported in the United States. The chart depicts the extent of the size of the outbreaks and compares numbers of cases in Tennessee with those in other southern states.

Aseptic Meningitis Outbreaks, 2001

State	Cases Aseptic Meningitis	Echoviris 13 Isolates
Tennessee	289	33
Louisiana	27	8
Mississippi	52	3

Public Health Impacts of EPA Removal Lead-Contaminated Battery Chips In and Around the College Grove Community

In the summer of 1999, the Division of Environmental Health Studies and Services, Tennessee Department of Health, and the Agency for Toxic Substances and Diseases Registry, carried out an exposure investigation to determine blood lead levels of children exposed to lead-contaminated battery chips in and around the College Grove community, Williamson County, Tennessee. Many years ago the local secondary lead smelter gave away chipped battery casings to be used as fill or paving material. Concentrations of lead in areas with battery chips ranged from 254 parts per million (ppm) to 48,000 ppm. The conclusion of the exposure investigation was that there was no community-wide elevation of blood lead levels in and around the College Grove community.

The U.S. Environmental Protection Agency (EPA) Region IV began emergency clean up or containment of lead contaminated areas. Priority for clean up or containment was based on the concentrations of lead found at a site, the presence of young children, and blood lead levels of children living at the site.

On May 22, 2001, in the Rockvale community near College Grove, an eight year old child's blood lead level was found to be 23.1 micrograms per deciliter (mg/dL) of blood. The source of the lead was thought to be battery chips on the family farm, mainly in front of the barn. EPA was notified and began removal of the battery chips in early July 2001. See the table for results of further blood lead testing.

The child was autistic and loved to play in the soil in front of the family barn. He chewed and sucked on the battery chips quite often. The maximum concentration of lead in front of the barn was 18,200 ppm. Except for removal of the battery chips, the child's environment remained the same.

[2] Kirschke, DL, Jones TF, Buckingham SC, Craig AS, Schaffner W. Outbreak of aseptic meningitis associated with echovirus 13. *Pediatr Infect Dis J* 2002; 21: 1034-8.

Blood Lead Levels in 8-Year Old Child

Date	Blood lead level (mg/dL)
May 22, 2001	23.1
July 17, 2001	21.8
October 16, 2001	16.7
January 15, 2002	11.6

The parents of the child were well-educated about the dangers of lead to children and in ways to minimize exposure to lead-based paint. The other child in the family did not have elevated blood lead levels. The parents were unable to prevent the child under discussion from chewing and sucking on objects in his environment, despite their best efforts. At a visit to the home on October 24, 2001, ATSDR provided the family with educational material about lead exposures and approved methods of lead-based paint removal and EHSS provided the family with a box of LeadCheck swabs.

This incident provides evidence that EPA clean up activities resulted in positive public health impacts when a child was exposed to battery chips and contaminated soil in a manner that exposed him to lead.

Pesticide Exposure, Winchester, Franklin County, Tennessee

Saturday, August 18, 2001, a maintenance worker employed by the owner of a building sprayed for pests. Sunday, August 19, 2001, the janitor for the building found puddles of chemicals on the tile floor and a very strong odor. He mopped up the puddles. Monday morning, August 20, 2001, employees noted a very strong odor and began experiencing symptoms. Their supervisor told people to go home or to work outside the office.

Tuesday morning, August 21, 2001, the odor was still very strong. The owner of the building brought in fans in an attempt to air out the building, cleaned the carpets with a mixture of lemon juice and ammonia, and stripped the tile floor with an ammonia-based stripping agent. Some employees left the building. Thursday, August 23, 2001, an inspector for General Environmental Health said that people should not work in or enter the building.

It was unclear which pesticide the maintenance worker used. He said that he sprayed with Enforcer II, a synthetic pyrethrin. An inspector with the Department of Agriculture took wipe samples throughout the building and had them analyzed at the laboratory in Department of Agriculture. Sampling results did not show the presence of a synthetic pyrethrin, but did show varying levels of the pesticide, chlorpyrifos. Chlorpyrifos is a type of pesticide called an organophosphate pesticide. In parts of the building, the levels of chlorpyrifos were above levels of health concern.

More than 50% of employees had trouble breathing, weakness, confusion, cough, headache, and drowsiness. More than 25% of employees also experienced excessive tearing of the eyes, diarrhea, fast heart rate, depression, agitation, blurred vision, numbness in the arms and legs, tingling in the arms and legs, and rashes.

The enzyme, cholinesterase, is necessary for proper functioning of the nervous system. Exposure to organophosphate pesticides inhibits this enzyme. The inhibition of the enzyme is responsible for the symptoms associated with exposure. A medically significant exposure to an organophosphate pesticide would cause at least a 20% inhibition of cholinesterase from a person's normal level. After a significant exposure, enzyme levels remain inhibited for two to three weeks. Levels return to normal after about six weeks

On September 10, 2001, the Health Officer of the Southeast Regional Health Department met with employees to explain the health effects of exposure to chlorpyrifos. That day, blood samples were drawn to test each employee's cholinesterase level. Since the normal cholinesterase levels vary among people, taking another blood sample after enough time for the cholinesterase levels to return to normal was necessary. Repeat blood draws were done on October 8 and 9, 2001.

Employees were exposed to chlorpyrifos, an organophosphate pesticide, and experienced symptoms associated with exposure. However, no one had a 20% decrease in cholinesterase activity with exposure. This means that, although people had symptoms, the exposure was not great enough to cause severe health problems.

Cluster of Hospitalizations for Penicillin-sensitive S. aureus Joint and Soft Tissue Infections Associated with Local Injection by a Single Physician

On August 21, 2001, the Tennessee Department of Health was notified that a hospital had reported a cluster of admissions of *S. aureus* joint and soft tissue infections. These were thought to be associated with joint or soft tissue injections by a single physician. There were six patients involved from three states, two of whom were from Tennessee. The results of the ongoing investigation are as follows. Between August 18 and August 20, five patients were admitted to a hospital with joint or soft tissue infections, four of which were found to be penicillin-sensitive *S. aureus*. The culture on the fifth was negative, but the patient was treated with antibiotics for several days before admission. A sixth patient was admitted to a hospital in a neighboring state during the same time period with cellulitis, however, no cultures were performed at the site of infection.

The age range of the patients was 25 to 77 years. Four of the patients were female and two were male. All of these patients had received local injections of triamcinolone and lidocaine at the site of infection by a physician between August 14 and August 17. During this period, the physician performed 10 injections using single dose vials of triamcinolone (attack rate = 60%). Of these, seven also involved the use of multi-dose vials of lidocaine (attack rate = 86%).

Penicillin-sensitive *S. aureus* is a relatively uncommon pathogen and is estimated to comprise only 3-5% of clinical isolates. The physician reported treating a patient in his office on August 7 for a hand abcess, which was positive for penicillin-sensitive *S. aureus*. This patient did receive an injection of triamcinolone as well, but not at the site of infection.

The physician initiated active surveillance for new cases, but besides identifying the case from a neighboring state, no new cases were found. One patient died during hospitalization; two other patients required arthroscopy with irrigation and debridement.

The physician closed his practice for several days, during which time the office was cleaned. He was advised to discard all opened supplies used for any procedure, including opened lidocaine or triamcinolone vials. Other recommendations included discontinuing the use of multi-dose vials in favor of single dose vials, with strict adherence to sterile technique during procedures, including hand washing, gloving, and masking.

The physician was a nasal carrier of *S. aureus*. This bacterium is fairly common, with carriage rates of 20 - 30% in the general population. Cultures of the clinic staff, opened and unopened vials of lidocaine and triamcinolone, and the clinic environment were all negative. Unfortunately, the putative multi-dose vial of lidocaine that was used for the six patients was not available for testing. Further testing, including pulsed-field gel electrophoresis was carried out to try to determine the relatedness of all strains collected during the investigation. The *S. aureus* from the four patients who had isolates were all indistinguishable by PFGE; the physician's isolate was different.

To date, no further cases have been reported and the remaining patients are reported to be recovering.

Cryptosporidiosis in Veterinary Technician Students - An Annual Rite of Passage

Cryptosporidiosis parvum is a protozoan parasite, which causes cryptosporidiosis. It can survive outside the body for a long period of time and has emerged as a significant cause of human diarrheal disease in the past decade. Though it has been an important cause of illness in developing countries since the 1970s, it is now recognized as an increasing threat in the United States. Cryptosporidiosis has been reported as a cause of commonly occurring "scours" or diarrhea in calves. Direct zoonotic transmission of this disease (from animal to human) has been reported, though uncommonly.

In October 2001, the Tennessee Department of Health received a report from a local community college about an outbreak of diarrhea among veterinary technician students who were members of a course on livestock management. Student activities included feeding, grooming, and taking rectal temperatures on calves three or more days per week. The principal instructor reported that similar outbreaks occurred each fall among students in his class shortly after the arrival of the calves. Tennessee Department of Health epidemiologists were requested to carry out an investigation of the outbreak.

Students were interviewed regarding gastrointestinal illness and exposure to calves cared for by the class. Human and bovine stools were cultured for *Salmonella, Shigella, Campylobacter*, and *E. coli* 0157. All stools were also examined for parasites by standard microscopic tech-

niques and for *Cryptosporidium parvum* and *Cyclospora cayetenesis* by direct fluorescent antibody (DFA). Three calves had been replaced due to severe diarrhea before their stool could be examined.

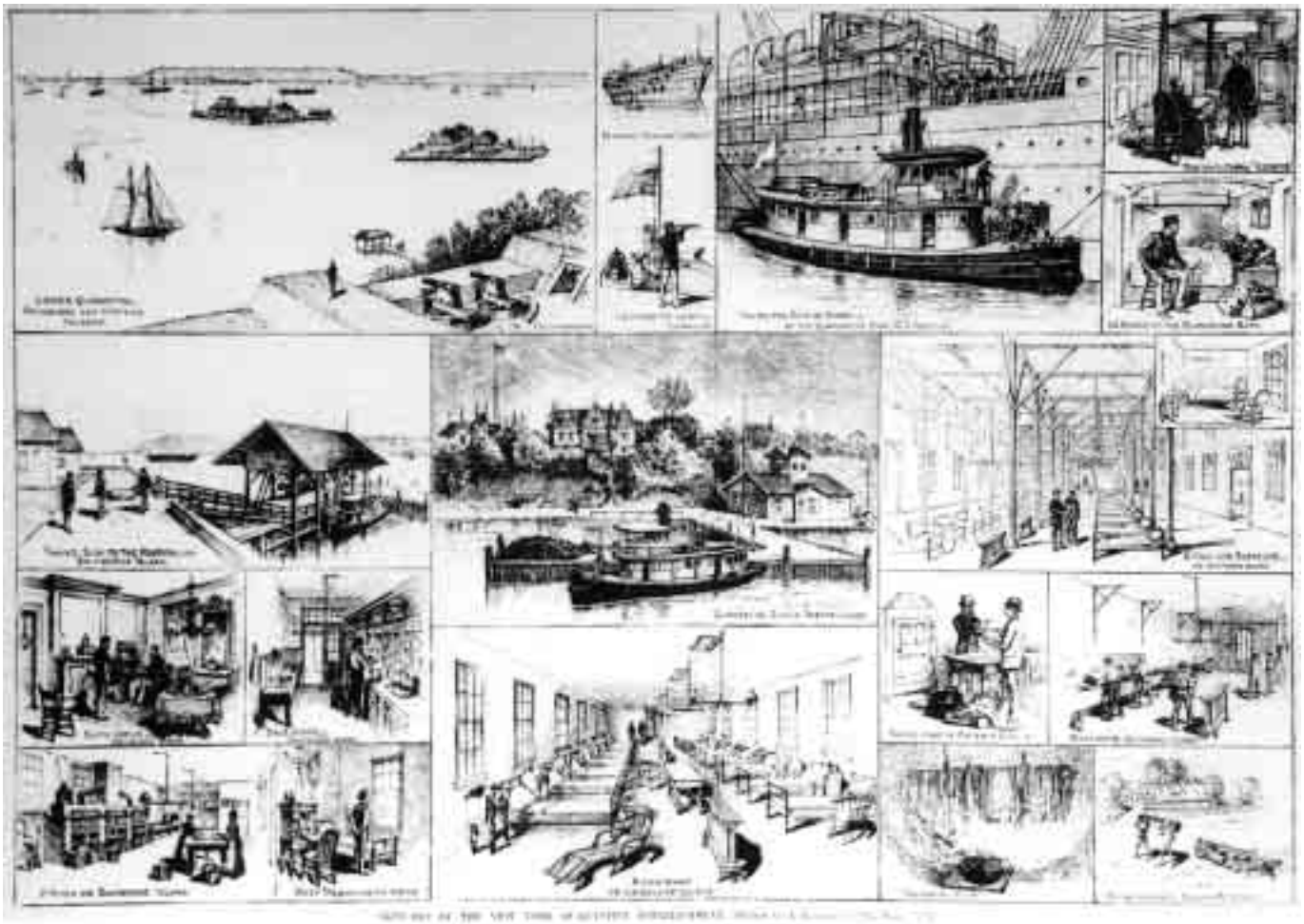
In the course of the investigation, 21 (95%) of 22 class members was interviewed. Fifteen (71%) of 21 students reported diarrhea. The average duration of diarrhea was eight days. Six sought medical attention for their illness; none were hospitalized. Stool cultures were collected from 10 (67%) of the ill students and from 9 (64%) of 14 calves; all cultures for bacterial pathogens were negative. However, three students were DFA positive for *Cryptosporidium parvum*, as was one calf. Five calves were DFA positive for *Giardia lamblia*. There was no statistical association between diarrhea and eating or drinking in the barn or hand washing habits.

Investigators determined that it was likely that the students contracted the *Cryptosporidium* infection via the fecal-oral route due to poor hygiene. They recommended that this annual rite of passage for students could be prevented by wearing overalls, boots and gloves, particularly when caring for ill calves, along with adherence to meticulous hand washing after class.

Section VII
Continuing Public Health Challenges

There is a chain that runs from the behavior of cells and molecules to the health of populations and back again, a chain in which the past and the present social environments of individuals and their perceptions of those environments constitute a key set of links. No one would pretend that the chain is fully understood, or is likely to be for a considerable time to come. But the research evidence currently available no longer permits anyone to deny its existence.

Why Are Some People Healthy and Others Not? Robert Evans, Morris Barrer, and Theodore Marmor, 1994



A group of 17 vignettes of various scenes depicting the treatment and care of sick persons, views of the facilities, boats, and burial grounds, at the quarantine stations at Swinbourne, Hoffman, and Staten Islands, New York City. Harper's Weekly, 31, October 8, 1887, 733.

Courtesy of the National Library of Medicine, History of Medicine Division
National Institutes of Health, Bethesda, MD.

The Challenge of Bioterrorism

Prior to the fall of 2001, the probability of a mass-casualty terrorist attack on U.S. civilians was considered implausible. However, in the aftermath of the September 11th World Trade Center attack and the anthrax attacks that followed, the true capabilities of terrorist organizations were realized. In addition, Tennessee and other states were faced with the inadequacy of their own levels of preparedness. These shortcomings ranged from lack of physician familiarity with the clinical signs of bioterrorism agents to the inability to receive, stage, and deploy the assets of the National Pharmaceutical Stockpile following release of a biologic agent.

In March of 2002, the Communicable and Environmental Disease Services section (CEDS) was granted $20 million dollars in supplemental federal funding, earmarked for public health and hospital preparedness and response to bioterrorism. The receipt of these funds represents both an opportunity and a challenge to CEDS to improve the overall ability of Tennessee's public health infrastructure. The expenditure of these monies -of which a large percentage will be used for regional and local preparedness — is to ensure adequacy in state, regional, and local preparedness to respond to bioterrorism, infectious disease outbreaks, and other public health threats and emergencies.

Of these monies, $17.6M came from the Centers for Disease Control and Prevention (CDC) for upgrades to state and local public health jurisdictions with the remaining $2.4M coming from the Health Resources and Services Administration (HRSA) for hospital preparedness activities. It is worth noting, however, that bioterrorism preparedness activities in Tennessee had been ongoing well in advance of this supplemental funding.

Public Health Preparedness

Following the identification of the first anthrax case in October 2001, Tennessee joined the rest of the nation in generalized anxiety about possible anthrax exposures and vulnerabilities. From October 1 to December 31, 2001, the Tennessee Department of Health State Laboratory tested nearly 1100 suspicious items for potential bacterial bioterrorist agents in addition to several hundred specimens taken from Tennessee post offices. Fortunately, all submitted specimens tested negative for potential bioterrorist agents. However, such an upswing in submissions stretched the state's laboratory resources to the limit. Laboratory personnel worked 10 to 18 hours per day, seven days per week to accommodate the demand for testing.

Despite personnel hiring freezes statewide, the Department was authorized to hire eight microbiologists to meet the increasing demands of the laboratory. Enhancements to the laboratory's diagnostic capabilities are planned and include the expansion of PCR and PFGE methodologies from the Nashville Department of Health Central Laboratory to the Knoxville, Jackson, and Memphis branches. Also under construction is an expanded bio-safety level three laboratory section to improve the laboratory staff's ability to work with potentially more virulent organisms like tularemia,

multidrug resistant tuberculosis, and anthrax.

In December 2001, the Department was authorized to hire 13 epidemiologists in order to enhance epidemiologic capacity within the metropolitan and regional health departments. The principal responsibilities of these epidemiologists are to enhance regional disease surveillance activities, especially for 24/7 reporting and evaluation of syndromes that might be indicative of exposure to bioterrorist agents or other possible outbreaks. At this writing, all of these positions have been filled.

The CDC-related supplemental funds have been utilized in a number of activities aimed at the overall goal of enhancing Tennessee's capacity to detect and respond to bioterrorism and to other infectious disease outbreaks. To augment the capacity of traditionally understaffed regional health departments to respond to public health emergencies, each of the regional and metropolitan health departments is hiring five new public health positions. These positions generally include a public health nurse, a public health physician, an emergency response coordinator, a network communications specialist, and an epidemiologist. Their addition to regional health department ranks will allow for more vigorous public health responses to everything from West Nile virus cases, to community tuberculosis treatment and outreach, to response to a bioterrorist event.

Completion of high-speed internet access to all 95 county and 13 regional health departments was completed in June 2002. Personal computers and other hardware and software have been purchased and installed to increase staff access to e-mail and the internet to foster high-speed communications capabilities. In the event of communications failures during an emergency, redundant communications systems, including e-mail, beepers, cell phones, faxes, and HAM radios, are being put into place. CEDS has also invested in a TEMA-maintained, computerized call-down system upgrade for broadcast emergency notification of key public health personnel across the state. These enhancements will not only augment public health personnel's ability to communicate amongst themselves, but will improve communications with hospitals, EMS, emergency management agencies, and law enforcement.

With an emphasis on all-hazards planning, each regional and metropolitan health department has begun an assessment of emergency response capacity at the county level. Regional emergency response coordinators will work with local emergency planning committees and regional emergency planning committees to develop integrated county and regional bioterrorism response plans. A high priority in the development of these plans is the inclusion of detailed plans concerning the receipt, staging, storing, and distribution of the National Pharmaceutical Stockpile assets. Additionally, regional emergency response coordinators will work with regional epidemiologists to evaluate past and future domestic preparedness assessments.

Each regional health department has been

charged with developing a system to identify disease clusters by syndrome and will assist disease investigators to quickly detect a possible outbreak of a BT agent on a 24/7 basis. Such systems, called aberration detection programs, are already in place at the metropolitan Knox County and Davidson County health departments. In these systems, multiple sources, including 911 call centers, hospital emergency departments, and school attendance offices, deliver data on a daily basis to health department epidemiologists. Health department staff would utilize SAS computer programs to compare daily changes in designated symptoms to a historical average for that given date. Knox County's health department also examines daily attendance reports from several local schools to identify unusual rates of absenteeism. In 2001, the Metropolitan Davidson County Health Department established their own aberration detection project. It is expected that each regional health department will have established one such system and will actively work to spread to other data sources within their jurisdictions.

It is important that health care providers be able to identify unusual patterns or signs of disease. For this reason, a poster differentiating chickenpox from smallpox was recently distributed to hospital emergency departments and to the offices of dermatologists across the state. Plans include delivery of the same poster to every primary physician in the state of Tennessee. Quick clinical identification is important in ensuring prompt reporting to appropriate public health officials. In turn, this will translate into timely public health response.

Another activity taking place to increase disease surveillance and epidemiologic capacity is the expansion of FoodNet to all microbiology laboratories in Tennessee. In existence in Tennessee since January 2000, FoodNet is a collaboration between CDC and ten sites across the United States, designed to carry out active surveillance for nine foodborne pathogens. From 2000 to present, this program has performed hospital-based surveillance in the four large metropolitan areas (Chattanooga, Knoxville, Memphis, and Nashville), 50% of the state's population and allowed estimation of the amount of foodborne illness in Tennesse.

Also worthy of note is the focus of emergency response plans on risk communication and health information dissemination. In a public health emergency, such as the identification of a case of smallpox, the overwhelming number of people rushing to emergency rooms, hospitals, and their doctors will be the "worried well" with the likely result of overwhelming our health care systems. Collaboration between health educators, emergency response coordinators, public information officers, and the media are underway to develop these risk communication tools. Plans will also need to include reaching traditionally underserved groups including minorities, non-English speakers, and the homeless populations.

Hospital Preparedness

The Tennessee Department of Health received a $2.4 million grant from the Department of Health and Human Services, Health Resources and Services

Administration for a Bioterrorism Hospital Preparedness Program. These grant funds are to be used to upgrade the ability of hospitals and other health care entities to respond to bioterrorist attacks and other outbreaks of infectious disease.

A Hospital Advisory Committee composed of health care representatives and governmental entities has been established to oversee the development of a multitiered system in which local health care entities are prepared to triage, isolate, treat, stabilize and refer multiple casualties of a bioterrorist incident to identified regional referral centers. In cooperation with the Tennessee Hospital Association, the Tennessee Department of Health has developed six regions based on the normal referral pattern of patients to the medical centers in each region.

The Tennessee Department of Health has contracted with General Physics Corporation to conduct a hospital survey by February 2003 that will assess the hospitals' preparedness to respond to a bioterrorism attack. After the final survey results are presented to the Department of Health, General Physics will develop six regional bioterrorism response plans by May 2003. General Physics will facilitate hospitals in collaboration with regional/metropolitan heath departments and other health care entities to develop these regional plans to enable health care entities to respond to incidents requiring mass immunization, treatment, isolation, and quarantine in the aftermath of a bioterrorism attack or other outbreaks of infectious disease. Once the plans are developed, General Physics will conduct six regional tabletop exercises by August 2003 to test the plans and the capability of the health care entities in each region to provide care to the people in their communities after a bioterrorism attack. The information from the survey, regional planning and the tabletop exercises will be used to update the Tennessee Department of Health Bioterrorism Response Plan.

The Future

In summary, the threat of harm to the citizens of the state of Tennessee and the United States in the past brief years has been utilized to build a stronger and more robust public health infrastructure that will help ensure a healthy tomorrow. As a result of the emotional and financial devastation perpetrated by terrorists on the citizens of the United States, the public health system has responded by strengthening both physical and personal capacities to respond to health care problems that will most certainly face us in the years ahead.