Tennessee Department of Health

Communicable and Environmental Disease Services

2003 Annual Report

Tennessee Department of Health

Communicable and Environmental Disease Services

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Communicable and Environmental Disease Services Section
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Communicable and Environmental Disease Services

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Available electronically at the Tennessee Department of Health website. Click on Programs, and then click on Communicable and Environmental Disease Services.
http://tennessee.gov/health

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

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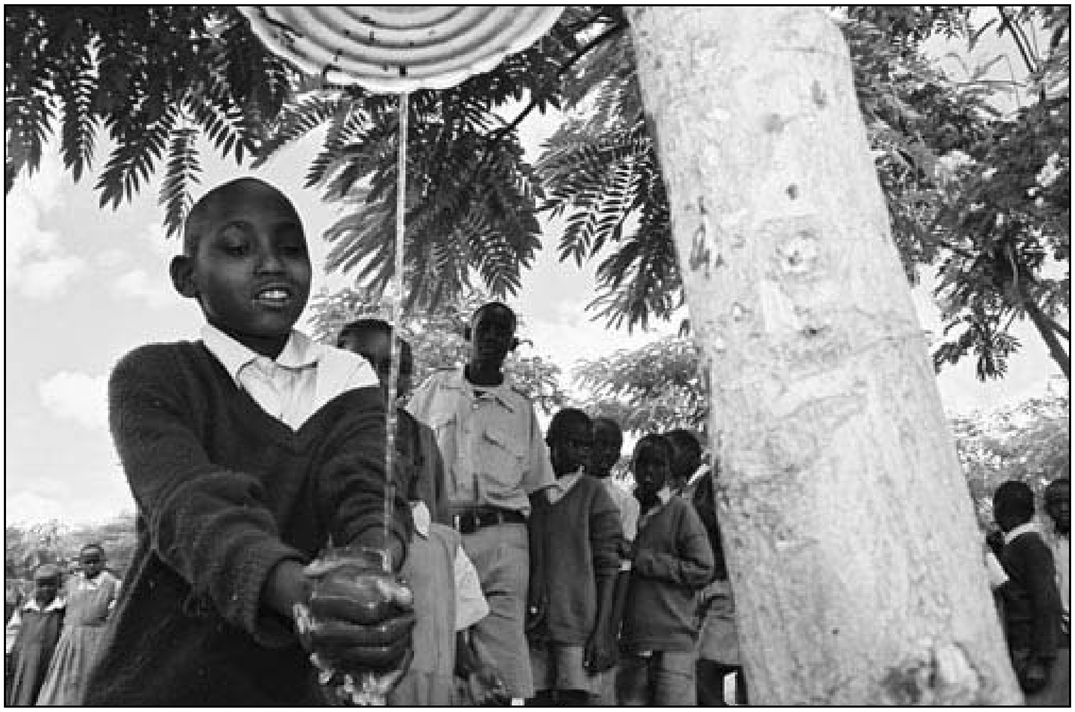
Section I
Introduction

While it is important for public health to provide information to facilitate better health decisions by individuals for themselves and their families, the big challenge is to develop social interventions that will change societal patterns of unhealthy behavior and promote healthy ones.

"Common Values: An Overview", The Future of Public Health, page 16



According the World Health Organization, more than 5 million children under the age of five years die each year from illnesses and other conditions caused by the environments in which they live, learn and play. Acute respiratory infections and diarrhea account for two-thirds of those child deaths. The simple act of washing one's hands with soap and water for 10-15 seconds could reduce this number by half.

Source: PHASE, GlaxoSmithKline

A. Purpose of Report

Communicable and Environmental Disease Services (CEDS) is one of the thirteen divisions of the Bureau of Health Services, within the Tennessee Department of Health. The twelve other divisions in the bureau include the following: Nutrition, Community Services, General Environmental Health, Maternal and Child Health, HIV/STD, Medical Services, Fiscal Services, Cost Allocation, Administrative Services, Personnel, Nursing Services and Oral Health Services. The seven rural health regions also report to the bureau.

Communicable and Environmental Disease Services (CEDS) is assigned the responsibility of detecting, preventing and controlling infectious and environmentally-related illnesses of public health significance. 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 lifestyle, nutrition and genetics. Detecting, preventing and controlling both infectious and environmental disease provides enormous financial and emotional benefits to the citizens of Tennessee.

The CEDS 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 reliable information. The annual report also provides an assessment of the efforts undertaken by CEDS over a period of years.

Surveillance, i.e. the tracking of infectious disease incidence and prevalence, is at the heart of the work of CEDS. The reporting and tracking of cases of illness is essential to knowing who is affected by disease and where the problems are occurring. Examining descriptive epidemiologic data over time is the foundation for knowing where prevention and control efforts need to be focused. One important goal of this report is to assist providers, laboratorians and infection control practitioners with reporting of notifiable diseases. Health department addresses, telephone numbers and policies relative to surveillance are presented to assist with this important task. This report is a summary of surveillance data from 1995 through 2003 and builds upon the 1999, 2000, 2001 and 2002 annual reports that were previously published by CEDS.

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 and Prevention

(CDC) 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, new diseases may be added to the list. Public health officials at state health departments and the CDC collaborate in determining which diseases should be notifiable, but laws at the state level govern reporting. In Tennessee, State Regulations 1200-14-1, sections .02 through .06, 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 2003. Important additions to the list include Creutzfeld-Jakob disease and variant Creutzfeld-Jakob disease as well as West Nile fever and West Nile encephalitis. The list is presented in Section H. Section I lists those diseases for which bacterial 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 (county) 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 is used for written reports to the health department. It can be obtained by calling your local health department or CEDS at 615-741-7247/800-404-3006. It can also be downloaded from the CEDS website at http://tennessee.gov/health. Click on Programs, and then click on Communicable and Environmental Disease Services. 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 reported 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. McMillian, et al, utilizing FoodNet data from 2002-2003, estimated that though one in twenty persons reported diarrhea in the previous month, less than one in five sought medical care. Further, less than one in five who sought medical care submitted a stool sample which would be needed for laboratory confirmation of the diagnosis. The study data suggested that well over 28 cases of acute diarrheal illness occur in the population for each stool specimen positive for enteric pathogens. The data in this annual report do not represent all cases of disease; they 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 diseases.

D. Isolate Characterization at the State Laboratory

Laboratory regulations require all clinical laboratories to forward isolates of selected pathogens from Tennessee residents 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

An important emphasis of CEDS is on new and emerging infections. These include antibiotic resistant infections and emerging foodborne pathogens, such as Cyclospora cayetanensis, E.coli O157:H7, Listeria and multi-drug resistant Salmonella serotype Newport. Emerging vector-borne diseases include ehrlichiosis, La Crosse encephalitis and West Nile virus. Avian influenza, meningococcal serogroup Y, monkeypox, adult and adolescent pertussis, SARS and multi-drug resistant tuberculosis are other emerging and re-emerging pathogens.

The Emerging Infections Program (EIP) is a population-based network of CDC and state health departments, working with collaborators (laboratories, 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 Medical Center 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 became part of 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 [Foodborne Diseases Active Surveillance Network (FoodNet) and Environmental Health Specialist Network (EHS-Net)], invasive bacterial infections [Active Bacterial Core Surveillance (ABCs)], unexplained encephalitis (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 http://tennessee.gov/health. Click Programs, and then click on Communicable and Environmental Disease Services.

G. Useful Contact Persons, Telephone Numbers, E-Mail and US 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
Group A Streptococcal Invasive Disease
Group B Streptococcal Invasive Disease
Haemophilus influenzae Invasive Disease
Hantavirus Disease
Hepatitis – Type A acute
Listeriosis
Measles (Imported, Indigenous)
Meningococcal Disease
Meningitis – Other Bacterial
Mumps
Pertussis
Plague
Poliomyelitis (Paralytic, Nonpara)
Prion Disease
  1. Creutzfeldt-Jakob Disease
  2. variant Creutzfeldt-Jakob Disease
Rabies – Human
Rubella & Congenital Rubella Syndrome
Typhoid Fever
West Nile Infections
  1. West Nile Encephalitis
  2. West Nile 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 (Gen, PID, Other)
Cholera
Cyclospora
Cryptosporidiosis
Ehrlichiosis (HME, HGE, Other)
Escherichia coli O157:H7
Giardiasis (acute)
Gonorrhea Gen, Oral, Rectal, PID, Opht)
Hemolytic Uremic Syndrome
Hepatitis, Viral
  1. Type B acute
  2. Type B chronic
  3. HBsAg positive pregnant female
  4. HBsAg positive infant
  5. Type C acute
  6. Type C chronic
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

Physicians required to report all blood lead test results $\geq$ 10 μg/dl

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 sensitivity 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.

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

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

J. Tennessee Population Estimates, 2002

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

SEX	POPULATION
Female	2,991,771
Male	2,848,489

RACE SEX	POPULATION
White Male	2,339,921
White Female	2,424,869
Black Male	462,312
Black Female	519,110
Other Male	46,256
Other Female	47,792
Total	5,840,260

AGE GROUP (years)	POPULATION
<1	76,773
1-4	309,542
5-9	394,918
10-14	406,772
15-19	404,366
20-24	396,567
25-29	398,998
30-34	413,636
35-39	432,036
40-44	454,084
45-49	434,479
50-54	396,116
55-59	333,252
60-64	263,352
65-69	214,526
70-74	177,912
75-79	144,484
80-84	100,752
85+	87,695

K. Tennessee Department of Health Regions

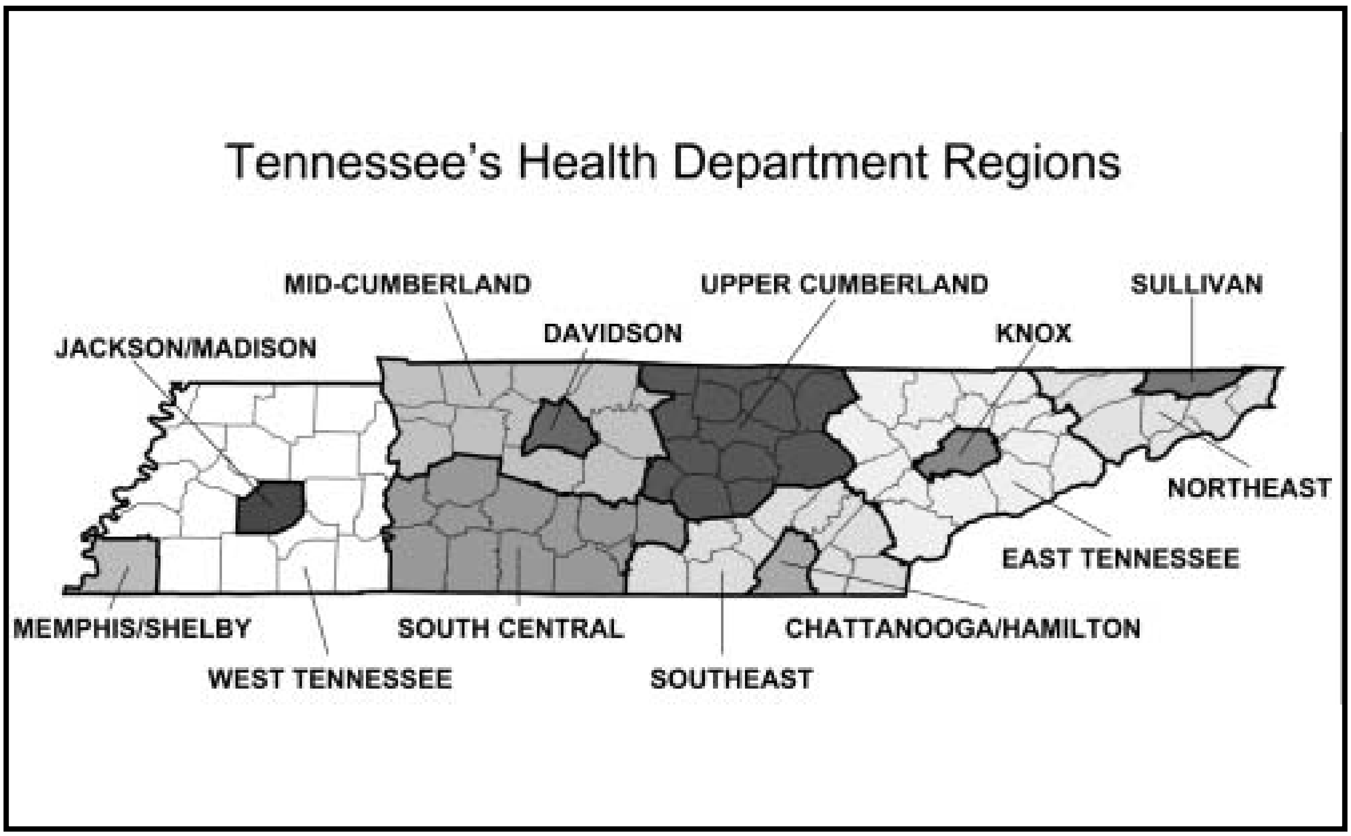
Metropolitan regions include six counties: Davidson (population 582,462), Hamilton (population 310,300), Knox (population 390,386), Madison (population 93,875), Shelby (population 914,478) and Sullivan (population 153,631).

Nonmetropolitan regions are comprised of the seven clusters of counties shown in the map.

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, 2002, *MMWR 2001*; 50, No.53.



M. Tennessee's Department of Health Non-metropolitan Regions: Counties and Population

Northeast
(Population 328,492)

Carter (57,126)
Greene (64,012)
Hancock (6,812)
Hawkins (54,843)
Johnson (17,899)
Unicoi (17,783)
Washington (110,017)

East
(Population 682,699)

Anderson (71,608)
Blount (109,412)
Campbell (40,419)
Claiborne (30,484)
Cocke (34,408)
Grainger (21,330)
Hamblen ((59,375)
Jefferson (46,322)
Loudon (40,516)
Monroe (40,514)
Morgan (20,194)
Roane (52,690)
Scott (21,829)
Sevier (74,863)
Union (18,735)

Southeast
(Population 304,916)

Bledsoe (12,647)
Bradley (90,681)
Franklin (40,077)
Grundy (14,562)
Marion (28,087)
McMinn (50,251)
Meigs (11,436)
Polk (16,272)
Rhea (29,057)
Sequatchie (11,846)

Upper Cumberland
(Population 313,983)

Cannon (13,173)
Clay (8,033)
Cumberland (48,698)
DeKalb (17,946)
Fentress (17,005)
Jackson (11,242)
Macon (21,069)
Overton (20,423)
Pickett (5,045)
Putnam (64,576)
Smith (18,341)
Van Buren (5,585)
Warren (39,251)
White (23,596)

Mid-Cumberland
(Population 887,754)

Cheatham (37,519)
Dickson (44,671)
Houston (8,149)
Humphreys (18,214)
Montgomery (140,458)
Robertson (57,326)
Rutherford (194,625)
Stewart (12,881)
Sumner (136,331)
Trousdale (7,471)
Williamson (136,589)
Wilson (93,520)

South Central
(Population 356,910)

Bedford (39,514)
Coffee (49,381)
Giles (29,817)
Hickman (23,373)
Lawrence (40,722)
Lewis (11,654)
Lincoln (31,993)
Marshall (27,688)
Maury (72,049)
Moore (5,863)
Perry (7,683)
Wayne (17,173)

West
(Population 520,374)

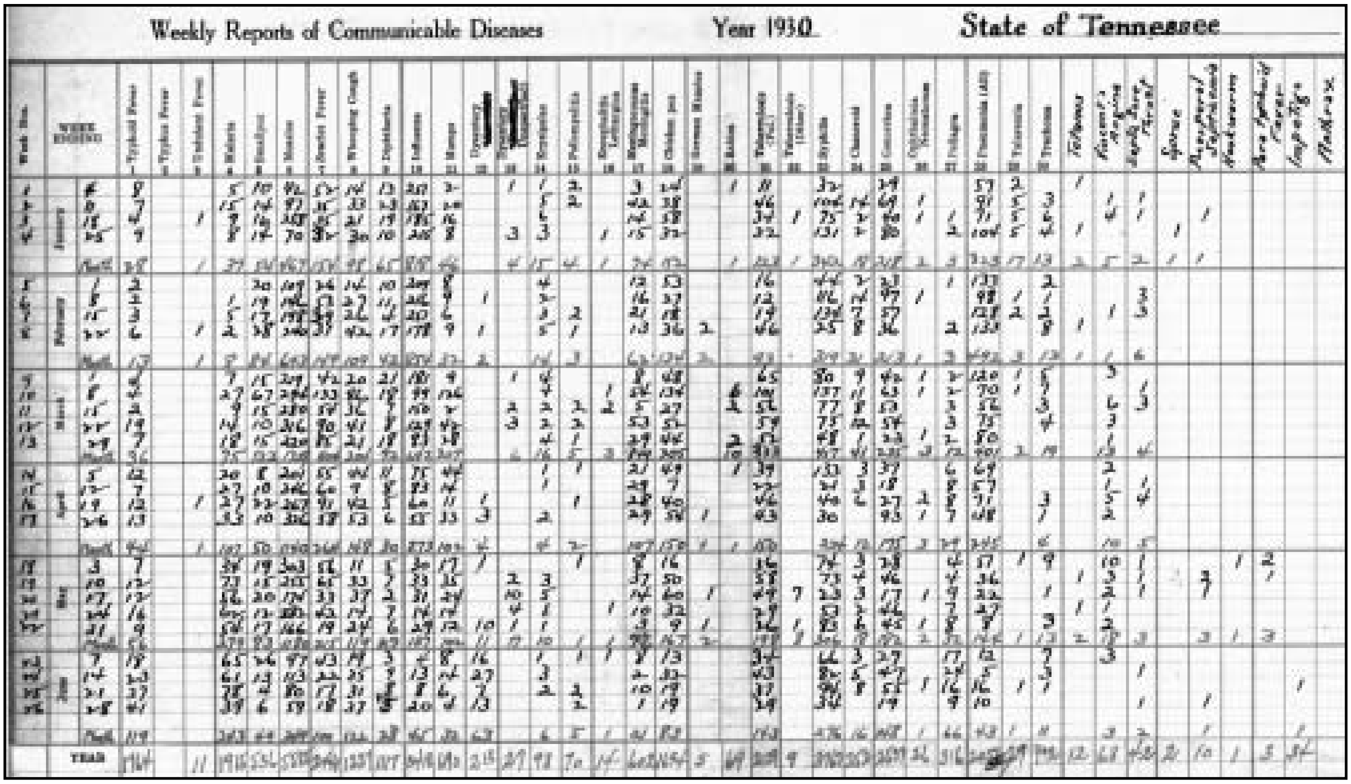
Benton (16,684)
Carroll (29,802)
Chester (16,037)
Crockett (14,817)
Decatur (11,784)
Dyer (37,724)
Fayette (30,174)
Gibson (48,370)
Hardeman (28,950)
Hardin (26,092)
Haywood (19,807)
Henderson (26,119)
Henry (31,458)
Lake (7,952)
Lauderdale (27,853)
McNairy (24,927)
Obion (32,681)
Tipton (53,861)
Weakley (35,282)

Section II.

Tennessee Reported Cases by Year of Diagnosis, 1995-2003

We need to learn from history, look after the present and plan for a future that gives them the respect they deserve.

Dr. Pete Moore, Killer Germs, page 27



In 1930, the Tennessee Department of Health was recording disease morbidity by hand. Diseases of concern (i.e. dysentery, smallpox, undulant fever, etc.) were very different, and more infectious in nature, than those that are notifiable today.

Source: Tennessee Department of Health

Tennessee Reported Cases by Year of Diagnosis, 1995-2003

DISEASE	1995	1996	1997	1998	1999	2000	2001	2002	2003
AIDS	930	881	749	790	650	674	606	663	600
Botulism, Foodborne	0	1	0	0	2	0	0	0	0
Botulism, Infant	0	0	0	1	2	1	4	3	1
Brucellosis	0	2	1	1	0	0	1	0	0
California/LaCrosse Encephalitis	*	1	8	9	6	19	17	15	14
Campylobacteriosis	346	335	299	285	251	272	364	298	448
Chlamydia	13152	13121	12501	13717	14216	15073	15556	16042	21034
Cryptosporidiosis	1	5	17	11	12	12	25	60	41
E. Coli 0157:H7		*45	46	55	53	59	50	51	35
Ehrlichiosis		*2	5	6	19	46	20	26	31
Giardiasis	146	155	175	207	159	184	190	188	187
Gonorrhea	13894	11710	11018	11840	11366	11877	10144	9348	8717
Group A *Streptococcus*		*13	87	42	50	83	87	89	167
Group B *Streptococcus*						*87	157	164	264
Haemophilus influenzae		*29	31	33	36	26	48	37	58
Hepatitis B Surface Antigen Positive, Pregnant				*2	3	36	104	103	109
Hepatitis A	1993	737	407	224	190	154	187	122	202
Hepatitis B, acute	640	517	437	266	228	213	272	128	212
Hepatitis C, acute	958	373	232	166	96	97	64	26	23
Hemolytic Uremic Syndome		*3	1	1	8	12	10	7	14
HIV	1080	972	966	840	803	1127	606	833	549
Legionellosis	25	27	32	23	23	14	30	20	37
Listeriosis		*6	14	13	7	13	9	12	9
Lyme Disease	29	25	47	45	39	28	30	27	19
Malaria	10	14	12	16	7	13	14	4	7
Measles (indigenous)	0	2	0	1	0	0	0	0	0
Meningococcal Disease	51	62	81	69	61	56	63	38	30
Meningitis, Other Bacterial			*41	36	44	52	54	39	28
Mumps	6	1	9	2	0	2	1	2	5
Penicillin-resistant *Streptoccus pneumoniae*		*6	82	192	291	266	226	125	133
Pertussis	210	27	42	41	40	41	72	119	82
Rocky Mountain Spotted Fever	33	47	38	31	55	57	87	81	74
Rubella	1	0	0	2	0	1	0	1	0
Salmonellosis, Non-Typhoidal	463	507	439	587	548	693	724	853	736
Shigellosis	390	216	285	884	622	344	124	175	396
Syphilis, Congenital	33	33	38	13	11	18	24	11	2
Syphilis, Early Latent	1129	957	984	659	649	627	553	390	227
Syphilis, Late Latent	529	472	595	499	426	511	570	424	461
Syphilis, Neurological	10	7	9	15	12	14	10	17	6
Syphilis, Primary	283	279	235	143	223	162	89	40	43
Syphilis, Secondary	623	571	512	424	418	370	242	128	93
Tetanus	1	1	2	1	0	0	1	1	0
Toxic Shock *Staphylococcus*	5	1	2	4	3	3	1	2	1
Toxic Shock *Streptococcus*				*6	5	1	0	0	1
Trichinosis	0	3	1	4	0	0	0	1	2
Tuberculosis	465	504	467	439	382	383	313	308	285
Tularemia	2	1	0	0	0	1	6	4	3
Typhoid	1	3	1	2	1	2	1	1	3
Vancomycin Resistant *Enterococci*	*	*	46	322	447	524	711	649	802

*Indicates year the disease became reportable

Number of Reported Cases of Selected Notifiable Diseases with Rates Per 100,000 Population by Age Group, Tennessee, 2003

Disease		<1Y	1-4	5-16	17-25	26-45	46-65	>65
	Total population	76773	309542	963436	718986	1705852	1383209	682463
AIDS Cases	Number	0	0	2	41	419	133	5
	Rate	0.0	0.0	0.2	5.7	24.6	9.6	0.7
Campylobacteriosis	Number	28	60	63	41	129	98	29
	Rate	36.5	19.4	6.5	5.7	7.6	7.1	4.2
Chlamydia	Number	0	12	2077	14563	4104	177	13
	Rate	0.0	3.9	215.6	2025.5	240.6	12.8	1.9
Gonorrhea	Number	0	4	660	5015	2646	341	15
	Rate	0.0	1.3	68.5	697.5	155.1	24.7	2.2
Group A *Streptococcus*	Number	9	14	8	8	34	35	59
	Rate	11.7	4.5	0.8	1.1	2.0	2.5	8.6
Hepatitis A	Number	2	2	6	26	62	77	27
	Rate	2.6	0.6	0.6	3.6	3.6	5.6	4.0
HIV Cases	Number	4	1	4	142	303	90	5
	Rate	5.2	0.3	0.4	19.8	17.8	6.5	0.7
Meningococcal Disease	Number	7	10	1	1	4	1	6
	Rate	9.1	3.2	0.1	0.1	0.2	0.1	0.9
Pertussis	Number	39	6	12	4	17	3	1
	Rate	50.8	1.9	1.2	0.6	1.0	0.2	0.1
Rocky Mountain Spotted Fever	Number	0	3	6	3	28	25	9
	Rate	0.0	1.0	0.6	0.4	1.6	1.8	1.3
Salmonellosis, Non-Typhoid	Number	104	140	116	45	121	117	93
	Rate	135.5	45.2	12.0	6.3	7.1	8.5	13.6
Shigellosis	Number	14	146	157	13	47	12	7
	Rate	18.2	47.2	16.3	1.8	2.8	0.9	1.0
Syphilis, Early Latent	Number	0	0	3	58	128	27	11
	Rate	0.0	0.0	0.3	8.1	7.5	2.0	1.6
Syphilis, Late Latent	Number	0	0	2	50	250	130	29
	Rate	0.0	0.0	2.1	69.5	146.6	94.0	42.5
Syphilis, Neurological	Number	0	0	0	0	3	1	2
	Rate	0.0	0.0	0.0	0.0	0.2	0.1	0.3
Syphilis, Primary	Number	0	0	0	12	22	9	0
	Rate	0.0	0.0	0.0	1.7	1.3	0.7	0.0
Syphilis, Secondary	Number	0	0	1	24	55	13	0
	Rate	0.0	0.0	0.1	3.3	3.2	0.9	0.0

Section III.
Disease Summaries

… the microbes are educated to resist penicillin and a host of penicillin-fast organisms is bred out which can be passed on to other individuals and perhaps from there to others until they reach someone who gets a septicemia or a pneumonia which penicillin cannot save. In such cases the thoughtless person playing with penicillin treatment is morally responsible for the death of the man who finally succumbs to infection with the penicillin-resistant organism. I hope this evil can be averted.

Sir Alexander Fleming, New York Times, June 26, 1945

A. FOODBORNE DISEASE

At a local fair in Oregon, some children pet an iguana while eating ice cream. Reptiles are known to frequently shed Salmonella in their feces.

Source: Dr. Paul Lewis, Oregon Department of Health

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 is 36 million persons, or 13% 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 that occur 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. Although foodborne diseases are extremely

[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.

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 regularly 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 occurs along 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

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 are 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) and Guillain-Barré syndrome (a serious complication of *Campylobacter* infection). The result is a comprehensive and timely database of foodborne illness in a well-defined population. Beginning in 2003, active surveillance has been conducted in the 136 hospital laboratories throughout Tennessee.

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 with 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 (STEC). In 2003, yet another survey was carried out to ascertain the use of culture- and non-culture methods of testing for non-0157:H7 STECs. Responses were received from 498 (95%) of 523 laboratories surveyed. Preliminary analysis shows that among the 459 (92%) laboratories that reported testing stool specimens for O157/STEC, 322 (70%) tested on-site. Of the 302 (94%) laboratories reporting testing on-site using culture methods, 211 (70%) tested routinely for *E. coli* O157 and 242 (79%) send isolates to the state public health laboratory (PHL) or reference lab for further testing or confirmation. Of the 29 (9%) laboratories using non-culture methods, 6 (21%) reported doing so routinely; 17 (59%) use an EIA (enzyme immunoassay) method. Twenty-four (83%) send either a Shiga toxin-positive isolate or broth to the state PHL for confirmation and serotyping. Regional differences were noted in the number of specimens tested on-site, determinants of testing and methodologies used.

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.

Survey of the population: Collaborating FoodNet investigators contact randomly selected residents of the 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 be associated with 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 the evaluation of foodborne disease because it allows for an estimate of the population who does not seek medical care when affected by diarrheal illness.

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 are expected to identify risk factors that can be addressed to prevent their occurrence.

EHS-Net

The Environmental Health Specialist Network (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 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). Currently a retail meat study is underway; the goal is to determine the prevalence of antimicrobial resistance among *Salmonella*, *Campylobacter*, *E. coli* and *Enterococci* isolated from a convenience sample of chicken breast, ground turkey, ground beef and pork chops purchased from grocery stores in the United States. A study of egg-handling practices in high-volume restaurants was completed in 2003. A study of how restaurants handle ground beef in hamburgers is in the planning stages.

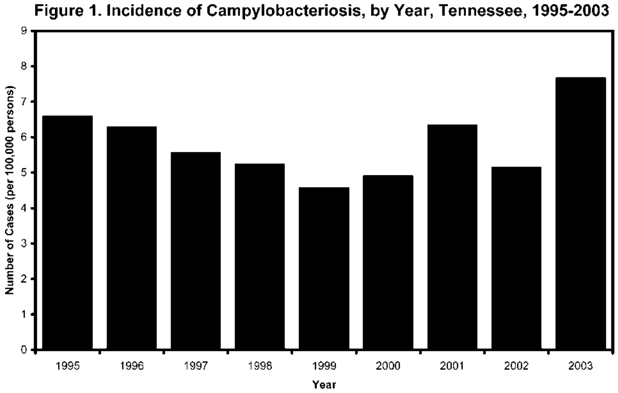
Additional information on FoodNet activities is available through the CDC website (http://www.cdc.gov/foodnet).

Campylobacteriosis

Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses, not only in the United States, but in Tennessee as well. The causative agent is primarily *Campylobacter jejuni*. Most of those persons infected with the bacterium usually develop diarrhea, cramping, abdominal pain and fever within two to five days after exposure, typically lasting one week.

Since 1995, rates of campylobacteriosis have been steadily declining. However, in 2001 there was a sharp increase to 6.3 cases per 100,000 persons. Although the rate decreased by 1.2 cases per 100,000 persons in 2002 (to 5.1 cases per 100,000 persons), the rate of disease in 2003 (7.7 cases per 100,000 persons) surpassed all of those since 1995 (**Figure 1**).

Figure 1. Incidence of Campylobacteriosis, by Year, Tennessee, 1995-2003

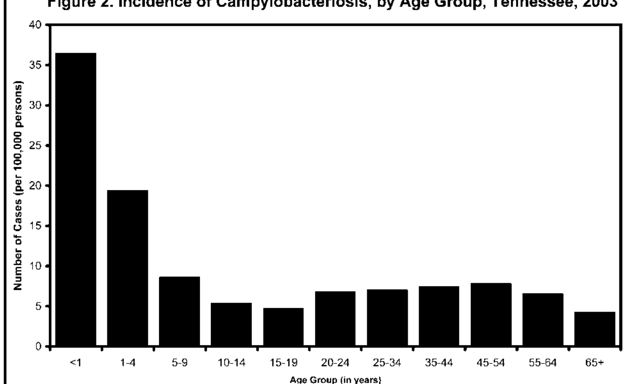


Active laboratory surveillance for *Campylobacter* is carried out in Tennessee under the auspices of the FoodNet program. In 2003, the catchment area for active laboratory surveillance was expanded statewide, which may partly account for the increase in the number of cases reported. Unlike other foodborne pathogens, isolates for *Campylobacter* are not required by state law to be sent in to the state laboratory.

From 1995 to 2002, reported cases of campylobacteriosis in Tennessee were highest during the summer months with two-thirds of cases occurring from May to October. However, in 2003, this distribution shifted with the number of cases more evenly spread throughout the year. The peak number of cases spanned across two months, June and July, each representing 13.8% of all cases.

Figure 2 illustrates that those at greatest risk of developing infection are those under the age of five years (22.8 cases per 100,000 persons). The risk for those under the age of one is highest at 36.5 cases per 100,000 persons.

Figure 2. Incidence of Campylobacteriosis, by Age Group, Tennessee, 2003



Campylobacteriosis is a disease that affects more people in the eastern portion of Tennessee than in the western portion. This phenomenon is consistent year after year. In 2003, the rate of disease varied region to region across the state, with the highest rate (14.6 cases per 100,000 persons) in the Knoxville/Knox County metropolitan area and

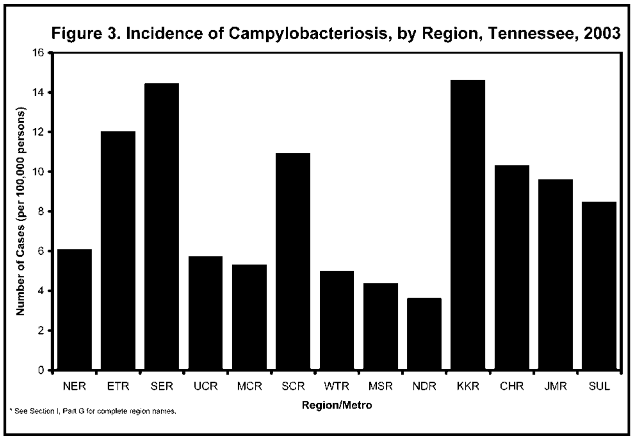


Figure 3. Incidence of Campylobacteriosis, by Region, Tennessee, 2003

the lowest (3.6 cases per 100,000 persons) in the Nashville/Davidson County metropolitan area (**Figure 3**).

This regional variation is not just a Tennessee phenomenon, but a national one as well. In FoodNet sites alone, there is remarkable variation in rates of campylobacteriosis. According to 2003 preliminary FoodNet data, Georgia reported the lowest rate of disease, with 7.0 cases per 100,000 persons, while California reported a rate nearly quadruple that (26.9 cases per 100,000 persons).

To better understand this variation, FoodNet has undertaken several studies – an analysis of hospitalization rates, a survey of laboratories, a survey of the general population and a survey of physicians. None have fully explained the differences. Examination of the differences in food consumption preferences within those participating sites in FoodNet has been proposed. One hypothesis is that persons on the eastern coast of the United States eat more frozen chicken, whereas those on the western coast eat more fresh chicken.

To help identify the risk factors for infants with campylobacteriosis and salmonellosis, a case-control study is currently underway in Tennessee. Inaugurated in March 2002, the study involves an interview with the parents of infants under the age of one, who are either diagnosed with one of these two diseases or are selected as a control. This important project should help to better understand the reasons for the disproportionately high rates of these diseases among one of the most vulnerable age groups.

Another study currently underway in the Emerging Infections Program is an investigation of the association between Guillan-Barre' Syndrome (GBS) and preceding infection with Campylobacter jejuni. 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, if you would like to enroll a patient.

E. coli O157:H7 and Hemolytic Uremic Syndome

Escherichia coli O157:H7 is an emerging cause of foodborne illness, not only in Tennessee, but in the rest of the nation as well. An estimated 73,000 cases of infection and 61 deaths occur in the United States each year. *E. coli O157:H7* infection is one of the most severe of the foodborne illnesses, especially among the immunosuppressed, the very young and the elderly. Infection often leads to bloody diarrhea, and occasionally kidney failure.

Stool testing for Shiga-producing *E. coli* (STEC) toxin is indicated for cases presenting with an acute onset of bloody diarrhea accompanied by a history of undercooked ground beef, untreated liquids or seed sprout consumption. A diagnosis of a life-threatening disease called post-diarrheal hemolytic uremic syndrome (HUS), is also an indication for *E. coli O157:H7* and Shiga-like toxin testing.

The Tennessee Department of Health State laboratory offers, at no cost to medical providers, stool testing for Shiga toxin. In instances where stool cultures are not available or produce negative results, serology testing for antibodies to *E. coli O157* may be requested.

In 2003, there were 35 cases of enterohemorrhagic *E. coli* (EHEC) infections reported to the Tennessee Department of Health Laboratory. All cases were further identified as *E. coli O157:H7*. This represents a 7% decrease from the previous year.

Additionally, there were 14 cases of HUS reported in Tennessee in 2003. Determining the true incidence of HUS is dependent on accurate surveillance of the illness. During the years 2000-2003, 49% of stools collected from patients with HUS yielded evidence of EHEC infection (**Figure 1**), while 69% of serum specimens collected yielded antibodies to EHEC (**Figure 2**).

Figure 1. Proportion of Stools Collected from HUS Patients in Which Enterohemorrhagic *E. coli* was Confirmed, Tennessee, 2000-2003

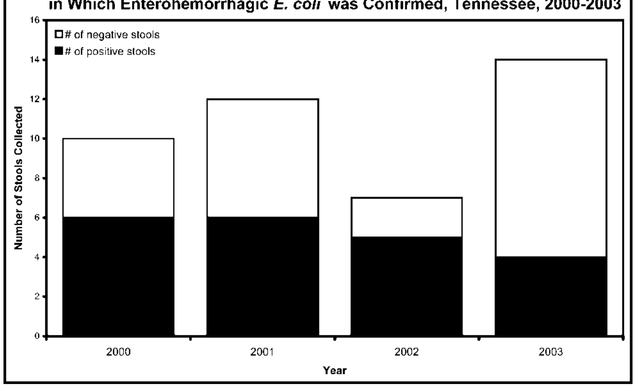
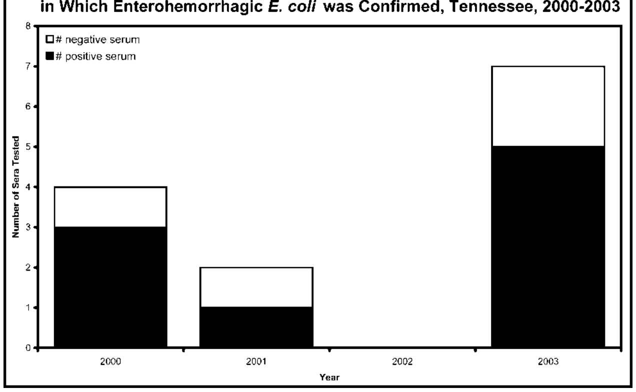


Figure 2. Proportion of Sera Collected from HUS Patients in Which Enterohemorrhagic *E. coli* was Confirmed, Tennessee, 2000-2003



Under the auspices of FoodNet, the Tennessee Department of Health uses many different tools to ascertain the incidence of HUS: population-based active surveillance of pediatric nephrologists, statewide notifiable disease reporting and auditing of the statewide hospital discharge database.

An analysis of the three systems for the years 2000-2002 found 28 HUS cases among persons less than 18 years of age (0.66 cases per 100,000 persons). Of these, 89% were detected through active surveillance. Of the 49 possible cases identified through ICD-10 codes in hospital discharge data, 20 (41%) were confirmed as HUS after chart review; 29% of all cases were identified only through active surveillance, 11% only through hospital discharge data and 61% through both methods.

Since the disease became reportable in Tennessee in 1996, a total of 56 cases of HUS have been identified. Of those HUS cases reported from the years 2000-2003, 88% were less than 18 years of age, with a median age of pediatric patients of 3 years (range=1-12 years). In all age groups, patients reported to the Tennessee Department of Health with HUS were hospitalized a median of 12 days (Range=0-66 days).

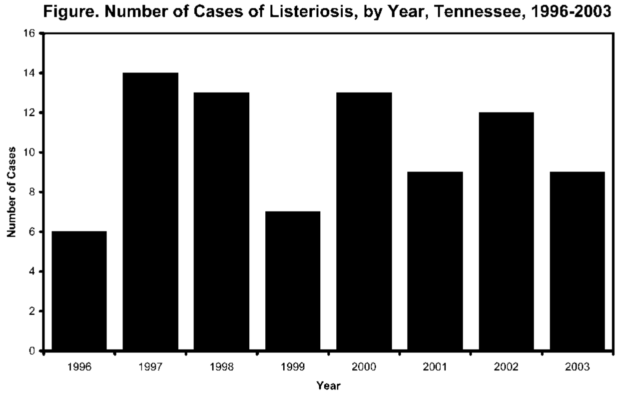
Listeriosis

The bacterium *Listeria monocytogenes* causes listeriosis, a rare but serious foodborne disease. It results in only about 2,500 cases of the estimated 76 million foodborne illnesses per year in the U.S. However, listeriosis accounts for 500 deaths and 2,300 hospitalizations, the highest rate of hospitalization of any foodborne illness. *Listeria* may cause meningitis, other severe neurological sequelae, spontaneous abortion and infection in the newborn infant. The primary vehicle is food.

The major risk factors for infection with *Listeria monocytogenes* include the consumption of high-risk foods (non-pasteurized dairy products, frankfurters and ready-to-eat deli meats) by those who are immunosuppressed or pregnant.

In Tennessee, listeriosis became a reportable disease in 1996. That year 6 cases were reported; the next year that 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] The number of cases in Tennessee has remained fairly constant since 1998; the **figure** depicts the trend.

Figure. Number of Cases of Listeriosis, by Year, Tennessee, 1996-2003



Among FoodNet sites in 2003, rates per 100,000 persons ranged from a low of 0.01 in Minnesota to a high of 0.05 in Connecticut. In Tennessee, the rate was 0.02 cases per 100,000 persons. The overall rate in FoodNet sites was 0.03 cases per 100,000 persons.

In 2000, a three-year long FoodNet listeriosis case-control study was inaugurated. It was designed to identify risk factors for listeriosis in FoodNet sites and to describe the spectrum of illness in patients with the disease. To date, 173 cases and 378 controls have been enrolled. Underlying medical conditions of enrolled cases have included consumption of oral steroids, cancer, diabetes, chemotherapy, end-stage renal disease, organ transplants, lupus and HIV/AIDS.

Norovirus

Noroviruses (genus *Norovirus*, family *Caliciviridae*) are a group of related, single-stranded ribonucleic acid (RNA), non-enveloped viruses that cause acute gastroenteritis in humans. Norovirus was recently approved as the official genus name for the group of viruses previously referred to as "Norwalk-like viruses" (NLV). This group of viruses is also referred to as caliciviruses (because of their virus family name).

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.

The virus 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 subtypes Hawaii,

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

Montgomery County and Snow Mountain. 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.

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 a majority of 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 include drinking contaminated water and swimming in pools or lakes in which ill individuals has been swimming, which serves as an indication of the highly infectious nature of these viruses. Contamination of foodstuffs has been traced to both pre-symptomatic 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 two-thirds of foodborne illnesses in the United States and 33% of all 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. Individual cases of norovirus are not on the list of reportable diseases in Tennessee, and thus incidence and prevalence data are not available. However, all foodborne outbreaks are required to be reported and so data about norovirus outbreaks are collected annually.

There were 6 norovirus outbreaks in Tennessee in 2003 with a total of 34 lab confirmed cases and 304 probable cases. Norovirus was responsible for just over a third of foodborne outbreaks in Tennessee in 2003. The number of norovirus outbreaks reported has been on the rise since 1999, with a slight decline observed in 2003 (**Figure 1**). In the past five years, norovirus outbreaks have been fairly well-distributed throughout the year, the exception being a sharp increase in outbreaks during the month of October (**Figure 2**). Thirty-three (10%) cases reported visiting a

Figure 1. Number of Norovirus Outbreaks, by Year, Tennessee, 1999-2003

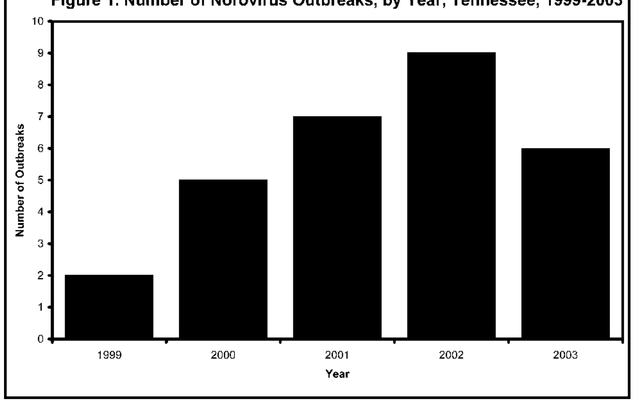
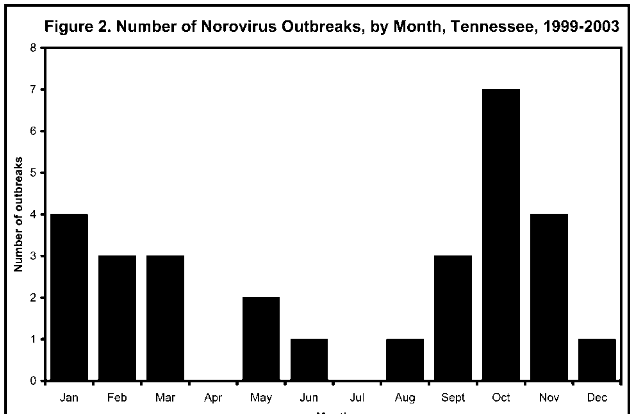


Figure 2. Number of Norovirus Outbreaks, by Month, Tennessee, 1999-2003



healthcare provider. Nine cases were hospitalized as a result of norovirus.

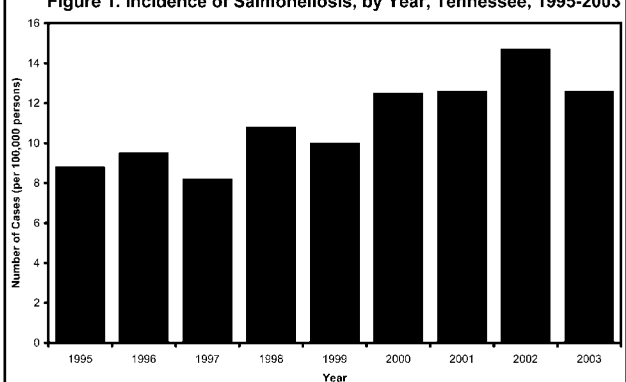
In five of the six outbreaks, a foodservice worker was implicated as the source of contamination. Three of the six outbreaks involved food prepared and consumed in a restaurant or deli.

Salmonellosis

Salmonellosis is an infectious disease caused by a group of bacteria called *Salmonella*. Most persons infected with *Salmonella* develop diarrhea, fever and abdominal cramps within 12 to 72 hours after infection. The illness usually lasts 4 to 7 days, and most persons recover without treatment. However, in some persons the diarrhea may be so severe that the patient needs to be hospitalized. In these patients, the *Salmonella* infection may spread from the intestines to the blood stream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics. Those persons at greatest risk of developing serious infection are the elderly, infants and those with impaired immune systems.

In 2003, the incidence rate of salmonellosis was similar to the rates in 2001 and 2002 (**Figure 1**). A total of 736 cases were reported to the health department, representing a 14% decrease from 853 cases in 2002. The overall 2003 rate in Tennessee was 12.6 cases per 100,000 persons, as compared to the 1995 rate of 8.8 cases per 100,000 persons and the 2002 United States rate of 11.5 cases per 100,000 persons; rates of infection also varied by region.

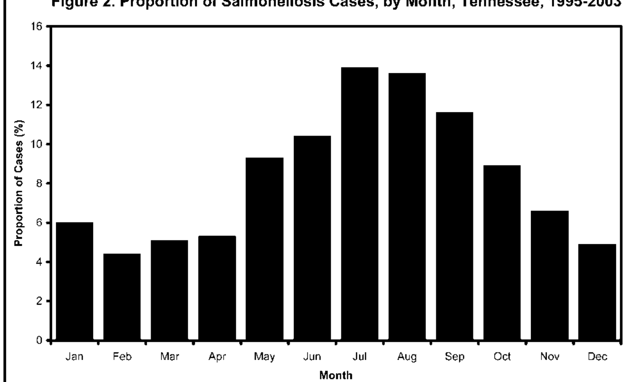
Figure 1. Incidence of Salmonellosis, by Year, Tennessee, 1995-2003



The western portions of the state had the highest rates of *Salmonella* infections in 2003. Jackson/Madison County, Shelby County and West Tennessee Region reported 57 cases per 100,000 persons, compared with 7 cases per 100,000 persons in Upper Cumberland Region and 9 cases per 100,000 persons each in Davidson County and the East Tennessee Region.

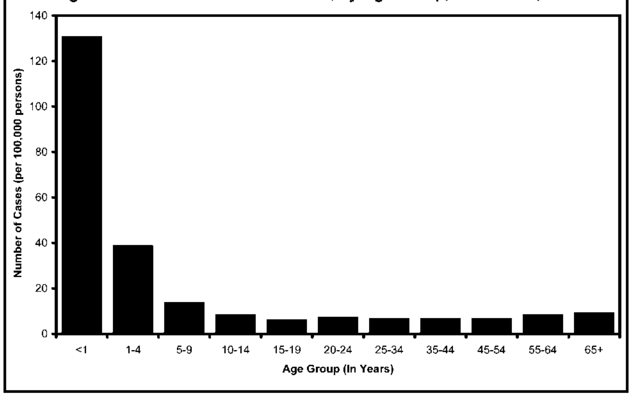
From 1995 to 2003, salmonellosis reports followed a typical seasonal trend with more than two thirds of cases occurring during the summer and fall. **Figure 2** depicts this trend. During this nine-year period, 67.7% of cases were reported during the months of May through October. In 2003, salmonellosis peaked in July with 100 (13.6%) cases.

Figure 2. Proportion of Salmonellosis Cases, by Month, Tennessee, 1995-2003



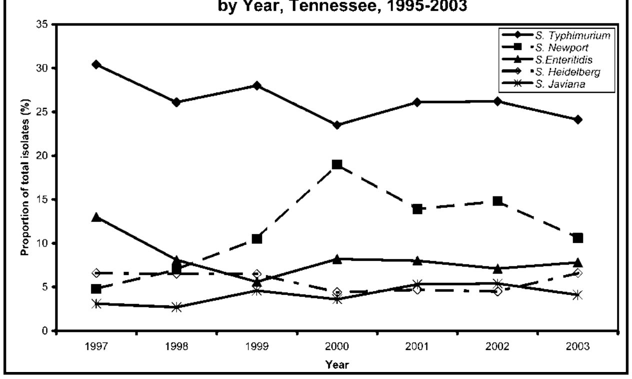
As shown in **Figure 3**, from 1995 to 2003, *Salmonella* was isolated most frequently from children under 5 years of age, who accounted for 35% of all salmonellosis cases. In 2003, the incidence of salmonellosis was 130.7 cases per 100,000 persons for infants under

Figure 3. Incidence of Salmonellosis, by Age Group, Tennessee, 1995-2003



the age of one and 38.8 for children 1-4 years of age. The distribution of isolates between the sexes was similar during the nine-year period. The three most common serotypes of *Salmonella* (*S.* Typhimurium, *S.* Enteritidis and *S.* Newport) accounted for 43% of all Salmonella isolates sent to Tennessee Department of Health State Laboratory in 2003 (**Figure 4**). S. Typhi was isolated from

Figure 4. Predominant Serotypes of Salmonella, by Year, Tennessee, 1995-2003



blood of three adults who reported traveling internationally to endemic areas in 2003.

Active laboratory surveillance is being conducted for *Salmonella* in Tennessee under the auspices of the FoodNet program, which in 2003 expanded statewide. In addition there are several projects that FoodNet is undertaking to better understand this disease.

The S. Enteritidis / S. Newport case-control study, conducted by CDC in 2002-2003, concluded that most multi-drug resistant strains of *S. Newport* are acquired domestically in the United States, while over one-quarter of S. Enteritidis infections in this study could be attributed to international travel. FoodNet is also working on methods to explain what proportion of *Salmonella* and *E. coli* O157 cases can be attributed to travel outside the continental United States.

Tennessee is now participating in the Retail Food Study under the auspices of the National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS) to identify the proportion of samples of meat and poultry purchased from a variety of retail food grocery stores that are culture-positive for *Salmonella*, *Campylobacter*, *E. coli* or *Enterococci*. *Salmonella* was isolated from 16% and 14% of ground turkey samples sent to Tennessee Department of Health State Laboratory in 2002 and 2003, respectively. The study is ongoing to determine the antimicrobial sensitivity trends among the positive isolates.

Shigellosis

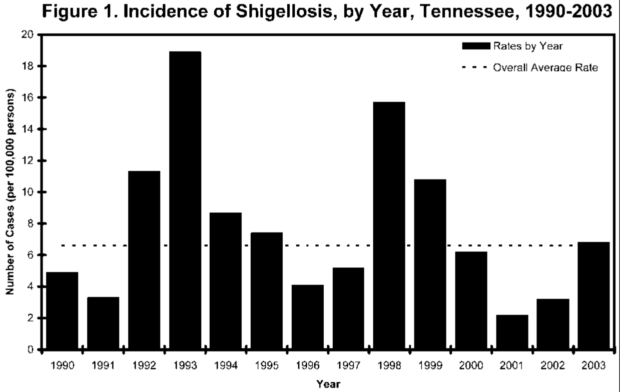
Shigellosis is an infectious disease caused by a group of bacteria called *Shigella*. Most of those infected with *Shigella* develop diarrhea, fever and stomach cramps within one or two days after they are exposed to the bacterium. The diarrhea is often bloody. However, shigellosis usually resolves in five to seven days.

In some persons, especially young children and the elderly, the diarrhea can be so severe that the patient needs to be hospitalized. Although, some infected persons may never show any symptoms at all, they may still pass the *Shigella* bacteria to others. Transmission occurs primarily 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, which in 2003 expanded statewide.

Even though the number of cases reported in Tennessee has varied over the years, the rate of disease has declined overall since 1962 (average incidence rate of 6.6 cases per 100,000 persons). However, in the early 1990s, things began to change. With major increases in incidence in 1993 (18.9 cases per 100,000 persons), 1998 (15.7 cases per 100,000 persons) and 2003 (6.8 cases per 100,000), it appears that shigellosis is now entering its third five-year cycle of intermittent increase (**Figure 1**).

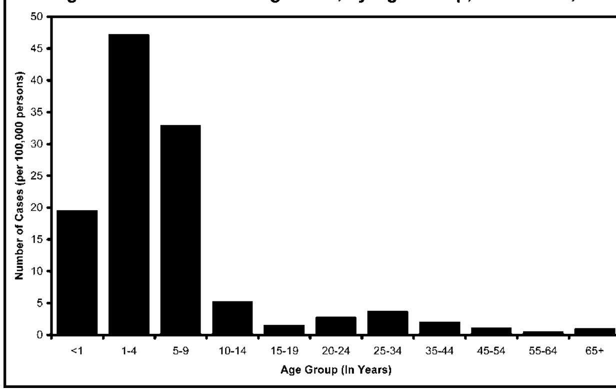
Figure 1. Incidence of Shigellosis, by Year, Tennessee, 1990-2003



In 2003, there were 396 cases of shigellosis reported in Tennessee (6.8 cases per 100,000 persons). This represents a significant increase in incidence, more than two-fold, from the previous year. The majority of those cases were concentrated in the Memphis/Shelby County metropolitan area (38.4%) and the East Tennessee region (29.5%), which were both experiencing community-wide outbreak of a clonal strain of *Shigella.*

The driving factor in many shigellosis outbreaks is daycare-associated cases, including attendees, employees or the family members of either group. Of those 396 cases reported this year, roughly three-quarters were under the age of ten (37.2 cases per 100,000 persons). The rate of disease is even greater for those children between the ages of one and four – 47.2 cases per 100,000 persons (**Figure 2**).

Figure 2. Incidence of Shigellosis, by Age Group, Tennessee, 2003



To address many of the aforementioned issues, some new projects were undertaken: an intervention pilot study of hand sanitizers, collection of pulsed-field gel electrophoresis data and collection of susceptibility data.

In the summer of 2003, during the ongoing outbreak of shigellosis in Memphis, a six-week intervention pilot study, implementing alcohol-based hand sanitizing gel, was launched in six day care centers (DCCs). The participating DCCs were assigned to one of two study arms; a traditional intervention of encouraging handwashing with soap and water or traditional handwashing with soap and water supplemented with the use of a waterless hand sanitizing gel. The ease of implementation and acceptability of the intervention was assessed. The logistics of participant recruitment, consent and enrollment, as well as of the implementation of the intervention were also evaluated.

At that same time, in July of 2003, the state laboratory began performing pulsed-field gel electrophoresis (PFGE) on every *Shigella* isolate received. PFGE is a sophisticated technique that creates a DNA fingerprint, which can be examined further to identify possible outbreaks (i.e. matching PFGE patterns). It was this technique that provided proof of the clonal pattern identified in the Memphis/Shelby County Metropolitan and East Tennessee Regional Health Departments.

To assess the susceptibility of the pathogen to certain antibiotics, data regarding the minimum inhibitory concentrations (MICs) of each isolate were collected from hospital laboratories in Memphis (n=80) and Knoxville (n=6), as available. Preliminary analysis has revealed that, of the 80 cases of shigellosis from Memphis with MIC data available, 91.3% were resistant to ampicillin/sulbactam, 56.3% were resistant to trimethoprim/sulfamethazole (i.e. Bactrim®) and 41.3% were resistant to tetracycline. The antibiotics cefixime, chloramphenicol and ciprofloxacin still prove effective against those prevalent strains.

The spread of *Shigella* from an infected person to other persons can be prevented 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. In addition, 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.

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.

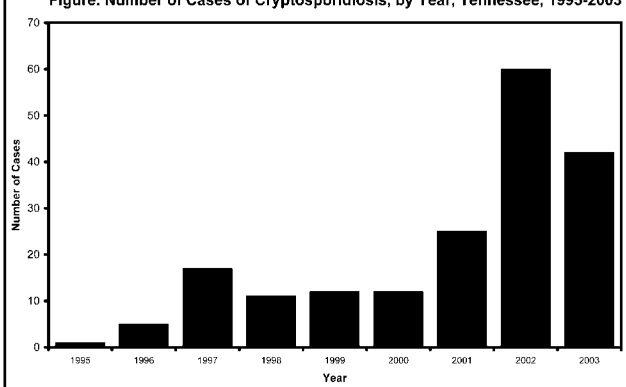
Cryptosporidiosis

The characteristics of *Cryptosporidia* make them a major threat to both drinking and recreational water. They are ubiquitous to animals, resistant to chlorine, 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 point of use, are all factors that may 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 number of cases in Tennessee has been increasing, ranging from 1 in 1995, to 60 in 2002. In 2003, the number of reported cases was 42 (**Figure**). A standard screen for a request for testing for ova and parasites is now frequently done with a kit that tests both *Giardia* and *Cryptosporidia*. That testing, along with heightened awareness may account for the increase in numbers from 1995 onward.

Figure. Number of Cases of Cryptosporidiosis, by Year, Tennessee, 1995-2003



The incidence of cryptosporidiosis varied considerably among FoodNet sites. In Tennessee, that rate was 0.06 cases per 100,000 persons; in Minnesota that rate was 0.26 and in Georgia it was 0.12. The overall incidence was 0.09 cases per 100,000 persons.

Cyclosporiasis

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

From 1995-2000, large outbreaks of cyclosporiasis in North America were associated with the consumption of fresh Guatemalan raspberries. These outbreaks prompted intensive study of *Cyclospora* in the United States.

The incidence of *Cyclospora* infections in this country is not known, but it is thought to be low. There was one case reported in Tennessee in 2002; none were reported in the previous seven years or in 2003. Among all FoodNet sites, in 2003, 15 cases were reported with an overall incidence rate of 0.003 per 100,000 persons. In 2002, there were 42 cases among the FoodNet sites with a rate of 0.009 per 100,000 persons.

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. In Tennessee, children under five years of age accounted for 27% of giardiasis cases from 1995 through 2003.

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

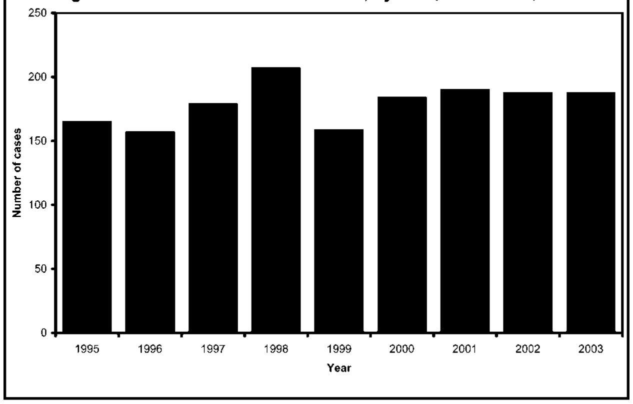


Figure. Number of Cases of Giardiasis, by Year, Tennessee, 1995-2003

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 is due to fecal exposure and most frequently occurs among small children in daycare centers, persons in custodial living centers and men who have sex with men.

The **figure** depicts the number of cases of giardiasis reported in Tennessee from 1995 through 2003; the numbers have remained fairly constant ranging from a low of 157 in 1996 to a high of 207 in 1998. For the nine-year period 1995-2003, giardiasis reports followed a typical seasonal trend with 65% of cases occurring during the summer and fall.

Foodborne Outbreaks

A foodborne outbreak is defined as diarrheal illness in two or more persons, which result from ingestion of common food. Unusual patterns of diarrheal illness should be reported promptly to the local health department. The Foodborne Diseases Active Surveillance Network (FoodNet) performs active laboratory surveillance in order to better monitor and track the incidence of foodborne illness for 5.7 million Tennesseans.

In 2003, Tennessee reported 17 foodborne outbreaks (**Table**). Throughout the state, the increased use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial isolates associated with suspected outbreaks has improved response by public health personnel. Additionally, polymerase chain reaction (PCR) techniques used at the Tennessee Department of Health Laboratory have improved rates of identification of the etiology of foodborne

Table. 2003 Foodborne Outbreaks, Tennessee

Onset Date	County	# Ill	Etiology	Site	Vehicle
1/3/2003	Madison	4	*Salmonella typhimurium*	Restaurant	Unknown
2/22/2003	Hamilton	15	Norovirus	Restaurant	Unknown
2/27/2003	Unicoi	80	Norovirus	Restaurant	Unknown
4/28/2003	Bedford	9	Unknown	Workplace cafeteria	Unknown
5/17/2003	Carroll	7	*Staphylococcus aureus*	Restaurant	Multiple foods
6/11/2003	Benton	65	Norovirus	Camp	Unknown
6/14/2003	Montgomery	7	*Vibrio parahemolyticus*	Restaurant	Raw oysters
6/27/2003	Sevier	5	*Salmonella Enteriditis*	Restaurant	Ham, cheese
7/3/2003	Carroll	3	*Staphylococcus aureus*	Restaurant	Pork BBQ
8/18/2003	Shelby	41	ETEC 169:H41(ST+)	Restaurant	Unknown
8/21/2003	Knox	57	Hepatitis A	Restaurant	Green onions
9/17/2003	Dickson	78	Norovirus	Catered event	Salads
10/1/2003	Sumner	16	*E. coli* O157:H7	School	Unknown
10/12/2003	Unicoi	5	Possibly *Staphylococcus aureus*	Restaurant	Unknown
11/13/2003	Hamilton	100	Norovirus	School	Unknown
11/16/2003	Washington	6	Norovirus	Restaurant	Ground beef
11/28/2003	Dyer	4	*Staphylococcus aureus*	Grocery store/restaurant	Turkey/dressing

Figure 1. Proportion of Foodborne Outbreaks with Unknown Etiologies, Tennessee, 1998-2003

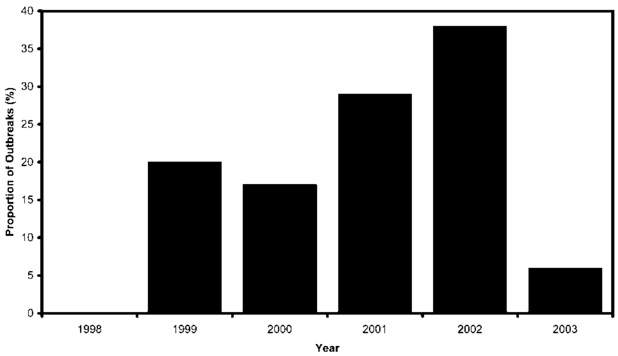
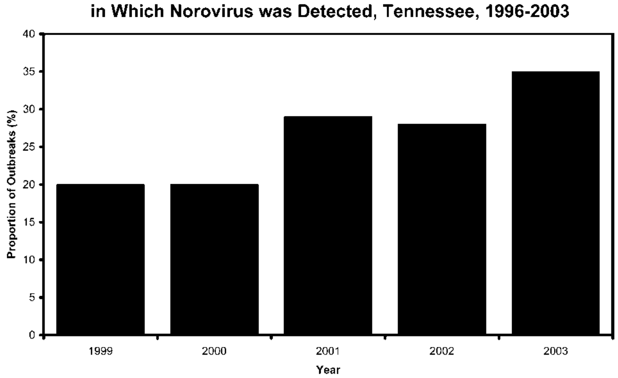
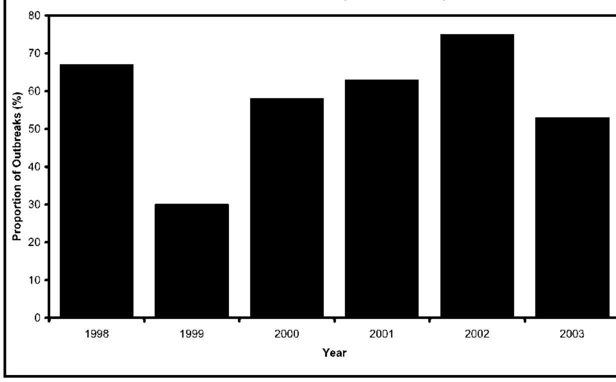


Figure 2. Proportion of Foodborne Outbreaks in Which Norovirus was Detected, Tennessee, 1996-2003



outbreaks in Tennessee to 95% in 2003 (**Figure 1**). As a result, there has been a 15% increase over the last four years in the detection of norovirus in foodborne outbreaks (**Figure 2**). **Figure 3** indicates that the vehicle of contamination remains unknown in greater than 50% of foodborne outbreaks in Tennessee. Frequently, no food specimen is available by the time the outbreak is reported. Moreover, testing a large number of foods is costly, and detection of viruses in food is not available.

Figure 3. Proportion of Foodborne Outbreaks with an Unknown Vehicle, Tennessee, 1998-2003



Irradiation technology is available to reduce the risk of some foodborne diseases in cold cuts, fresh produce, fresh meat and processed meats. However, public acceptance and demand will determine the future of food irradiation. Increased efforts to further reduce illness are still needed.

Groups most at risk for foodborne illness include the immune suppressed, pregnant women, children and the elderly. Consumer education remains one of public health's most important tools in the prevention and control of foodborne illnesses. Safe food handling practices, prevention of cross-contamination, proper cooking temperature and adherence to recommended storage and reheating of foods decrease the opportunities for the proliferation of pathogens. Nevertheless, proper hand washing with soap and water is still the most effective tool in preventing illness.

Current information regarding food safety is available at http://tennessee.gov/health.

B. HEPATITIS

"DO I HAVE HEPATITIS C?"

There's only one way to know: **GET TESTED** Four million Americans have been infected with the hepatitis C virus, and many do not know it.

Hepatitis viruses: The ABCs	HOW IT SPREADS:	HOW YOU CAN GET IT:	IS THERE A VACCINE?
Hepatitis A	Through feces (poop)	• Close, personal contact with an infected person • Sexual contact with an infected person	Yes.
Hepatitis B	Through infected blood or body fluids	• Sexual contact with an infected person • Shooting drugs or sharing needles or "works" *(cotton, spoons, syringes, etc.)* • During birth, an infected mother can pass the virus to her baby	Yes.
Hepatitis C	Through infected blood or body fluids	• Shooting drugs or sharing needles or "works" *(cotton, spoons, syringes, etc.)* • Received a blood transfusion before July 1992 or solid organ transplant before July 1992 • Received treatment for clotting problems with a blood product made before 1987	No.

TO TALK TO SOMEONE ABOUT HEPATITIS, CALL 1-800-227-8922

For more information about hepatitis, call 1-800-227-8922 or visit www.cdc.gov/hepatitis

The ABCs of Hepatitis is a campaign to push testing for hepatitis C. Antibodies to hepatitis C virus can be found in the blood of 70% of infected persons as soon as symptoms begin, and in 90% of persons within three months after symptoms begin. However, it is important to note that many persons who have hepatitis C never develop any symptoms at all.

Source: Centers for Disease Control and Prevention

Hepatitis A

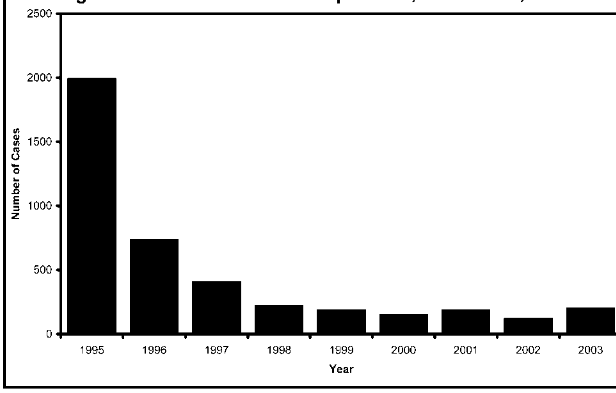
Hepatitis A virus (HAV) is an RNA virus classified as a member of the picornavirus group. The most common mode of transmission is person-to-person, resulting from fecal contamination and oral ingestion (i.e. the fecal-oral route). Infection is characterized by an acute, self-limited illness associated with fever, malaise, jaundice, anorexia and nausea. Symptomatic HAV infection occurs in approximately 30% of infected children under the age of 6 years, few of whom will have jaundice. Among older children and adults, infection is usually symptomatic and typically lasts several weeks, with jaundice occurring in approximately 70% of cases. Prolonged or relapsing disease, lasting as long as 6 months, can also occur. Fulminant hepatitis is rare, but is more common in people with underlying liver disease. Chronic infection does not occur.

Mean age at infection varies with socioeconomic status and associated living conditions. In developing countries, where infection is endemic, most people are infected during the first decade of life. In the United States, hepatitis A is one of the most commonly reported vaccine-preventable diseases. During epidemic years, the number of reported cases has reached 35,000. The highest rates occur among children 5 to 14 years old, whereas the lowest rates occur among adults older than 40 years of age.

In Tennessee, a major outbreak of hepatitis A occurred in 1995 in Shelby County where almost 80% of cases occurred as shown in the **figure**. In the fall of 2003, approximately 80 cases were attributed to a hepatitis A outbreak resulting from ingestion of contaminated green onions at a restaurant located in East Tennessee.

Among cases of hepatitis A infection reported to the CDC, the identified vehicle of infection

Figure. Number of Cases of Hepatitis A, Tennessee, 1995-2003



included a wide spectrum of sources: close personal contact with a person infected with HAV, household or personal contact with a child care center, international travel, a recognized foodborne or waterborne outbreak, male homosexual activity and use of injection drugs. In child care centers, recognized symptomatic (icteric) illness occurs primarily among adult contacts of children. Most infected children in child care centers are asymptomatic or have nonspecific manifestations, so spread of HAV infection within and outside a child care center often occurs before recognition of the index case(s).

In most infected people, the highest titers of HAV in stool occur during the 1 to 2 weeks before the onset of illness, when patients are most likely to transmit HAV. The risk of transmission subsequently diminishes and is minimal by 1 week after the onset of jaundice. However, HAV can be detected in stool for longer periods, especially in neonates and young children. The incubation period is 15 to 50 days, with an average of 25 to 30 days.

Immune globulin, when given within 2 weeks after exposure to HAV, is greater than 85% effective in preventing symptomatic infection. Prevention by always washing your hands with soap and water after using the bathroom or changing a diaper and before preparing and/or eating food is important. Hepatitis A vaccine, of which there are two: Havrix and

Vaqta, is made from an inactivated form of the virus and is considered the best protection. These two vaccines are approved for people 2 years of age and older. Twinrix, a hepatitis A/B combination vaccine, was recently approved by FDA for use in adults greater than 17 years of age.

Hepatitis B

Persons with hepatitis B virus (HBV) infection may present with a variety of signs and symptoms, including a subacute illness with nonspecific symptoms (eg. anorexia, nausea or malaise), clinical hepatitis with jaundice and fulminant fatal hepatitis. Other signs of infection may include jaundice, fatigue, abdominal pain, loss of appetite, nausea and/or vomiting and joint pain. However, about 30% of persons have no signs or symptoms at all, which occurs more frequently among children than adults. The incubation period for acute infection is 45 to 160 days, with an average of 90 days.

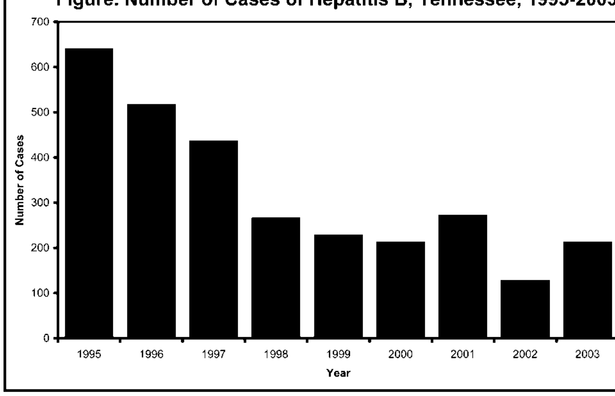
Furthermore, acute hepatitis B cannot be distinguished from other forms of acute viral hepatitis on the basis of clinical signs and symptoms or nonspecific laboratory findings alone. Chronic infection occurs in 90% of infants infected at birth, 30% of children infected at age 1-5 years and 6% of persons infected after 5 years of age. Death from chronic liver disease occurs in 15-25% of chronically infected persons.

HBV is transmitted through blood or body fluids, including wound exudates, semen, cervical secretions and saliva. People with chronic HBV infection are the primary reservoirs for infection. Common modes of transmission include percutaneous and permucosal exposure to infectious body fluids, sharing or using nonsterilized needles or syringes, sexual contact with an infected person and perinatal exposure to an infected mother. Persons at risk for HBV infection are also at risk for infection with hepatitis C virus (HCV) or human immunodeficiency virus (HIV).

HBV infection is highly endemic in many parts of the world, including China, Southeast Asia, Eastern Europe, the Central Asian republics of the former Soviet Union, most of the Middle East, Africa, the Amazon Basin and the Pacific Islands. In these areas, most infections occur in infants or children younger than 5 years of age where 70-90 % of the adult population has been infected, and 8-15% of the population has chronic infection.

However, in the United States, HBV infection occurs primarily in adults and adolescents; 5-8% of the total population has been infected, and 0.2-0.9% of the population has chronic infection. In Tennessee, Hepatitis B case reports for 2003 are at the same level as experienced in the year 2000, as shown in the **figure**. The prevalence of HBV infection among adolescents and adults is 3-4 times greater for black individuals than white individuals. HBV

Figure. Number of Cases of Hepatitis B, Tennessee, 1995-2003



infection, in both adolescents and adults, is associated with other sexually transmitted diseases, including syphilis and HIV.

The number of new infections per year in the United States has declined from an average of 260,000 in the 1980s to about 74,000 in 2003. The highest rate of disease occurs in 20-49 year olds, with the greatest decline among children and adolescents due to routine hepatitis B vaccination. Approximately 1.25 million Americans are chronically infected with HBV of whom 20-30% acquired their infection during childhood.

Hepatitis B vaccine, which has been available since 1982, is the best protection against HBV infection. Routine vaccination of 0-18 year olds and vaccination of high-risk groups of all ages is recommended.

Perinatal Hepatitis B

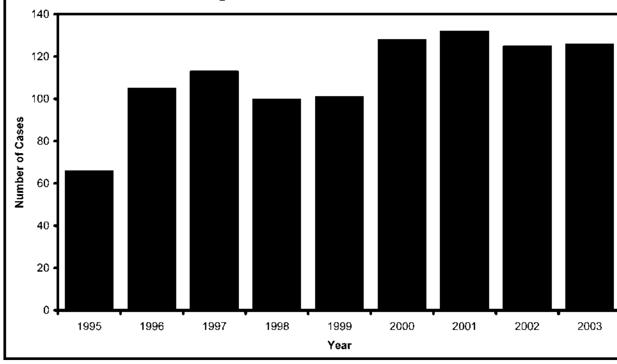
Children born to hepatitis B surface antigen (HBsAg) positive women are at high risk of becoming chronic carriers for hepatitis B. If these children are administered hepatitis B immune globulin (HBIG) and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly increased.

Tennessee Code Annotated 68-5-602 (a) requires that all women in Tennessee be tested for hepatitis B during the prenatal period, and that positive test results be passed on to the delivering hospital and the health department. 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 (CDC).

The Tennessee Department of Health receives the 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 that it has HBIG and vaccine available.

The **figure** shows the number of infants reported as being born to an HBsAg positive mother.

Figure. Number of Infants Born to Hepatitis B Surface Antigen Positive Mothers, Tennessee, 1995-2002

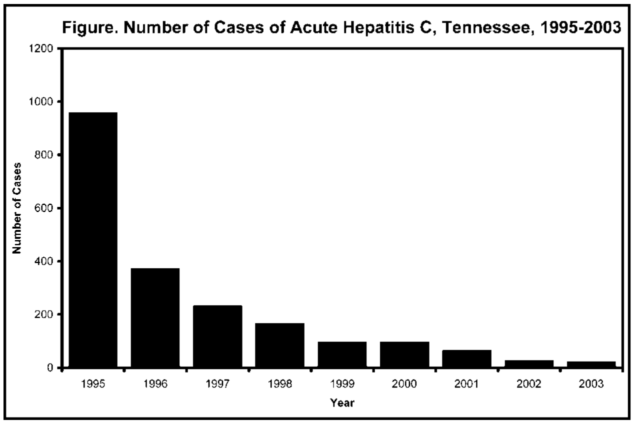


Hepatitis C

Hepatitis C virus (HCV) is a small, single-stranded RNA virus and is a member of the Flavivirus family. Multiple HCV genotypes and subtypes exist. The signs and symptoms of HCV infection are indistinguishable from those of hepatitis A or B. Acute HCV disease tends to be mild and insidious in onset, and most infections are asymptomatic. Jaundice occurs in <20% of patients, and abnormalities in liver function tests generally are less pronounced than abnormalities in patients with hepatitis B virus (HBV) infections.

However, persistent infection with HCV occurs in 50-60% of infected children, even in the absence of biochemical evidence of liver disease. Most children with chronic HCV infection are asymptomatic. Although chronic hepatitis develops in approximately 60-70% of infected adults, limited data indicate that <10% of infected children develop chronic hepatitis, and <5% develop cirrhosis. Infection with HCV is the leading reason for liver transplantation among adults in the United States. In Tennessee during 2003, there were 23 cases of acute HCV reported, as shown in the **figure**.

The prevalence of HCV infection in the general population of the United States is approximately 1.8%; the seroprevalence is 0.2% for children under the age of 12 years and 0.4% for adolescents 12 to 19 years of



age. Seroprevalence also varies among populations according to their associated risk factors. Infection is spread primarily by parenteral exposure to blood of HCV infected people. Some commonly documented exposures include sharing needles or "works" when "shooting" drugs, needlesticks or sharps exposures on the job, and exposure of a baby during birth to his or her infected mother.

Persons at risk for HCV infection might also be at risk from infection with HBV and/or HIV. The incubation period for hepatitis C disease averages 6 to 7 weeks, with a range of 2 weeks to 6 months. The time from exposure to development of viremia is generally 1 to 2 weeks.

The number of new HCV infections per year has declined from an average of 240,000 in the 1980s to approximately 25,000 in 2003. Most infections are due to illegal injection drug use. Transfusion-associated cases occurred prior to blood donor screening, but now occurs in <1 per million transfused units of blood. Approximately 3.9 million (1.8 %) Americans have been infected with HCV, of whom 2.7 million are chronically infected.

HCV positive persons should be evaluated by their physician for liver disease. Interferon and ribavirin are two drugs licensed for the treatment of persons with chronic hepatitis C. Interferon can be taken alone or in combination with ribavirin. Combination therapy, using pegylated interferon and ribavirin, is currently the treatment of choice. Combination therapy can get rid of the virus in up to 5 out of 10 persons with genotype 1 and in up to 8 of 10 persons with genotype 2 or 3. Drinking alcohol can make liver disease worse. There is no vaccine to prevent hepatitis C. at risk for infection with hepatitis B virus (HBV) or human immune deficiency virus (HIV). Health care workers who handle needles or other sharps are at risk for HCV and HIV and should be vaccinated against hepatitis B.

To diagnose HCV, the EIA (enzyme immunoassay) test is done first to detect antibodies to HCV (anti-HCV). If this test is positive, it should be confirmed using the RIBA (recombinant immunoblot assay). The anti-HCV EIA alone does not tell whether the infection is new (acute), chronic (long-term) or past.

Long-term consequences of HCV infection are serious and include the following: 75-85% develop long-term infection; 70% may develop chronic liver disease; and 15% may develop cirrhosis over a period of 20-30 years. Less than 3% die from the consequences of long-term infection (liver cancer or cirrhosis).

There is no vaccine to prevent hepatitis C, thus it is a leading indication for liver transplants. Aspects of CEDS initiatives include informing high-risk individuals about the importance of screening for hepatitis C along with integrating hepatitis C prevention into ongoing HIV and sexually transmitted disease (STD) prenatal and counseling activities. Funding from CDC has been provided to educate medical providers, medical staff and field workers in Tennessee about HCV infection, epidemiology, transmission routes, risk factors, co-infection with HIV, disease outcomes, and prevention.

C. MENINGITIS/ENCEPHALITIS AND SEPTICEMIA

Following a diagnosis with Group B streptococcus, a baby is admitted into a hospital's Intensive Care Unit with serious complications.

Source: Dr. Carol Baker, Centers for Disease Control and Prevention

Active Bacterial Core Surveillance: The ABCs Program

One of the programs under the umbrella of the Emerging Infections Program (EIP) 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 Centers for Disease Control and Prevention (CDC) for further study. ABCs has been in place in Tennessee in the four major metropolitan areas (Chattanooga/Hamilton, Knox/Knoxville, Memphis/Shelby, and Nashville/Davidson) since 1988. In 1997, seven additional counties were added including Cheatham, Dickson, Robertson, Rutherford, Sumner, Williamson and Wilson.

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 the major metropolitan areas of 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 continuing 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 and effectiveness of pneumococcal conjugate vaccines for infants on disease burden.
- To evaluate prevention among the elderly through pneumococcal polysaccharide vaccine use.

Under the auspices of ABCs, a number of studies have been undertaken to reach some of the objectives listed above. They are in various stages of completion. An assessment of the effectiveness of current prenatal group B streptococcus screening guidelines was completed in 2002. Additionally, a multistate study initiated in the year 2000 to assess the field-effectiveness of the new conjugate pneumococcal vaccine is currently underway. This vaccine covers the seven most common pneumococcal serotypes causing invasive disease in children. Finally, a pneumococcal preventability project to assess the burden of invasive pneumococcal disease that could have been prevented, had current adult vaccination recommendations been followed, is ongoing. This project will also examine the burden of fluoroquinolone resistance in the ABCs surveillance area.

Tennessee Unexplained Encephalitis Study (TUES)

Encephalitis, inflammation of the brain, is a potentially devastating neurologic disease. In the last 5 years, West Nile Virus, an emerging cause of epidemic encephalitis in the United States, and outbreaks in Asia of Nipah Virus and enterovirus 71 have focused attention on this syndrome. Over 100 different infectious agents have been associated with this syndrome; however, in the majority of cases no pathogen is ever identified. [1,2]

One reason for the high proportion of unexplained cases is the difficulty in culturing organisms causing encephalitis from cerebrospinal fluid (CSF). Newer diagnostic tests targeting species-specific DNA sequences, such as the polymerase chain reaction (PCR), allow rapid, highly sensitive methods to detect pathogens in the central nervous system (CNS). [3]

In response to the changing epidemiology of encephalitis, and the development of these improved diagnostic methods, the Emerging Infections Program (EIP) initiated encephalitis surveillance at three sites. The Tennessee Unexplained Encephalitis Study (TUES), which began in January 2000, was inaugurated to better characterize the epidemiology and microbiology of encephalitis in the state.

Cases of encephalitis are identified by passive surveillance through clinician referral. Criteria for enrollment include:

- Altered mental status > 24 hours

And at least one of the following:

- Fever
- Seizure
- Focal neurologic abnormality

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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 Engl 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.

- Abnormal neuroimaging study or EEG
- Cerebrospinal fluid pleocytosis

Cases <6 months of age and patients with severe immunocompromise are excluded. After study personnel obtain informed consent, physicians are asked to submit residual specimens, which are tested for a number of core pathogens. Supplementary tests for less common pathogens are performed as indicated by specific epidemiological factors or exposures. The testing protocol is listed in the **table** below.

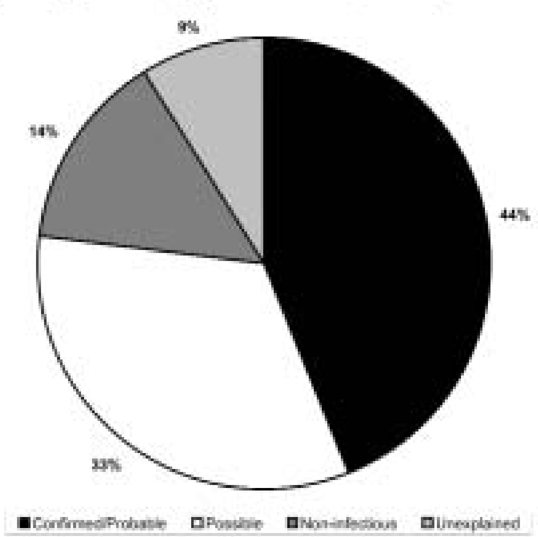
A total of 309 patients meeting the case definition for encephalitis have been enrolled into the study through December 2003. While the majority of cases were referred from acute care facilities in Tennessee, 19% lived in adjacent states and 5% were from distant states. Cases ranged in age from 6 months to 89 years (median age of 28 years). Cases were evenly divided among males and females, and the racial and ethnic distribution reflected state demographics. Cases were often critically ill: 57% required ICU care, 20% were comatose at the time of study entry and 11% died within 3 months of study entry.

Table. Core Testing Protocol for the TUES Study

Class	Agent	CSF PCR	NP PCR	Serology	Other
Viral					
	Herpes simplex virus	X			
	Epstein-Barr virus	X		CI	
	Varicella zoster virus	X			
	Human herpes virus 6	X			
	Enteroviruses	X	X		
	Influenza A & B*		X		
	Adenovirus		X	X	
	Parainfluenza 1-3*		X		
	Parvovirus B-19			X	
	Rotavirus*				Ag
	Arboviruses*				
	LaCrosse	CI		X	
	Eastern equine encephalitis			X	
	Western equine encephalitis			X	
	St.Louis encephalitis			X	
	West Nile virus			X	
Bacterial					
	Bartonella (Cat Scratch Fever)	CI		X	
	Chlamydia pneumoniae		X		
	*Ehrlichia**	CI		X	
	Mycobacterium tuberculosis	CI			
	Mycoplasma pneumoniae	CI	X	X	
	Rickettsia rickettsia (Rocky Mountain Spotted Fever)*			X	
	Treponema (syphilis)				CI

* Seasonal tests CI = Clinically Indicated Ag = Antigen

Figure. Diagnostic Category of TUES Cases, Tennessee, 2000-2003



Diagnoses were classified as infectious, non-infectious or unexplained. Infectious diagnoses were sub-classified based on standardized, organism-specific criteria as confirmed, probable or possible (**Figure**). Of cases initially believed to represent acute encephalitis, 9% were ultimately diagnosed with a non-infectious condition, including lymphoma, multiple sclerosis, vasculitis, mitochondrial disorders, cerebrovascular accidents and psychiatric conditions.

In one-third of cases, a confirmed or probable infectious etiology was identified. Viral agents were most frequently identified, including herpes simplex virus, Epstein-Barr virus, varicella zoster virus, La Crosse virus, West Nile virus, rabies virus, parvovirus B-19 and rotavirus. Other infectious agents included bartonella, rickettsia, ehrlichia, Mycobacterium tuberculosis and Treponema pallidum. Fungi, parasites and/or prions accounted for only 1% of cases.

Results from the TUES 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 even with 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 at (877) 756-5800. Karen Bloch, MD, the Principal Investigator can be reached at (615) 222-6611.

Group A Streptococcal Disease

Reporting of group A streptococcal disease (GAS) began in 1996 in Tennessee. Case reports increased dramatically from 1999 to 2000 and since then have remained fairly stable until a dramatic increase in 2003 (**Figure 1**). The 2003 Tennessee GAS rate (2.9 cases per 100,000 persons) was lower than

Figure 1. Number of Cases of Invasive Group A Streptococcus, Tennessee, 1996-2003

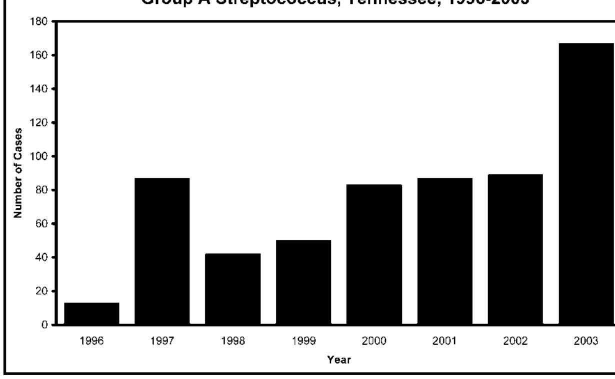
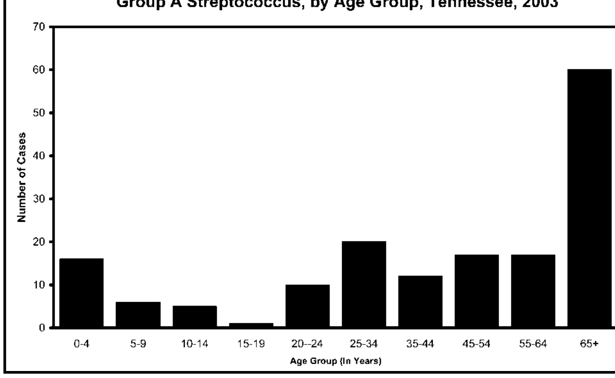


Figure 2. Number of Cases of Invasive Group A Streptococcus, by Age Group, Tennessee, 2003



the 2002 United States rate of 3.2 cases per 100,000 persons.

Tennessee data indicates GAS cases were most frequent in persons aged 65 and over (8.3 cases per 100,000 persons) (**Figure 2**). The oldest adult age group exhibited its greatest change from 1999 to 2000, with more than a 2.5-fold increase, and has continued the upsurge with an 88% increase in cases from 2002 to 2003.

GAS rates in the metro areas ranged from 1.0 case per 100,000 persons in Jackson/ Madison County to Chattanooga/Hamilton County with a rate five times greater (5.2 cases per 100,000 persons). The Mid-Cumberland Region had the highest rate (4.6 cases per 100,000 persons) of GAS among the rural regions of Tennessee.

Nationally, Streptococcal Toxic Shock Syndrome (STSS) and Necrotizing Fasciitis (NF) each accounted for approximately 6% of invasive cases of GAS. 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, 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 invasive GAS. Blacks (3.0 cases per 100,000 persons) are more often affected than whites (2.0 cases per 100,000 persons). There has been national passive surveillance for GAS invasive infection and STSS since 1995. Active laboratory-based surveillance for invasive GAS is currently conducted within the ten states that are participating in the Emerging Infection Program (total population: 37.2 million).

Worldwide, rates of GAS invasive disease, STSS and NF increased from the mid-1980s to early 1990s. Rates of invasive disease have been stable over the last five years throughout the United States. Increases in the rate and severity of GAS invasive disease are associated with increases in the prevalence of the M-1 and M–3 serotypes.

Additionally, development of a new genotyping system for GAS isolates (emm typing) at the Centers for Disease Control and Prevention (CDC) allowed for better strain identification. Investigating clusters of disease will also help 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 post-partum and post-surgical GAS cases.[1]

Group B Streptococcal Disease

Group B Streptococcus (GBS) is an infectious disease caused by the bacteria *Streptococcus agalactiae*. It emerged as the leading infectious cause of neonatal morbidity and mortality in the United States in the 1970s. However, required reporting of GBS cases in Tennessee did not begin until the year 2000, in which only 87 were reported. In 2003, however, that number nearly tripled (264), representing a 60% increase in incidence from the previous year (**Figure 1**).

[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 post surgical patients: recommendations from the Centers for Disease Control and Prevention. *Clin Infect* Dis 2002; 35:950-959.

Figure 1. Incidence of Invasive Group B Streptococcus, Tennessee, 2000-2003

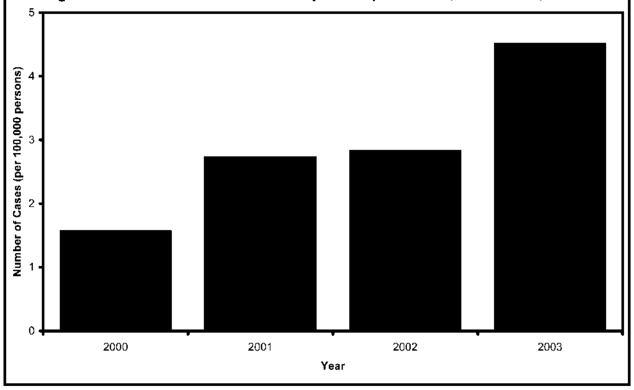
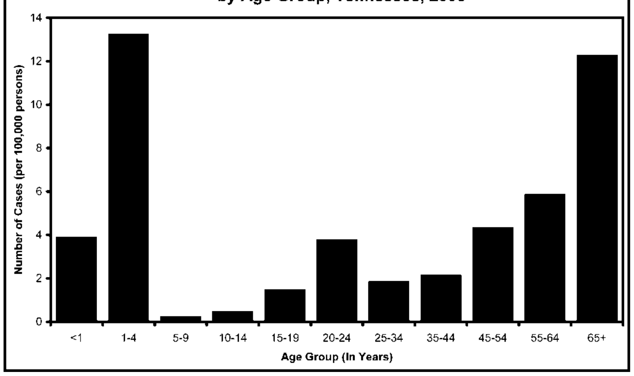


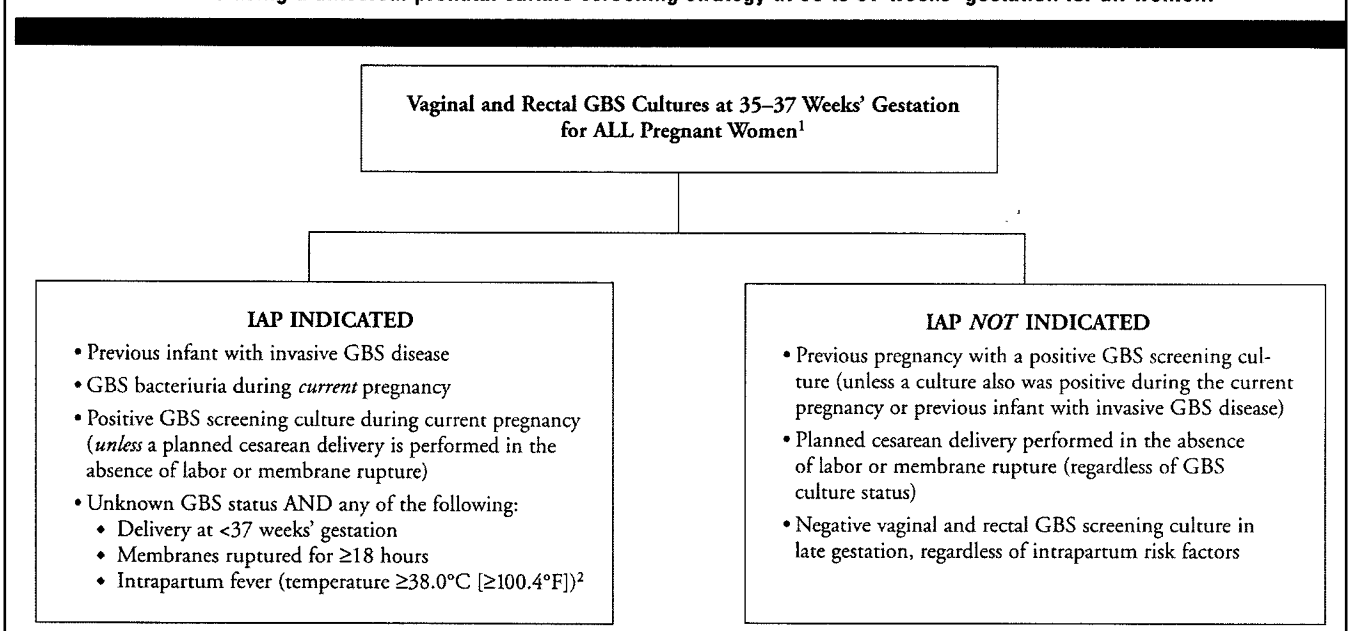
Figure 2. Incidence of Invasive Group B Streptococcus, by Age Group, Tennessee, 2003



Those persons at greatest risk of developing infection are newborn babies, pregnant women, those over the age of 65 and other adults with underlying illnesses, such as diabetes mellitus and/or liver disease. Rate of disease is highest for those between the ages of one and four (13.2 cases per 100,000 persons), followed by those over the age of 65, with 12.3 cases per 100,000 persons (**Figure 2**).

Infection in newborns is classified into two distinct categories: early onset disease (0-7 days) and late onset disease (8 days to several months). Early onset disease is characterized by sepsis, respiratory distress, apnea, shock and pneumonia. The case fatality rate among this group is 50%. Infection is either acquired in utero or during delivery. Newborns delivered at less than 37 weeks gestation are more likely to develop this type of the disease, which is a more severe infection.

Figure 3. Indications for intrapartum antimicrobial prophylaxis (IAP) to prevent early-onset group B streptococcal (GBS) disease using a universal prenatal culture screening strategy at 35 to 37 weeks' gestation for all women.



[1] Exceptions: women with GBS bacteriuria during the current pregnancy or women with a previous infant with invasive GBS disease.
[2] If chorioamnionitis is suspected, broad-spectrum antimicrobial therapy that includes an agent known to be active against GBS should replace GBS IAP.

In contrast, late onset disease is characterized by sepsis and meningitis. This type of disease is not as fatal as early onset disease, with a case fatality rate of only 25%. Infection is usually caused by person-to-person contact and occurs more frequently in full-term infants. Since the year 2000, only 167 GBS cases under the age of one have been reported in Tennessee, 30% of which were reported this year. When comparing those cases under the age of one in 2003, 53.3% were reported as early onset disease, while 46.7% were reported as late onset disease. This represents only a minor shift in distribution from previous years. Infection in adults is more systemic, especially for those with other underlying illnesses. As shown in Figure 2, rates of disease are highest in older age groups and in 1-4 year olds.

The recommended guidelines for diagnosis and treatment of GBS, which were first adopted in 2002, employs a single screening-based approach urging physicians to screen 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 (**Figure 3**). Increased surveillance and awareness may be partly responsible for the upsurge in incidence in 2003.

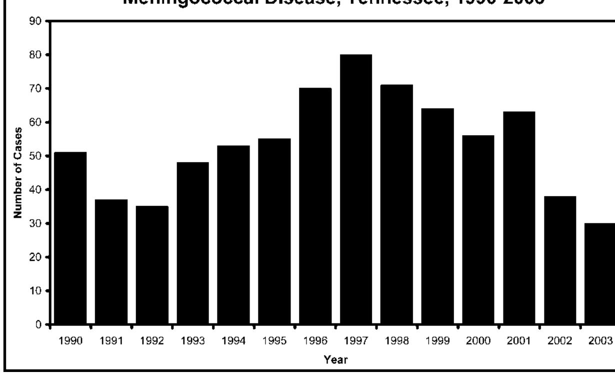
Meningococcal Disease

Meningococcal disease is a bacterial infection caused by *Neisseria meningitides* that may result in meningitis or sepsis. A clinically compatible case is classified as confirmed by a positive blood or cerebrospinal fluid (CSF). A case is classified as probable if, in the absence of a positive culture, clinical purpura fulminans or a positive CSF antigen are present. 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 the 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, and people exposed to active and passive tobacco smoke.

Surveillance is conducted statewide through the National Electronic Disease Surveillance System (NEDSS) and the Emerging Infection Program's Active Bacterial Core Surveillance (ABCs). Immediate reporting via telephone is

Figure. Number of Cases of Invasive Meningococcal Disease, Tennessee, 1990-2003



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 high in 1997 of 81 cases. Thirty cases were reported in 2003 (**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. A total of 20 isolates were sent to the Tennessee Department of Health Laboratory for serotyping. Of these isolates serotyped, Group B with 8 (40%) was most frequently identified, followed by Group W135 with 5 (23%).

Rabies

Tennessee has had widespread, longstanding endemic rabies in bats and skunks, but prior to this year had not had any recent endemic infection with the "raccoon variant" of the rabies virus. In April 2003, Tennessee became the 20th state in the nation to encounter the raccoon variant of the rabies virus. The disease was found in the northeast corner of the state in Carter and Johnson Counties. There were four positive raccoons identified in Carter County, in addition to a rabid cat infected with the raccoon strain in Johnson County. All positive animals from northeast Tennessee (as well as all positive animals across the state) with the exception of bats and skunks, undergo Monoclonal Antibody testing in the Tennessee Department of Health Laboratory in Nashville to determine the variant or strain of virus. This not only aids in tracking the natural movement of the raccoon strain, but aids in detecting any translocation of fox or raccoon rabies into the state.

The raccoon strain has become the dominant type of rabies in the country, accounting for over 40% of total rabid animals. It also presents a disproportionate public health risk due to the following factors:

a) raccoon populations are heaviest in urban and suburban areas;
b) raccoons are very aggressive when rabid; and
c) raccoons infect many additional species, which increases the risk to humans and domestic animals.

The raccoon strain has been documented in those North Carolina and Virginia counties bordering northeast Tennessee since 1997, and in those Georgia counties bordering southeast Tennessee since 2001.

To slow or stop the movement of raccoon rabies into Tennessee, the Department of Health, along with many other state agencies, in the fall of 2002 entered into a cooperative program with the Centers for Disease Control and Prevention and the United States Department of Agriculture's Wildlife Services. The cooperative program's goal was to extend a barrier of vaccinated wild raccoons into seven counties in the northeast portion of the state. Oral rabies vaccine (ORV) is to be distributed annually to immunize as many raccoons within this barrier region as possible. This barrier of immunized animals extends from the Ohio/Pennsylvania border southward, and is part of a national effort to stop the westward movement of raccoon rabies. The baits are primarily distributed by air, with hand baiting by volunteers in municipal areas such as Kingsport.

In the fall of 2003, 260,000 baits were distributed over a 1,560 square-mile area in the same seven

Figure 1. Oral Rabies Vaccine Barrier, Tennessee, 2003

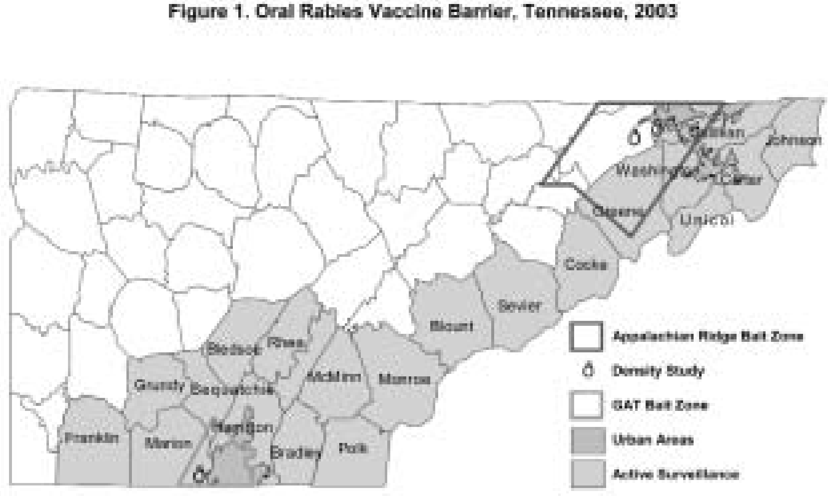
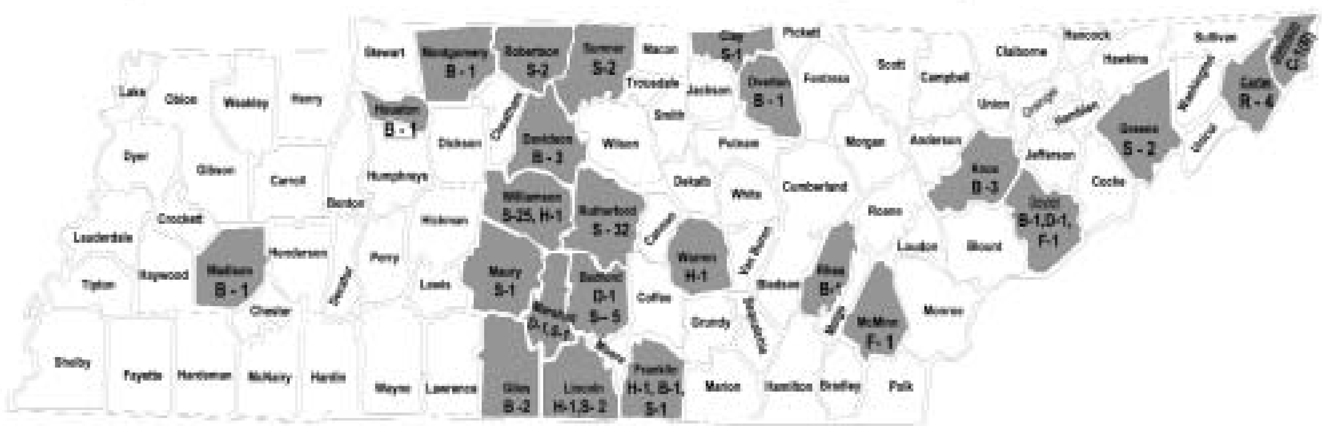


Figure 2. Number of Animals Positive for Rabies, by County, Tennessee, 2003



Bat	15	Fox (Skunk-1,Bat-1 Strain)	2
Cat (Raccoon Strain)	1	Horse (Bat-2, Skunk-2 Strain)	4
Dog (Skunk Strain)	3	Raccoon (Raccoon Strain)	4
Fox (Skunk-1, Bat-1 Strain)	2	Skunk	74
		Total	103

counties as in the previous year. In addition, another special ORV program involving the area where Georgia, Alabama and Tennessee meet, referred to as the GAT project, was initiated late in 2003 in response to the imminent threat of raccoon rabies bordering Hamilton County. Over 60,000 baits were distributed by hand in Hamilton County, making it the second largest metropolitan area baited (after Pittsburgh, Pennsylvania). Follow-up live trapping, testing and release showed an 11-23% immunity level in the area, similar to other ORV attempts. **Figure 1** depicts the areas of the state where the ORV barrier is being established.

As demonstrated in **Figure 2**, endemic skunk rabies remains at a low level in northeast Tennessee; the 15 positive bats were scattered throughout the state, and skunks are at high endemic levels in middle Tennessee. All positive dogs were from skunk encounters, as they have been since variant testing was initiated. A higher number of rabid horses than usual (4) were reported in 2003, with two due to a skunk strain and two due to a bat strain (a first for TN). The **table** depicts the total number of positive brain tissue IFA tests, by species of animal, over the past nine years.

Table. Total Number of Positive Brain Tissue IFA Tests, by Species of Animal, Tennessee, 1995-2003

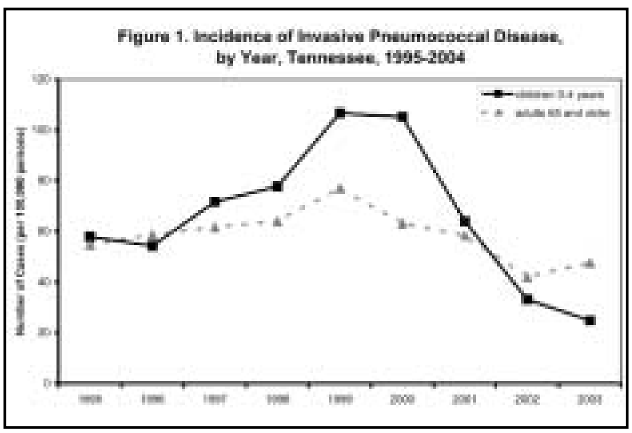
Species	1995	1996	1997	1998	1999	2000	2001	2002	2003
Skunk	82	80	135	127	79	88	98	76	74
Bat	7	12	8	5	10	15	11	27	15
Cat	0	0	0	0	0	1	0	0	1
Cow	3	0	0	1	0	0	0	1	0
Dog	3	6	3	6	5	3	2	2	3
Fox	4	1	1	1	1	0	0	1	2
Goat	0	0	0	1	0	0	0	0	0
Horse	1	1	2	1	0	0	0	0	4
Raccoon	0	0	0	0	0	0	0	1	4
Total	**100**	**100**	**149**	**142**	**95**	**107**	**111**	**108**	**103**

Among the 2,000 to 2,500 animals tested, the total number of positives has remained around 100 each year. Skunks remain the primary rabies vector, comprising 70-90% of the total positive tests annually.

Streptococcus pneumoniae Invasive Disease

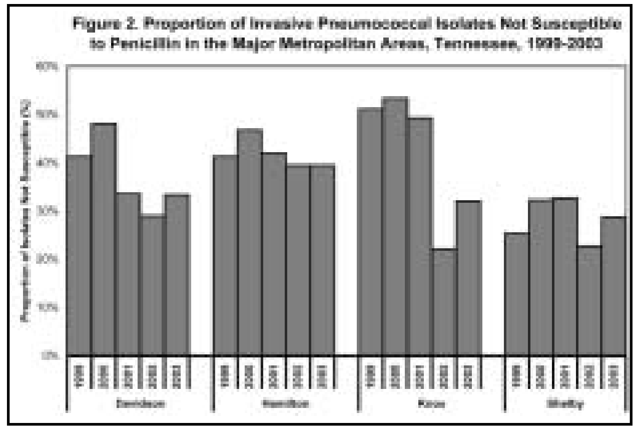
Streptococcus pneumoniae is the leading cause of meningitis and pneumonia in hospitalized patients. It is the second leading cause of bacteremia in the very young and very old; in these age groups, it causes serious invasive disease.

As seen in **Figure 1**, the rate of invasive pneumococcal disease in young children has dropped significantly since the introduction of the pneumococcal conjugate vaccine



(Prevnar®). Unfortunately, supplies of Prevnar® have been limited until recent months. Rates of invasive pneumococcal disease in the elderly also appear to have increased slightly in 2003 (**Figure 1**); more efforts need to be made to increase pneumococcal vaccination in the elderly.

Additionally, there has been a reduction in the percentage of invasive S. pneumoniae isolates that are non-susceptible to penicillin (**Figure 2**); this is particularly evident in Knox and Davidson counties.



Because of alarming rates of drug resistance in the late 1990s (**Figure 2**), the Tennessee Department of Health formed appropriate antibiotic use coalitions in Davidson and Knox counties. These consist of members from physician groups, managed care organizations, hospitals, pharmaceutical companies, nurse practitioner groups, child care centers, schools and others interested in preventing antibiotic resistance. The coalitions' missions are to reduce inappropriate use and the spread of antibiotic-resistant bacteria that cause many upper respiratory illnesses. This mission is being accomplished through state and local partnerships across Tennessee to further educate parents of young children and practitioners about the importance of appropriate antibiotic use. In addition, Tennessee's Appropriate Antibiotic Use Campaign encourages the use of the pneumococcal conjugate vaccine (Prevnar®) in young children.

D. SEXUALLY TRANSMITTED DISEASES

An HIV-positive woman is receiving antiretroviral (ARV) treatment at her local clinic. ARV treatment can help people at all stages of HIV disease stay healthy.

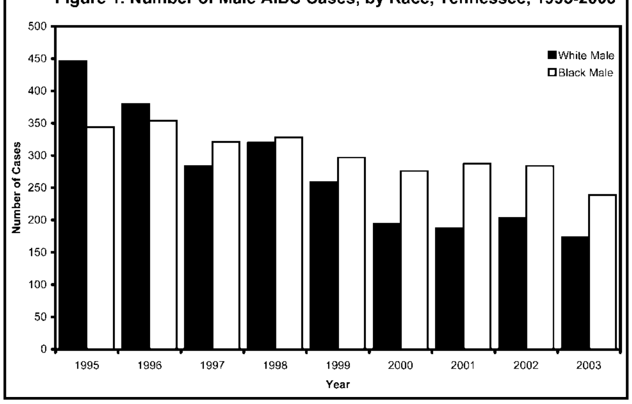
Source: Eric Miller, World Health Organization

HIV (Human Immunodeficiency Virus)

In 1992, Human Immunodeficiency Virus (HIV) infection became a reportable disease in Tennessee. From 1992 through 2002, the number of reported cases of HIV (not including AIDS) was 6,685. The number of non-duplicated cases of HIV and AIDS among Tennessee residents from the year of first reporting until 2003 is 17,534. Historically, cases are assigned to the year of earliest reported diagnosis.

Approximately 60% of HIV cases reported in Tennessee have been among blacks. There are over twice as many males reported with HIV than females. **Figure 1** indicates that the

Figure 1. Number of Male AIDS Cases, by Race, Tennessee, 1995-2003



highest risk of HIV infection is among men having sex with men. The next most common risk behavior for adults is having heterosexual sex with other individuals infected with HIV/AIDS followed by individuals infected through intravenous drug use.

The regional HIV rates per 100,000 persons in 2003 are presented by the consortia planning regions; the rural regions are East, 2.3; Southeast, 1.6; Middle, 2.6; West, 3.2 and Southwest, 5.9. The metropolitan rates are: Davidson, 30.0; Hamilton, 11.6; Knox, 9.9; Madison, 6.4; Shelby, 22.1 and Sullivan, 1.9. The overall state HIV incidence rate per 100,000 persons in 2003 is 6.8. The counties with the highest reported incidence rates for the same year include: Shelby (25.6), Davidson (20.8), Lauderdale (18.0) and Cannon (15.2).

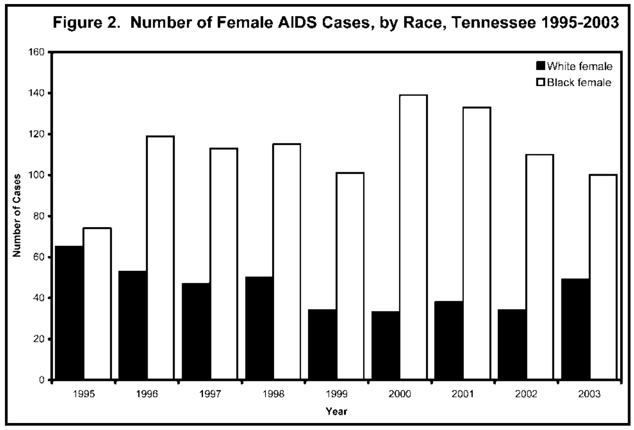
AIDS (Acquired Immunodeficiency Syndrome)

In 2003, the State of Tennessee started separating cases of Human Immunodeficiency Virus (HIV) and the Acquired Immunodeficiency Syndrome (AIDS) into two distinct groups. The first group is composed of individuals reported as HIV positive. The second group includes persons who were initially diagnosed as HIV positive and have progressed to AIDS, as well as those who were initially diagnosed as AIDS.

The total number of reported cases of AIDS from 1982 (the year AIDS data were first recorded) through 2003 is 10,663. The number of new cases of AIDS identified annually has decreased most significantly among whites, from 510 cases in 1995 to 222 cases in 2003. New AIDS cases among the black population have also decreased, from 415 in 1995 to 339 cases in 2003.

Historically, males have had higher rates of AIDS than females. From 2002 to 2003, the number of AIDS cases among white females has increased slightly. **Figures 1** and **2** depict the changes in the number of cases among females by race and among males by race,

Figure 2. Number of Female AIDS Cases, by Race, Tennessee 1995-2003



respectively. There were 10 cases diagnosed with AIDS in 2003 which were of Hispanic descent.

The overall state AIDS incidence rate in 2003 was 9.9 cases per 100,000 persons. The 2002 AIDS incidence rate within the United States was 17.3 for adolescents and adults and 0.2 for children under the age of 12 (statistics for 2003 have not yet been released at the time of printing). The regional AIDS rates per 100,000 persons in 2003 are presented by the HIV/AIDS consortia planning regions; the rural regions are East, 3.5; Southeast, 3.3; Middle, 3.5; West, 4.8 and Southwest, 3.7. The metropolitan rates are: Davidson, 30.0; Hamilton, 11.6; Knox, 9.9; Madison, 6.4; Shelby, 21.1 and Sullivan, 1.9. The counties with the highest incidence rates of AIDS in 2003 include, in descending order: Davidson (30.0), Haywood (25.2), Shelby (21.1) and DeKalb (16.7).

Additionally, 41 persons who were residents of Tennessee died with AIDS in 2003 (includes individuals who had AIDS but may have died from other causes; such as, motor vehicle crashes, etc.). The total number of deaths of Tennessee residents dying from AIDS, from 1982 through 2003 was 4,895. **Figure 3** depicts a slight decrease in the number of deaths in 2003. Highly active anti-retroviral therapy, as well as other advances in medical treatments, has greatly improved the quality of life among persons living with AIDS.

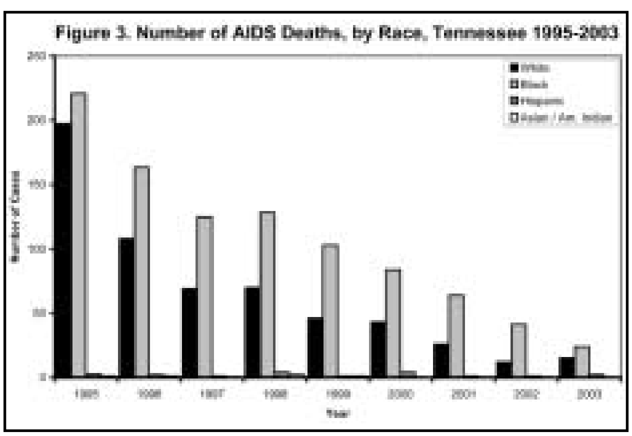


Figure 3. Number of AIDS Deaths, by Race, Tennessee 1995-2003

Pediatric HIV/AIDS Due to Perinatal Risk

From 1995 to 2003, there were 766 infants reported to have a perinatal exposure to mothers with HIV infection and/or an AIDS diagnosis, of which 82 cases were reported in 2003. Additional infants who were perinatally exposed to the AIDS or HIV virus may have gone uncounted due to reporting delays of these cases. The number of infants infected with HIV/AIDS has averaged between 3-7 cases per year, peaking in 1993 with 15. In 2002, 1 infant was diagnosed with AIDS, while 8 were HIV positive (numbers for 2003 have not yet been released at the time of printing). Improved interventions, including anti-retroviral agents used during pregnancy and labor and medical care for women and their newborns has greatly decreased the chances of exposed infants developing HIV or AIDS.

Chlamydia

Infections due to *Chlamydia trachomatis* are among the most prevalent of all sexually transmitted diseases (STD). In women, these infections, if left untreated, often result in pelvic inflammatory disease, which can cause infertility, ectopic pregnancy and chronic pain. In addition, pregnant women may also pass on infection to their babies during vaginal delivery. *Chlamydia* became reportable in Tennessee in July 1987. In 1988, 1,880 cases were reported; the number continued to steadily increase through 1991, in which 5,359 cases were documented. However, cases only increased modestly through 1994, when 6,787 cases were reported to the Tennessee Department of Health.

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 the previous year. This same level of funding was also available in 1996 and 1997. Furthermore, the introduction of funding for the Region IV Infertility Project in 1998 has led to a modest increase in testing each year through the present. As a result, the number of cases in 2003 increased to 21,034.

In 2003, 87% of *Chlamydia* morbidity occurred among patients aged 15-19 years (7,656) and 20-29 years (10,692). Females comprised 73% of all reported cases; this reflects the fact that most *Chlamydia* tests are performed on women visiting family planning, maternity and STD clinics. Additionally, 34% percent of female morbidity was reported among blacks and 37% among whites, while 29% had no race category identified (**Figure 1**). Black females aged 15-19 years have the highest rate of infection with 5,112 cases per 100,000 persons. Moreover, screenings of just over 83,200 patients for *Chlamydia* in health department STD, prenatal and family planning clinics in 2003 resulted in a range of 8% to 21% positivity rates in metropolitan areas and 5% to 11% positivity rates in rural areas. The overall statewide screening positivity rate for *Chlamydia* increased from 7% in 2002 to 12% in 2003. The increase can be attributed to more sensitive laboratory testing methods implemented in February 2003 (**Figure 2**).

Figure 1. Incidence of *Chlamydia trachomatis*, by Gender and Race, Tennessee, 2003

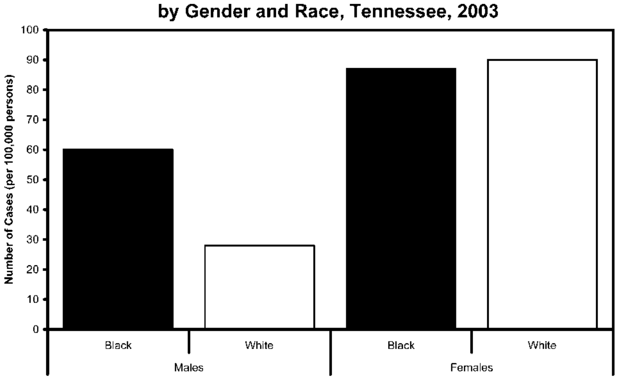
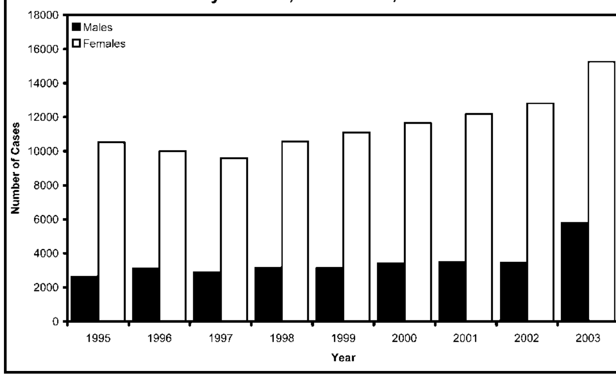


Figure 2. Number of Cases of *Chlamydia trachomatis*, by Gender, Tennessee, 1995-2003



Gonorrhea

Gonorrhea is a sexually transmitted disease (STD) caused by *Neisseria gonorrhoeae*, a bacterium that can grow and multiply easily in the warm, moist areas of the reproductive tract, including the cervix (opening to the womb), uterus (womb) and fallopian tubes (egg canals) in women, and in the urethra (urine canal) in both men and women. The bacterium can also grow in the mouth, throat, eyes and anus. CDC estimates that more than 700,000 persons in the U.S. get new gonorrheal infections each year, of which only about half are reported to CDC. Infections due to *Neisseria gonorrhoeae* remain a major cause of pelvic inflammatory disease, infertility, ectopic pregnancy and chronic pelvic pain. Furthermore, epidemiologic studies provide strong evidence that gonococcal infections facilitate HIV transmission.

Following a record high of 35,362 gonorrhea cases reported in 1976 (rate=817 cases per 100,000 persons), the number decreased by 76% to 8,717 cases in 2003 (rate=146 cases per 100,000 persons) (**Figure 1**). The metropolitan regions of the state have consistently accounted for 75-85% of the state's morbidity during this time period. In 2003, 60% of all reported cases of gonorrhea in Tennessee were black (**Figure 2**). In contrast to the first half of the 1990s, when cases

Figure 1. Number of Cases of *Neisseria gonorrhoeae*, by Gender, Tennessee, 1995-2003

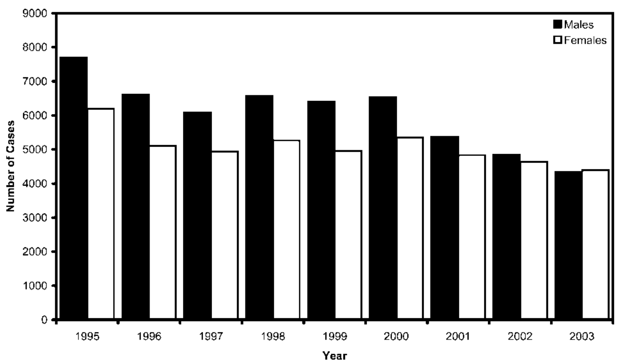
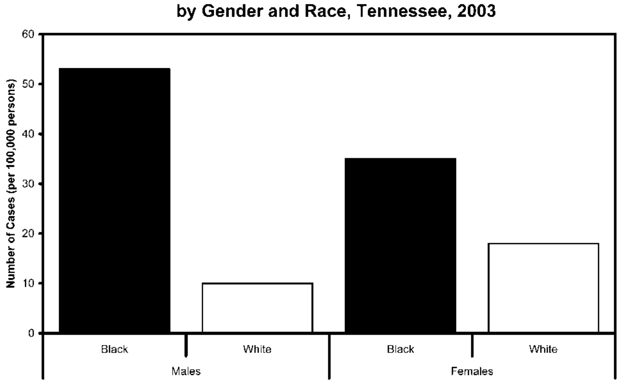


Figure 2. Incidence of *Neisseria gonorrhoeae*, by Gender and Race, Tennessee, 2003



decreased dramatically, the decrease in reported cases has been less striking in the past few years. In 2003, an overall decrease of 9% compared to 2002 was broadly based with decreases in half of Tennessee's 95 counties. The overall rate of 146 per 100,000 persons was well above the *Healthy People 2010* national goal of 19.

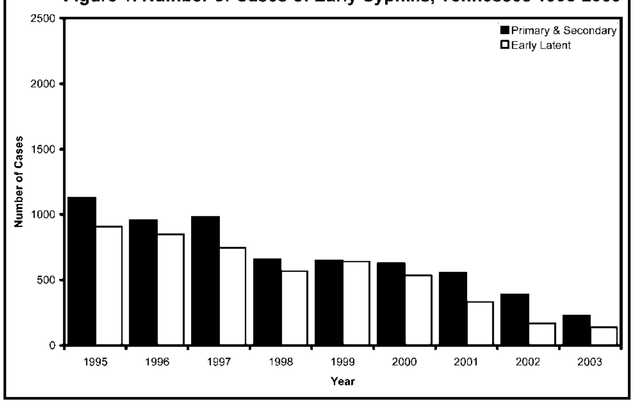
In previous years, women aged 15-19 years had the highest rates of gonorrhea in Tennessee, but in 2003 there was a shift. Women aged 20-29 years (492 cases per 100,000 persons) surpassed their younger counterparts, while men aged 20-29 years surpassed everyone to have the highest rate of all (512 cases per 100,000 persons). Additionally, screening approximately 83,200 patients for gonorrhea in health department STD, prenatal and family planning clinics in 2003 detected a range of 1-12% positivity rates in metropolitan areas and 3-9% positivity rates in the more rural areas of the state. These screening activities are directed primarily at women, particularly those aged 15-19 years.

Syphilis

Syphilis is a sexually transmitted disease (STD) caused by the bacterium *Treponema pallidum*. It has often been called "the great imitator" because so many of the signs and symptoms are indistinguishable from those of other diseases. Syphilis is passed from person to person through direct contact with a syphilitic sore. Sores occur mainly on the external genitals, vagina, anus or in the rectum, but can also occur on the lips and in the mouth. Transmission of the organism occurs during vaginal, anal and/or oral sex. Pregnant women with the disease can pass it on to the babies they are carrying. Many people infected with syphilis do not have any symptoms for years, yet remain at risk for late complications if they are not treated. Although transmission appears to occur from persons with sores who are in the primary or secondary stage, many of these sores are unrecognized. Thus, most transmission is from persons who are unaware of their infection.

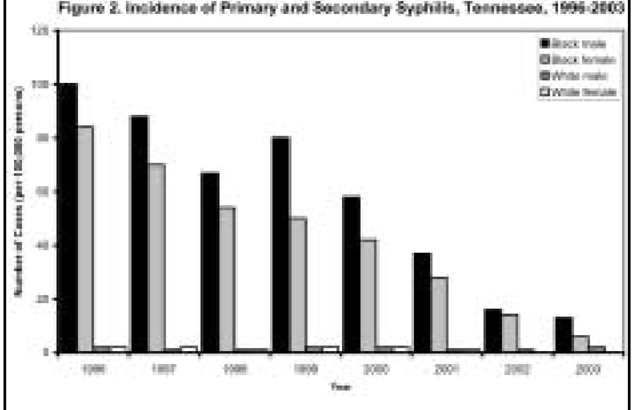
Historically, most syphilis cases in Tennessee occur in the large metropolitan areas. The six Tennessee metropolitan regions collectively represent 42% of the state's population; they account for 82% of the 363 cases of early syphilis (primary, secondary and early latent) cases in 2003. These six metropolitan regions include the following: Chattanooga-Hamilton County, Jackson-Madison County, Knoxville-Knox County, Nashville-Davidson County, Memphis-Shelby County and Sullivan County. In 2003, two metropolitan areas, Shelby County and Davidson County, reported 230 and 46 cases, respectively, or 77% of the state's total syphilis cases. The seven remaining rural regions comprise 58% of the state's population but accounted for only 12% of the early syphilis cases in 2003. Cases of early syphilis have decreased steadily in Tennessee since 1990 (**Figure 1**).

Figure 1. Number of Cases of Early Syphilis, Tennessee 1995-2003



Early syphilis cases are slightly higher among males than females. In addition, syphilis rates among both black males and females are disproportionately high. For example, blacks, make up 17% of the state's population, but historically represent about 76% of reported early syphilis cases. In 2003, the overall rate for primary and secondary syphilis within Tennessee was 5 cases per 100,000 persons; the rate for blacks was 28. Since 1996, syphilis rates have decreased 63% or 14 cases per 100,000 persons, and rates among blacks have decreased 66% to 277 cases per 100,000 persons (**Figure 2**). In 1996, blacks aged 20-29 years and 30-39 years had rates of 211 and 198 cases per 100,000 persons,

Figure 2. Incidence of Primary and Secondary Syphilis, Tennessee, 1996-2003



respectively. By 2003, the rate for these groups had fallen from 78% and 88%, to 63 and 45 cases per 100,000 persons.

In 2001, the state had two major cities with populations > 200,000 (Memphis and Nashville) among the top ten cities in the nation with syphilis. However, in the last year, Tennessee decreased the rate of syphilis among its residents. According to the latest report published by the MMWR, *Primary and Secondary Syphilis – United States 2002*, Memphis, Tennessee, ranked 19th in the top 19 cities in the United States. The rate of syphilis in Memphis among males and females are 8.9 and 10.9 cases per 100,000 persons, respectively.

In 2003, 136 cases were diagnosed with primary or secondary syphilis, 227 with early latent (less than one year) syphilis, 461 were late or latent cases and 2 were congenital cases. Statewide, the 136 primary and secondary cases combined represent a rate of 2.3 cases per 100,000 persons, greater than, but within reach of, the Healthy People 2010 national objective of 0.2 cases per 100,000 persons.

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 syphilis disease rates throughout Tennessee.

E. VACCINE-PREVENTABLE DISEASES

A physician's assistant is administering the second part of a Hepatitis B vaccination to this nine-month old infant. Regular checkups are a way to monitor an infant's health and development.
Source: Jim Gathany, Centers for Disease Control and Prevention

Vaccine-Preventable Diseases

One of the most powerful public health tools available in the United States is vaccination, with its ability to eliminate or control vaccine-preventable diseases. The Tennessee Immunization Program's goal is to achieve a 90% level of complete immunization against the following 10 vaccine preventable diseases: diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *Haemophilus influenza* type b, hepatitis B and varicella. In recent years, their occurrence has declined markedly in Tennessee. This is largely due to the widespread use of vaccines against these diseases and institutional requirements that ensure that children and adolescents attending day care and schools are adequately protected. With the exception of pertussis, the occurrence of these diseases is very low. **Table 1** below depicts the number of cases reported from 2000 to 2003.

As these diseases have become increasingly rare, progress regarding control of vaccine preventable diseases is not measured by a case count, but rather by assessing levels of immunologic protection against the diseases. To establish estimates of those levels, the Tennessee Immunization Program conducts annual surveys of certain population sub-groups: children 24 months old, children entering school for the first time and children enrolled in licensed day care centers (**Table 2**).

Of these surveys, the most important is the survey of 24-month-old children. This study not only establishes estimates of immunization levels in Tennessee, but it measures regional differences in those levels and identifies certain characteristics of those who do not complete their immunization series on time, thus providing a target population on which to focus to further improve immunization levels.

Complete immunization for children aged 24 months is defined as having received four doses of DTaP vaccine, three doses of polio vaccine, one dose of MMR vaccine, three doses of *Haemophilus influenza* type b vaccine, three doses of Hepatitis B vaccine and one dose of varicella vaccine ("4:3:1:3:3:1"). Prior surveys have defined complete immunization as the receipt of a minimum of four doses of DTaP, three doses of polio and one dose of MMR vaccine ("4:3:1") among children 24 months of age. For comparability purposes, those data will also be presented in the 2003 survey, but the more stringent measure has been included to address the

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2000-2003

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenza* type b < 5 y.o.
2000	41	0	0	0	0	2	1	0	2
2001	72	0	1	0	0	1	0	0	9
2002	119	0	1	0	0	2	1	0	5
2003	82	0	1	0	0	5	0	0	8

Table 2. Immunization Survey Results, Tennessee, 2003

Survey	Immunization Level
24 month Old Children*	83.30%
Day Care Center Enrollees**	89.30%
Public Kindergarten Survey**	98.40%
Non-Public Kindergarten Survey**	98.80%

* "4:3:1" series complete

** meet legal requirements for specific immunizations

Program's progress toward the achievement of the goal of 90% immunization coverage against the three additional diseases, as well as to measure the percent of children receiving all recommended vaccines by 24 months of age. A comparative graph of surveys conducted since 2000 and more detailed results of the 2003 surveys are cited below (**Figures 1-3**).

Inferences from the 2003 Survey:

Prior surveys have identified certain characteristics of children at increased risk of not completing immunizations. Principally, those are:

1. Children beginning immunizations at greater than 120 days of life;
2. Children who have two or more living siblings at birth; and
3. Children on TennCare who receive all of their immunizations at a private physicians office.

The 2003 survey continues to support these earlier conclusions and points out some other factors influencing the survey. Those are:

a) Immunization levels are in the third year of a decline. This is most likely due to ongoing shortages of DTaP, MMR and pneumococcal vaccines.

b) The market share for providers (i.e. proportion of vaccines administered by various provider groups) shows an increase in private provider share and a corresponding loss of approximately 5% in public provider share.

c) Current levels of complete immunization, four doses of DTaP, three doses of Polio, one dose of MMR, three doses of HIB, three doses of Hepatitis B and one dose of Varicella, ("4:3:1:3:3:1") do not approach the goal of 90%.

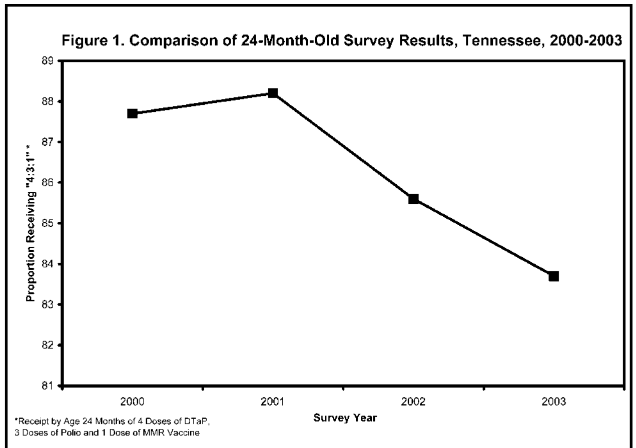


Figure 1. Comparison of 24-Month-Old Survey Results, Tennessee, 2000-2003

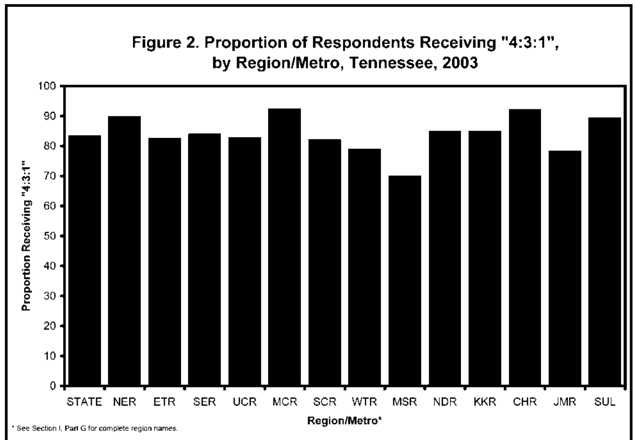


Figure 2. Proportion of Respondents Receiving "4:3:1", by Region/Metro, Tennessee, 2003

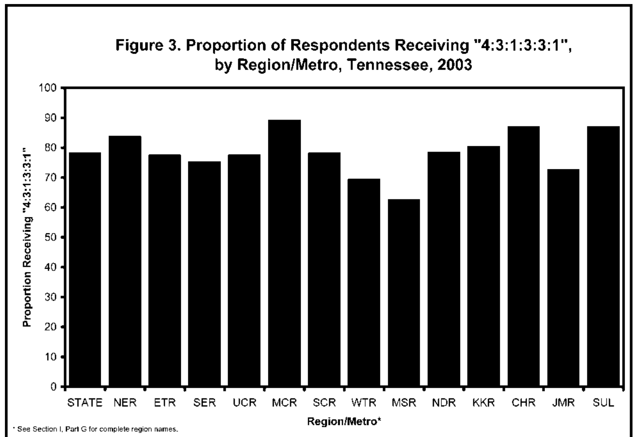


Figure 3. Proportion of Respondents Receiving "4:3:1:3:3:1", by Region/Metro, Tennessee, 2003

d) The administration of the fourth dose of DTaP is a major influencing factor in non-completion of both the comparison value for prior surveys ("4:3:1") and the new measure ("4:3:1:3:3:1"). The "3:3:1" value for 2003 is 91.1%. The

"3:3:1:3:3:1" level for 2003 is 84.1%. Failure to administer the fourth dose of DTaP reduced the "4:3:1" and "4:3:1:3:3:1" levels to 83.3% and 78.0%, respectively. Shortages of vaccine during the period the survey children were to receive this vaccine is a significant contributor to the low level of DTaP 4 immunization.

e) Immunization levels for "4:3:1" are higher for those vaccinated in private practices as a group than public health departments.
f) Those enrolled in TennCare are not as well-immunized as those not enrolled. TennCare enrollees seen solely by private physicians are significantly less well-immunized than children not enrolled in TennCare seen solely by private physicians (82.3% versus 92.2%, respectively).
g) Children enrolled in the Women, Infants and Children (WIC) program are not as well-immunized as those not enrolled.
h) Race appears to be a predictive factor in failure to complete immunizations.
i) The number of siblings continues to be a predictive factor in failure to complete immunizations.

The 2003 Childhood and Adolescent Immunization Schedule is presented at the end of this section. It can also be accessed at www.cdc.gov/nip. This is the website of the Centers for Disease Control and Prevention's National Immunization Program that contains valuable information for both clinicians and the lay public about this important public health resource.

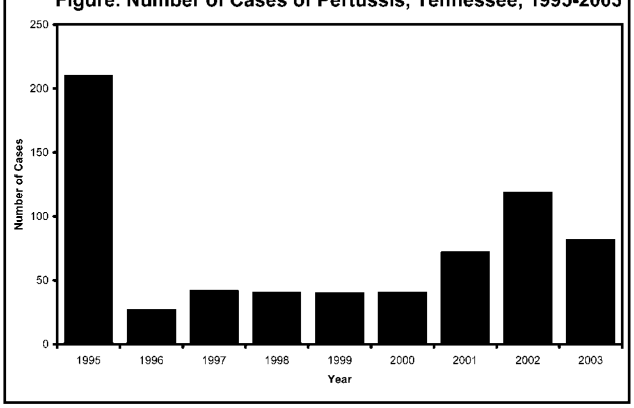
Pertussis

Pertussis, or whooping cough, is an acute, infectious, toxin-mediated disease caused by the bacterium *Bordetella pertussis*. The bacterium invades the respiratory cilia and produces toxins that cause inflammation of tissues and a subsequent cough, which proceeds from moderate to severe spasms with vomiting often following. These attacks may last for several weeks and convalescence may last for months.

Infants and young children are at greatest risk from pertussis. While 20% of all pertussis cases from 1997 to 2000 in the United States were hospitalized, approximately 63% of infected infants less than 6 months of age were hospitalized. In that same four-year span, 62 persons died from pertussis; 90% were less than 6 months of age.

The most common complication among those with pertussis, as well as the leading cause of mortality, is secondary bacterial pneumonia. Seizures and encephalopathy are also complications. These are more frequent in young children. Pertussis remains one of the most common childhood diseases and a major cause of childhood mortality in the United States. The **figure** shows the number of pertussis cases from 1995 to 2003 in Tennessee.

Figure. Number of Cases of Pertussis, Tennessee, 1995-2003



In recent years, studies of outbreaks of pertussis have identified older children, adolescents and adults as sources of pertussis infection. In the adolescent and adult populations, diagnosis may be more difficult as the symptoms of the disease are milder and not necessarily recognized as pertussis. *B. pertussis* is estimated to account for as much as 7% of the cough illnesses experienced by older persons in the United States. Adults are now thought to contribute substantially to the chains of transmission of disease in children. While childhood immunization against pertussis has reduced the disease burden in that population, the lack of a vaccine to protect older children (pertussis vaccine is not recommended for those over 6 years of age), adolescents and adults, as well as waning immunity from early childhood immunization contribute to pertussis susceptibility in those age groups and consequently a higher likelihood of infection upon exposure. The development of a vaccine for those over 6 may have an impact on the susceptibility of adults to pertussis. This vaccine is expected to be licensed in the United States within the next 12 months.

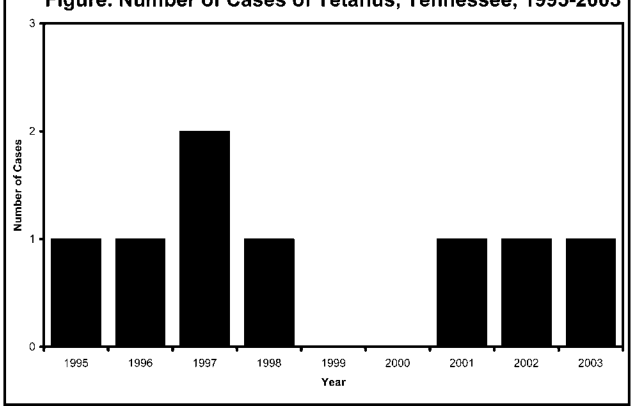
Tetanus

Tetanus is an acute, often fatal disease caused by an exotoxin produced by *Clostrdium tetani*. It is characterized by generalized rigidity and convulsive spasms of skeletal muscles. The muscle stiffness usually involves the jaw and neck (hence the common name "lockjaw") and then becomes generalized.

C. tetani produces spores which are widely distributed in soil and in the intestines and feces of horses, sheep, cattle, dogs, cats, rats, guinea pigs and chickens. Tetanus spores usually enter the body through a wound. However, tetanus is not communicable from one person to another. Infection is the result of direct inoculation of the body with the spores. Almost all cases of tetanus are in persons who were either never vaccinated or who had completed a primary series of vaccine, but failed to receive a booster in the 10 years preceding the infection.

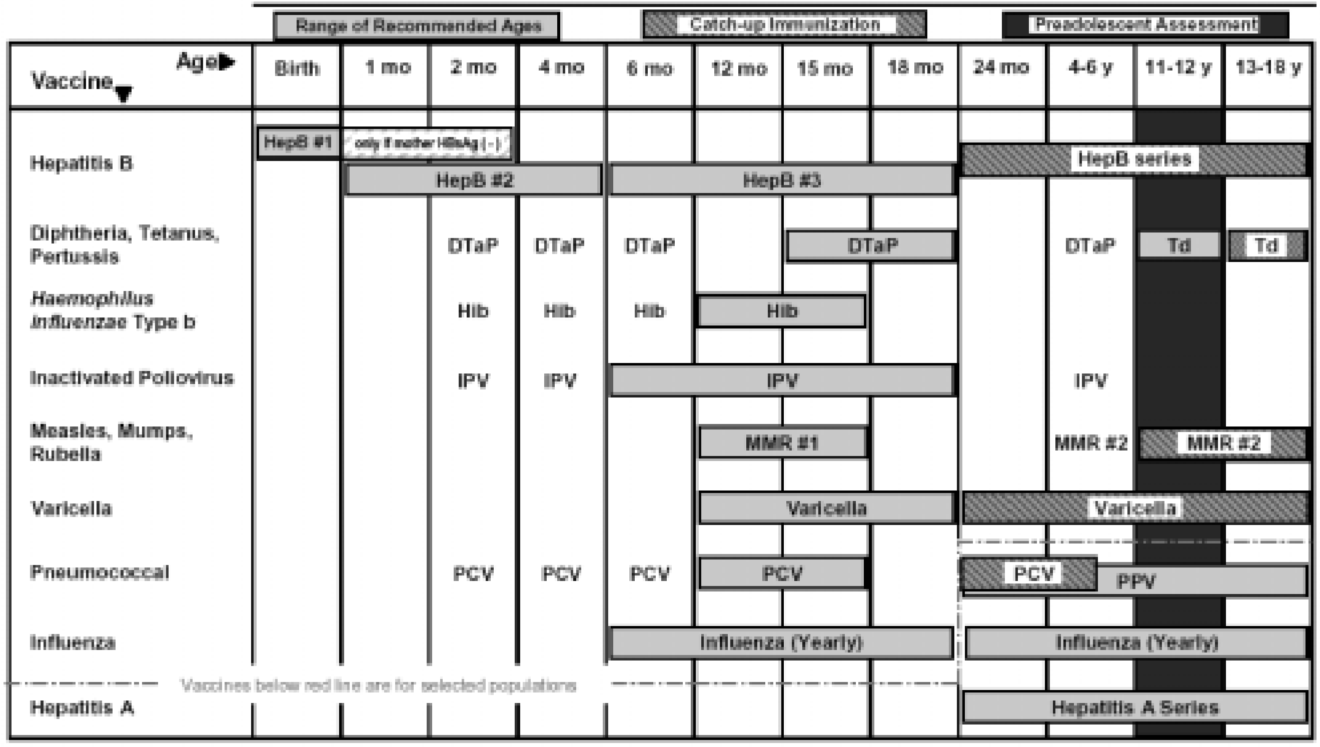
Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; nosocomial and secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality rate for tetanus is approximately 11%. The mortality rate is highest in those ≥60 years of age (18%) and unvaccinated persons (22%). In about 20% of cases, no other pathology can be identified and death is attributed to the direct effect of the toxin.

Figure. Number of Cases of Tetanus, Tennessee, 1995-2003



In Tennessee, tetanus is a rare disease; a total of 8 tetanus cases have been reported since 1995. The **figure** outlines the yearly distribution of those cases. The current recommendation for prophylaxis of tetanus is a primary series of three doses of DTaP/Td/DT vaccine and a booster dose every ten years (five years for persons working with horses).

Recommended Childhood and Adolescent Immunization Schedule
United States · July–December 2004



F. VECTOR-BORNE DISEASES

A man is applying a DEET repellant to his clothing in order to repel mosquitoes. Double protect. Wear long sleeves during peak mosquito biting hours, and spray DEET repellent directly onto your clothes. Don't apply repellents containing permethrin directly to skin, or spray repellent containing DEET on the skin under your clothing.

Source: James Gathany, Centers for Disease Control and Prevention

Arboviral Disease

Two arboviral diseases are currently prevalent in Tennessee: La Crosse encephalitis and West Nile fever.

La Crosse Encephalitis

La Crosse encephalitis (LAC) virus is the most medically significant of all the California serogroup viruses reported in the United States. The virus was initially discovered in 1963 in La Crosse, Wisconsin. The traditional endemic foci of the disease have been in the Great-Lake states, but in recent years an increase in incidence has been detected in the Mid-Atlantic States. **Figure 1** depicts the states that reported cases with case counts during 2003. Five of the eight states bordering Tennessee reported LAC cases in 2003. LAC is the leading cause of pediatric arboviral encephalitis and is considered an emerging disease in Tennessee.

Figure 1. Number of Reported Cases of La Crosse Encephalitis, by State, 2003

In 2002, 164 cases of La Crosse encephalitis were reported from 16 states in the United States, representing the most reported to CDC in any year since 1964. Due to the similarity of symptoms between LAC and West Nile virus (WNV), the increase in cases is likely due to improved WNV human case surveillance in the United States (MMWR 2003, 51:53). In Tennessee, from 1995-2003, a median of 14 cases (mean: 13; range: 6-19) were reported each year (**Table 1**). Since the disease is endemic in the eastern half of the United States, incidence rates for the Tennessee population are higher than the incidence rates of the United States population (**Table 1**). Rates have ranged from 0.03-0.06 cases per 100,000 persons in the United States (1995-2003) and 0.11-0.33 cases per 100,000 persons in Tennessee (1995-2003); the Tennessee rates have remained relatively consistent since 1998. In Tennessee, the disease primarily occurs from late May through October with peak transmission in August (**Figure 2**).

Figure 2. Distribution of La Crosse Encephalitis Cases, by Month of Onset, Tennessee, 1998-2003

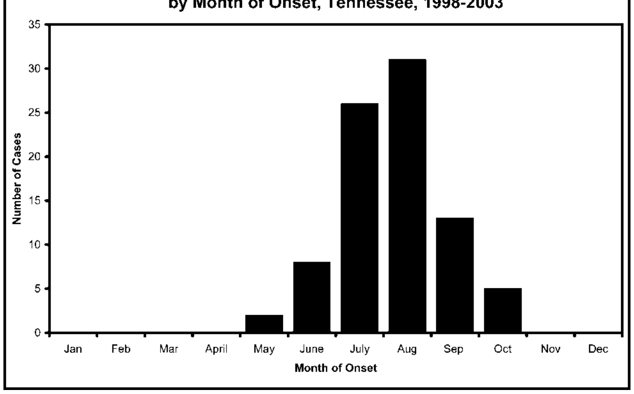


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 1995-2003

	1995		1996		1997		1998		1999		2000		2001		2002		2003	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN*	-	0.00	1	0.02	8	0.15	9	0.17	6	0.11	19	0.33	17	0.3	15	0.26	14	0.24
US**	11	#	123	#	129	#	97	0.04	70	0.03	114	0.04	128	0.05	164	0.06	NA	NA

NA=2003 Notifiable Diseases is not compliled # Not nationally notifiable * 2003 Data ** 2002 Data

Traditionally, *Ochlerotatus triseriatus* (the eastern treehole mosquito) is the primary vector of LAC, but in recent years *Aedes albopictus* (the Asian tiger mosquito) has been suggested to be associated with LAC cases in eastern Tennessee. The dramatic increase in LAC cases in Tennessee since 1996 has coincided with the arrival of *Ae. albopictus* in the eastern Tennessee region suggesting that this mosquito may become an important accessory vector potentially increasing the number of human cases in endemic foci or expanding the range of the disease. In 2003, three cases of La Crosse encephalitis were identified in Hickman (2) and Robertson (1) counties which may add to the increasing evidence that the virus is moving westward across the state due to the increasing presence of the *Ae. albopictus* mosquito.

LAC virus can result in mild to severe infections. Fatalities are rare (CFR <1%) and the ratio of unrecognized to recognized infections range from 26:1 to over 1500:1. The majority of cases (93%) occur in children < 15 years of age; however, Tennessee reported one case > 65 years of age this year. Although deaths are rarely associated with this disease, one death was reported in a child in the 1-4 year old age group in Tennessee (**Table 2**).

The primary risk groups for this disease are children < 16 years old that are active outdoors and/or reside in woodland habitats with numerous natural (tree holes) and artificial (tires, gutters, etc.) containers capable of supporting a resident *Oc. triseriatus* and *Ae. albopictus* population. Traditionally, the rural poor are the most affected sector of the population, although suburban families are increasingly relocating to rural areas, which may be a factor in changing this trend.

The most effective means of controlling the disease lies with effective public education of residents in risk-reduction practices, which include personal protection and mosquito breeding site source reduction around the home. Personal protection includes the wearing of insect repellents containing DEET. Since the species of mosquitoes that transmit LAC virus are relatively weak flyers and stay near their breeding site as adults, reducing stagnant water sources around the home is critical to reducing disease risk. Since the primary mosquito vectors develop in containers as small as tin cans and are active during the day, use of adulticides for community mosquito control is not very effective. Organized community mosquito control programs should focus on public education and homeowner/community source reduction.

LAC should be considered among patients (particularly children) presenting with fever and signs or symptoms of central nervous system involvement (i.e. aseptic meningitis or encephalitis) during the 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

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Age Group, Tennessee and the United States, 2003

	<1 year		1-4 years1		5-14 years		15-24 years		25-39 years		40-64 years		>65 years	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0.00	1	0.32	12	1.5	0	0.00	0	0.00	0	0.00	1	0.16
US**	3	0.08	35	0.23	100	0.24	5	0.01	10	0.02	11	0.01	0	0

* 2003 Data ** 2002 Data [1] One Fatality

specimens, or identifying IgM by 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) has emerged in recent years in temperate regions of Europe and North America, presenting a threat to public and animal health. The most serious manifestation of WNV infection is fatal encephalitis (inflammation of the brain) in humans and horses, as well as mortality in certain domestic and wild birds (particularly crows and blue jays). WNV has been a significant cause of human illness in the United States in 2002 and 2003. The incidence rate of WNV in Tennessee (0.97 cases per 100,000 persons) and the US (1.01 cases per 100,000 persons) were comparable during 2002 (**Table 1**). However in 2003 the Tennessee rate decreased to 0.44 cases per 100,000 persons.

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, by Year, Tennessee and the United States, 2001-2003

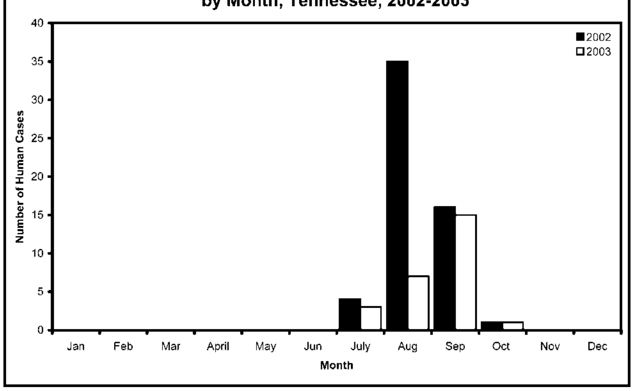
	2001		2002		2003	
	No.	Rate	No.	Rate	No.	Rate
TN	0	0	56	0.97	26	0.44
US	#	#	2840	1.01	2866	0.99

Not nationally notifiable

The natural transmission cycle of WNV involves birds and bird-feeding mosquitoes. As the summer progresses, the viral load in the bird population builds, increasing the risk that bird/mammalian-feeding (opportunistic) mosquitoes will come in contact with the virus and transmit it to the human and equine population. Humans and horses are referred to as dead-end hosts because they do not circulate enough infectious units in the blood system to re-infect a subsequent feeding mosquito.

In 2003 in Tennessee, there were 26 human cases of WNV reported, with 1 death. This was a 46% decrease compared to the previous year. In the 2002 season, 87% of the human cases reported were from the West Tennessee region and the Memphis/Shelby County metropolitan area, whereas in 2003 cases were more evenly spread throughout the state. The reason for this shift in disease occurrence is unknown. Additionally, most of the reported human cases occurred in late July through early October, peaking in August and September; this coincides with the period of primary mosquito vector activity (**Figure 1**).

Figure 1. Distribution of West Nile Virus Human Cases, by Month, Tennessee, 2002-2003



WNV can cause symptomatic disease in all age groups, but the majority of cases reported are over the age of 50 years (81%); the median age is 66.5 years (mean: 63.5 years;

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, by Age Group, Tennessee and the United States, 2003

	<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years		>65 years[1]	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0	0	0	0	0	1	1.12	3	0.24	8	0.42	14	2.17
US**	10	0.26	14	0.09	47	0.11	135	0.34	405	0.65	1065	1.26	1159	3.31

* 2003 Data ** 2002 Data [1] One Fatality

range: 16-92 years). Incidence rates for all age groups in Tennessee, with the exception of 15-24 year olds, were consistently lower than the national rates (**Table 2**). Of the 26 human cases reported in 2003, 21 (81%) were identified with WNV meningoencephalitis, while 5 (19%) were identified with WNV fever. 91% of the WNV meningoencephalitis cases were over the age of 50 years.

In 2002, the blood bank industry discovered that the virus could be spread by blood transfusions. Blood banks developed diagnostic tools to test every blood donation to ensure that the nations' blood supply remains safe. Through this screening process, WNV viremic blood donors were identified and reported to state health departments. There were three Tennesseans identified as WNV positive blood donors through this system; only one developed disease symptoms and was subsequently reported as a case.

After a thorough review of the 2002 WNV human cases, we found that WNV infections lead to high rates of mortality and persistent morbidity. People of advanced age with preexisting health conditions are particularly susceptible to severe neurological disease, long-term morbidity and death from WNV. Of WNV meningoencephalitis patients over the age of 70 years, 42% had not returned to their previous functional levels at least one year after acute the illness. Although WNV fever is considered a "milder" form of the illness than meningoencephalitis, our findings suggest that WNV fever can also be associated with substantial morbidity. Prevention efforts should be targeted towards those populations at greatest risk of developing severe sequelae.

Tick-Borne Diseases

There are several tick-borne diseases of concern in Tennessee: erlichiosis, Lyme disease and other tick-associated rash illnesses, and Rocky Mountain spotted fever.

Ehrlichiosis

Human ehrlichiosis is an emerging tick-borne disease that was first identified in 1986 in a 51-year-old man in Arkansas. It was initially thought that he had an *Ehrlichia canis* infection, a severe hemorrhagic disease of dogs. However, subsequent testing revealed that the causative agent was another closely related *Ehrlichia* (Rickettsiae) organism.

Ehrlichiosis became nationally notifiable in 1999, although Tennessee has been tracking cases since 1996. As with many other arboviral diseases, human ehrlichiosis is probably underreported because the etiology may not be elucidated. Since the initial discovery in 1986, two strains of human ehrlichiosis have been identified in the United States, human monocytic ehrlichiosis (HME) and human granulocytic ehrlichiosis (HGE) (**Table 1**). HME is the only strain that has been reported in Tennessee.

Table 1. Comparison of the Key Characteristics of the Two Strains of Human Ehrlichiosis

Disease	Human Monocytic Ehrlichiosis	Human Granulocytic Ehrlichiosis
Fatality Rate	2-5%	7-10%
Year Discovered	1987	1994
Etiologic Agent	Ehrlichia chaffeensis	Ehrlichia phagocytophila
Tick Vector	*Amblyomma americanum* (Lone Star Tick) *Dermacentor variabalis* (American Dog Tick)	*Ixodes scapularis* (Midwestern, Northeastern States *Ixodes pacificus* (California)
Reservoir	White tailed deer, dogs, rodents	White tailed deer, rodents
US Cases/year	150	275
US Distribution	Southern, South Central States	Northeast, Upper Midwest

HME is characterized by the acute onset of high fever, severe headache, myalgia, rigors and/or malaise with leukopenia, thrombocytopenia and elevated liver enzymes. Rashes may occur in 20-30% of cases and usually do not involve the palms or soles. Elderly and immunocompromised persons often experience more severe symptoms.

HME primarily occurs within the geographic distribution of the tick vector, *Amblyomma americanum* (lone star tick), which is responsible for transmission to humans; it is ubiquitous in Tennessee. The lone star tick is closely associated with the causative agent, *Ehrlichia chaffeensis*, and the reservoir, the white-tailed deer. The causative agent has been detected by molecular techniques (PCR) in lone star ticks collected in Missouri, North Carolina, Kentucky and New Jersey. The tick vector responsible for HGE, *Ixodes scapularis*, is rarely found in Tennessee, although there have been a few documented reports of this tick species in the state.

The majority of HME cases have occurred within the geographic range of *A. americanum*, the likely primary vector of the disease, but there are regions of the United States where that is not the case. *Ehrlichia chaffeensis* has also been detected in the American dog tick (*Dermacentor variabilis*), which may be responsible for disease transmission in some areas. In addition, some HME cases have been reported outside the geographic range of both tick species, which suggests there may be another tick vector in some regions or another unknown *Ehrlichia* agent.

HME incidence rates in Tennessee were higher in the years 2000, 2001 and 2002 compared to the incidence rates in the United States (**Table 2**). The 2003 Tennessee rate (0.53 cases per 100,000 persons) is the second highest rate for HME activity since the inauguration of surveillance in the state. Overall, Tennessee surpasses nearly every national incidence rate by category (i.e. age, gender and by year), which supports the fact that Tennessee is one of the leading states in HME activity in the United States.

Since 1996, 46% of the human cases in Tennessee have been reported from the Mid-Cumberland Region and the Nashville/Davidson Metropolitan area, with another 20% from the West Tennessee region. Although cases are reported throughout the year, national incidence peaks from May to July. However, incidence rates in Tennessee peak from June to September (**Figure 1**), which reflects the longer summer season and peak tick vector activity. Overall, 70% of the

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Age Group, Tennessee and the United States, 2003

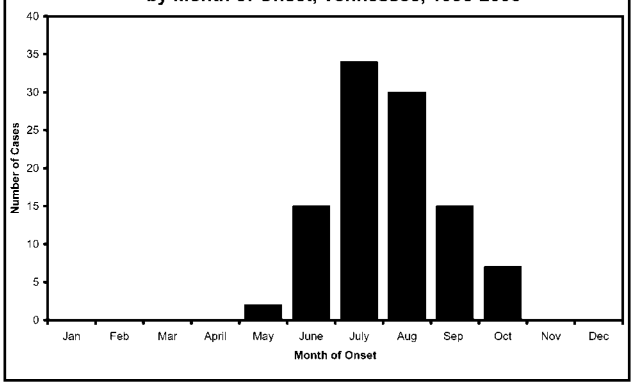
	<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years		>65 years	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0	1	0.32	2	0.25	1	0.12	6	0.48	12	0.64	9	1.41
US**	1	0.03	4	0.03	7	0.02	9	0.02	37	0.06	97	0.12	59	0.17

* 2003 Data ** 2002 Data

Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 1995-2003

	2000		2001		2002		2003	
	No.	IR	No.	IR	No.	IR	No.	IR
TN	46	0.81	20	0.35	26	0.45	31	0.53
US	200	0.09	142	0.05	216	0.08	321	0.11

Figure 1. Distribution of Ehrlichiosis Cases, by Month of Onset, Tennessee, 1998-2003



cases occur in persons over the age of 40 (**Table 3**); 75% are male.

Nationwide, it is suspected that most infections go undiagnosed. The severity of illness varies greatly and asymptomatic infections are common. The primary risk groups for symptomatic disease are males over the age of 40 years with tick exposure during the spring or summer months. Other human risk exposures are rural and suburban residence and recreational, peridomestic, occupational, and military activities. The most practical method of prevention is avoidance of tick infested habitats and exposure. Products containing DEET (N,N-diethyl-m-toluamide) can be used on exposed skin and products containing permethrin can be used on clothing or shoes. Wearing light colored clothing will enable quicker visualization of ticks. Tuck pant legs into socks or boots to create a physical barrier to exposed skin. Full body checks for ticks after potential exposure and removal of ticks immediately is critical for disease prevention. Removal of a tick shortly after imbedding in a host will significantly decrease the chance of disease transmission. Ticks must stay attached and feeding on the host 24-48 hours before the transfer of organisms can occur. Attached ticks should be removed with tweezers by gently squeezing the head and applying a slow but firm deliberate pressure to ensure the head of the tick is removed with the body. Ticks should not be removed from pets with bare hands.

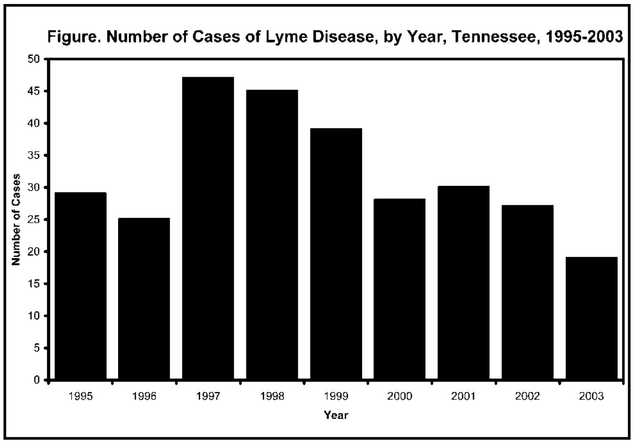
Lyme Disease and Other Tick-Associated Rash Illnesses

Lyme disease is caused by the spirochete *Borrelia burgdorferi*, which is transmitted to humans through the bite of infected *Ixodes* species ticks. Most Lyme disease is reported in the northeast and upper midwestern United States, with 95% of all cases reported nationally occurring in 12 states (Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Wisconsin).

The primary vector of Lyme disease, *Ixodes scapularis*, is rare in Tennessee. *Ixodes* ticks are much smaller than common dog and cattle ticks. In their larval and nymphal stages, they are no bigger than a pinhead. Ticks feed by inserting their mouths into the skin of a host and slowly taking in blood. *Ixodes* ticks are most likely to transmit infection after feeding for two or more days.

Lyme disease generally presents with a characteristic "bull's-eye" rash (erythema migrans), accompanied by nonspecific symptoms such as fever, malaise, fatigue, headache, muscle aches (myalgia), and joint aches (arthralgia). The incubation period from infection to onset of erythema migrans is typically 7 to 14 days but may be as short as 3 days and as long as 30 days. Neurologic symptoms and long-term sequelae such as arthritis have also been associated with Lyme disease.

The **figure** depicts the number of reported cases of Lyme disease in Tennessee since 1995. In contrast to Tennessee's incidence rate



of 0.3 per 100,000 persons in 2003, the national incidence rate in 2002 was 8.2 cases per 100,000 persons.

In recent years, patients from southern and southwestern states have been reported with rash illnesses following tick bites, but without laboratory confirmation of Lyme disease. This newly recognized disease has been called Southern tick associated rash illness (STARI). STARI infections are characterized by an expanding circular skin rash, similar to the erythema migrans of Lyme disease, at the site of a tick bite. Symptoms can include generalized fatigue, headache, stiff neck, fever and other non-specific symptoms. STARI should be considered in patients with localized rash, history of tick exposure, and absence of antibodies to *B. burgdorferi* using standard serologic Lyme disease testing methods. Symptoms resolve quickly with antibiotic therapy. STARI patients do not normally experience disseminated disease or long-term sequelae.

The lone star tick (*Amblyomma americanum*), the most abundant tick species in Tennessee, is the suspected vector of STARI. A new *Borrelia*, tentatively named *B. lonestarii*, has been identified in this tick species and is currently under investigation to determine its potential association with STARI.

STARI is not a nationally notifiable disease and the true prevalence/incidence is not known. There is currently no commercially available diagnostic test for STARI. It is likely that some of the Lyme disease cases reported in Tennessee are actually STARI. Patients suspected of having possible STARI can be enrolled in a CDC study by contacting CEDS.

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever (RMSF) is the most severe and most frequently reported rickettsial illness in the United States. The incubation period ranges from 2-14 days, although the majority of cases are symptomatic within 5-7 days. The initial symptoms are fever, headache, malaise, myalgia, nausea and GI involvement. The typical rash generally occurs 3-5 days after symptoms begin. The rash, if present, usually begins on the ankles and/or wrists, extremities and then spreads to the rest of the body. If the disease is not recognized or treated properly, symptoms can advance to mental confusion, coma and death. Approximately 20% of patients who do not receive anti-rickettsial therapy will die; even with proper treatment, 2% will die.

RMSF is caused by *Rickettsia rickettsii*, a species of bacteria that is spread to humans by ixodid (hard) ticks. The primary tick vector in Tennessee is *Dermacentor variabalis* (American dog tick). *R. rickettsii* has also been isolated from *Amblyomma americanum* (Lone Star tick), but this remains a minor vector and has had little impact on the transmission cycle. *R. rickettsii* normally circulates in nature between ticks and small rodents (ie. ground squirrels, chipmunks, mice and voles). As with many of zoonoses, humans and companion animals (canines) are incidental hosts.

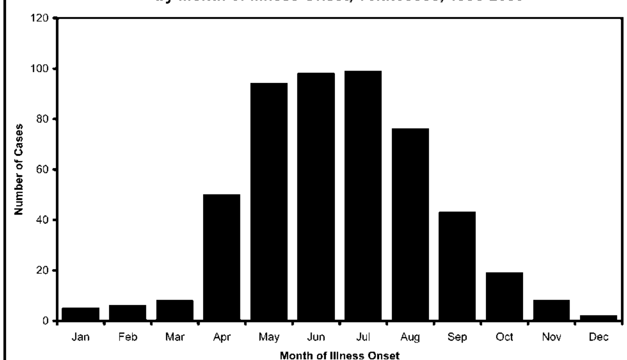
The risk of RMSF human cases even in tick-infested areas is quite low. Even in areas of human RMSF activity, only 1-3% of the tick population may carry the pathogen. Ticks are not only considered the vector, but can serve as a reservoir of the pathogen as well. Maintenance of the pathogen in nature is remarkably efficient and maintained by three independent transmission methods:

1. The pathogen can be passed horizontally from a viremic rodent to a feeding tick, which will remain infected for life, or
2. The pathogen can be transovarially transmitted from the female tick to its offspring, or
3. The pathogen can be venereally transmitted from male to female tick during the mating process.

Tennessee is one of the top five states in RMSF incidence, accounting for approximately 12% of all cases in the nation. The incidence rates in Tennessee have been significantly higher than the national rates (**Table 1**), with the exception occurring in 1998. Most RMSF activity is located in the south Atlantic and south central regions of the United States, although there have been a few documented cases in the western portion of the country.

Since 1995, cases have been identified throughout the state, with the Mid-Cumberland and Upper Cumberland regions reporting 30% of all cases. In 2003, cases were identified from every age group (**Table 2**). Approximately 62% of cases were over the age of 39 years, of which 80% were in the 40-64 year-old age group. Males (55%) appear to be slightly more at risk than females (45%). Dates of onset have occurred throughout the year in Tennessee, although the peak transmission time is generally between April and September (**Figure 1**).

Figure 1. Distribution of Rocky Mountain Spotted Fever Cases, by Month of Illness Onset, Tennessee, 1996-2003



Community supported prevention measures to reduce tick populations are not practical. Therefore, public education regarding personal protective measures is critical to reducing the chance of exposure. Before rickettsial transmission can occur, ticks must feed (imbed in skin and feed on blood) on the host for several hours to days. Transmission cannot occur with ticks just walking over the skin. For this reason,

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Year, Tennessee and the United States, 1995-2003

	1995		1996		1997		1998		1999		2000		2001		2002		2003	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	33	0.62	47	0.88	38	0.7	31	0.57	55	1.0	57	1.0	85	1.5	81	1.4	74	1.27
US	590	0.23	831	0.32	409	0.16	365	0.14	579	0.21	495	0.18	695	0.25	1014	0.39	1091	0.38

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Tennessee and the United States, 2003

	<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0	3	0.97	6	0.75	3	0.37	15	1.21	37	1.97
US**	4	0.11	43	0.28	137	0.33	100	0.26	227	0.36	437	0.52

* 2003 Data ** 2002 Data

it is important for people to perform full body tick checks after potential tick exposure. Swift identification and removal of the tick from the skin is vital for prevention. Use of DEET-containing insect repellants during all periods of potential exposure is important.

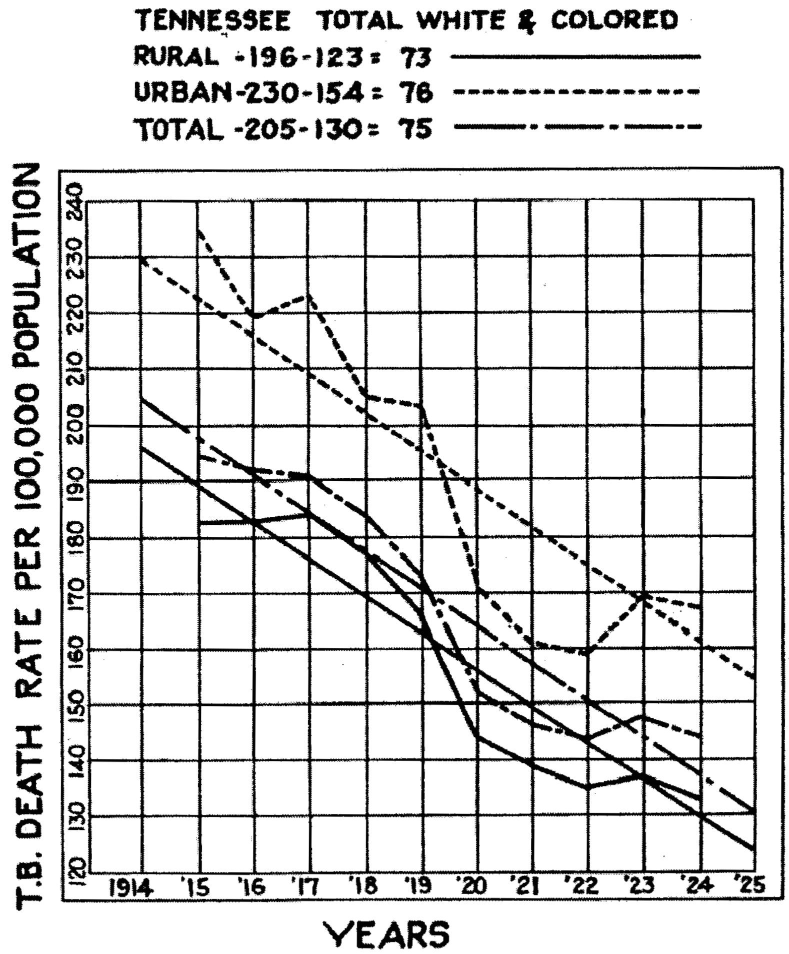
Prevention of Tick-borne Diseases

The best prevention for tick-borne diseases is avoidance of tick-infested habitats and tick bites. Products containing DEET (N,N-diethyl-m-toluamide) can be used on exposed skin or clothing; products containing permethrin can only be used on clothing or shoes. Wearing light colored clothing can enable prompt recognition of ticks. Tucking pant legs into socks or boots can create a physical barrier to exposed skin. Full body checks for ticks after potential exposures and prompt removal of ticks are critical to disease prevention. Removal of a tick shortly after it is imbedded in a host will significantly decrease the chance of disease transmission. Ticks must stay attached and feed on the host 24-48 hours before the transfer of organisms can occur. Attached ticks should be removed using tweezers by gently squeezing the head and applying slow firm pressure to ensure that the head of the tick is removed with the body. Ticks should not be removed from pets with bare hands.

G. TUBERCULOSIS

CHART IV.

TREND OF TENNESSEE
TUBERCULOSIS MORTALITY RATE



(138)

From 1914 to 1925, Tuberculosis was one of the leading causes of death in both Tennessee and the United States. In 2003, the Tennessee Department of Health's Tuberculosis Elimination Program is working to eradicate TB in Tennessee by promptly identifying persons with TB, as well as their contacts, and ensuring the completion of appropriate therapy.

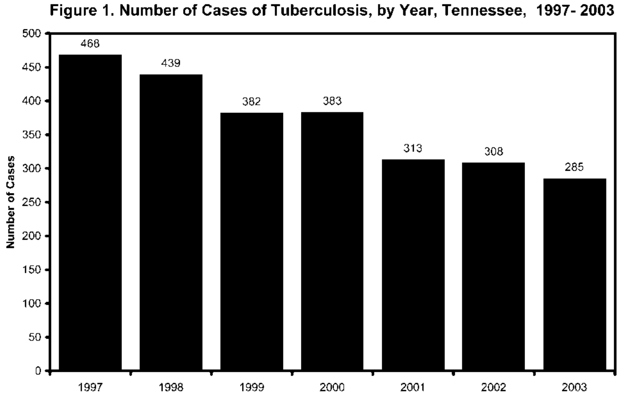
Source: Tennessee Tuberculosis Hospital Commission

Tuberculosis Elimination Program

In 2003, there were 285 cases of tuberculosis (TB) reported in Tennessee, representing a 7.5% decline from the previous year. The corresponding TB case rate of 4.9 cases per 100,000 persons is the lowest ever recorded for the state and is slightly below the 2003 national case rate (5.1 cases per 100,000 persons). Tennessee is ranked by the Centers for Disease Control and Prevention (CDC) as having the 15th highest TB case rate and the 12th highest number of TB cases in the nation.

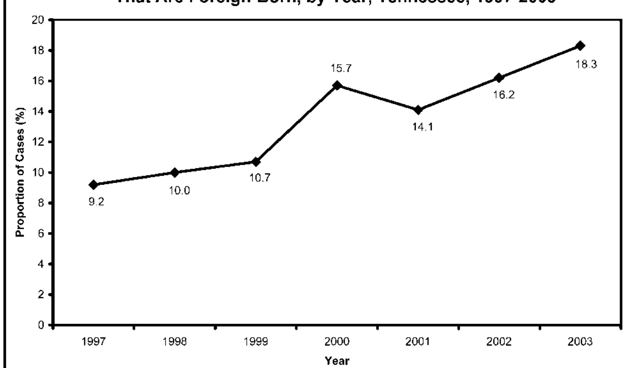
The burden of disease in 2003 is highest among Tennessee's two largest metropolitan areas, Memphis/Shelby County (8.9 cases per 100,000 persons) and Nashville/Davidson County (10.9 cases per 100,000 persons). Among those cases reported in 2003, 49.1% were non-Hispanic whites, 40.7% were non-Hispanic blacks, 8.4% were Hispanic (all races) and 8.4% were Asian or Pacific Islanders. Males accounted for 66% of the total morbidity. **Figure 1** illustrates the steady decline of TB morbidity in Tennessee from 1997 through 2003.

Figure 1. Number of Cases of Tuberculosis, by Year, Tennessee, 1997- 2003



From 1998 through 2003, the percentage of TB cases occurring among foreign-born persons, as well as the demographics of those cases, has changed remarkably. These changes reflect both the global prevalence of TB and the immigration trends in Tennessee. The total number of foreign-born cases and the percentage of the total morbidity they represent are shown in **Figure 2**. The increasing number of foreign-born cases has prompted the Tennessee Tuberculosis

Figure 2. Proportion of Reported Tuberculosis Cases That Are Foreign-Born, by Year, Tennessee, 1997-2003



Elimination Program to implement a targeted testing and treatment initiative to identify and treat members of this population for active TB disease and latent TB infection (LTBI).

The Tennessee Department of Health's Targeted Testing Initiative (TTI) began in March of 2002. In 2003, regional and metropolitan TB programs continued to carry out the TTI's mission to provide TB/LTBI education and screening to groups at high-risk for infection through individual screening at local health departments and in the community. A strong emphasis was placed on educating and screening foreign-born persons, since the incidence of TB/LTBI is high in this population. Individuals with specific medical conditions, exposure risk factors and a history of TB/LTBI infection are also at high-risk for TB infection.

During 2003, over 6,500 foreign-born persons were educated and screened for LTBI; 36.1% of those persons tested were diagnosed with LTBI, and four cases of active TB were detected. Over 16,400 non-foreign-born persons considered high risk for TB/LTBI were screened, educated and tested for LTBI; 7.6%

were diagnosed with LTBI and one active TB case was discovered. The Tennessee Department of Health continues to discourage the testing of low-risk individuals for TB/LTBI, given that approximately 1% of individuals classified as low-risk through screening have tested positive for LTBI since the initiation of the TTI program.

The incidence of drug-resistant TB continues to decline in Tennessee. In 2003, there was only one reported case of multi-drug resistant TB (MDR-TB), which is defined by the CDC as those cases with organisms resistant to at least isoniazid and rifampin. However, a total of 7% of TB cases reported had resistance to at least one TB medication, including 4% with initial isoniazid resistance. Therefore, the CDC and the Tennessee Department of Health strongly recommend that all patients diagnosed with active TB begin treatment with 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 2003, approximately 58% of TB cases reported in Tennessee received strict DOT, 35% were treated with a combination of DOT and self-administered therapy, and only 1% of patients were allowed completely self-administered therapy. In 2004, the Tennessee TB Elimination Program will continue to increase provider and patient awareness of the benefits of utilizing DOT throughout the duration of TB treatment.

Section IV.
Environmental Health

It is change, continuing change, inevitable change that is the dominant factor in society today. No sensible decision can be made any longer without taking into account not only the world as it is, but as the world as it will be.

Isaac Asimov

"Ensuring Healthy Environments for Children - the theme of the World Health Day 2003- is vital to our efforts to help shape the future of life. The biggest threats to children's health are found in the very places that should be safest – their homes, their schools and their communities." – Dr. Gro Harlem Brundtland, Director-General, World Health Organization

Source: P. Virot, World Health Organization

Putting the 'E' in CEDS

Environmental issues are divided among three different areas of state government: the Tennessee Department of Environment and Conservation (TDEC), the Department of Health's General Environmental Health (GEH) division and the Environmental Epidemiology Program (EEP) within Communicable and Environmental Disease Services (CEDS). TDEC has the responsibility to ensure a clean and safe environment in the state's parks, natural areas and communities. GEH is charged with maintaining healthful standards for potentially harmful environments, such as swimming pools, as well as ensuring that food service establishments meet appropriate standards. EEP is responsible for environmental public health activities that relate to chemical exposures and pollution. EEP investigates disease clusters that may be environmentally related to an exposure to chemicals or radionuclides.

EEP is funded through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is the federal public health agency within the Centers for Disease Control and

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

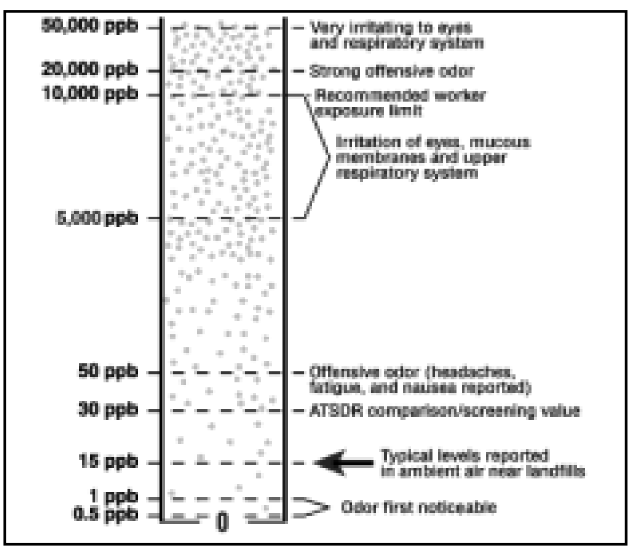
Prevention (CDC) whose mission is to prevent exposure to hazardous substances that may result in adverse human health effects and diminished quality of life. Many of these exposures are associated with waste sites, unplanned releases and other sources of pollution. Most of EEPs' investigations are related to hazardous waste sites, but cases do arise from emergencies and public complaint. Outside the Tennessee Department of Health (TDH), EEP frequently collaborates with TDEC, the U.S. Environmental Protection Agency (EPA), CDC, and other state and local agencies.

EEP conducts a variety of activities to carry out its mission to serve the needs of the public. These activities include: *public health assessments* (PHAs), *public health consultations* (HCs), exposure investigations, community involvement and health education. PHAs are written, certified publications that evaluate data and information on the release of hazardous substances into the environment in order to assess any past, current or future impact on public health. PHAs are a three-step project starting with a draft review, followed by a public comment period and concluding with the final printed publication. Environmental public health questions commonly answered include:

- How can chemicals at a hazardous waste site affect public health?
- Is there a present health hazard to people living near the site?
- Will there be a future public health hazard from the site?
- What actions are recommended to protect public health from pollutants?
- How can the state, ATSDR, or EPA best protect public health?

The most common environmental health investigation takes the form of a *health consultation*. Consultations are similar to PHAs, but usually discuss one specific, site-related public health question. HCs can determine whether cleanup actions are necessary to protect public health or respond to EPA requests, such as reviewing sampling plans and feasibility studies. If site conditions change or new data becomes available, a series of HCs may be written for one site. These investigations are intended to prevent or mitigate environmental exposure by recommending a public health action plan. Recommendations might include restricting land use, changing a drinking water source, conducting additional environmental sampling, restricting site access, implementing health education campaigns or removing contaminated material. In 2003, EEP worked in the following areas around the state, publishing 10 certified public health consultations, with associated site visits, public meetings and educational materials development. These consultations may be viewed on the TDH website at http://tennessee.gov/health. Click on Programs, then Communicable and Environmental Disease Services, then Environmental Epidemiology.

Jackson, Madison County: In responding to employee indoor air complaints, EEP discovered that the office building in question was built over an old landfill. Environmental sampling showed that methane, carbon



dioxide and other landfill gases were accumulating in the building. This led to engineering controls to mitigate the infiltration of gases into the building, installation of methane and carbon dioxide meters, and monitoring of other nearby businesses for landfill gas infiltration. Work products completed include two certified HCs, one exposure investigation protocol, five educational materials, one door-to-door notification, one public meeting and one public availability session.

Manchester, Coffee County: TDEC discovered that several private water wells in a subdivision were contaminated with the solvent perchloroethylene. The source of the contamination has not been identified. EEP concluded that, although several residential wells were contaminated, no health hazard currently existed. EEP recommended that an alternative water source be supplied to several households, more sampling of residential homes should occur, the source of the PCE contamination should be identified and the migration of the PCE plume in groundwater should be monitored. This investigation was documented in a certified public health consultation.

Chattanooga, Hamilton County: TDEC contacted EEP concerning a proposal for the creation of a greenway along Chattanooga Creek, an area with a long history of industrial pollution. During 2003, EEP began review of

data, meeting with various stakeholders and planning how to best address the issues of the proposal. The first of several documents is scheduled for publication in the near future.

College Grove, Williamson County: In 2003, a resident who had recently purchased a home in College Grove discovered battery chips in the yard and asked for assistance. The battery chips were similar to others found in the College Grove area in 1999. EEP worked with TDEC to have the soil tested and with the parents to have the child's blood tested for lead. Thankfully, children's blood lead levels were within the normal range, as lead can cause neurological problems in young children. However, EEP recommended that the residents take off their shoes and wash their hands before entering the house to minimize any exposure to lead. TDEC worked with the homeowner to remediate the area of lead contamination and did further testing at the residence to ensure no further areas of lead contamination existed. The family was given educational materials regarding lead exposure. This investigation resulted in one certified HC, the creation of education materials about lead, and a site visit with the parents.

Copper Basin Mining District: TDEC asked EEP to provide guidance on the possibility of adverse health effects from elevated levels of manganese in soil in an area where children played. EEP concluded that no apparent health hazard existed from the manganese in soil. The investigation was recorded in a certified HC.

Memphis, Shelby County: TDEC requested EEP's review of a report about indoor air sampling inside an elementary school that was built on the site of a former drycleaning facility. EEP reviewed the initial data set. A second data set was collected at the request of EEP to further rule out the possibility of a health hazard. A third data set was collected during a one-year environmental health checkup of the school. The final conclusion was that no public health hazard existed at the school. Investigation resulted in the publication of two certified HCs in 2003.

Sparta, White County: At TDEC's request, EEP investigated possible health effects from an underground gasoline storage tank leak and a former methamphetamine laboratory. EEP concluded that while no apparent public health hazard existed in the homes in the area, offensive odor can negatively affect quality of life. EEP recommended that the offensive odor be eliminated. Following a site visit, face-to-face meetings with concerned residents, telephone interviews and analysis of environmental data, a Public Health Consultation documenting the investigation was provided.

Greenbrier, Robertson County: EEP investigated a complaint that chemicals had been improperly disposed of in a residential neighborhood. Sampling and analysis of soil indicated the presence of dioxins, furans, DDT and dieldrin. All the chemicals' concentrations were well below levels of health concern. This investigation resulted in a certified public health consultation.

Memphis, Shelby County: TDEC asked EEP to determine if contamination from a state Superfund site, Sixty-One Industrial Park, posed a public health hazard. Sixty-One Industrial had many former uses including pyrotechnics manufacturing, metal plating, ordinance manufacturing, scrap metal recycling, use as a truck driving school, worm farming, a paint-ball game area and a junk yard. EEP concluded that no apparent public health hazard existed from the shallow aquifer contamination because this area of Memphis, Tennessee, was reported to be served by municipally-treated drinking water drawn from a separate, deep-water aquifer; an indeterminate public health hazard existed from the shallow aquifer contamination for people in nearby Mississippi who might get drinking water from private wells; an indeterminate future health hazard exists for the deep water aquifer if pollutant transfer through the Memphis sand layer has occurred or occurs over a period of time; and numerous physical hazards existed at the site. Recommendations included: ruling out use of the shallow water aquifer for Mississippi public or private wells; ruling out migration of chemicals from the shallow aquifer through the Memphis sand layer into the deep aquifer that is a source of Memphis municipal drinking water; limiting access to the Sixty-One Industrial site; and posting signage that clearly states the site is a hazardous waste site that contains chemicals harmful to human health and physical hazards.

Collierville, Shelby County: The U.S. EPA detected chromium in monitoring wells at the Smalley-Piper CERCLA site. EPA asked for a health consultation on the site because they were concerned that chromium contamination from the site could travel in the groundwater and could impact the Town of Collierville's drinking water, which is drawn from eleven wells supplying five water treatment plants. Periodic testing for chromium in raw water from two of the town's wells that serve Water Treatment Plant #2 was mandated in 2002. Chromium levels were increasing, although the levels were below the Maximum Contaminant Level (MCL) for total chromium allowed by the EPA and TDEC. Regulatory authorities and the Town of Collierville were most concerned because a large portion of the chromium in the two wells was in the hexavalent form. Hexavalent chromium is much more toxic than trivalent chromium, especially to children. Plant #2 supplies about 8% of Collierville's total demand.

EEP concluded that:

- No apparent public health hazard existed for consumption of water supplied by the Town of Collierville's Department of Public Services Water Plant #2.
- An indeterminate future public health hazard exists. If the chromium concentration in finished drinking water continues to increase, the result could become a public health hazard.
- Private groundwater wells are no longer used for drinking water in Collierville.

EEP recommended the following:

- Continue to monitor the total chromium and hexavalent chromium(VI) concentrations in well numbers 201 and 202 and the finished drinking water product at Water Plant #2.

- If the hexavalent chromium(VI) concentration remains consistently over 30 ppb in finished drinking water, then additional chromium-reduction procedures should be implemented to protect children's health.
- If the total chromium concentration in finished drinking water exceeds the voluntary contaminant level of 50 ppb, then the Department of Public Services should stop using Water Plant #2 to protect public health.

In addition to the written public health consultations, EEP assisted many citizens and agencies with verbal consultations. The more interesting of those were:

- Review of protective actions at the East Tennessee Regional Health Office resulting from a mercury spill.
- Assistance with health hazards identification from a catechol spill in Greene County.
- Finalizing, with the Memphis/Shelby County Health Department and the Department of Public Works, educational materials to be delivered to homes near North Hollywood Dump.

In order to facilitate and increase the effectiveness of environmental public health investigations, environmental epidemiologist positions were created in 2003 in each of the 13 regional health offices. EEP looks forward to increased collaboration between EEP and the regional health offices in planning joint responses to environmental public health issues.

Section V.
Investigations and Outbreaks

Infectious diseases are here to stay. Our task is to give them as little room for manoeuvre as possible lest they develop their skills and become pandemic-causing superbugs.

Dr. Pete Moore, Killer Germs, page 217

In the valley of Mexicali (Mexico), one of the most profitable crops is the green onion. Because it is in such high demand, with exports to the United States and various other parts of the world, the cultivation of green onions provides jobs to a large number of people. In 2003, the contamination of green onions in Mexico was at the center of the Hepatitis A outbreak investigation in Knoxville.

Source: "Cebollín", La Voz de la frontera, November 13, 2003

Investigations and Outbreaks in Tennessee in 2003

The following section presents significant investigations that highlight efforts of the Communicable and Environmental Disease Services section (CEDS) and health department personnel from across the state in 2003. The investigations illustrate the burden of illness for patients and families, as well as the actions taken by public health professionals to prevent additional outbreaks. There are a wide variety of problems encountered in the public health setting; strategies utilized to deal with them vary as well. Publication of findings such as these can lead to the prevention of future outbreaks, which have the potential to harm large numbers of people. The following are examples of outbreaks and public health investigations undertaken in Tennessee in 2003:

Foodborne Outbreak of Hepatitis A from Green Onions — Tennessee, 2003

Background: Hepatitis A is one of the most common vaccine preventable infections in the United States. Hepatitis A rates have decreased in areas of the United States where routine vaccination is recommended. In 2003, hepatitis A gained notoriety in several restaurant-associated foodborne outbreaks in the U.S, resulting in at least 3 deaths and over 700 acute infections.

Objectives: To identify the source of a restaurant foodborne outbreak of hepatitis A.

Methods: A case-control study was undertaken with employees and patrons of Restaurant A in Knoxville. Cases were defined as persons with a history of eating at Restaurant A between August 1-31, 2003, with clinical symptoms of hepatitis A and IgM positive serology for hepatitis A. Controls were persons without illness who ate at Restaurant A between August 1-31, 2003. Controls were excluded if they had a history of jaundice or dark urine between August-September 2003, a history of hepatitis or hepatitis A vaccination. A standardized questionnaire was administered to cases and controls either in person or by telephone. Serum samples from cases were sent to the Centers for Disease Control and Prevention (CDC) for viral sequencing.

Results: A total of 57 cases and 204 controls were enrolled in the study. Of the 57 cases, 7 were employees that contracted hepatitis A during the same time period as patrons. A significant association between consumption of green onions and illness was found (OR=65.5, 95% CI=8.9-482.5). Twenty-eight serum samples were sent to the CDC; all had identical viral sequences similar to those of hepatitis A patients living along the U.S-Mexico border. A traceback investigation determined that the green onions originated from farms in Mexico.

Conclusions: This outbreak of hepatitis A was associated with eating uncooked green onions. Routine immunization for hepatitis A may avoid such future outbreaks in the United States.The virus was identified by genetic sequence analysis as a variant associated with silver-haired and eastern pipistrelle bats.

Foodborne Outbreak of Enterotoxigenic *E.coli* O169:H41 — Tennessee, 2003

Background: Enterotoxigenic *Escherichia coli* (ETEC) is traditionally recognized as a common cause of traveler's diarrhea, but is becoming a more frequent cause of foodborne disease outbreaks in the United States. The local and state health departments of Tennessee investigated an outbreak of gastroenteritis among employees involved with inventory of company A in Tennessee. This case illustrates the importance of considering ETEC as a possible cause of domestically acquired gastroenteritis.

Methods: A cohort study was conducted among all employees participating in inventory work and catered meals on August 14 or 15. A case was defined as diarrhea or vomiting, or fever and cramps in an employee within seven days of eating a catered meal at Company A on August 14 or 15. A standardized questionnaire was administered to all employees by telephone or personal interview. Stool samples were tested at the state laboratory and CDC. Data were analyzed using Epi-Info 2002.

Results: Of 63 employees, 36 met the case definition (attack rate 57%). Symptoms included diarrhea (92%), cramps (72%), fever (31%) and vomiting (6%). Mean incubation period was 57 hours. Mean duration of illness was 2.7 days. Eating catfish (RR=2.07, 95% CI=1.1-4.0) or coleslaw (RR=1.9, 95% CI=1.2-3.0) at lunch on August 15 was significantly associated with illness. Stool samples from all 18 patients were negative on routine culture; 12 of 18 specimens tested at CDC revealed ETEC O169:H41. One employee reported travel to Mexico two weeks previously, but denied illness before this outbreak.

Conclusions: ETEC should be considered as a potential cause of domestically acquired gastroenteritis. When ETEC is suspected clinically and routine stool cultures are negative, special studies at a reference laboratory are required to identify the pathogen.

Salmonella enteriditis Outbreaks Associated with Eggs at a Restaurant

In June 2003, the East Tennessee Regional Health Department staff investigated a restaurant-associated outbreak of S. enteriditis. A total of 46 ill persons were identified, including patrons from 7 states. The mean incubation period was 39 hours. A case-control study implicated ham-and-cheese omelettes as the likely vehicle, with an odds ratio of 53 (!). Eggs are a frequently implicated vehicle in the transmission of *Salmonella* enteriditis to humans.

Foodborne Outbreak at a Golf Benefit

Background: On September17th, 2003, a golf benefit was held in Dickson, Tennessee. Approximately 170 people were involved in the day's activities. Three meals were prepared and served that day by a caterer. It was noticed in the ensuing days that multiple employees were absent from work due to illness.

Methods: A cohort study was performed. A roster of golf teams, a list of volunteers and a list of employees were obtained. Questionnaires were administered by telephone inquiring about patient demographics, whether they were ill or not, onset of symptoms and what specific foods or drinks they had eaten at each meal. Illness was defined as having either diarrhea or vomiting, or a combination of nausea and cramps. If the individual was an employee of the catering service or a volunteer, they were also asked about involvement in food and drink preparation and serving.

Results: A total of 134 questionnaires were completed. Of these, 78 met the case definition of being ill. The main symptoms reported were diarrhea (82%), cramps (67.5%), vomiting (52%) and nausea (90 %). The mean incubation period was 1.2 days. Eating the catered lunch was associated with a relative risk of illness of 3 ($p<0.0001$). Relative risks (RR) of particular foods included 2.14 for chicken salad ($p<0.01$), pasta salad RR 1.78 ($p=0.00004$) and tuna salad RR 1.53 ($p=0.01$). Combinations of chicken salad with pasta salad or tuna salad gave a RR of 2.4 ($p<0.001$) and 2.7, respectively. Those who ate chicken salad, pasta salad or tuna salad had a RR of 3.27 ($p<0.001$). A child of an employee working for the catering company was ill with gastroenteritis prior to the golf benefit. Stool samples from the child, as well as from ill golfers and volunteers, were positive for norovirus by PCR.

Conclusions: Norovirus is an RNA virus that causes a primarily vomiting illness with diarrhea. Illness usually begins within 24-48 hours after exposure and is a common cause of foodborne outbreaks. It is likely that the child of an employee for the catering service was ill with norwalk gastroenteritis and transmitted the virus to the food handler who then contaminated uncooked foods served for lunch at this event. This case illustrates the need for thorough hand washing and good hygiene in preventing the spread of disease.

Multiple Modes of Transmission of Norovirus at a Fast-Food Restaurant — Tennessee, 2003

Background: Noroviruses cause an estimated 23 million cases of acute gastroenteritis in the United States annually. In March 2003, we investigated an outbreak of norovirus gastroenteritis associated with a fast-food restaurant in Tennessee. Over 100 persons reported illness.

Methods: We conducted a case-control study among Fast-Food Restaurant A (FFRA) patrons to determine risk factors for illness. We defined a case as vomiting or diarrhea (≥3 loose stools/24 hours) between February 27 and March 3 in a person who ate at FFRA in the week before illness. Controls ate at FFRA in the same period, but were well. Stool samples were tested for norovirus using reverse transcriptase polymerase chain reaction (RT-PCR).

Results: We interviewed 49 case-patients and 64 controls. Illnesses peaked on March 1, with a median incubation period of 29 hours. RT-PCR testing confirmed norovirus as the causative agent. On logistic regression analysis, exposures independently associated with illness were: sandwiches (odds ratio [OR] 14.0, 95% confidence interval [CI] 4.1-47.3), french fries (OR 3.9, 95% CI 1.4-11.1), lunch on February 27 (OR 9.6, 95% CI 2.9-32.4), lunch on February 28 (OR 6.3, 95% CI 1.3-31.7), and food from the drive-thru window (OR 5.6, 95% CI 1.7-18.1). One FFRA employee reported being ill while working as the drive-thru cashier, handling only money, during lunch on February 27 and 28.

Conclusions: Infected employees were the probable source of a large norovirus outbreak at FFRA. Illness was associated with two types of food, specific mealtimes, and the drive-thru window where an ill employee handled money, suggesting multiple modes of transmission including food, direct contact and fomites. Food handlers with acute vomiting or diarrhea should not work while potentially infectious. Work restrictions may also need to be extended to restaurant employees in non-food handling positions as well.

Survey of Public Knowledge, Attitudes and Behaviors Regarding West Nile Virus, Tennessee, 2003

Background: Since 1999, West Nile virus (WNV) has spread throughout the United States and caused substantial concern among the public, media and medical providers. Few data exist on public perception of the disease or acceptance of risk reduction recommendations.

Methods: A telephone questionnaire was administered to adults randomly selected from the three major geographic divisions of Tennessee.

Results: Questionnaires were administered to 1200 people; 24% listed WNV among the top 3 public health issues of concern. One third of respondents believed that at least 25% of persons bitten by an infected mosquito would become ill, and 18% believed that at least 25%

of persons ill with WNV would die. Of respondents, 54% believed WNV could be transmitted by contact with birds or animals, and 14% thought it was transmitted by sneezing or coughing. Of respondents, 42% were “not very” or “not at all” concerned about becoming infected with WNV; 49% believed that using insect repellant was the best way to prevent infection, but only 13% of persons had changed their use of insect repellants in the previous year because of concerns about the disease. Sixteen percent of persons had decreased the time spent outdoors to avoid WNV infection; 62% would want insecticides sprayed in their neighborhoods to reduce the chances of getting WNV.

Conclusions: The majority of respondents correctly answer questions regarding the transmission and clinical characteristics of WNV, though a substantial proportion of the population continues to have misconceptions. Despite this, few people have changed behaviors in response to the threat of WNV infection. Improved, targeted education regarding risk reduction is necessary.

Feasibility of Implementing Alcohol-based Hand Sanitizing Gel in Daycare Centers during an Area Outbreak of Diarrhea due to *Shigella* Infection

Background: Frequent and prolonged outbreaks of Shigella infection involving day care center (DCC) attendees occur each year in the U.S. Existing recommendations for control and prevention have focused on education and reinforcement of traditional hand washing with soap and water. In spite of these efforts, transmission of diarrhea due to Shigella infection often persists. The supplemental use of a waterless, alcohol-based hand sanitizing gel has been effective in reducing nosocomial disease in hospitals, but has not been evaluated in the DCC setting.

Methods: We enrolled 3 DCCs in Memphis, Tennessee in a three-week pilot intervention study during an area outbreak of shigellosis involving multiple DCCs. We examined baseline DCC characteristics using a pre-intervention survey. At each DCC, we conducted a training session which included a slide presentation for teachers, and a short video and song for children. We demonstrated proper hand sanitizer use and installed a three-week supply of hand sanitizer using one personal-size 2-ounce bottle for each teacher, and one 12-ounce bottle and one wall dispenser unit near the hand washing area in each classroom. We measured the volume of hand sanitizer used from each source weekly and conducted post-intervention assessments to assess acceptability and safety of hand sanitizer use.

Results: The median number of children ≤5 years enrolled was 200 (range 50-350), and 87 % required state-funded subsidies for DCC attendance. The hand hygiene training and introduction of hand sanitizer were well accepted by DCC staff and children. The average daily volume of hand sanitizer used per child increased from 14 ml in the first week to 27 ml in the third week. All 11 responding teachers reported that most children who they supervised used the hand sanitizer regularly, with an average use of 6 times per day. No adverse events associated with hand sanitizer use were reported.

Conclusions: A waterless alcohol-based hand sanitizing gel intervention was successfully implemented in three large, lower income DCCs in Memphis during an ongoing outbreak of shigellosis. Further studies to assess health outcomes related to hand sanitizer use in DCCs are needed.

Food Safety Education Among Tennessee Residents, 2002-2003

Background: Foodborne diseases cause 76 million illnesses and 500 deaths in the United States each year. Most foodborne disease could be prevented by proper handling and preparation of food, yet few population-based studies have been done examining how people are educated regarding food safety.

Methods: In 2002-2003, the CDC's Foodborne Diseases Active Surveillance Network (FoodNet) administered an extensive questionnaire by telephone to residents of nine states, using random-digit dialing methodology. We examined the responses of residents of the four major metropolitan areas of Tennessee, who were asked questions regarding food safety education.

Results: Of 1,824 persons interviewed, the median age was 42 years (range 1 to 96 years); 58% were female. Of respondents, 85% had prepared at least one meal at home in the previous month; 60% had prepared more than 10. In addition, 137 (8%) stated they had worked preparing food for persons other than their family in the previous month. Of all respondents, 63% stated that they had never received any training or information regarding safe food handling; 25% of those recently working in food service outside the home had not. Of 660 persons who had received food safety training, 213 (32%) received it at school, 24% from on-the-job or commercial training, 8% from various media sources and 25% from a variety of other sources; only 9% received training from a health department, health care provider or nutritionist. Of respondents, 746 (41%) reported ever receiving information regarding risky or unsafe foods. Of those, 21 (3%) had consumed undercooked ground beef, 36 (5%) had consumed unpasteurized juice and 80 (11%) had consumed runny eggs or items containing raw eggs within the previous week. These responses did not differ significantly from those stating that they had never received education regarding risky or unsafe foods.

Conclusions: A substantial proportion of people who handle food report never having received education or training in food safety, including institutional foodhandlers. If foodborne diseases are to be prevented, the general population must be better educated regarding safe food handling.

Restaurant Inspections: An Epidemiologic Analysis of Scores in a Statewide System and Implications for the Prevention of Foodborne Disease

Restaurants in the United States are regularly inspected by health departments, but there are few data regarding the effect of restaurant inspections on food safety. We examined statewide inspection records from July 1993 through June 2000. Data were available from 168,351 restaurant inspections. From 1993 to 2000, mean scores rose steadily from 80.2 to 83.8. Mean inspection scores of individual inspectors ranged from 69 to 92. None of the 12 most commonly cited violations were critical food safety hazards. Establishments scoring under 60 had a mean improvement of 16 points on subsequent inspections. Mean scores of restaurants experiencing foodborne disease outbreaks did not differ from restaurants with no reported outbreaks. A variety of factors influence the uniformity of restaurant inspections. The restaurant inspection system should be examined to identify ways to ensure that it effectively promotes food safety.

Monkeypox

During May and June 2003, a cluster of febrile vesicular rash illnesses was identified among human patients from Midwestern states who reported contact with ill pet prairie dogs. Investigation by the CDC, USDA, and numerous other federal and state agencies eventually identified over 70 human cases of monkeypox, representing the first introduction of this disease in the Western Hemisphere. Extensive animal tracebacks identified the source as prairie dogs from (or exposed to) a single imported shipment of 800 small mammals (including a Gambian rat) from Ghana. This outbreak led to widespread media attention and an extensive public health response. Smallpox vaccine was administered to some exposed humans. In Tennessee, animals potentially associated with the implicated international shipment had to be traced, evaluated and quarantined. None were found to have had monkeypox. This outbreak led to re-evaluation of working relationships and communication between numerous federal and state agencies involved in human and animal health and commerce, as well as laws applicable to the control of such zoonotic diseases of public health importance.

Section VI.
Bioterrorism

The significant problems we face today cannot be solved at the same level of thinking we were at when we created them.

Albert Einstein

Public health personnel in Knox County and East Tennessee, BT Preparedness Program staff and other key community responders executed a full-scale Strategic National Stockpile (SNS) warehouse and mass clinic drill. Under tight security from local law enforcement, mock medical assets were delivered to the designated SNS warehouse and "orders" were transported to two area hospitals and two mass clinics. Hundreds of volunteer patients were moved through each clinic testing plans for clinic transportation and communications, contact tracing, medical evaluation, medication dispensation, patient education, security and triage.

Source: Tennessee Department of Health

Preparedness for Bioterrorism

In August of 2002, the Communicable and Environmental Disease Services section (CEDS) was granted $19.9 million dollars in supplemental federal funding, earmarked for public health and hospital preparedness and response to bioterrorism. Of these monies, $18.6M came from the Centers for Disease Control and Prevention (CDC) for improvements to state and local public health preparedness with the remaining $1.3M coming from the U.S. Department of Homeland Security to prepare for the receipt and distribution of assets from the Strategic National Stockpile (SNS) of emergency response supplies.

Early on, it was recognized that preparedness for bioterrorism in Tennessee naturally equated to the state public health system's ability to respond to all kinds of public health threats. The overall objective for the use of these funds is to build public health infrastructure that will help us do our day-to-day jobs better, as well as to prepare for bioterrorism, outbreaks of other infectious diseases and other public health emergencies. Sixty-two percent (62%) of these monies in 2003 were dedicated to ensure adequacy in regional and local preparedness and response.

Public Health Preparedness

The statewide Integrated Terrorism and Disaster Response Plan (ITDRP) was recently completed and approved to become an annex to the Emergency Support Function-8 of the Tennessee Emergency Response Plan (TEMP), which is maintained at the Tennessee Emergency Management Agency (TEMA). Plans to address mental health needs of the public and of emergency response personnel are under development. As these future initiatives are approved, they will be integrated in to the ITDRP, as well as annexed to the TEMP. A high priority in the development of these plans is the inclusion of detailed plans concerning the receipt, staging, storing and distribution of assets from the SNS. Also, in order to better coordinate the mobilization of over 25,000 community volunteers recruited and interface with hospitals and medical care providers in a public health emergency, regional health departments have begun to fill 21 volunteer coordinator and 13 regional hospital coordinator positions across the state.

The Tennessee Department of Health (TDH) Laboratory Services has worked to improve networks among the state's clinical and hospital laboratories. A survey was recently completed in which hospital and clinical labs detailed their diagnostic capabilities and indicated their capacity to assist TDH in an emergency situation. Training was also provided to hospital laboratories across the state in culture and diagnosis of potential bioterrorist agents. Additionally, a new emphasis on chemical terrorism laboratory response was placed in this year's CDC funding. Renovations are currently underway at the TDH Laboratory Services Nashville branch lab to develop a laboratory that will be capable of testing clinical specimens for chemical terrorist agents.

The regional health department epidemiologists have also worked to enhance regional disease surveillance activities, particularly by implementing 24/7 systems to evaluate community and health indicators of syndromes that might signal a large-scale exposure to bioterrorist agents or other possible outbreaks. To date, aberration detection systems have been implemented utilizing 99 different electronic data sources from across Tennessee, including 911 call centers, ambulance dispatch volume, chief complaint information from hospital emergency departments, pharmacy prescriptions and work or school absenteeism. Also, additional epidemiologic personnel have been added to the regional health departments. The hiring of one environmental epidemiologist for each region has begun. These personnel will interact directly with the CEDS environmental disease staff and will work locally on issues ranging from mercury spills to assessing chemical and environmental vulnerabilities within their jurisdictions.

In the event of communications failure during an emergency, redundant communications systems have been enhanced to augment public health personnel's ability to communicate with each other and to improve communications with hospitals, EMS, emergency management agencies and law enforcement. E-mail, pager, cell phone, fax, HAM radios and high-frequency radios are now viable modes of communications for public health staff statewide. CEDS has purchased a more robust, computerized call-down system for broadcast emergency notification of approximately 30,000 key public health personnel, mass clinic volunteers and key responders from other agencies across the state.

The regional health department-based video-conferencing infrastructure, which includes a "SMART" Classroom, is complete and has been used to facilitate multiple public health training sessions. The Bioterrorism (BT) Preparedness Program continues to facilitate the delivery of education and training to key public health professionals through contractual arrangements with the University of Tennessee (UT), the UT Center for Health Sciences and the East Tennessee State University. The Tennessee Public Health Workforce Development Consortium was formed with these partners and oversees course offerings and content to ensure that the education is appropriate to address public health needs. A BT Learning/Resource Center is being constructed within Central Office to provide access to numerous training and educational materials to anyone across the state requesting such information. TDH is developing and participating in conferences and meetings focusing on educating health professionals and the public about threats of emerging infections and bioterrorism.

In 2003, the CEDS BT Preparedness Program staff was involved in several regional tabletop and full-scale exercises, including one tabletop with the state of Kentucky. From May to August of 2003, TDH conducted six regional hospital tabletop exercises with approximately 400 attendees from health departments, law enforcement, fire departments, emergency management, ambulance services and hospitals. Additionally, a joint terrorism education and exercise program is under development with the Governor's Office of Homeland Security, the Hospital Bioterrorism Preparedness Program, TEMA, Tennessee Department of Agriculture, Tennessee Bureau of Investigation (TBI) and many other agencies. The program will be conducted over a three-year period in the 11 Tennessee Office of Homeland Security Jurisdictional Districts. Its goal is to foster multi-agency collaboration through the combined, comprehensive scenario-driven tabletop and full-scale terrorism exercises and will be of sufficient intensity to impact the community and the state's operations in a manner similar to what would be expected during an actual terrorism incident.

The BT Preparedness Program continues to focus on emergency response plans that incorporate risk communication and health information dissemination strategies. In a public health emergency (ie. the identification of a case of smallpox), the number of asymptomatic, worried people rushing to emergency rooms, hospitals and their doctors would be overwhelming. This would likely result in the shutdown of our health care systems. In order to assuage the public's fears, a risk communication plan has been developed to facilitate the collaboration between health educators, emergency response coordinators, public information officers and the media. Traditionally underserved groups, including minorities, non-English speakers and the homeless population, will be the targets of future refinements of this plan.

Hospital Preparedness

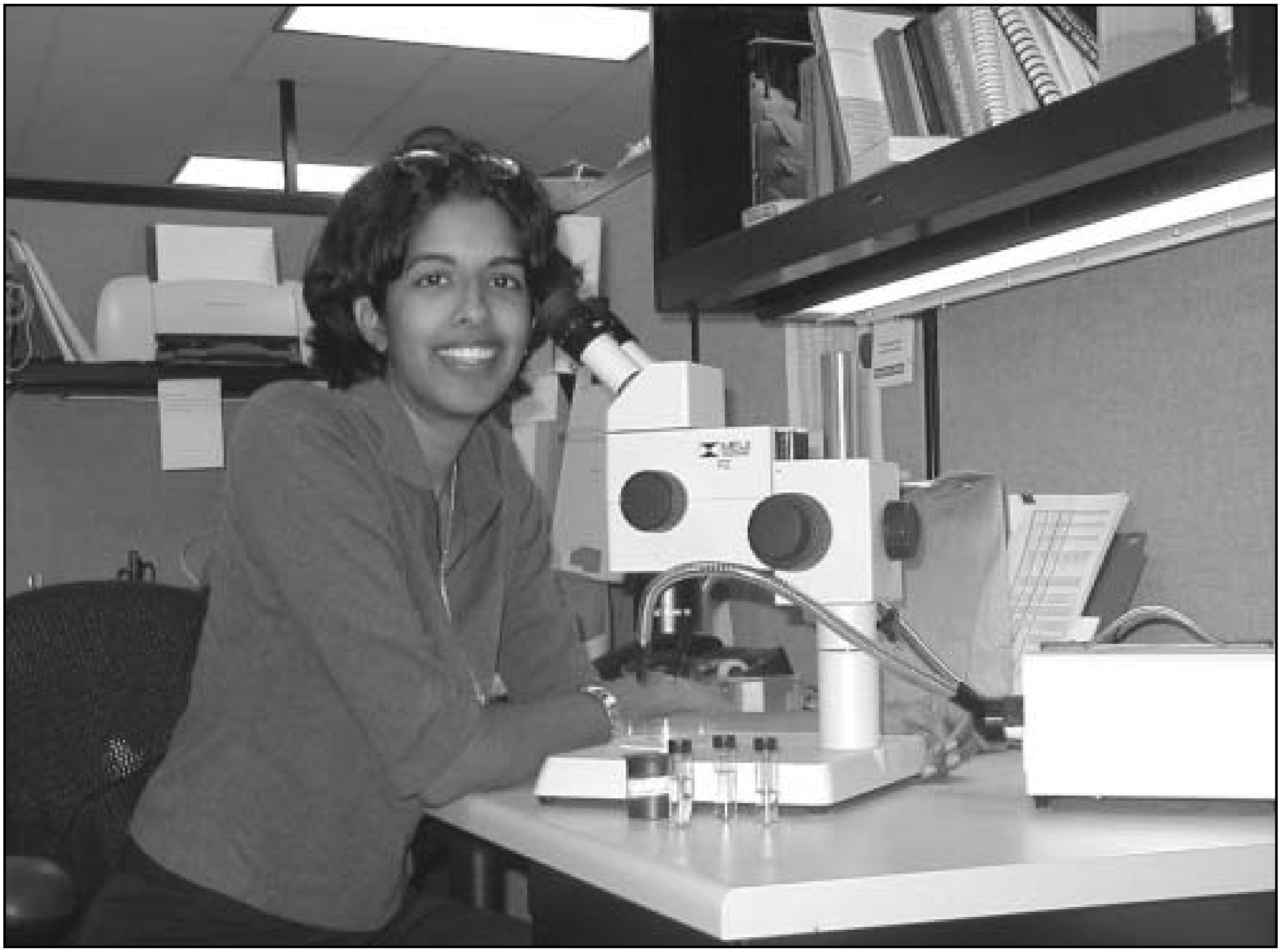
As part of the 2002-2003 funding, $2.4 million was received by TDH from the Department of Health and Human Services, Health Resources and Services Administration for a Bioterrorism Hospital Preparedness Program. These funds have been used to upgrade the ability of hospitals and other health care entities to respond to bioterrorist attacks and other outbreaks of infectious disease.

TDH contracted with General Physics Corporation to conduct a hospital survey that was completed in February 2003 that assessed the hospitals' preparedness to respond to a bioterrorism attack. After the final survey results were presented to TDH, General Physics developed six regional bioterrorism response plans. General Physics then worked with 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. Finally, General Physics conducted six regional tabletop exercises to test the plans and the capability of the healthcare 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 were used to update the TDH Integrated Terrorism and Disaster Response Plan.

Section VII.
Epidemic Intelligence Service

This kind of 'epidemiology in the trenches' is very badly needed when we live in a world where babies are still dying, children are still dying of diarrheal diseases at a high rate. Parasitic infections are still endemic in large parts of the world…And this is preventable. So there's simply no shortage of work to be done…Everybody here could make a long list of important epidemiologic discoveries in the past half century. So I think that rather than having reached its limit, epidemiology is just coming into its full stride.

Dr. Clarice Weinberg, "Epidemiology at a Crossroads", The Future of Public Health, page 43



In July of 2003, Dr. Rose Devasia began her assignment as the current Epidemic Intelligence Service officer in Tennessee.
Source: Tennessee Department of Health

Epidemic Intelligence Service (EIS)

The Epidemic Intelligence Service (EIS) was established in 1951 following the start of the Korean War as an early warning system against biological warfare and man-made epidemics. The program, composed of medical doctors, researchers and scientists who serve in two-year assignments, today has expanded into a surveillance and response unit for all types of epidemics, including chronic disease and injuries.

Over the past 50 years, nearly 2,500 EIS officers have played pivotal roles in combating the root causes of major epidemics. The EIS played a key role in the global eradication of smallpox by sending officers to the farthest reaches of the world; discovering how the AIDS virus is transmitted; investigating the first outbreaks of Legionnaires' disease, hantavirus and E. coli O157; responding to the introduction of West Nile virus and SARS in the United States; and responding to bioterrorism attacks and improving the public health preparedness for future events. Many of the nation's medical and public health leaders, including CDC directors and deans of the country's top schools of public health, are EIS alumni. Approximately 70% of alumni pursue careers in public health following their EIS training.

EIS officers include physicians or personnel with advanced degrees and training in public health. Officers are assigned to positions either at the Centers for Disease Control and Prevention headquarters in Atlanta, or positions based at state health departments. In those positions, they gain experience and provide important support for a variety of epidemiologic investigations.

The Tennessee Department of Health has been hosting EIS officers since 1970. In July of 2003, Dr. Rose Devasia, a physician board certified in internal medicine and pediatrics, began her assignment as the current officer in Tennessee.

Examples of recent EIS investigations in Tennessee include:

- Analysis of the effects of Medicaid managed care on childhood immunization rates in Tennessee
- Analysis of outcomes of infection with multi-drug-resistant *Salmonella* Newport
- Outbreak of domestically-acquired foodborne enterotoxigenic *E. coli*
- Foodborne norovirus outbreak at a country club
- Evaluation of the surveillance system for pediatric tuberculosis in Memphis/Shelby County
- Investigation of a potential allograft-associated infection
- Community cluster of viral meningitis
- Hepatitis A outbreak associated with green onions

Epidemic Intelligence Service Officers, 1970-2003
Tennessee Department of Health

1970-1971	G. Doty Murphy, M.D.
1971-1972	David L. Freeman, M.D.
1972-1974	Bernard Guyer, M.D.
1974-1976	David S. Folland, M.D.
1976-1977	R. Campbell McIntyre, M.D.
1977-1979	Timothy J. Dondero, M.D.
1980-1982	Tracy L. Gustafson, M.D.
1982-1984	Michael D. Decker, M.D., M.P.H.
1984-1986	William T. Brinton, M.D.
1986-1988	Melinda Wharton, M.D.
1988-1990	Ban Mishu, M.D.
1990-1992	Peter A. Briss, M.D.
1992-1994	Steven M. Standaert, M.D.
1995-1997	Allen S. Craig, M.D.
1997-1999	Timothy F. Jones, M.D.
1999-2001	Joseph F. Perz, DrPH
2001-2003	David L. Kirschke M.D.
2003	Rose Devasia, MD

Section VIII.

Presentations and Publications by Communicable and Environmental Disease Services and Tennessee Emerging Infections Program Authors, 2003

Scientists often miss the big picture and assume that there's nothing that we can do about things that are happening out there in the world. And I don't believe that's true.

Dr. Bruce Alberts, "Crossing Boundaries", The Future of Public Health, page 208

The United Nations estimates the overall costs of humanitarian relief at $349 million (U.S.). Government, non-profit and private sectors alike use these monies to collect data, coordinate health responses, implement special community programs, prevent outbreaks of deadly disease and rehabilitate hospitals.

Source: GlaxoSmithKline

Alphabetical Listing of Publications:

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Cassady J, Kirschke D, Jones TF, Craig A, Schaffner W. Outbreak of conversion disorder among Amish adolescent girls- 2002. APHA 131st Annual Mtg., San Francisco, CA, November 15, 2003.

Craig AS. "Lessons From the Field: Implementing a Smallpox Vaccination Program – State and Hospital Perspectives - The Tennessee Experience." 37th National Immunization Conference, Chicago, IL, March 19, 2003.

Craig AS, Narramore J, Schaffner W. "Smallpox vaccination in Tennessee – health care and public health worker response and adverse events." .41st Annual Infectious Diseases Society of America meeting. San Diego, CA, October 9-12, 2003.

Craig AS. "Smallpox Vaccination of Health Care Workers: The Real-World Experience – Tennessee." Thomson American Health Consultants Audio Conference, March 26, 2003.

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